STORMWATER MANAGEMENT & POLLUTION PREVENTION PLAN

Prepared for:

IV2 Rockland Logistics, LLC

Proposed Industrial Park at 25 Old Mill Road
Section 55.22, Block 1, Lot 1; Section 55.37, Block 1, Lot 31
Old Mill Road and Hemion Road (CR 93)
Village of Suffern
Rockland County, NY

Prepared by:

DYNAMIC ENGINEERING

1904 Main Street
Lake Como, NJ 07719
(732) 974-0198

Joshua M. Sewald, PE
NY Professional Engineer License #097639

August 2022
Last Revised, January 2023
DEC# 3709-99-004

TABLE OF CONTENTS

APPENDIX

- NRCS Soil Mapping
- Geotechnical Reports
- Existing and Proposed Curve Number (CN) Calculations
- Existing and Proposed Hydrographs – 1-, 10-, 25- & 100-Year Storm Events
- Outlet Protection (Scour Hole) Calculations
- Manufactured Treatment Device Certification
- Operation & Maintenance Manuals and Inspection Checklists
- Site Logbook
- Maintenance and Inspection Checklist
- Existing and Proposed Drainage Area Maps
- Preliminary and Final Major Site Plans (Attached Separately)

I. INTRODUCTION

Dynamic Engineering Consultants, PC has been retained by the Applicant (IV2 Rockland Logistics) to prepare a New York State Department of Environmental Conservation (NYSDEC or Department) Stormwater Pollution Prevention Plan (SWPPP) for the Proposed Project located within the Ramapo River watershed. The Project Site is located at Old Mill Road and Hemion Road (CR 93) in the Village of Suffern, Rockland County, New York (Section 55.22 Block 1, Lot 1). This report has been developed in accordance with:

- The NYSDEC State Pollution Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activity General Permit Number (GP-0-20-001) (Appendix A), and
- 2015 New York State Stormwater Management Design Manual

II. EXISTING SITE CONDITIONS

The site currently contains a pharmaceutical manufacturing facility which has been out of service since 2017. The pharmaceutical manufacturing facility comprised of multiple buildings having a total area of approximately 370,000 SF with associated parking, drive aisles, stormwater and utility facilities and associated site amenities. The Project Site is generally bound by Old Mill Road and the New York State Thruway to the north, the Village of Montebello municipal boundary to the east, railroad tracks to the south, and the Union Hill Quarry to the west. The existing conditions on site are depicted on the Boundary & Topographic Survey, prepared by Dynamic Survey, LLC, dated October 28, 2021.

Topography

The site generally slopes from the east, south and west towards the wetland pockets near the westerly property line and ultimately towards the Mahwah River which is located beyond the Thruway to the north of the site.

Surface Water

The Mahwah River is located beyond the New York State Thruway to the north of the site. A tributary to the Mahwah River flows from south to north across the subject parcel.

Hydrologic Soil Groups

Soil characteristics are described in Table 1, below. This information has been compiled from data available from the USDA NRCS Web Soil Survey. Hydrologic soils are grouped into A, B, C, D; Group A soils have 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 have a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately 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 have 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 have a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have high shrink-swell potential, soils that have a permanent 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.

Table 1 – Soil Characteristics

SOIL TYPE (SYMBOL)	SOIL TYPE (NAME)	HYDROLOGIC SOIL GROUP
WeB	Wethersfield gravelly silt loam	C
WeD	Wethersfield gravelly silt loam, 15 to 25 percent slopes	C
Us	Udorthents, smoothed	A
W	Water	
Ux	Urban land	
HoD	Holyoke-Rock outcrop complex, hilly	D

Soil Borings

Soil borings, test pits and standard penetration tests were completed by Dynamic Earth, LLC. Soil boring and permeability reports can be found in the appendix of this report.

Groundwater

Investigation of groundwater conditions was conducted by Dynamic Earth, LLC as part of their geotechnical analysis. Groundwater was typically encountered at depths ranging between approximately 4 feet and 8 feet below ground surface (bgs) throughout the project site, however there were several test locations where no groundwater was encountered.

III. PROPOSED SITE CONDITIONS

The project proposes to demolish the existing pharmaceutical facility for the construction of three (3) one-story warehouse buildings with associated parking, loading docks and access drives. The subject property is approximately 5,441,754 square feet (124.93 acres); however, the project is confined to approximately 2,670,433 square feet (61.30 acres) area within the subject property.

Table 2 - Project Summary

Description	Acres
Total Site Area	124.93
Usable Lot Area (Pursuant to Village of Suffern Code)	77.50
Existing Development Coverage Area	20.86
Proposed Development Coverage Area	52.79

The Proposed Project is depicted in detail on the Preliminary and Final Major Site Plan drawings, prepared by Dynamic Engineering, dated 12/17/2021, last revised 09/01/2022.

Construction Stormwater Team

The construction stormwater team will be listed in appendix of this report before construction begins. Each developer or contractor must sign a certification which will be maintained on-site document with the approved SWPPP. The responsibility for the ESC plan will be designated to the trained contractor. All erosion and sedimentation controls will be installed, monitored, repaired and replaced in accordance with the New York State Standards and Specifications for Erosion and Sediment Control.

Construction Phasing

The Proposed Project will entail the following activities:

1. Land Clearing
2. Grading
3. Building Construction
4. Stormwater Management Practices
5. Parking lot construction and final stabilization

Based on the scope of the proposed development, it is not feasible to limit disturbance to five (5) acres. Construction activities will be phased to limit areas of disturbance to the maximum extent practicable and soil management practices will be implemented to minimize the potential for increased pollution of stormwater runoff. Phasing plans will be developed and submitted to the local MS4 Official for review.

As the project anticipates disturbance greater than five acres of soil, the following phased general construction stages have been developed.

Below is a discussion of site-specific practices that will be implemented to protect water quality during each construction stage. Further, when site disturbances exceed 5 acres the qualified inspector will conduct at least two site inspections every seven calendar days. The two inspections will be separated by a minimum of two full calendar days. In areas where soil disturbance activity has temporarily or permanently ceased, the application of soil stabilization measures will be initiated by the end of the next business day and completed within seven days from the date the soil disturbance activity ceased.

Based on the qualified inspectors site inspections, additional site-specific practices may be installed if determined necessary to protect water quality.

Details for the erosion control measures can be found on the Erosion and Stormwater Pollution Prevention Plan drawings.

Stage 1

Prior to the start of construction, the work area will be prepared by installing public safety measures such as:

- Construction fencing,
- Permits and/or signs.

- Plan Stage 1 – Clearing and Grading. Sediment and erosion control devices to be placed around and throughout the construction envelope during this construction phase include:
    - Construction fence demarcating the limit of disturbance;
    - Stabilized construction entrance established along the access road to the site;
    - Delineation of a vehicle and equipment staging area with flags, tape and/or spray paint;
    - Field office trailers for the construction engineers and managers, portable toilets, and dumpsters for trash will be installed within this area, as necessary;
    - Delineation of material stockpile area with silt fencing;

  - Silt fencing;
  - Haybales;
  - Paved surface inlet protection; and
  - Spill kits

Site Clearing
The project entails clearing and re-grading approximately 53 acres.
Sediment laden debris will be stockpiled within designated
material stockpile areas. Cleared debris may be also temporarily stockpiled until it is transported offsite for disposal.

Grading
The proposed project, will require significant regrading of the site as depicted on the Grading Plans. To the maximum extent practicable, the required clean suitable soil/fill material will be placed immediately, however, in the event stockpile of material is necessary, designated stockpile areas will be demarcated with haybales and silt fencing.

Fill material shall be spread and compacted in layers one foot or less in thickness.

Stage 2
Building Construction
Concrete will be poured for the building foundations. The concrete truck washout will remain at the site near the stabilized construction entrance. Upon completion of the foundation, construction of the superstructure will begin. Finally, interior fit-out activities will commence.

Stage 3
Stormwater Management Practices
The project includes installation of storm drains, catch basins, piping, aboveground and underground infiltration and detention units, and structural manufactures stormwater treatment devices to capture, infiltrate, and treat stormwater runoff prior to discharge to the point of analysis described as Tributary 1 to the Mahwah River. Associated drains and piping will be installed to convey stormwater to each designated stormwater management practice. Additionally, subsurface utility installation will be conducted during this phase. Prior to stabilization, all drain inlets will be protected with inlet protection measures.

In the event stormwater pools within utility trenches or excavation pits, localized dewatering will occur, as necessary.

Parking Lot
Construction of the sidewalks, curbs, drive aisles, loading docks and parking lot will constitute final stabilization of the Project Site. As appropriate, the installed stormwater infrastructure will be put on-line for the capture, conveyance, and discharge of site stormwater.

IV. EROSION AND SEDEMENTATION CONTROLS

Erosion and Sedimentation Controls

The Erosion and Stormwater Pollution Prevention Plans, depict the specific locations, sizes, and lengths of each erosion and sediment control practice, as detailed below. All contractors and sub-contractors will be required to understand the Erosion and Stormwater Pollution Prevention Plans and sign the certification statement provided described above. The responsibility for the Erosion and Stormwater Pollution Prevention Plans will be designated to the trained contractor. All erosion and sedimentation controls will be installed, monitored, repaired and replaced in accordance with the New York State Standards and Specifications for Erosion and Sediment Control.

Stabilized Construction Access
Stabilized construction access points will be used at all points of construction ingress and egress. The construction access point will consist of a stabilized pad of aggregate underlain with geotextile located at any point where traffic will be entering or leaving the Project 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. The stabilized construction access points will be established at two site access points from Old Mill Road. The stabilized construction access points will be constructed in accordance with the 2016 New York State Standards and Specifications for Erosion and Sediment Control.

Temporary Stockpiles
Materials, such as topsoil, will be temporarily stockpiled, as necessary, on the Project Site during the construction process. Temporary stockpile areas will be located, as depicted on the Erosion and Stormwater Pollution Prevention Plans, in areas away from storm drainage, water bodies and/or drainage courses to the maximum extent practicable. The stockpile areas will be surrounded with silt fencing to prevent runoff sediment laden runoff from exiting these areas. Soils will be stockpiled on, at minimum, double layers of 8-mil minimum sheeting, and will be kept covered when not in use with appropriately anchored plastic tarps. Broken or ripped tarps will be promptly replaced.

Silt Fence
Silt fencing will be installed, as depicted on the Erosion and Stormwater Pollution Prevention Plans, and in accordance with the New York State Standards and Specifications for Erosion and Sediment Control. These barriers may extend into non-impact areas to provide adequate protection of adjacent lands. Silt fencing will serve to intercept sediment laden runoff from areas with disturbed soils, reduce the runoff velocity and initiate deposition of the transported sediment. Tall stakes will be used for the silt fencing to allow for visibility above potential snowpack.

Haybales
A temporary barrier of straw, or similar material, used to intercept sediment laden runoff in areas where it is not feasible to utilize silt fence, as depicted on the Erosion and Stormwater Pollution Prevention Plans. All bales shall be placed in accordance with the New York State Standards and Specifications for Erosion and Sediment Control.

Catch Basin Inlet Protection
Catch basins within and surrounding the project site with the potential to receive sediment laden runoff from the site will be protected by a filter fabric drop or manufactured insert inlet protection measures. The filter fabric barriers will be installed around inlets to detain 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. The top of the barrier will be maintained to allow overflow to drop into the drop inlet and not bypass the inlet to unprotected lower areas. Support stakes for fabric will be installed in accordance with the New York State Standards and Specifications for Erosion and Sediment Control.

Geotextile Filter Bag

In the event that dewatering is required, or stormwater ponding is present, localized dewatering will occur and geotextile bags will be used to trap and retain sediment onsite from pumped water.

Concrete Truck Washout

A concrete truck washout will be installed nearby the stabilized construction entrances along the access road in accordance with the New York State Standards and Specifications for Erosion and Sediment Control. The concrete truck washout will allow concrete truck mixers and equipment to be washed after their loads have been discharged, to prevent highly alkaline runoff from entering storm drainage systems or leaching into soil. They will be constructed to contain solids, wash water, and rainfall in addition to allowing for the evaporation of such waters.

Dust Control

Dust control measures will be implemented throughout the project site. To the extent practical construction activities will be phased to minimize the amount of area disturbed at one time. For disturbed areas, not subject to traffic, vegetation will be utilized to stabilize the exposed surfaces. For disturbed areas subject to traffic dust control methods utilizing water or wind breakers will be used as necessary.

Sprinkling

To provide short term dust control the project site may be sprayed with water until the surface is wet. No surface runoff will be generated from spraying activities.

Windbreakers

A silt fence or similar barrier may be used, if deemed necessary by the trained contractor, to control air currents at intervals equal to ten times the barrier height. Preservation of the existing wind barrier vegetation will occur to the maximum extent practical.

Winter Stabilization

Sediment and erosion controls will be modified in the as follows during winter months:

Snow Management

A snow management plan will be prepared allowing for adequate storage of mounded snow and control of the melt water, while not impacting ongoing construction activities. Stabilized construction access points will be widened as necessary to allow for snow management and stockpiling. Snow management activities (plowing) must not destroy or de grade installed erosion and sediment control practices. A minimum 25-foot buffer will be maintained, to the extent practical, from all perimeter controls such as silt fencing. 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.

Exposed Soil

Exposed soils will be protected by the use of established vegetation, anchored straw mulch, rolled stabilization matting, or other durable covering. In areas where soil disturbance activity has temporarily or permanently ceased, the application of soil stabilization measures as described above will be initiated. Disturbed areas remaining exposed for more than 14 days during construction operations will be stabilized temporarily. Straw or manufactured mulch will be applied at double the typical application rate when mulching is alone used for stabilization. Stone paths will be utilized when deemed necessary by the trained contractor or qualified inspector to stabilize access perimeters of buildings under construction and areas where construction vehicle traffic is anticipated.

Erosion and Sedimentation Control Inspections

Inspections by Qualified Inspector
Inspections will be completed by a qualified inspector to fully document each inspection. Site inspection checklists and guidelines can be found in the appendix of this report.

Erosion and sediment control measures will be inspected in accordance with SPDES requirements as follows:

- Start of construction;
- When soil disturbance activities are on-going, a qualified inspector will conduct a site inspection at least once every seven calendar days;
- When soil disturbance activities have been temporarily suspended and temporary stabilization measures have been applied to all disturbed areas, a qualified inspector will conduct a site inspection at least once every 30 calendar days. The applicant or operator will notify the NYSDEC Regional Office stormwater contact person in writing prior to reducing the frequency of inspections.

The qualified inspector will maintain a record of all inspection reports in a logbook, maintained onsite. Any changes to the proposed SWPPP will be documented. During each inspection, the following information will be recorded:

- Indicate on a site map all areas of the Project Site that have undergone temporary or permanent stabilization.
- Indicate all disturbed areas that have not undergone active work du ring the previous 14-day period. Inspect all sediment control practices and record the approximate degree of sediment accumulation as a percentage of the sediment storage volume.
- Inspect all erosion and sediment control practices and document all maintenance activities.
- Document any excessive deposition of sediment or ponding water along barrier or diversion systems.

At a minimum, the qualified inspector shall inspect:

- All erosion and sediment control practices and pollution prevention measures;
- All post-construction stormwater management practices under construction;
- All areas of disturbance that have not achieved final stabilization;
- All points of discharge to natural surface waterbodies located within, or immediately adjacent to, the property boundaries of the construction site, and;
- All points of discharge from the construction site.

Inspections by Trained Contractor
ESC inspections will be conducted daily by a trained contractor to determine when ESC measures need maintenance or repair. The trained contractor will inspect the erosion and sediment control practices and pollution prevention measures being implemented within the active work area daily. If deficiencies are identified, the trained contractor shall begin implementing corrective actions within one business day and will complete the corrective actions in a reasonable time frame.

If soil disturbance activities become temporarily suspended and temporary stabilization measures have been applied to all disturbed areas or if soil disturbance activities shut down with partial project completion, the daily inspections will also be suspended until soil disturbance activities resume.

Maintenance and inspection schedules for the contractor(s) have been provided in the appendix of this report.

Stabilized Construction Access Point

Periodic inspections and maintenance will be provided after each rainfall event and on an as needed basis at the discretion trained contractor and/or qualified inspector. The entrances will be maintained in a condition which will prevent tracking of sediment onto public rights-of-way.

Temporary Stockpiles

The stockpiles will be inspected to confirm the integrity of the surrounding silt fencing.

Silt Fence

Silt fencing will be frequently monitored frequently for degradation and blockage. Maintenance will be performed as needed and material removed when bulges develop in the fencing.

Haybales

Haybales will be frequently monitored for degradation and blockage. Replacement will occur promptly when the qualified inspector has determined the straw bale is no longer functioning as intended.

Catch Basin Inlet Protection

The fabric barrier will be inspected after each rainfall event and removal of sediment and/or repairs will be performed as needed.

Geotextile Filter Bag

The geotextile filter bag is considered full and should be replaced when remaining bag flow area has been reduced by 75%.

Concrete Truck Washout

The concrete washout areas will be inspected daily for damage or leaks by the trained contractor. Facilities will be repaired or replaced immediately upon the discovery of any leaks or damages. Accumulated hardened material will be removed when 75% of the storage capacity of the structure is filled.

Dust Control

Dust control measures will be maintained through dry weather periods until all disturbed areas are stabilized.

Winter Stabilization

The site will be inspected frequently to ensure that the erosion and sediment control plan is functioning as intended.

Compliance inspections must be performed and reports filed properly in accordance with this SWPPP during a winter shutdown as described above.

Soil Stabilization Plan

Please refer to the Soil Erosion and Sediment Control Notes & Details for detailed information regarding temporary and permanent stabilization.

Temporary Soil Stabilization

Disturbed areas will be stabilized as soon as possible after construction is completed. Temporary seeding or mulching will be used on areas which will be exposed for more than 14 days and maintenance will be performed as necessary to ensure continued stabilization.

Permanent Soil Stabilization

Permanent stabilization will be performed as soon as possible after the completion of final grading and utility installation. Permanent seeding will be used on unpaved areas.

Inspections

Implementation of the Soil Stabilization Plan will be inspected at the same frequency at erosion and sediment controls. Site inspection checklists and guidelines can be found in appendix of this report.

Good Housekeeping and Pollution Prevention Measures

Vehicle and Construction Equipment Staging and Maintenance

Vehicle and construction equipment staging and maintenance areas will be located away from all drainage ways. Equipment cleaning, maintenance and repair will be conducted in designated areas with the perimeter of the area protected by silt fencing.

Equipment and Vehicle Washing

The erosion and sedimentation controls and concrete washout area detailed above, will be maintained as necessary to contain soil and prevent vehicles tracking material off site. Wash waters will consist of clean water only. No soaps, detergents, or solvents will be used to clean construction equipment and vehicle while onsite.

Construction Materials and Debris

The Project Site will be inspected at the end of each work day for building materials, construction wastes, trash, landscape materials, fertilizers, pesticides, herbicides, detergents, sanitary waste and other materials that may be exposed to precipitation and stormwater. Materials identified as having the potential to discharge pollutants will be protected from precipitation and stormwater. Solid wastes will be disposed of in accordance with local, state and federal laws.

Spill and Leak Prevention Plan

The spill prevention and control plan, detailed below, will be implemented by the trained contractor, as necessary, in accordance with the NYSDEC Spill Guidance Manual.

Spill Prevention

Refueling equipment shall be located at least 100 feet from all wetlands, streams and other surface waters.

All construction vehicles will be inspected daily for visible leaks of automotive fluid. If a leak is identified, immediate actions, as detailed in the spill prevention and control plan, will be taken to contain and clean up spilled fluids.

The trained contractor is responsible for maintaining all necessary Material Safety Data Sheets (MSDS) for all materials to be stored on-site. All state and federal regulations shall be followed for the storage, handling, application, usage, and disposal of pesticides, fertilizers, and petroleum products. All workers on-site will be required to be trained on safe handling and spill prevention procedures for all materials used during construction. Informational material regarding proper handling, spill response, spill kit location, and emergency actions to be taken, will be posted and available to all construction personnel.

Spill Reporting and Initial Notification Requirements

20-gallon spill kits for fast response for emergency oil, water-based and chemical liquid spills will be distributed around active construction areas. Spill kits, will include:

- 15 x 19" Pads
- 3" x 12' Sorbent Socks
- 18 x 18" Pillows
- Nitrile Gloves
- Emergency Handbook
- Googles
- Disposal Bags

Under New York State law, all petroleum and most hazardous material spills must be reported to DEC Hotline (1-800-457-7362). If a spill is discovered and the responsible party cannot be located, the person who discovers who discovers the spill shall report the spill. Parties responsible for spills will be informed of their responsibilities by the trained contractor. In the event of additional on-scene assistance is required, local authorities shall be contacted.

Petroleum spills must be reported to DEC unless they meet all of the following criteria:

- The spill is known to be less than 5 gallons;
- The spill is contained and under the control of the spiller;
- The spill has not and will not reach any State’s water or land; and
- The spill is cleaned up within 2 hours of discovery.

For spills not deemed reportable, it is strongly recommended that the facts concerning the incident be documented by the spiller and a record maintained for one year.

Steps Following an Accidental Spill

- No party shall place themselves in a hazardous situation;
- Stay upwind and upgrade of the accident site;
- Do not walk in or near the spill, leak, or fire until this can be done safely;
- Treat any unknown substance as a hazardous material until the identity of the substance becomes known;
- Defer to the authority of the response agencies who have the responsibility and resources for taking actions at the emergency scene;

Sanitary facilities

Sanitary facilities will be provided for onsite personnel by the Contractor and must be utilized by all construction personnel.

Prohibited Discharges

The following discharges are prohibited:

- Wastewater from washout of concrete;
- Wastewater from washout and cleanout of stucco, paint, form release oils, curing compounds and other construction materials;
- Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance;
- Soaps or solvents used in vehicle and equipment washing; and
- Toxic or hazardous substances from a spill or other release.

Inspections

Pollution prevention measure inspections within the active work area will be conducted by a qualified professional and trained contractor as described above. If deficiencies are identified, the qualified inspector shall begin implementing corrective actions within one business day and will complete the corrective actions in a reasonable time frame.

V. EXISTING DRAINAGE CONDITIONS

Pre-Construction Stormwater

The site has been evaluated using the TR-55 'Urban Hydrology for Small Watersheds' standards with the following existing drainage sub-watershed area as depicted on the Existing Drainage Area Map.

Ex. Study Area Stream: As described above, the site drains to the existing wetland pockets near the westerly property line and ultimately drains to the Mahwah River via the onsite tributary to the Mahwah River. The point of analysis utilized for this analysis is the most downstream point onsite of the tributary to the Mahwah River, identified as Tributary 1.

VI. PROPOSED DRAINAGE CONDITIONS

Post Construction Stormwater

In the proposed condition, the site will utilize a number of infiltration and detention facilities which will release stormwater runoff at a controlled rate through outlet control structures into the onsite tributary. The infiltration and detention facilities have been designed to satisfy the channel protection, overbank flood, and extreme storm requirements set forth by the New York State Stormwater Design Manual.

The site has been evaluated using the TR-55 'Urban Hydrology for Small Watersheds' standards and with the following proposed drainage sub-watershed areas as depicted on the Proposed Drainage Area Map. Please note, all of the sub-drainage areas described below are ultimately tributary to the point of analysis described above.

Study Area AG Basin B1 North: This area consists of the parking area to the north of building 1.

Study Area AG Basin B1 Northwest: This area consists of a portion of the access drive and open space areas to the west of building 1.

Study Area AG Basin B1 Southwest: This area consists of a portion of the access drive and open space areas to the west of building 1.

Study Area AG Basin B1 South: This area consists of portions of the parking areas to the south of building 1 as well as a portion of the access drives and open space areas to the south of building 1.

Study Area AG Basin B2: This area consists of the building 2 parking area, access drive and adjacent open space areas.

Study Area UG Barrels B1 Northeast: This area consists of a portion of the building 1 roof and portions of the trailer parking and loading areas to the east of building 1.

Study Area UG Barrels B1 Southeast: This area consists of a portion of the building 1 roof and portions of the trailer parking and loading areas to the east of building 1.

Study Area UG Barrels South: This area consists of the parking area to the east of building 3 and adjacent open space areas.

Study Area UG Infiltration B1 Northwest: This area consists of a portion of the building 1 roof and portions of the trailer parking and loading areas to the west of building 1.

Study Area UG Infiltration B1Southwest: This area consists of a portion of the building 1 roof and portions of the trailer parking and loading areas to the west of building 1.

Study Area UG Infiltration B1 South: This area consists of portions of the parking areas to the south of building 1 as well as a portion of the access drives and open space areas to the south of building 1.

Study Area UG Infiltration B2: This area consists of the building 2 roof and the trailer parking and loading areas to the west of building 2

Study Area UG Infiltration B3: This area consists of the building 3 roof and the trailer parking and loading areas to the west of building 3

Study Area Stream Undetained: This area consists of primarily open space areas and a small area of impervious coverage within the limit of disturbance that could not be captured by the proposed stormwater collection facilities.

Site Planning Practices

The project represents the redevelopment of a highly disturbed site with a use that is compatible with the adjacent uses and underlying zoning. The proposed disturbance will be primarily limited to interior portions of the site that is previously developed and is intended to preserve undisturbed areas and mature vegetation. The project is intended to limit disturbance to the existing wetlands and watercourse to the maximum extent practicable. Native plant species have been proposed as part of the Landscaping Plan to mitigate disturbed areas and promote growth within the surrounding habitats for native species.

Water Quality

Post-construction stormwater quality was evaluated in accordance with the 2015 NYSDEC SMDM. The Water Quality Volume (WQv) was determined and incorporated into the project's overall design.

The WQv is intended to improve water quality by capturing and treating runoff from small, frequent storm events that tend to contain higher pollutant levels. The WQv is reduced to the maximum extent practical through the proposed site design and any remaining WQv is treated prior to site discharge. The minimum WQv that must be treated is unique per each is calculated per NYSDEC standards in the table below. Runoff reduction is achieved by infiltration. Areas of the site where in-situ soils are not favorable for infiltration practices will utilize manufactured treatment devices to treat stormwater runoff to 80% removal of total suspended solids and 40% phosphorus removal.

Additionally, the project proposes hydrodynamic separators to pretreat runoff tributary to underground infiltration facilities through the removal of sediment, floatables, oil and grease.

Water Quality Volume Summary

Water Quality Volume (cubic feet)	275,386
Minimum Runoff Reduction Volume (cubic feet)	150,188
Runoff Reduction (proposed infiltration)	226,512

Water Quantity

Water quantity control practices for the channel protection volume, overbank flood and extreme flood conditions in the pre- and post-construction condition are detailed below.

Overall Runoff Rates (CFS) and Volumes (Cubic Feet)

Design Storm	Existing Combined Runoff Rates (cfs)	Proposed Combined Runoff Rates (cfs)	Existing Volume (CF)	Proposed Volume (CF)
1-Year (channel protection)	51.60	0.590	230,317	4,053
10-Year (overbank flood)	101.73	17.05	500,795	451,661
25-Year	102.27	17.51	504,201	457,275
100-Year (extreme flood)	189.42	75.43	918,799	1,073,741

As shown in the table above, through the implementation of the proposed stormwater management system, the proposed runoff rates during each storm event would be significantly reduced in accordance with SPDES General Permit for Stormwater Discharges from Construction Activity. While the 100-year storm event results in an increase of runoff volume, through the multitude of stormwater management basins and outlet control structures, the volume of water is released at a controlled rate that will not result in flooding or negative downstream impacts to Tributary 1. Proposed Action would have no adverse impacts on downstream properties or stormwater conveying systems, and in fact would significantly improve overall runoff rates from the Project Site.

Stormwater Management Practices

Impacts to stormwater as a result of the development have been reduced through the implementation of volume reduction (infiltration) techniques and outlet control structures designed to release water a controlled volume in order to reduce flood. Utilization of structural stormwater controls, such as underground infiltration units, will infiltrate and treat runoff to satisfy the post-construction requirements of the SPDES General Permit for Stormwater Discharges from Construction Activity - GP-0-20-001.

Infiltration Facilities

The proposed aboveground and underground infiltration facilities have been designed in accordance with the following requirements set forth by the New York State Stormwater Design Manual:

- ***The bottom of the infiltration facility shall be separated by at least three feet vertically from the seasonally high-water table or bedrock layer (Four feet in sole source aquifers)***
- ***A minimum pretreatment volume of 25% of the WQv must be provided prior to entry to an infiltration facility.***

Based on the relatively shallow depths from the existing grades to the seasonally high-water table (SHWT), it was necessary to raise the grade on-site in order to provide the necessary separation between the SHWT and the proposed infiltration facilities. As such, it will be necessary to, place the proposed infiltration facilities in fill soils.

Hydrodynamic Separators
As noted above, the project proposes to provide Contech Cascade hydrodynamic separators to pre-treat surface runoff upstream of the infiltration basins.

Jellyfish Media Filter
The Jellyfish Filter is designed to treat the WQv through the removal of potential pollutants. The Jellyfish Filter is a stormwater quality treatment technology featuring high flow pretreatment and membrane filtration in a compact stand-alone system. The Jellyfish filter removes floatables, trash, oil, debris, TSS, fine silt-sized particles, and a high percentage of particulate-bound pollutants; including phosphorus, nitrogen, metals and hydrocarbons. This filter system is a proprietary practice that has been reviewed by NYSDEC. NYSDEC has determined that the practice is acceptable for use on new development.

The Jellyfish® filter has been designed to treat the remaining WQv that is unable to be captured and retained by the infiltration facilities units.

Inspection
During construction, a qualified inspector will inspect all post-construction stormwater management practices under construction to ensure that they are constructed in conformance with the SWPPP.

Operation and Maintenance Plan
A consulting professional engineer should perform regularly scheduled maintenance inspections of the stormwater facilities at least twice each year. The primary purpose of these inspections is to ascertain the operational conditions and safeties of the facilities, particularly the conditions of the embankments, pipe beds, outlet structures, rip rap, and other safety-related aspects. Inspections will provide information on the effectiveness of the preventative and aesthetic maintenance procedures as well as determine the need for and timing of corrective maintenance procedures. Preventative maintenance is to ensure that stormwater management aspects of the basins remain operational and safe at all times, and to minimize the need for emergency or corrective maintenance. Aesthetic maintenance is necessary to maintain visual appeal and aesthetic quality of the facilities. Corrective maintenance is necessary in order to repair a facility component that is damaged or failing which results in a negative impact on the performance of the stormwater management facility.

The responsibility for implementation of long-term operation and maintenance of a postconstruction stormwater management practice is the responsibility of the applicant. A maintenance agreement will be used to ensure long term operation and maintenance of the stormwater management practices.

Operation and maintenance for each stormwater management practice or runoff reduction technique, inclusive of inspection and maintenance schedules and actions to ensure continuous and effective operation, is detailed below.

Underground Infiltration Facilities

The applicant will be responsible for long term operation and maintenance of the underground infiltration facilities. Maintenance of the underground infiltration facilities will require the upstream collection system feeding the chambers be routinely inspected and cleaned. Upstream catch basins shall incorporate a sump and hooded outlet pipes as preventive measures. Debris accumulating in these structures shall be inspected and cleaned once every 2-3 months.

Aboveground Infiltration Facilities

Maintenance of the aboveground facilities require maintenance of the adjacent areas through the use of regularly scheduled landscaping to prevent overgrowth in and around the basins. Removal of debris and trash will reduce the chance of outlet structures, catch basins, and other components, becoming clogged and inoperable during storm events. Basins should be overserved for sedimentation or the buildup of other debris which could affect the capacity of the basin. A reduction in basin volume could result in excess flow leaving the basin or failure if severely unkept. Damage to the surrounding walls of the basin as a result of scouring or erosion should be addressed immediately as it could result in the collapse of the basin walls and significant failure of the basin.

Hydrodynamic Separators

The applicant will be responsible for long term operation and maintenance of the hydrodynamic separator unit. The vortex separator unit allows for easy and safe inspection, monitoring and clean-out procedures. Inspection is a simple process that does not involve entry into the vortex separator units and does not require the internal components to be removed. Maintenance crews should be familiar with the vortex separator units and its components prior to inspection. Schedule cleaning with local company to remove sediment, oil and other floatable pollutants during dry weather conditions. Access ports are located in the top of the manhole to facilitate the maintenance.

The captured material generally does not require special treatment or handling for disposal. Site-specific conditions or the presence of known contaminants may necessitate those appropriate actions be taken to clean and dispose of materials captured and retained by the treatment device. All cleaning activities should be performed in accordance with property health and safety procedures. All materials removed from the pretreatment devices during the maintenance process be handled and disposed in accordance with local and state environmental or other regulatory requirements. Inspect the hydrodynamic separator every three (3) months and clean the system as needed during construction. The hydrodynamic separator should be inspected and cleaned at the end of construction regardless of whether it has reached its maintenance trigger.

During the first-year post-construction, inspect the hydrodynamic separator every three (3) months and clean the system as needed. Inspect and clean the system once annually regardless of whether it has reached its sediment or floatable pollutant storage capacity. If the hydrodynamic separator does not reach full sediment or floatable pollutant capacity in the first-year post-construction period, the system can be inspected twice annually and cleaned once annually. If the pretreatment units reach full sediment or floatable pollutant capacity in less than 12 months in the first-year post-construction period, the system should be inspected once every three (3) months and cleaned as needed. The hydrodynamic separator should be cleaned annually regardless of whether it reaches its sediment or floatable pollutant capacity.

The maintenance authority for the development shall refer to the proprietary Inspection and Maintenance Manuals for additional detailed instructions. Long term operation and maintenance of the vortex separator units will be ensured through a maintenance agreement.

Jellyfish Filter
The applicant will be responsible for long term operation and maintenance of the Jellyfish filter system. Performing preventative maintenance will prevent long term damage and help avoid potential malfunctions. Preventative maintenance includes the general practice of good housekeeping around the project site. The Jellyfish filter systems should be inspected quarterly and after all storm events for debris build up, proper flow and signs of leaking to verify that they are working as intended.

Required maintenance for the Jellyfish Filter is based upon results of the most recent inspection, historical maintenance records, or the site-specific water quality management plan; whichever is more frequent. In general, maintenance requires some combination of the following:

1. Sediment removal for depths reaching 12 inches or greater, or within 3 years of the most recent sediment cleaning, whichever occurs sooner.
2. Floatable trash, debris, and oil removal.
3. Deck cleaned and free from sediment.
4. Filter cartridges rinsed and re-installed as required by the most recent inspection results, or within 12 months of the most recent filter rinsing, whichever occurs sooner.
5. Replace tentacles if rinsing does not restore adequate hydraulic capacity, remove accumulated sediment, or if damaged or missing. It is recommended that tentacles should remain in service no longer than 5 years before replacement.
6. Damaged or missing cartridge deck components must be repaired or replaced as indicated by results of the most recent inspection.
7. The unit must be cleaned out and filter cartridges inspected immediately after an upstream oil, fuel, or chemical spill. Filter cartridge tentacles should be replaced if damaged or compromised by the spill.

An inspection checklist and Jellyfish Filter System Maintenance Guide can be found in the appendix of this report.

VII. MONTEBELLO DRAINAGE CONDITIONS

Proposed Action

Under existing conditions, there is an apparent ridgeline running north-south through the portion of the site which is located in Montebello (Section 55.06, Block 1, Lot 1). Approximately one-third of the lot appears to drain via overland flow to the west towards the existing Novartis Pharmaceutical facility. The remaining portion of the Montebello lot appears to drain via overland flow to the existing stormwater infrastructure along Hemion Road, which slopes from south to north towards Old Mill Road and the NYS Thruway.

In the proposed action, no disturbance to the Montebello lot is proposed, as the primary site access points are off of Old Mill Road, and therefore no new stormwater management measures are required on that portion of the site and there will be no change to existing drainage patterns.

Alternate Site Plan 'D'

Under Alternate Site Plan 'D', the sole access point to the proposed development is through the existing driveway off of Hemion Road which is located at the southeasterly portion of the site. To accommodate truck traffic generated by the proposed development, it is anticipated that modifications to the driveway will be required to widen the road and decrease the slope of same. These modifications will require disturbance on the Montebello lot, and thus new stormwater management measures may be required.

Under existing conditions, approximately two-thirds of the driveway flows overland into one of two swales located along either side of the driveway, heading in the northwesterly direction, before ultimately discharging to the stream tributary located on site. Stormwater runoff from the remaining portion of the driveway is tributary to Hemion Road via overland flow.

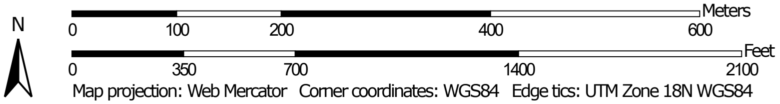
In order to maintain existing drainage patterns to the best extent practicable, it is anticipated a series of inlets will be installed with the driveway improvements to capture runoff and route same to the appropriate study area – that is, either west towards the proposed development or east towards Hemion Road. Approximately two-thirds of the runoff would be routed to the west and tributary to one of the various stormwater management basins associated with the proposed action. The remaining runoff, which is currently flowing towards Hemion Road under existing conditions, would either have to be re-routed to the west towards the proposed development or would require installation of a new stormwater basin adjacent to Hemion Road to reduce flow rates. It is anticipated this basin will ultimately discharge any stormwater which does not infiltrate to the existing infrastructure along Hemion Road.

APPENDIX

NRCS SOIL MAPPING

Hydrologic Soil Group—Rockland County, New York

Map Scale: 1:7,220 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 1:24,000.

> Warning: Soil Map may not be valid at this scale.
>
> Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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: Rockland County, New York
Survey Area Data: Version 18, Jun 11, 2020

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

Date(s) aerial images were photographed: Aug 22, 2020—Sep 23, 2020

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
Ad	Alden silt loam	C/D	4.3	2.3%
HoD	Holyoke-Rock outcrop complex, hilly	D	23.4	12.4%
Pt	Pits, gravel		4.2	2.2%
Us	Udorthents, smoothed	A	64.6	34.3%
Ux	Urban land		22.1	11.8%
W	Water		1.3	0.7%
Wc	Watchaug fine sandy loam	C	0.9	0.5%
WeB	Wethersfield gravelly silt loam, 3 to 8 percent slopes	C	40.6	21.6%
WeC	Wethersfield gravelly silt loam, 8 to 15 percent slopes	C	12.7	6.7%
WeD	Wethersfield gravelly silt loam, 15 to 25 percent slope s	C	14.1	7.5%
Totals for Area of Interest			**188.3**	**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

GEOTECHNICAL REPORTS

REPORT OF PRELIMINARY GEOTECHNICAL INVESTIGATION

PROPOSED INDUSTRIAL PARK
Old Mill Road and Hemion Road (CR 93)
Section 55.22, Block 1, Lot 1; Village of Suffern
Rockland County, New York

Prepared for:

TREETOP DEVELOPMENT, LLC
500 Frank W Burr Boulevard # 47
Teaneck, NJ 07666

Prepared by:

DYNAMIC
EARTH

245 Main Street, Suite 110
Chester, New Jersey 07930

Francis Van Cleve

Peter H. Howell, P.E.
Principal
NY PE License No. 87392

Francis Van Cleve
Project Manager

Project No.: 2803-99-005E
September 1, 2020
Updated: December 9, 2022

REPORT OF PRELIMINARY GEOTECHNICAL INVESTIGATION

Proposed Industrial Park
Old Mill Road and Hemion Road (CR 93)
Section 55.22, Block 1, Lot 1; Village of Suffern
Rockland County, New York

TABLE OF CONTENTS

REPORT OF PRELIMINARY GEOTECHNICAL INVESTIGATION

Proposed Industrial Park
Old Mill Road and Hemion Road (CR 93)
Section 55.22, Block 1, Lot 1; Village of Suffern
Rockland County, New York

TABLE OF CONTENTS
(continued)

APPENDICES

1.0 EXECUTIVE SUMMARY

Dynamic Earth, LLC (Dynamic Earth) has completed a preliminary geotechnical investigation at the subject site. The subsurface conditions encountered as part of this investigation included existing fill material underlain by natural glacial deposits that were encountered in a relatively loose/very loose condition at various depths throughout the soil profile. **The existing fill material and loose/very loose natural soils are not suitable for direct foundation support without the risk of excessive settlement.** While overexcavation and replacement of existing fill material and relatively deeper loose/very loose materials within the foundation influence zone may technically be feasible; shored/sloped excavations and/or excavations extending below the groundwater level would likely be required. As such, we preliminarily anticipate ground improvement (such as installation of aggregate piers) will be advantageous to minimize overexcavation and replacement of unsuitable soils.

Alternatively, depending on final structural loads, installation of a deep foundation system is also considered feasible to support the proposed structures. The appropriate foundation system should be selected by the project's structural engineer following a supplemental geotechnical investigation and evaluation of the final building configuration, structural loads, and grading plans. Preliminary recommendations for feasible foundation systems are included herein.

2.0 PROJECT DETAILS

The subject site is located Old Mill Road and Hemion Road (CR93) and is further identified as Section 55.22, Block 1, Lot 1 in the Village of Suffern, Rockland County, New York. The subject site is bound to the north by New York State Thruway Route I-87; to the east by Hemion Road; to the south by a wooded area and Lafayette Avenue beyond; and to the west by a wooded area, with Union Hill Quarry beyond.

At the time of our investigation, the site was developed with an existing industrial building (former Novartis Pharmaceuticals facility) and associated pavement, utilities, landscaped areas, and wooded areas. Based on a December 17, 2021 *Overall Site Plan* prepared by Dynamic Engineering Consultants, PC, the proposed site redevelopment will include demolition of the existing structures and construction of three warehouse buildings (identified as buildings 1 through 3) and associated improvements. Building #1 will be located within the central/northern portion of the site and will occupy a footprint area of approximately 963,100 square feet; Building #2 will be located within the southwestern portion of the site and will occupy a footprint area of approximately 170,500 square feet; and Building #3 will be located within the southern portion of the site and will occupy a footprint area of approximately 88,200 square feet. Additional site improvements are expected to include new pavements, utilities, landscaping, and potential stormwater management facilities.

Conceptual site grading plans were not finalized at the time of this report, however we preliminarily anticipate earth fills will be required to achieve proposed grades for the proposed buildings.

The final structural loads have not been developed this time. Based on our experience with similar facilities, we assume that the maximum loads will be less than the following:

- Axial column loads – 180 kips;
- Wall loads – 3.0 kips per liner foot
- Floor Slab – 600 pounds per square feet
- Pavement – 300,000 Equivalent Single Axle Loads (ESAL's)

3.0 SCOPE OF SERVICES

3.1 Field Investigation

Field exploration of the project site was conducted by means of 12 soil borings (identified as Borings B-1 through B-11 and offset boring B-8A. The borings were drilled with an ATV mounted drill rig using hollow stem auger drilling techniques. The test locations are shown on the accompanying *Boring Location Plan* in the Appendix of this report.

TEST LOCATION SUMMARY

Number	Proposed Location	Final Depth (feet)
B-1	Building #1	50.0
B-2		37.0
B-3		50.0
B-4		50.0
B-5	Building #2	27.0
B-6		27.0
B-7	Building #3	42.0
B-8		22.0[1]
B-8A		37.0
B-9	Building #1	42.0
B-10		30.0
B-11		45.8

[1] Refusal

The soil borings were completed in the presence of a Dynamic Earth engineer who performed field tests, recorded visual classifications, and collected samples of the various strata encountered. The test locations were located in the field using conventional taping procedures with estimated right angles, and are presumed to be accurate within several feet of the locations plotted on the plans.

Soil borings and standard penetration tests (SPTs) were conducted in general accordance with ASTM D6151 (*Standard Practice for Using Hollow-Stem Augers for Geotechnical Exploration and Soil*

Sampling) and ASTM D1586 (*Standard Test Method for Standard Penetration Test and Split Barrel Sampling of Soils)*. The SPT resistance values (N) can be used as an indicator of the consistency of fine-grained soils and relative density of coarse-grained soils. The N-value for various soil types can be correlated with engineering behavior of soils to develop foundation and earthwork recommendations.

Groundwater level observations were recorded during and at the completion of field operations prior to backfilling the borings. Seasonal variations, temperature, anthropogenic, seasonality, soil permeability, and precipitation will influence the actual and observed groundwater levels. Groundwater elevations derived from sources other than seasonally observed groundwater monitoring wells may not be representative of true groundwater levels.

3.2 Laboratory Testing

Physical/Textural Analysis: Each sample was visually classified in general accordance with the visual-manual method (ASTM D2488). In addition, representative samples of selected strata encountered were subjected to a laboratory testing program which included moisture content determinations (ASTM D2216), Atterberg limits (ASTM D4318), and washed gradation analyses (ASTM D422) in order to perform supplementary engineering soil classifications in general accordance with ASTM D2487. The soil strata tested were classified by the Unified Soil Classification System (USCS) and results of the laboratory testing are summarized in the following table.

LABORATORY TEST RESULTS

Boring	Sample No.	Depth (feet)	Moisture Content (%)	Liquid Limit	Plasticity Index	Percent Passing No. 200 (%)	USCS Classification
B-1	S-7	15-17	20.8	Not Plastic		3.2	SP
B-2	S-4	6-8	24.5			35.3	SM
B-3	S-5	8-10	8.6			10.0	SW-SM
B-4	S-4	6-8	19.5			5.0	SP-SM
	S-8	20-22	16.5			4.0	SP
	S-13	45-47	17.8			50.3	ML
B-6	S-7	15-17	7.9			12.9	GM
B-7	S-8	20-22	16.3			3.9	SP
B-8A	S-2	30-32	14.1			19.1	SM
B-9	S-5	8-10	13.2			6.9	SW-SM
B-11	S-3	4-6	4.6			5.8	SP-SM

The engineering classifications are useful when considered in conjunction with the additional site data to estimate other properties of the soil types encountered and to predict the soil's behavior under construction and service loads.

4.0 SUMMARY OF SUBSURFACE CONDITIONS

4.1 Site Geology

The subject site is located in a region of the Piedmont Physiographic Province of New York known as the Newark Basin. The Newark Basin contains rocks of the Newark Super Group which is a stratigraphic series of Triassic to Jurassic age sedimentary rocks containing intrusive sills and dikes as well as extrusive volcanics. The formations mapped within the area of the site include the Hammer Formation which reportedly consists of conglomerate; and the Ladentown diabase and basaltic lava which reportedly consists of basalt.

The surficial deposits at the site reportedly include outwash sand and gravel (Og) consisting of coarse to fine stratified sand. Overlying materials also include manmade fill material.

4.2 Historic Aerial Imagery

Dynamic Earth perform a cursory review of available historic aerial imagery. Based on review of a historic aerial image from 1952, the subject site was apparently utilized as agricultural land. Based on a historic aerial image from 1965, Interstate I-87 had been constructed to the north of the site; and a building and parking lot had been constructed within the northern portion of the site. An historic aerial image from 1974 depicts a relatively smaller building within the western portion of the site and an apparent stormwater pond with the southern portion of the site. A historic aerial image from 1995 depicts an apparent building expansion within the central portion of the site and an access road within the southeastern portion of the site. Based on a 2002 aerial image, the structure within the western portion of the site was no longer present. The site appears relatively unchanged from 2002 to the time of our field investigation.

4.3 Subsurface Soil Profile

Details of the subsurface materials encountered are presented on the *Records of Subsurface Exploration* presented in the Appendix of this report. The subsurface soil conditions encountered in the soil borings consisted of the following generalized strata in order of increasing depth.

Surface Cover Material: Soil borings were performed within existing pavement and landscaped/undeveloped areas. Borings performed within the existing pavement encountered approximately four inches and six inches of asphaltic concrete at the surface with no apparent subbase material. Borings performed within existing landscaped/undeveloped areas encountered approximately four inches to seven inches of topsoil or three inches of gravel at the surface.

Existing Fill Material: Beneath the surface cover, existing fill material was encountered that generally consisted of sand, gravel, and silt with variable amounts of clay and debris. The debris encountered included metal, asphalt millings, and roots. The existing fill material was encountered to depths ranging between approximately two feet to ten feet below the ground surface. Standard Penetration Tests (SPT) N-values within this stratum ranged between four blows per foot (bpf) and 56 bpf.

Natural Glacial Deposits: Beneath the existing fill material, natural coastal plain deposits were encountered that generally consisted of sand (USCS: SM, SP-SM, SW-SM, and SP), silt (USCS: ML) and gravel (USCS: GP) with variable amounts of clay. The natural glacial deposits were encountered to termination/refusal depths ranging between approximately 22 feet and 50 feet below the ground surface. Refusal on a suspected boulder was encountered at one test location (B-8) at a depth of approximately 22 feet below the ground surface. Portions of this stratum were encountered in a very loose/relatively loose condition at variable depths ranging between approximately eight feet and 45 feet below the ground surface. Except where refusal of the split spoon sampler was encountered or when the weight of hammer (W.O.H.) advanced the split spoon sampler, SPT N-values ranged between three bpf and 100 bpf, and averaged approximately 23 bpf, generally indicating a medium dense condition within the coarse-grained soils.

4.4 Groundwater

Groundwater was encountered at depths ranging between approximately six feet and 20 feet below the ground surface. In addition, apparent perched water was encountered within the existing fill layer at depths ranging between approximately two feet and three feet below the ground surface. Groundwater levels are expected to fluctuate seasonally, and following significant periods of precipitation.

5.0 PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

5.1 General

The following preliminary considerations are based on the soil conditions encountered during our limited subsurface investigation for the proposed site development and are intended to provide general characteristics of the subsurface conditions for preliminary planning purposes and should not be utilized for final design of structural foundations, floor slabs, or pavements. Final recommendations pertaining to the geotechnical aspects of the site development will need to be developed from a supplemental subsurface investigation and engineering analyses of the final site development plans.

The subsurface conditions encountered as part of this investigation included existing fill material and very loose/relatively loose natural glacial deposits at various depths throughout the soil profile. **The existing fill material and loose/very loose natural soils are not suitable for direct foundation support without the risk of excessive settlement.** Depending on final site plans and structural loading conditions, overexcavation and replacement of existing fill material and loose/very loose natural deposits from below foundation influence zones may be evaluated, however, overexcavation and replacement of relatively deeper unsuitable materials will likely require shored/sloped excavations and excavations extending below the groundwater level. As such, we preliminarily anticipate ground improvement with installation of aggregate piers will be advantageous to minimize overexcavation and replacement of unsuitable soils.

Following ground improvement and/or overexcavation and replacement, we preliminarily anticipate the proposed structures may be supported on a conventional shallow foundation bearing within approved subgrade soils.

Alternatively, depending on final design loads, installation of a deep foundation system may be considered to support relatively heavily loaded structures. Preliminary recommendations for feasible foundation systems are presented below.

5.2 Preliminary Shallow Foundation Design Recommendations

Anticipated Bearing Strata: Proposed foundations are preliminarily expected to bear within existing fill material and/or relatively loose/very loose natural glacial deposits. As detailed throughout this report, these materials are not suitable for direct foundation support and will need to be improved or overexcavated and replaced below proposed foundations.

Conventional Shallow Foundations: Following ground improvement and/or overexcavation and replacement, Dynamic Earth preliminarily recommends supporting the proposed structures on conventional shallow foundations bearing within compacted structural fill material and/or approved subgrade soils. Foundations may preliminarily be designed to impart a maximum allowable bearing pressure of 3,000 pounds per square foot (psf), but a higher bearing capacity may be feasible if ground improvement with installation of aggregate piers is performed. Regardless of loading conditions, proposed foundations should be sized no less than a minimum of 24 inches for continuous wall footings and 36 inches for isolated column footings.

Ground Improvement (Aggregate Piers): As an alternative to overexcavation and replacement, ground improvement with installation of aggregate piers may be advantageous for this project. Ground improvement with aggregate pier elements is performed by driving a specialized displacement mandrel to the design bearing depth and using a rammer head to ram thin lifts of aggregate into the cavity created by the mandrel. Installation of aggregate piers allows for improvement of soils directly below proposed foundation and floor slab zones to a limited depth and the subsequent installation of a relatively standard conventional shallow foundation. While the risk of post-construction settlement for this option is higher than standard deep foundations, this option may contain a low risk of post-construction, total or differential settlement, and also would yield relatively fixed costs. A specialty contractor would be required for aggregate pier installation.

Inspection/Overexcavation Criteria: The suitability of the bearing soils along and below the footing bottoms must be verified by Dynamic Earth's geotechnical engineer prior to placing concrete, especially to confirm that unsuitable materials are removed and new fills are adequately placed and compacted. Any overexcavation to be restored with structural fill (on-site or imported) will need to extend at least one foot laterally beyond footing edges for each vertical foot of overexcavation to a depth of approximately twice the width of the footing. In areas where existing fill materials are encountered below foundation influence zones, the overexcavation may continue vertically to the bottom of the fill layer. Depending on supplemental evaluation, overexcavation and replacement may be limited to the influence zone of the proposed foundations. The bottom of overexcavations should be compacted with smooth drum rollers, walk-behind compactors, vibrating plates or plate tampers ("jumping jacks") to compact locally disturbed materials and densify underlying natural soil zones.

Unsuitable materials should be overexcavated prior to placing new fill material, where site grades are to be raised. The extent of overexcavation should be determined based on an evaluation of the final site grades, supplemental geotechnical investigation, and foundation layout plan. Furthermore, the proposed building footprint/interior column foundation locations should be located by a professional surveyor prior to performing overexcavation operations.

Settlement: Once design loading conditions have been determined, settlement associated with the proposed structures will be required as part of the final evaluation.

Frost Coverage Embedment Depth: Footings subject to frost action should be placed at least 40 inches below adjacent exterior grades or as required by the local building code to provide protection from frost penetration. Interior footings not subject to frost action (including during the period of construction) may be placed at a minimum depth of 18 inches below the slab subgrade.

5.3 Alternative Deep Foundation Considerations

Driven Pile Foundation: As an alternative to overexcavation or ground improvement, several deep foundation types are also preliminarily expected to be feasible, but common piles include driven timber or steel piles. A driven pile foundation should be designed to bear within the relatively dense underlying natural glacial deposits. Based on the relatively deep very loose/loose materials encountered, timber piles are not expected to be practical for the site due the typically limited installation depths. Driven steel piles typically provide higher axial capacity (on the order of approximately 50 tons) and allow some flexibility with installation of variable lengths, as splices may be designed for steel piles.

Due to the debris encountered, installation of driven piles may be complicated by the obstructions within the existing fill material. Therefore, pre-drilling and/or pre-excavation to remove obstructions within the existing fill material should be anticipated.

Drilled Pile Foundations: Often, drilled pile foundation systems may be a competitive alternative to driving steel pipes. These pile systems are generally installed using hydraulic powered rotary equipment and a high pressure grout is pumped into the pile during installation. Drilled piles may be advanced with a solid outer casing to prevent hole collapse (casing may be retracted following installation). Drilled piles may be designed as friction piles bearing within the relatively dense/stiff portions of the natural glacial deposits.

The feasibility and cost effectiveness of a deep pile foundation should be evaluated once the structural loads and proposed grading plans are available for this project. Dynamic Earth can provide detailed pile recommendations if required based on subsequent supplemental geotechnical investigation and development of structural loads.

5.4 Preliminary Floor Slab Recommendations

Dynamic Earth anticipates that on-site soils improved with aggregate piers and/or compacted structural fill material placed over approved natural subgrades will be suitable for support of the proposed floor slabs, provided these materials are properly evaluated, compacted and proofrolled in accordance with Sections 5.2 and 5.3 of this report. **Due to the potential variability of the existing fill material and moisture sensitive on-site soils encountered, at least partial**

overexcavation and replacement and/or subgrade stabilization should be anticipated below proposed floor slabs. Depending on construction phase evaluation, overexcavation may be limited (to a typical depth of approximately two feet) with the use of geogrid reinforcement. Any areas that become softened or disturbed as a result of wetting and/or repeated exposure to construction traffic should be removed and replaced with compacted structural fill. The properly prepared on-site soils are expected to yield a minimum subgrade modulus (k) of 125 psi/in.

If a deep foundation system is selected, a structurally reinforced floor slab should be designed to bear directly on the deep pile foundation system. Deep foundation supported slabs are achieved by either directly thickening and structurally reinforcing the slab at the deep foundation element location, or indirectly by a structurally reinforced slab on a network of deep foundation elements supported by grade beams.

A minimum four-inch layer of stone should be installed below the floor slabs to provide a capillary break. A vapor barrier beneath the floor slab is recommended. Total and post-construction settlements of floor slabs installed in accordance with the recommendations outlined in this report are preliminarily estimated to be less than one-quarter inch.

5.5 Preliminary Pavement Recommendations

The on-site soils are preliminarily expected to be suitable for support of proposed pavement provided that the risk of more frequent paving and/or increased maintenance is acceptable. If this risk is not acceptable, considerations for additional overexcavation and replacement or subgrade stabilization may be evaluated. **Due to the potential variability of the existing fill material and moisture sensitivity of the on-site soils, at least partial overexcavation and replacement and/or subgrade stabilization should be anticipated below proposed pavements.** Pavement life may benefit from using a geogrid (typically biaxial or triaxial) to provide additional subgrade reinforcement to minimize the amount of overexcavation and attempt to stabilize marginally suitable subgrade soils.

Preliminary Design Criteria: A preliminary design California Bearing Ratio (CBR) value of ten has been assigned to the anticipated properly prepared subgrade soils for pavement design purposes. Pavement section recommendations should be developed based on supplemental Geotechnical Investigation.

5.6 Preliminary Groundwater Considerations

Depending on final grading plans, groundwater levels are expected to be deeper than proposed foundation bearing depths. However, groundwater should be anticipated where overexcavation and replacement of relatively deep unsuitable materials is proposed. As such, the contractor should anticipate the need for groundwater control during construction.

While groundwater control means and methods are the responsibility of the contractor, excavations extending to depths of approximately two feet below the static groundwater elevation typically may be controlled by sump pumps and strategically placed sump pits in and adjacent to excavations for relatively small areas. Larger excavations and excavations extending deeper than two feet below groundwater may require deeper well recovery points.

Surface water runoff must be controlled and diverted away from construction areas by grading and limiting the exposure of excavations to rainfall.

5.7 Preliminary Earthwork Considerations

Demolition/Surface Cover Stripping: Prior to the start of construction, all utilities should be identified and secured. If encountered, existing structural elements, such as concrete foundations, slabs, and remnant basement walls, should be removed entirely from below proposed foundations and slabs and excavated to at least two feet below pavement subgrades. Remnant structural elements may remain in-place below these depths below pavements provided they do not interfere with future construction. Any slabs left in-place should be thoroughly fractured to promote vertical drainage in the presence of a qualified Geotechnical Engineer and should be backfilled with structural fill in accordance with the recommendations included herein.

The surface cover materials, including pavement, gravel, vegetation, and topsoil, should be removed from within, and at least five feet beyond, the limits of the proposed buildings and new pavement areas as well as any other area which will require fill placement. Removal of trees should include root mats and tree stumps.

Surface Preparation/Proofrolling: Prior to placing any fill or subbase materials to raise or restore grades to the desired building pad or pavement subgrade elevations, the existing exposed soils should be compacted to a firm and unyielding surface with several passes in two perpendicular directions with a vibratory, smooth drum roller during favorable moisture conditions. The drum roller should be operated in the static mode or a kneading “sheepsfoot” roller should be used if fine-grained soils are encountered at the subgrade elevation. The surface should then be proofrolled with a loaded tandem axle truck in the presence of Dynamic Earth to help identify soft or loose pockets which may require removal and replacement or further investigation. Dynamic Earth anticipates at least partial overexcavation if the subgrade is wetted or subjected to repeated construction traffic. Any fill or backfill should be placed and compacted in accordance with the recommendations included herein.

Subgrade Protection and Inspection: Every effort should be made to minimize disturbance of the on-site soils by construction traffic and surface runoff. Occasional layers of sand with increased silt/clay content were encountered which are considered moisture sensitive. These materials could become increasingly difficult to reuse and compact if wetted beyond the optimum moisture content. In addition, the predominantly sandy soils can dry quickly and may require wetting during hot, dry periods to attain proper compaction. Therefore, the contractor should anticipate the need for moisture conditioning. On-site materials placed as fill should be sealed on a daily basis using a smooth drum roller to promote drainage and prevent ponding of stormwater. Alternatively, imported fill material or subgrade stabilization geogrids (biaxial or triaxial) may be required to attain the desired grades and expedite earthwork operations during wet weather periods. Dynamic Earth should be retained as the Geotechnical Engineer of Record to inspect soil conditions during construction and verify the suitability of prepared foundation, floor slab and pavement subgrades for support of design loads.

Import/On-site Structural Fill Material: Soils placed as structural fill material should consist of well graded sand or gravel with a maximum particle size of three inches in diameter and less than 15 percent of material passing the number 200 sieve. These materials should be free of objectionable debris (clay clumps, organic and/or deleterious material, etc.) and within moisture contents suitable for compaction. Alternative soil types with higher percentages of silt and clay may be considered, provided that the contractor is able to achieve proper compaction and maintain suitable subgrade once the material is placed. Fine-grained soils and/or granular soils with higher percentages of silt and clay are extremely moisture sensitive and will only be suitable for reuse as structural fill material under ideal weather conditions. Materials wetted beyond the optimum moisture content; that contain oversized material or debris; or with increased amounts of objectionable debris will not be suitable for reuse as structural fill material without special handling. As such, the contractor should be responsible for importing structural fill material and/or processing on-site soils as required so that these materials are suitable for structural fill placement.

If encountered, cobbles, boulders and/or oversized debris greater than three inches in diameter will need to be separated from material to be placed as structural fill. Approved material between three to 12 inches in diameter may be crushed or individually placed in fill layers deeper than two feet below proposed subgrade levels. Care must be taken to individually seat any large particles and to compact soil around large particles with hand operated equipment to minimize the risk of void formation. The larger material should not be placed near areas of the proposed utility or planned excavation. Boulders larger than approximately 12 inches are not expected to be adequate for use as fill or backfill and should be removed from the site or crushed to an adequate size.

The on-site soils include existing fill material and natural glacial deposits. The on-site soils (above the saturated zones) are preliminary anticipated to be suitable for reuse as structural fill material, provided moisture contents are within tolerable limits to achieve compaction and

oversized and deleterious debris is separated. Portions of the on-site soil are considered moisture sensitive and will likely require moisture conditioning during a period of favorable weather or become impractical for reuse if exposed to moisture. Reuse of these materials will be contingent upon further evaluation during construction.

Compaction and Placement Requirements: Structural fill and backfill should be placed in maximum 12 inch loose lifts and compacted to 95 percent of the maximum dry density within a targeted two percent of the optimum moisture content as determined by ASTM D 1557 (Modified Proctor). Variations in moisture content may be acceptable subject to Dynamic Earth's on-site geotechnical engineer's approval if the contractor is able to achieve the necessary compaction. Dynamic Earth recommends using a minimum 20-ton smooth drum roller to compact subgrade soils beneath pavements or slabs and hand operated vibratory jumping jacks and plate compactors within confined excavations for foundations or utilities. The drum roller should be operated in the static mode or a kneading "sheepsfoot" roller should be used to compact fine-grained soils. Fill material compacted with hand operated equipment, static drum roller and/or sheepsfoot roller, may need to be placed in thinner, loose lifts and an increased number of passes may be required to achieve proper compaction.

Structural Fill Testing: Before filling operations begin, representative samples of each proposed fill material (on-site and imported) should be collected. The samples should be tested to determine the maximum dry density, optimum moisture content, natural moisture content, gradation, and plasticity of the soil. These tests are needed for quality control during compaction and also to determine if the fill material is acceptable. The placement of all fill and backfill will need to be monitored by Dynamic Earth to ensure that the specified material and lift thicknesses are properly installed. A sufficient number of in-place density tests should be performed during fill placement to ensure that the specified compaction is achieved throughout the height of the fill or backfill.

5.8 Retaining Walls and Lateral Earth Pressure Recommendations

General: While proposed retaining walls have not been identified at this time, Dynamic Earth presents the following preliminary design recommendations for potential earth retaining structures for temporary excavation support and/or loading docks.

Soil Parameters and Design Considerations: Proposed retaining walls that are free to rotate generally can be designed to resist active earth pressures. Restrained walls and retaining wall corners need to be designed to resist at-rest earth pressures. Backfill soils adjacent to retaining structures should consist of freely draining materials composed primarily of sand and gravel. The soil parameters provided below apply to properly compacted granular fill and backfill placed in a well-drained, level condition and may be used for preliminary design of retaining structures.

SUMMARY OF LATERAL EARTH PRESSURE PARAMETERS						
Stratum	**Moist Density, γ_{moist}, (pcf)**	**Internal Friction Angle, Φ (degrees)**	**Coefficient of Active Earth Pressure (K_a)**	**Coefficient of Passive Earth Pressure (K_p)**	**Coefficient of At-Rest Earth Pressure (K_o)**	**Cohesion (psf)**
Existing Fill Material[1]	115	27	0.38	2.66	0.55	0
Natural Granular Deposits	120	30	0.33	3.0	0.50	0
Import/ Compacted Granular Soil	130	32	0.31	3.25	0.47	0

[1]Should be neglected for resistance

The effect of any surcharge loads including construction equipment, traffic, proposed/existing structures and temporary and permanent stockpiles also will need to be included in earth pressure calculations. Dynamic Earth would be pleased to assist with the calculation of lateral earth pressures based on the soil parameters presented herein during the structural design phase.

Retaining walls should be designed so that the combined effect of vertical and horizontal resultant loads and overturning moment does not exceed the maximum allowable soil bearing capacity recommended in this report.

Adequate drainage of water which may collect on the backfill side of the retaining walls should be incorporated into the design and/or hydrostatic pressures should be added to the pressure calculations. A system of perforated drain pipes should be used at the base of the backfill side of the wall structure to collect and remove the water and relieve hydrostatic pressure.

Dynamic Earth recommends that granular soils be used to backfill the proposed subgrade and retaining walls. Clays and silts or soils with a fine fraction with a liquid limit exceeding 40 or a plastic index exceeding 20 should not be used as backfill. Acceptable backfill should be placed in maximum nine-inch loose lifts and compacted to 95 percent of the maximum dry density, within two percent of the optimum moisture content, as determined by ASTM D 1557 (Modified Proctor). A maximum density of 130 pounds per cubic foot should not be exceeded in order to avoid creating excessive lateral pressure on the walls during compaction operations.

Dynamic Earth recommends that backfill directly behind the walls be compacted with light, hand-held compactors. Heavy compactors and grading equipment should not be allowed to operate within a zone measured at a 45-degree angle from the base of the walls during backfilling to avoid developing excessive temporary or long-term lateral soil pressures.

Resistance to sliding should be provided by friction resistance at the base of the retaining structure foundation. For mass concrete on the natural on-site soils, a coefficient of friction against sliding of 0.35 should be used in the design of the retaining structures. Passive earth pressures at the toe of the retaining structure should be neglected in the design.

5.9 Temporary Excavations

The granular soils encountered during the investigation are consistent with Type C Soil Conditions as defined by 29 CFR Part 1926 (OSHA) which require a maximum unbraced excavation angle of 1.5:1 (horizontal: vertical). Actual conditions encountered during construction should be evaluated by a competent person (as defined by OSHA) to ensure that safe excavation methods and/or shoring and bracing requirements are implemented.

5.10 Supplemental Evaluation and Investigation

Final Design: Since these preliminary geotechnical investigation activities have been completed during the initial design phase, many critical assumptions or preliminarily details regarding assumed structural loads, existing and proposed elevations, etc. affect the geotechnical analysis. The preliminary considerations presented herein should be considered to help develop the optimum site design and grading, and Dynamic Earth should remain involved during final design. Supplemental investigation with soil test borings and standard penetration testing with specific geotechnical recommendations should be developed as the design progresses and/or to satisfy tenant specific geotechnical requirements. In addition, the subsurface conditions in presently inaccessible areas below the existing structure also should be evaluated following demolition to verify if the underlying soil conditions are consistent with the soil conditions encountered during this subsurface exploration.

Construction Monitoring and Testing: The recommendations presented herein are contingent on the owner retaining Dynamic Earth to perform inspection, testing and consultation during construction as described in previous sections of this report. **Construction phase evaluation by means of proofroll inspections, soil probes, and/or witnessing the installation of ground improvement/deep pile foundations will be needed to confirm adequate support for the proposed structures.** Monitoring and testing should also be performed to verify that suitable materials are used for controlled fill, and that they are properly placed and compacted over suitable subgrade soils. Testing of fill placement will also be critical to limiting differential settlement.

6.0 GENERAL COMMENTS AND LIMITATIONS

Supplemental recommendations will be required upon finalization of conceptual site plans or if significant changes are made in the characteristics or location of the proposed structures. Dynamic Earth should be included as a consultant to the design team and should be provided final plans for review to confirm these criteria apply or to modify recommendations as necessary.

The recommendations presented herein should be utilized by a qualified engineer in preparing preliminary design concepts and site grading. The engineer should consider these recommendations as minimum physical standards that may be superseded by local and regional building codes and structural considerations. These recommendations are prepared for the use of the client for the specific project detailed and should not be used by any third party. These recommendations are relevant to the preliminary design phase and should not be substituted for construction specifications.

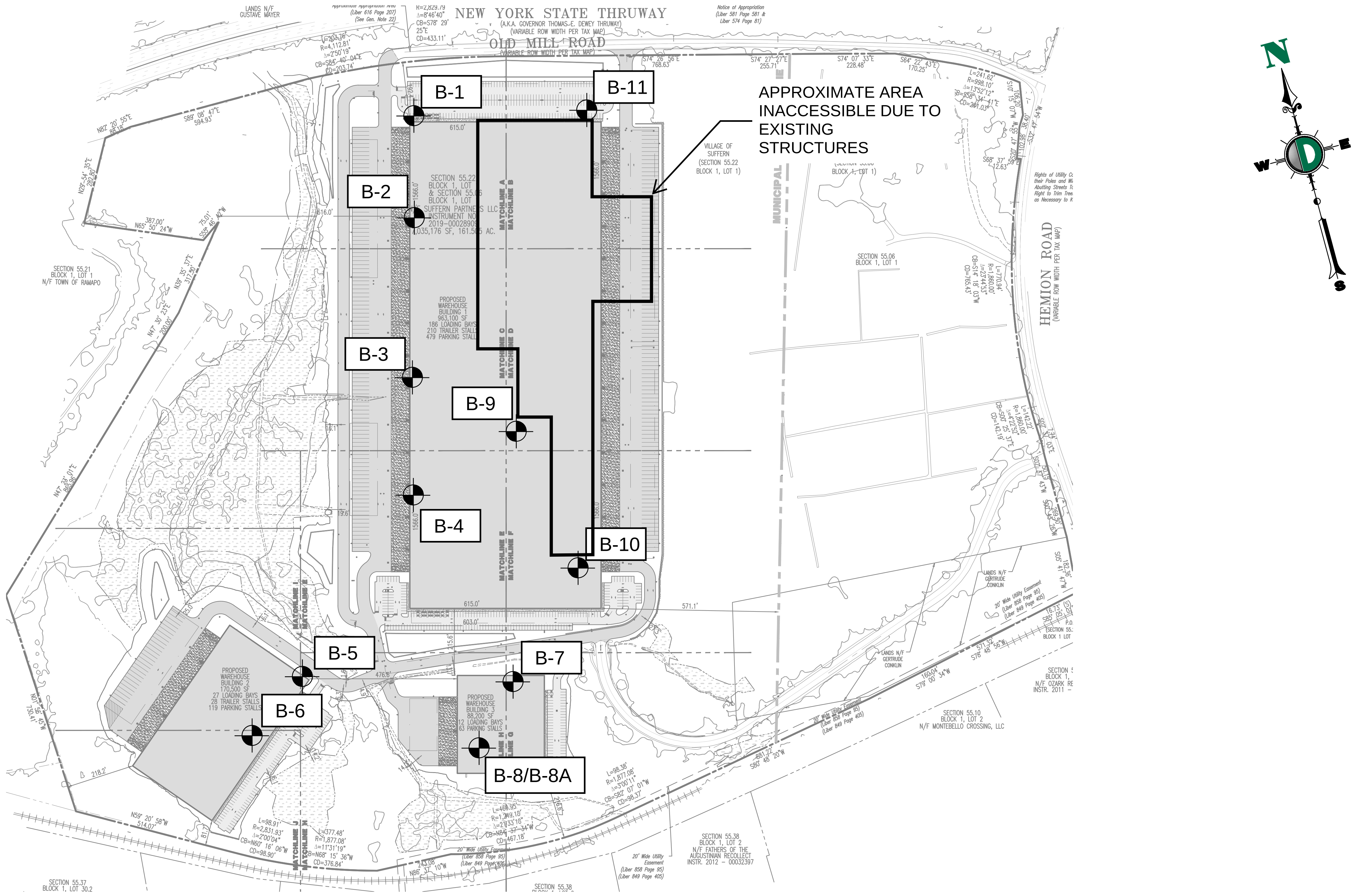
The possibility exists that conditions between test locations may differ from those at specific test pit locations, and conditions may not be as anticipated by the designers or contractors. In addition, the construction process may itself alter soil conditions. Therefore, Dynamic Earth Geotechnical Engineers or their representatives should observe and document the final construction procedures used and the conditions encountered, as well as conduct testing and inspection to ensure the design criteria are met or recommendations to address deviations are implemented.

Dynamic Earth assumes that a qualified contractor will be employed to perform the construction work, and that the contractor will be required to exercise care to ensure all excavations are performed in accordance with applicable regulations and good practice. Particular attention should be paid to avoiding damaging or undermining adjacent properties and maintaining slope stability.

The exploration and analysis of the foundation conditions reported herein are presented to form a reasonable basis for preliminary site evaluation. The recommendations submitted for the proposed construction are based on the available soil information and the preliminary design details furnished or assumed. Deviations from the noted subsurface conditions encountered during construction should be brought to the attention of the geotechnical engineer.

The geotechnical engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been promulgated after being prepared in accordance with generally accepted professional engineering practice in the fields of foundation engineering, soil mechanics, and engineering geology. No other warranties are implied or expressed.

Boring Location Plan



SCALE: N.T.S.

JOB No: 2803-99-005E

SHEET No:

1

OF 1

DRAWN BY: GS

DESIGNED BY: -

CHECKED BY: FVC

DATE: 12/06/22

TITLE:

BORING LOCATION PLAN

PROJECT: **TREETOP DEVELOPMENT, LLC**
Proposed Industrial Park
Old Mill Road and Hemion Road (CR 93)
Section 55.22 Block 1, Lot 1; Village of Suffern
Rockland County, New York

Rev. # 0

DEC Client Code: 2803

LEGEND:

B-X — APPROXIMATE LOCATION OF SOIL BORING

NOTES:
1. THIS PLAN IS NOT FOR CONSTRUCTION AND WAS PREPARED TO ILLUSTRATE TEST LOCATIONS ONLY AND MAY NOT REFLECT THE MOST CURRENT REVISION OF THE BASE PLAN.
2. THIS PLAN HAS BEEN PREPARED BASED ON A DECEMBER 17, 2021 *OVERALL SITE PLAN* BY DYNAMIC ENGINEERING CONSULTANTS, PC.

DYNAMIC EARTH, LLC
245 Main Street - Suite 110
Chester, NJ 07930
T: 908.879.7095 - F: 908.879.0222
www.dynamic-earth.com

Records of Subsurface Exploration

BOREHOLE LOG

Boring No : B-01

Page 1 of 2

Project:	Proposed Industrial Park	**Proj. No.:**	2803-99-005E
Location:	Old Mill Road and Hemion Road (CR93), Village of Suffern, Rockland County, NY	**Client:**	Treetop Development, LLC

Surface Elevation:	Not surveyed/Provided	**Date Started:**	08-12-2020
Termination Depth:	50.0 feet	**Date Completed:**	08-12-2020
Proposed Location:	Building #1	**Logged by:**	B. Hertzig
Drill/Test Method:	HSA/SPT	**Contractor:**	General Borings
Hammer Type:	Auto	**Rig Type:**	Diedrich D-50 Turbo

Groundwater Data		**Depth (ft)**	**El. (ft)**	**Additional Groundwater Data**	**Depth (ft)**	**El. (ft)**
While Drilling:	∇	7.0	--			
At Completion:	▼	7.0	--			

Sample Information

Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (mm:ss)		N
0.0-2.0	S-1	SS	8	--	33 6	6 7	12
2.0-4.0	S-2	SS	12	--	11 18	16 17	34
4.0-6.0	S-3	SS	16	--	10 12	12 15	24
6.0-8.0	S-4	SS	16	--	15 20	20 23	40
8.0-10.0	S-5	SS	16	--	16 15	17 16	32
10.0-12.0	S-6	SS	16	--	3 4	4 4	8
15.0-17.0	S-7	SS	16	--	1 3	2 2	5
20.0-22.0	S-8	SS	18	--	2 6	4 6	10

Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
	Surface Cover	4" Asphaltic concrete, with no apparent subbase material	
	FILL	Brown to gray coarse to fine sand, little silt, trace coarse to fine gravel, wet (FILL)	Perched ground water at 2ft
	Glacial Deposits	Brown coarse to fine sand, some coarse to fine gravel, little silt, moist, dense (SM)	
		Brown coarse to fine sand, little coarse to fine gravel, little silt, moist, medium dense (SM)	
5		As above, moist to wet, dense (SM)	
▼		Gray coarse to fine sand, some coarse to fine gravel, trace silt, wet, dense (SP-SM)	
10		Brown coarse to fine sand, some coarse to fine gravel, little silt, wet, loose (SM)	
15		Brown coarse to fine sand, trace silt, trace fine gravel, wet, loose (SP)	
20		Brown coarse to fine sand, little coarse to fine gravel, little silt, wet, medium dense (SM)	

BOREHOLE LOG

Boring No : B-01

Page 2 of 2

Project:	Proposed Industrial Park	**Proj. No.:**	2803-99-005E
Location:	Old Mill Road and Hemion Road (CR93), Village of Suffern, Rockland County, NY	**Client:**	Treetop Development, LLC

Surface Elevation:	Not surveyed/Provided	**Date Started:**	08-12-2020
Termination Depth:	50.0 feet	**Date Completed:**	08-12-2020
Proposed Location:	Building #1	**Logged by:**	B. Hertzig
Drill/Test Method:	HSA/SPT	**Contractor:**	General Borings
Hammer Type:	Auto	**Rig Type:**	Diedrich D-50 Turbo

Groundwater Data	**Depth (ft)**	**El. (ft)**	**Additional Groundwater Data**	**Depth (ft)**	**El. (ft)**
While Drilling: ▽	7.0	--			
At Completion: ▼	7.0	--			

Sample Information								Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (mm:ss)		N				
25.0-27.0	S-9	SS	16	--	2	4	9		Glacial Deposits	Brown fine sand, little silt, wet, loose (SM)	
					5	5					
30.0-32.0	S-10	SS	16	--	WOH	2	7	30		As above (SM)	
					5	5					
35.0-37.0	S-11	SS	14	--	6	5	11	35		Brown fine sand, little silt, wet, medium dense (SM)	
					6	8					
40.0-42.0	S-12	SS	16	--	2	3	8	40		Brown fine sand, little silt, wet, loose (SM)	
					5	8					
45.0-47.0	S-13	SS	18	--	5	5	7	45		Brown fine sand, some silt, wet, loose (SM)	
					2	5					
48.0-50.0	S-14	SS	18	--	4	5	22			As above, medium dense (SM)	
					17	14					

Boring B-01 was terminated at approximately 50.0 feet below the ground surface.

DYNAMIC EARTH

BOREHOLE LOG

Boring No : B-02

Page 1 of 2

Project:	Proposed Industrial Park	**Proj. No.:**	2803-99-005E
Location:	Old Mill Road and Hemion Road (CR93), Village of Suffern, Rockland County, NY	**Client:**	Treetop Development, LLC

Surface Elevation:	Not surveyed/Provided	**Date Started:**	08-12-2020
Termination Depth:	37.0 feet	**Date Completed:**	08-12-2020
Proposed Location:	Building #1	**Logged by:**	B. Hertzig
Drill/Test Method:	HSA/SPT	**Contractor:**	General Borings
Hammer Type:	Auto	**Rig Type:**	Diedrich D-50 Turbo

Groundwater Data	**Depth (ft)**	**El. (ft)**	**Additional Groundwater Data**	**Depth (ft)**	**El. (ft)**
While Drilling: ▽	9.0	--			
At Completion: ▼	9.0	--			

Sample Information							Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (mm:ss)	N				
0.0-2.0	S-1	SS	16	--	37 8 9 11	17		Surface Cover FILL	6" Asphaltic concrete, with no apparent subbase material Brown to gray coarse to fine sand, some silt, little coarse to fine gravel, moist (FILL)	
2.0-4.0	S-2	SS	14	--	12 13 12 11	25		Glacial Deposits	Reddish brown coarse to fine sand, some silt, trace coarse to fine gravel, moist, dense (SM)	
4.0-6.0	S-3	SS	16	--	35 12 12 13	24	5		Brown coarse to fine sand, little silt, moist, medium dense (SM)	
6.0-8.0	S-4	SS	18	--	11 13 14 12	27			Orange to brown coarse to fine sand, and silt, moist, medium dense (SM)	Possible mottling at 7.5 ft
8.0-10.0	S-5	SS	18	--	9 8 7 8	15	▼		Brown coarse to fine sand, little silt, moist to wet, medium dense (SM)	
10.0-12.0	S-6	SS	14	--	3 2 7 7	9	10		Brown coarse to fine sand, little silt, wet, loose (SM)	
15.0-17.0	S-7	SS	19	--	3 3 6 8	9	15		As above (SM)	
20.0-22.0	S-8	SS	16	--	4 3 2 5	5	20		As above (SM)	

DYNAMIC EARTH

BOREHOLE LOG

Boring No : B-02

Page 2 of 2

Project:	Proposed Industrial Park	**Proj. No.:**	2803-99-005E
Location:	Old Mill Road and Hemion Road (CR93), Village of Suffern, Rockland County, NY	**Client:**	Treetop Development, LLC

Surface Elevation:	Not surveyed/Provided	**Date Started:**	08-12-2020
Termination Depth:	37.0 feet	**Date Completed:**	08-12-2020
Proposed Location:	Building #1	**Logged by:**	B. Hertzig
Drill/Test Method:	HSA/SPT	**Contractor:**	General Borings
Hammer Type:	Auto	**Rig Type:**	Diedrich D-50 Turbo

Groundwater Data	**Depth (ft)**	**El. (ft)**	**Additional Groundwater Data**	**Depth (ft)**	**El. (ft)**
While Drilling: ▽	9.0	--			
At Completion: ▼	9.0	--			

Sample Information										
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (mm:ss)	N	Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
25.0-27.0	S-9	SS	18	--	2, 4 6, 10	10		Glacial Deposits	Brown fine sand, little silt, wet, medium dense (SM)	
30.0-32.0	S-10	SS	18	--	3, 5 11, 9	16	30		Brown coarse to fine sand, some silt, trace coarse to fine gravel, wet, medium dense (SM)	
35.0-37.0	S-11	SS	18	--	2, 8 11, 9	19	35		Brown coarse to fine sand, little coarse to fine gravel, little silt, wet, medium dense (SM)	
									Boring B-02 was terminated at approximately 37.0 feet below the ground surface.	
							40			
							45			

DYNAMIC EARTH

BOREHOLE LOG

Boring No : B-03

Page 1 of 2

Project: Proposed Industrial Park **Proj. No.:** 2803-99-005E

Location: Old Mill Road and Hemion Road (CR93), Village of Suffern, Rockland County, NY **Client:** Treetop Development, LLC

Surface Elevation:	Not surveyed/Provided	**Date Started:**	08-12-2020	**Groundwater Data**	**Depth (ft)**	**El. (ft)**	**Additional Groundwater Data**	**Depth (ft)**	**El. (ft)**
Termination Depth:	50.0 feet	**Date Completed:**	08-13-2020						
Proposed Location:	Building #1	**Logged by:**	B. Hertzig	**While Drilling:** ∇	9.0	--			
Drill/Test Method:	HSA/SPT	**Contractor:**	General Borings	**At Completion:** ▼	9.0	--			
Hammer Type:	Auto	**Rig Type:**	Diedrich D-50 Turbo						

Sample Information								Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (mm:ss)		N				
0.0-2.0	S-1	SS	14	--	7 12	12 12	24		Surface Cover	4" Topsoil Brown coarse to fine sand, some silt, little coarse to fine gravel, moist (FILL)	
2.0-4.0	S-2	SS	16	--	8 16	15 14	31			As above (FILL)	
4.0-6.0	S-3	SS	10	--	6 4	4 2	8	5	FILL	Brown coarse to fine sand, some silt, trace fine gravel, moist (FILL)	
6.0-8.0	S-4	SS	12	--	3 3	1 2	4			Brown coarse to fine sand, some silt, trace fine gravel, trace debris (concrete) moist (FILL)	
8.0-10.0	S-5	SS	14	--	2 4	2 6	6	▼		Reddish brown coarse to fine sand, little fine gravel, trace silt, moist to wet, loose (SW-SM)	
10.0-12.0	S-6	SS	8	--	6 9	7 11	16	10		Brown coarse to fine sand, little silt, little coarse to fine gravel, wet, medium dense (SM)	
15.0-17.0	S-7	SS	14	--	1 4	2 4	6	15	Glacial Deposits	Reddish brown coarse to fine sand, little coarse to fine gravel, little silt, wet, loose (SM)	
20.0-22.0	S-8	SS	18	--	4 10	7 9	17	20		Reddish brown coarse to fine sand, some coarse to fine gravel, little silt, wet, medium dense (SM)	

BOREHOLE LOG

Boring No : B-03

Page 2 of 2

Project:	Proposed Industrial Park	**Proj. No.:**	2803-99-005E
Location:	Old Mill Road and Hemion Road (CR93), Village of Suffern, Rockland County, NY	**Client:**	Treetop Development, LLC

Surface Elevation:	Not surveyed/Provided	**Date Started:**	08-12-2020
Termination Depth:	50.0 feet	**Date Completed:**	08-13-2020
Proposed Location:	Building #1	**Logged by:**	B. Hertzig
Drill/Test Method:	HSA/SPT	**Contractor:**	General Borings
Hammer Type:	Auto	**Rig Type:**	Diedrich D-50 Turbo

Groundwater Data	**Depth (ft)**	**El. (ft)**	**Additional Groundwater Data**	**Depth (ft)**	**El. (ft)**
While Drilling: ▽	9.0	--			
At Completion: ▼	9.0	--			

Sample Information										
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (mm:ss)	N	Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
25.0-27.0	S-9	SS	16	--	2 3 4 4	7		Glacial Deposits	Brown coarse to fine sand, little coarse to fine gravel, little silt, wet, loose (SM)	
30.0-32.0	S-10	SS	16	--	4 3 5 5	8	30		Reddish brown coarse to fine sand, little coarse to fine gravel, little silt, wet, loose (SM)	
35.0-37.0	S-11	SS	18	--	4 3 5 12	8	35		Brown coarse to fine sand, little silt, wet, loose (SM)	
40.0-42.0	S-12	SS	14	--	2 1 2 7	3	40		As above, very loose (SM)	
45.0-47.0	S-13	SS	18	--	5 7 13 15	20	45		Brown medium to fine sand, little silt, wet, medium dense (SM)	
48.0-50.0	S-14	SS	16	--	13 9 3 11	12			Brown medium to fine sand, some silt, wet, medium dense (SM)	

Boring B-03 was terminated at approximately 50.0 feet below the ground surface.

DYNAMIC EARTH

BOREHOLE LOG

Boring No : B-04

Page 1 of 2

Project:	Proposed Industrial Park	**Proj. No.:**	2803-99-005E
Location:	Old Mill Road and Hemion Road (CR93), Village of Suffern, Rockland County, NY	**Client:**	Treetop Development, LLC

Surface Elevation:	Not surveyed/Provided	**Date Started:**	08-13-2020
Termination Depth:	50.0 feet	**Date Completed:**	08-13-2020
Proposed Location:	Building #1	**Logged by:**	B. Hertzig
Drill/Test Method:	HSA/SPT	**Contractor:**	General Borings
Hammer Type:	Auto	**Rig Type:**	Diedrich D-50 Turbo

Groundwater Data	**Depth (ft)**	**El. (ft)**	**Additional Groundwater Data**	**Depth (ft)**	**El. (ft)**
While Drilling: ∇	6.0	--			
At Completion: ▼	6.0	--			

Sample Information								Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (mm:ss)		N				
0.0-2.0	S-1	SS	14	--	4 17	12 11	29		Surface Cover FILL	5" Topsoil Brown coarse to fine sand, and coarse to fine gravel, little silt, moist (FILL)	
2.0-4.0	S-2	SS	14	--	10 7	10 10	17			Light orangish brown coarse to fine sand, little silt, little coarse to fine gravel, moist (FILL)	
4.0-6.0	S-3	SS	12	--	11 7	7 12	14	5 ▼	Glacial Deposits	Brown coarse to fine sand, little coarse to fine gravel, little silt, moist, medium dense (SM)	
6.0-8.0	S-4	SS	16	--	11 6	10 7	16			Brown coarse to fine sand, little fine gravel, trace silt, wet, medium dense (SP-SM)	
8.0-10.0	S-5	SS	10	--	6 12	12 12	24			Brown coarse to fine gravel, trace coarse to fine sand, trace silt, wet, medium dense (GP)	
10.0-12.0	S-6	SS	10	--	6 2	4 4	6	10		Brown coarse to fine sand, some coarse to fine gravel, little silt, wet, loose (SM)	
15.0-17.0	S-7	SS	14	--	1 5	1 8	6	15		Brown coarse to fine sand, some coarse to fine gravel, little silt, wet, loose (SM)	
20.0-22.0	S-8	SS	14	--	4 2	2 3	4	20		Brown coarse to fine sand, little fine gravel, trace silt , wet, loose (SP)	

DYNAMIC EARTH

BOREHOLE LOG

Boring No : B-04

Page 2 of 2

Project:	Proposed Industrial Park	**Proj. No.:**	2803-99-005E
Location:	Old Mill Road and Hemion Road (CR93), Village of Suffern, Rockland County, NY	**Client:**	Treetop Development, LLC

Surface Elevation:	Not surveyed/Provided	**Date Started:**	08-13-2020
Termination Depth:	50.0 feet	**Date Completed:**	08-13-2020
Proposed Location:	Building #1	**Logged by:**	B. Hertzig
Drill/Test Method:	HSA/SPT	**Contractor:**	General Borings
Hammer Type:	Auto	**Rig Type:**	Diedrich D-50 Turbo

Groundwater Data	**Depth (ft)**	**El. (ft)**	**Additional Groundwater Data**	**Depth (ft)**	**El. (ft)**
While Drilling: ▽	6.0	--			
At Completion: ▼	6.0	--			

Sample Information							Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (mm:ss)	N				
25.0-27.0	S-9	SS	16	--	5 5 5 5	10		Glacial Deposits	Brown coarse to fine sand, little fine gravel, little silt, wet,medium dense (SM)	
30.0-32.0	S-10	SS	16	--	3 4 3 4	7	30		Orangish brown coarse to fine sand, some coarse to fine gravel, little silt, wet, loose (SM)	
35.0-37.0	S-11	SS	14	--	8 5 5 6	10	35		Brown coarse to fine sand, little silt, wet, medium dense (SM)	
40.0-42.0	S-12	SS	14	--	2 2 2 3	4	40		As above, very loose (SM)	
45.0-47.0	S-13	SS	16	--	5 8 8 9	16	45		Brown silt and coarse to fine sand, wet, stiff (ML)	
48.0-50.0	S-14	SS	18	--	6 4 7 7	11			Brown medium to fine sand, some silt, wet, medium dense (SM)	

Boring B-04 was terminated at approximately 50.0 feet below the ground surface.

BOREHOLE LOG

Boring No : B-05

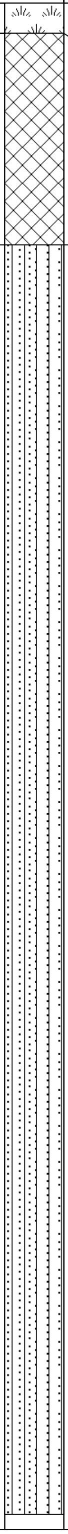
Page 1 of 2

Project:	Proposed Industrial Park	**Proj. No.:**	2803-99-005E
Location:	Old Mill Road and Hemion Road (CR93), Village of Suffern, Rockland County, NY	**Client:**	Treetop Development, LLC

Surface Elevation:	Not surveyed/Provided	**Date Started:**	08-13-2020
Termination Depth:	27.0 feet	**Date Completed:**	08-14-2020
Proposed Location:	Building #4	**Logged by:**	B. Hertzig
Drill/Test Method:	HSA/SPT	**Contractor:**	General Borings
Hammer Type:	Auto	**Rig Type:**	Diedrich D-50 Turbo

Groundwater Data	**Depth (ft)**	**El. (ft)**	**Additional Groundwater Data**	**Depth (ft)**	**El. (ft)**
While Drilling: ▽	17.0	--			
At Completion: ▼	17.0	--			

Sample Information											
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (mm:ss)		N	Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
0.0-2.0	S-1	SS	16	--	6 23	24 30	47		Surface Cover FILL	7" Topsoil Gray to brown coarse to fine sand, some coarse to fine gravel, little silt, trace debris (asphalt millings), moist (FILL)	
2.0-4.0	S-2	SS	16	--	13 25	31 17	56			As above (FILL)	
4.0-6.0	S-3	SS	18	--	6 7	5 6	12	5		Dark reddish brown coarse to fine sand, some silt, trace fine gravel, moist, medium dense (SM)	
6.0-8.0	S-4	SS	18	--	9 15	15 19	30			As above, dense (SM)	
8.0-10.0	S-5	SS	18	--	34 26	37 25	63			As above, very dense (SM)	
10.0-12.0	S-6	SS	18	--	13 21	11 21	32	10		Brown and reddish brown coarse to fine sand, some silt, little coarse to fine gravel, moist, medium dense (SM)	
									Glacial Deposits		
15.0-17.0	S-7	SS	18	--	11 20	18 24	38	15		Dark reddish brown coarse to fine sand, some silt, little coarse to fine gravel, moist to wet, dense (SM)	
								▼			
20.0-22.0	S-8	SS	16	--	19 29	23 30	52	20		Brown coarse to fine sand, some silt, little coarse to fine gravel, wet, very dense (SM)	



BOREHOLE LOG

Boring No : B-05

Page 2 of 2

Project: Proposed Industrial Park **Proj. No.:** 2803-99-005E

Location: Old Mill Road and Hemion Road (CR93), Village of Suffern, Rockland County, NY **Client:** Treetop Development, LLC

Surface Elevation:	Not surveyed/Provided	**Date Started:**	08-13-2020
Termination Depth:	27.0 feet	**Date Completed:**	08-14-2020
Proposed Location:	Building #4	**Logged by:**	B. Hertzig
Drill/Test Method:	HSA/SPT	**Contractor:**	General Borings
Hammer Type:	Auto	**Rig Type:**	Diedrich D-50 Turbo

Groundwater Data	**Depth (ft)**	**El. (ft)**	**Additional Groundwater Data**	**Depth (ft)**	**El. (ft)**
While Drilling: ▽	17.0	--			
At Completion: ▼	17.0	--			

Sample Information								Depth (ft)	Strata		DESCRIPTION OF MATERIALS (Classification)	Remarks
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (mm:ss)		N					
25.0-27.0	S-9	SS	16	--	20 45	45 49	90		Glacial Deposits	▨	As above (SM)	
								30 35 40 45			Boring B-05 was terminated at approximately 27.0 feet below the ground surface.	

BOREHOLE LOG

Boring No : B-06

Page 1 of 2

Project:	Proposed Industrial Park	**Proj. No.:**	2803-99-005E
Location:	Old Mill Road and Hemion Road (CR93), Village of Suffern, Rockland County, NY	**Client:**	Treetop Development, LLC

Surface Elevation:	Not surveyed/Provided	**Date Started:**	08-14-2020
Termination Depth:	27.0 feet	**Date Completed:**	08-14-2020
Proposed Location:	Building #4	**Logged by:**	B. Hertzig
Drill/Test Method:	HSA/SPT	**Contractor:**	General Borings
Hammer Type:	Auto	**Rig Type:**	Diedrich D-50 Turbo

Groundwater Data	**Depth (ft)**	**El. (ft)**	**Additional Groundwater Data**	**Depth (ft)**	**El. (ft)**
While Drilling: ▽	20.0	--			
At Completion: ▼	20.0	--			

Sample Information							Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (mm:ss)	N				
0.0-2.0	S-1	SS	16	--	4 12 17 18	29		Surface Cover FILL	4" Topsoil Brown coarse to fine sand, some silt, little coarse to fine gravel, moist (FILL)	
2.0-4.0	S-2	SS	18	--	20 22 23 12	45		FILL	As above (FILL)	
4.0-6.0	S-3	SS	16	--	9 7 4 6	11	5	FILL	Gray coarse to fine sand, some silt, trace coarse to fine gravel, moist (FILL)	
6.0-8.0	S-4	SS	14	--	4 2 3 3	5		FILL	As above (FILL)	
8.0-10.0	S-5	SS	14	--	3 5 4 16	9		FILL	Grayish brown coarse to fine sand, some silt, trace coarse to fine gravel, moist (FILL)	
10.0-11.7	S-6	SS	18	--	27 40 60 50/2	100	10	Glacial Deposits	Reddish brown coarse to fine gravel, some coarse to fine sand, little silt, moist, very dense (GM)	Boulder at 10.5ft
								Glacial Deposits		
15.0-17.0	S-7	SS	14	--	21 49 43 37	92	15	Glacial Deposits	Brown coarse to fine gravel and coarse to fine sand, little silt, moist, very dense (GM)	
								Glacial Deposits		
20.0- 20.8	S-8	SS	8	--	47 50/3 -- --	50/3	▼20	Glacial Deposits	As above, wet (SM)	
								Glacial Deposits		

DYNAMIC EARTH

BOREHOLE LOG

Boring No : B-06

Project:	Proposed Industrial Park	**Proj. No.:**	2803-99-005E
Location:	Old Mill Road and Hemion Road (CR93), Village of Suffern, Rockland County, NY	**Client:**	Treetop Development, LLC

Surface Elevation:	Not surveyed/Provided	**Date Started:**	08-14-2020
Termination Depth:	27.0 feet	**Date Completed:**	08-14-2020
Proposed Location:	Building #4	**Logged by:**	B. Hertzig
Drill/Test Method:	HSA/SPT	**Contractor:**	General Borings
Hammer Type:	Auto	**Rig Type:**	Diedrich D-50 Turbo

Groundwater Data		**Depth (ft)**	**El. (ft)**	**Additional Groundwater Data**	**Depth (ft)**	**El. (ft)**
While Drilling:	∇	20.0	--			
At Completion:	▼	20.0	--			

Sample Information								Depth (ft)	Strata		DESCRIPTION OF MATERIALS (Classification)	Remarks
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (mm:ss)		N					
25.0-27.0	S-9	SS	8	--	60 45	45 49	90		Glacial Deposits	▨	As above (SM)	
											Boring B-06 was terminaed at approximately 27.0 feet below the ground surface.	
								30				
								35				
								40				
								45				

BOREHOLE LOG

Boring No : B-07

Page 1 of 2

Project: Proposed Industrial Park
Proj. No.: 2803-99-005E

Location: Old Mill Road and Hemion Road (CR93), Village of Suffern, Rockland County, NY
Client: Treetop Development, LLC

Surface Elevation:	Not surveyed/Provided	**Date Started:**	08-14-2020
Termination Depth:	42.0 feet	**Date Completed:**	08-14-2020
Proposed Location:	Building #3	**Logged by:**	B. Hertzig
Drill/Test Method:	HSA/SPT	**Contractor:**	General Borings
Hammer Type:	Auto	**Rig Type:**	Diedrich D-50 Turbo

Groundwater Data	**Depth (ft)**	**El. (ft)**	**Additional Groundwater Data**	**Depth (ft)**	**El. (ft)**
While Drilling: ∇	10.0	--			
At Completion: ▼	10.0	--			

Sample Information								Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (mm:ss)		N				
0.0-2.0	S-1	SS	14	--	9 17	6 11	23		Surface Cover FILL	3" Gravel Dark gray coarse to fine sand, some silt, some coarse to fine gravel, trace roots, moist (FILL)	
2.0-4.0	S-2	SS	8	--	5 5	13 6	18			As above (FILL)	
4.0-6.0	S-3	SS	16	--	13 14	18 15	32	5		As above (FILL) Brown coarse to fine sand, little coarse to fine gravel, little silt, moist, dense (SM)	
6.0-8.0	S-4	SS	4	--	18 15	15 15	30			As above (SM)	
8.0-10.0	S-5	SS	8	--	14 8	8 9	16			Brown coarse to fine sand, some coarse to fine gravel, little silt, moist to wet, medium dense (SM)	
10.0-12.0	S-6	SS	6	--	8 9	6 6	15	▼ 10		Brown coarse to fine sand, some coarse to fine gravel, little silt, wet, medium dense (SM)	
15.0-17.0	S-7	SS	18	--	3 8	7 16	15	15	Glacial Deposits	Brown coarse to fine sand, some coarse to fine gravel, little silt, wet, medium dense (SM)	
20.0-22.0	S-8	SS	18	--	5 3	3 5	6	20		Brown coarse to fine sand, trace silt, wet, loose (SP)	

BOREHOLE LOG

Boring No : B-07

Project:	Proposed Industrial Park	**Proj. No.:**	2803-99-005E
Location:	Old Mill Road and Hemion Road (CR93), Village of Suffern, Rockland County, NY	**Client:**	Treetop Development, LLC

Surface Elevation:	Not surveyed/Provided	**Date Started:**	08-14-2020
Termination Depth:	42.0 feet	**Date Completed:**	08-14-2020
Proposed Location:	Building #3	**Logged by:**	B. Hertzig
Drill/Test Method:	HSA/SPT	**Contractor:**	General Borings
Hammer Type:	Auto	**Rig Type:**	Diedrich D-50 Turbo

Groundwater Data	**Depth (ft)**	**El. (ft)**	**Additional Groundwater Data**	**Depth (ft)**	**El. (ft)**
While Drilling: ▽	10.0	--			
At Completion: ▼	10.0	--			

Sample Information							Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (mm:ss)	N				
25.0-27.0	S-9	SS	0	--	7 4 3 4	7		Glacial Deposits	No recovery	
30.0-32.0	S-10	SS	18	--	33 12 14 12	26	30		Brown coarse to fine sand, some silt, wet, medium dense (SM)	
35.0-37.0	S-11	SS	18	--	8 9 13 20	22	35		Brown coarse to fine sand, and silt, wet, medium dense (SM)	
40.0-42.0	S-12	SS	18	--	13 11 9 10	20	40		Brown coarse to fine sand, some silt, wet, medium dense (SM)	
							45		Boring B-07 encountered refusal at approximately 42 feet below the ground surface.	

BOREHOLE LOG

Boring No : B-08

Page 1 of 1

Project: Proposed Industrial Park **Proj. No.:** 2803-99-005E

Location: Old Mill Road and Hemion Road (CR93), Village of Suffern, Rockland County, NY **Client:** Treetop Development, LLC

Surface Elevation: Not surveyed/Provided
Termination Depth: 22.0 feet
Proposed Location: Building #3
Drill/Test Method: HSA/SPT
Hammer Type: Auto

Date Started: 08-17-2020
Date Completed: 08-17-2020
Logged by: B. Hertzig
Contractor: General Borings
Rig Type: Diedrich D-50 Turbo

Groundwater Data	Depth (ft)	El. (ft)	Additional Groundwater Data	Depth (ft)	El. (ft)
While Drilling: ▽	8.0	--			
At Completion: ▼	8.0	--			

Sample Information							Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (mm:ss)	N				
0.0-2.0	S-1	SS	16	--	56 7 3 3	10		Surface Cover FILL	5" Asphaltic concrete Brown coarse to fine sand, some silt, little coarse to fine gravel, moist (FILL) Dark gray coarse to fine sand, some silt, moist (FILL)	
2.0-4.0	S-2	SS	18	--	5 4 7 13	11		Glacial Deposits	Light brown coarse to fine sand, little silt, moist, medium dense (SM)	
4.0-6.0	S-3	SS	18	--	11 14 13 19	27	5		Brown coarse to fine sand, some silt, little coarse to fine gravel, moist, medium dense (SM)	
6.0-8.0	S-4	SS	18	--	11 10 15 15	25	▼		Brown coarse to fine sand, little coarse to fine gravel, little silt, moist, medium dense (SM)	
8.0-10.0	S-5	SS	14	--	10 13 35 21	48			Brown coarse to fine sand, some coarse to fine gravel, little silt, wet, dense (SM)	
10.0-12.0	S-6	SS	4	--	9 9 7 10	16	10		Reddish brown coarse to fine sand, little silt, little coarse to fine gravel, wet, medium dense (SM)	
15.0-17.0	S-7	SS	0	--	16 11 9 7	20	15		No recovery	Gravel stuck in cone
20.0-22.0	S-8	SS	18	--	5 3 6 11	9	20		Brown coarse to fine gravel, little coarse to fine gravel, trace silt, wet, loose (GP)	Boring Boring B-08 encountered refusal due to suspected boulder causing augers to bend
									Boring B-08 encountered refusal at approximately 22.0 feet below the ground surface and was offset to B-08A	

BOREHOLE LOG

Boring No : B-08A

Page 1 of 2

Project:	Proposed Industrial Park	**Proj. No.:**	2803-99-005E
Location:	Old Mill Road and Hemion Road (CR93), Village of Suffern, Rockland County, NY	**Client:**	Treetop Development, LLC

Surface Elevation:	Not surveyed/Provided	**Date Started:**	08-17-2020	**Groundwater Data**	**Depth (ft)**	**El. (ft)**	**Additional Groundwater Data**	**Depth (ft)**	**El. (ft)**
Termination Depth:	37.0 feet	**Date Completed:**	08-17-2020						
Proposed Location:	Building #3	**Logged by:**	B. Hertzig	**While Drilling:** ▽	8.0	--			
Drill/Test Method:	HSA/SPT	**Contractor:**	General Borings	**At Completion:** ▼	8.0	--			
Hammer Type:	Auto	**Rig Type:**	Diedrich D-50 Turbo						

Sample Information										
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (mm:ss)	N	Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
0 - 25	--	--	--	--	--	--		Surface Cover	5" Asphaltic Concrete	Offset approximately 5 feet north of B-8 and augered directly to 25 feet
								FILL	Similar to B-8 from auger cuttings	
							5 ▼ 10 15	Glacial Deposits	Similar to B-8 from auger cuttings	
							20		Similar to B-8 from auger cuttings	

DYNAMIC EARTH

BOREHOLE LOG

Boring No : B-08A

Page 2 of 2

Project: Proposed Industrial Park
Proj. No.: 2803-99-005E

Location: Old Mill Road and Hemion Road (CR93), Village of Suffern, Rockland County, NY
Client: Treetop Development, LLC

Surface Elevation:	Not surveyed/Provided	**Date Started:**	08-17-2020
Termination Depth:	37.0 feet	**Date Completed:**	08-17-2020
Proposed Location:	Building #3	**Logged by:**	B. Hertzig
Drill/Test Method:	HSA/SPT	**Contractor:**	General Borings
Hammer Type:	Auto	**Rig Type:**	Diedrich D-50 Turbo

Groundwater Data	**Depth (ft)**	**El. (ft)**	**Additional Groundwater Data**	**Depth (ft)**	**El. (ft)**
While Drilling: ▽	8.0	--			
At Completion: ▼	8.0	--			

Sample Information										
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (mm:ss)	N	Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
25.0-27.0	S-1	SS	6	--	3 16 16 22	32		Glacial Deposits	Brown coarse to fine sand, some silt, little fine gravel, wet, dense (SM)	
30.0-32.0	S-2	SS	18	--	6 10 13 23	23	30		Brown coarse to fine sand, little silt, little fine gravel, wet, medium dense (SM)	
35.0-37.0	S-3	SS	18	--	6 9 16 26	25	35		Brown coarse to fine sand, little silt, trace fine gravel, wet, medium dense (SM)	
									Boring B-08 was terminated at approximately 37.0 feet below the ground surface.	
							40			
							45			

BOREHOLE LOG

Boring No : B-09

Page 1 of 2

Project:	Proposed Industrial Park	**Proj. No.:**	2803-99-005E
Location:	Old Mill Road and Hemion Road (CR93), Village of Suffern, Rockland County, NY	**Client:**	Treetop Development, LLC

Surface Elevation:	Not surveyed/Provided	**Date Started:**	08-14-2020
Termination Depth:	42.0 feet	**Date Completed:**	08-14-2020
Proposed Location:	Building #1	**Logged by:**	B. Hertzig
Drill/Test Method:	HSA/SPT	**Contractor:**	General Borings
Hammer Type:	Auto	**Rig Type:**	Diedrich D-50 Turbo

Groundwater Data	Depth (ft)	El. (ft)	Additional Groundwater Data	Depth (ft)	El. (ft)
While Drilling: ▽	8.0	--			
At Completion: ▼	8.0	--			

Sample Information							
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (mm:ss)		N
0.0-2.0	S-1	SS	16	--	33 14	13 13	27
2.0-4.0	S-2	SS	14	--	7 11	5 16	16
4.0-6.0	S-3	SS	14	--	7 16	11 24	27
6.0-8.0	S-4	SS	10	--	14 8	10 50	18
8.0-10.0	S-5	SS	12	--	14 5	7 5	12
10.0-12.0	S-6	SS	4	--	6 14	13 9	27
15.0-17.0	S-7	SS	2	--	22 17	11 21	28
20.0-22.0	S-8	SS	0	--	7 3	3 11	6

Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
	Surface Cover	5" Asphaltic concrete, no apparent subbase	
	FILL	Gray coarse to fine gravel, and coarse to fine sand, trace silt, moist (FILL)	
		Gray silt, little coarse to fine sand, little coarse to fine gravel, trace silt, moist (FILL)	
5		Brown coarse to fine sand, some silt, little coarse to fine gravel, moist (FILL)	
	Glacial Deposits	Reddish brown coarse to fine sand, some silt, little coarse to fine gravel, moist, medium dense (SM)	
▼		Light brown coarse to fine sand, some coarse to fine gravel, trace silt, wet, medium dense (SW-SM)	
10		Light brown coarse to fine gravel, little coarse to fine gravel, trace silt, wet, medium dense (GP)	Gravel stuck in cone
15		Brown coarse to fine sand, little silt, wet, medium dense (SM)	Very easy drilling from 17-18 ft
20		No recovery	

DYNAMIC EARTH

BOREHOLE LOG

Boring No : B-09

Page 2 of 2

Project: Proposed Industrial Park

Proj. No.: 2803-99-005E

Location: Old Mill Road and Hemion Road (CR93), Village of Suffern, Rockland County, NY

Client: Treetop Development, LLC

Surface Elevation:	Not surveyed/Provided	**Date Started:**	08-14-2020
Termination Depth:	42.0 feet	**Date Completed:**	08-14-2020
Proposed Location:	Building #1	**Logged by:**	B. Hertzig
Drill/Test Method:	HSA/SPT	**Contractor:**	General Borings
Hammer Type:	Auto	**Rig Type:**	Diedrich D-50 Turbo

Groundwater Data	**Depth (ft)**	**El. (ft)**	**Additional Groundwater Data**	**Depth (ft)**	**El. (ft)**
While Drilling: ▽	8.0	--			
At Completion: ▼	8.0	--			

Sample Information										
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (mm:ss)	N	Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
25.0-27.0	S-9	SS	8	--	5 4 3 6	7		Glacial Deposits	Brown coarse to fine sand, some coarse to fine gravel, little silt, wet, loose (SM)	
30.0-32.0	S-10	SS	12	--	6 4 6 9	10	30		Brown coarse to fine sand, little coarse to fine gravel, little silt, wet, medium dense (SM)	
35.0-37.0	S-11	SS	2	--	7 6 11 24	17	35		As above (SM)	
40.0-42.0	S-12	SS	8	--	7 5 5 6	10	40		Brown coarse to fine sand, some silt, wet, medium dense (SM)	
									Boring B-09 was terminated at approximately 42 feet below the ground surface.	
							45			

BOREHOLE LOG

Boring No : B-10

Project: Proposed Industrial Park **Proj. No.:** 2803-99-005E

Location: Old Mill Road and Hemion Road (CR93), Village of Suffern, Rockland County, NY **Client:** Treetop Development, LLC

Surface Elevation:	Not surveyed/Provided	**Date Started:**	08-18-2020
Termination Depth:	30.0 feet	**Date Completed:**	08-18-2020
Proposed Location:	Building #1	**Logged by:**	B. Hertzig
Drill/Test Method:	HSA/SPT	**Contractor:**	General Borings
Hammer Type:	Auto	**Rig Type:**	Diedrich D-50 Turbo

Groundwater Data	**Depth (ft)**	**El. (ft)**	**Additional Groundwater Data**	**Depth (ft)**	**El. (ft)**
While Drilling: ▽	10.0	--			
At Completion: ▼	10.0	--			

Sample Information										
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (mm:ss)	N	Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
0.0-2.0	S-1	SS	16	--	8 6 8 9	14		Surface Cover FILL	5" Asphaltic concrete, no apparent subbase Gray coarse to fine sand, little silt, trace coarse to fine gravel, moist (FILL)	
2.0-4.0	S-2	SS	10	--	7 9 27 14	36			Brown coarse to fine sand, little silt, trace coarse to fine gravel, wet (FILL)	Perched ground water at 3ft
4.0-6.0	S-3	SS	8	--	33 19 10 34	29	5	Glacial Deposits	Brown coarse to fine sand, little coarse to fine gravel, little silt, moist, medium dense (SM)	
6.0-8.0	S-4	SS	14	--	46 17 22 17	39			As above, dense (SM)	Hard drilling from 5-10 ft
8.0-10.0	S-5	SS	12	--	17 36 43 43	79			As above, very dense (SM)	
10.0-12.0	S-6	SS	10	--	26 21 25 24	56	▼ 10		Brown coarse to fine sand, some coarse to fine gravel, little silt, wet, very dense (SM)	
										Hard drilling from 10-15 ft
15.0-17.0	S-7	SS	16	--	13 10 9 12	19	15		Brown coarse to fine sand, little coarse to fine gravel, little silt, wet, medium dense (SM)	
20.0-22.0	S-8	SS	16	--	13 7 7 9	14	20		Brown coarse to fine sand, some coarse to fine gravel, little silt, wet, medium dense(SM)	

BOREHOLE LOG

Boring No : B-10

Page 2 of 2

Project: Proposed Industrial Park **Proj. No.:** 2803-99-005E

Location: Old Mill Road and Hemion Road (CR93), Village of Suffern, Rockland County, NY **Client:** Treetop Development, LLC

Surface Elevation:	Not surveyed/Provided	**Date Started:**	08-18-2020
Termination Depth:	30.0 feet	**Date Completed:**	08-18-2020
Proposed Location:	Building #1	**Logged by:**	B. Hertzig
Drill/Test Method:	HSA/SPT	**Contractor:**	General Borings
Hammer Type:	Auto	**Rig Type:**	Diedrich D-50 Turbo

Groundwater Data	**Depth (ft)**	**El. (ft)**	**Additional Groundwater Data**	**Depth (ft)**	**El. (ft)**
While Drilling: ▽	10.0	--			
At Completion: ▼	10.0	--			

Sample Information								Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (mm:ss)		N				
25.0- 25.7	S-9	SS	6	--	13	50/2	50/2		Glacial Deposits	As above, very dense (SM)	Hard drilling from 26-28 ft
					--	--					
28.0-30.0	S-10	SS	10	--	21	20	43			As above (SM)	
					23	25					
								30		Boring B-10 was terminated at approximately 30.0 feet below the ground surface.	
								35			
								40			
								45			

DYNAMIC EARTH

BOREHOLE LOG

Boring No : B-11

Project: Proposed Industrial Park **Proj. No.:** 2803-99-005E

Location: Old Mill Road and Hemion Road (CR93), Village of Suffern, Rockland County, NY **Client:** Treetop Development, LLC

Surface Elevation:	Not surveyed/Provided	**Date Started:**	08-18-2020
Termination Depth:	45.8 feet	**Date Completed:**	08-18-2020
Proposed Location:	Building #1	**Logged by:**	B. Hertzig
Drill/Test Method:	HSA/SPT	**Contractor:**	General Borings
Hammer Type:	Auto	**Rig Type:**	Diedrich D-50 Turbo

Groundwater Data	**Depth (ft)**	**El. (ft)**	**Additional Groundwater Data**	**Depth (ft)**	**El. (ft)**
While Drilling: ▽	11.5	--			
At Completion: ▼	11.5	--			

Sample Information							Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (mm:ss)	N				
0.0-2.0	S-1	SS	12	--	4 4 12 7	16		Surface Cover	4" Topsoil Brown coarse to fine sand, little coarse to fine gravel, little silt, moist, medium dense (SM)	
2.0-4.0	S-2	SS	18	--	20 24 20 24	44			As above, dense (SM)	
4.0-6.0	S-3	SS	18	--	10 11 15 13	26	5		Brown coarse to fine sand, trace fine gravel, trace silt, moist, medium dense (SP-SM)	
6.0-8.0	S-4	SS	18	--	11 9 7 9	16			As above (SP-SM)	
8.0-10.0	S-5	SS	18	--	6 7 7 7	14			As above (SP-SM)	
10.0-12.0	S-6	SS	18	--	5 7 5 6	12	10 ▼		Brown coarse to fine sand, little fine gravel, little silt, moist to wet, medium dense (SM)	
								Glacial Deposits		
15.0-17.0	S-7	SS	18	--	3 3 2 4	5	15		Brown coarse to fine sand, little silt, wet, loose (SM)	
20.0-22.0	S-8	SS	16	--	5 5 6 8	11	20		Brown medium to fine sand, some silt, wet, medium dense (SM)	

BOREHOLE LOG

Project:	Proposed Industrial Park	**Proj. No.:**	2803-99-005E
Location:	Old Mill Road and Hemion Road (CR93), Village of Suffern, Rockland County, NY	**Client:**	Treetop Development, LLC

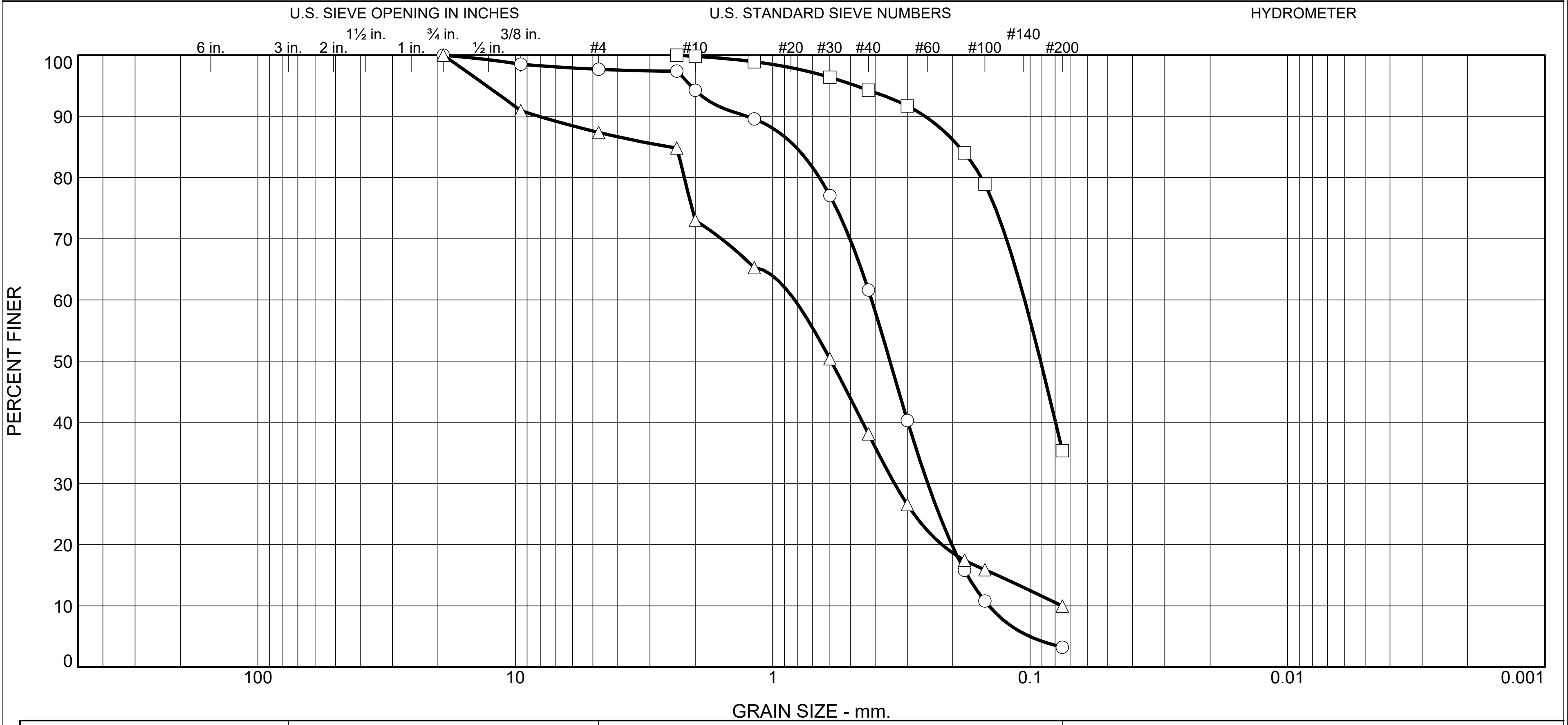
Surface Elevation:	Not surveyed/Provided	**Date Started:**	08-18-2020
Termination Depth:	45.8 feet	**Date Completed:**	08-18-2020
Proposed Location:	Building #1	**Logged by:**	B. Hertzig
Drill/Test Method:	HSA/SPT	**Contractor:**	General Borings
Hammer Type:	Auto	**Rig Type:**	Diedrich D-50 Turbo

Groundwater Data	**Depth (ft)**	**El. (ft)**	**Additional Groundwater Data**	**Depth (ft)**	**El. (ft)**
While Drilling: ▽	11.5	--			
At Completion: ▼	11.5	--			

Sample Information											
Depth (Feet)	Number	Type	Rec (in)	RQD %	Blows per 6" or drill time (mm:ss)		N	Depth (ft)	Strata	DESCRIPTION OF MATERIALS (Classification)	Remarks
25.0-27.0	S-9	SS	18	--	7 11	9 12	20			As above (SM)	
30.0-32.0	S-10	SS	18	--	WOH WOH	WOH 5	WOH	30		Brown coarse to fine sand, little silt, trace fine gravel, wet, very loose (SM)	
35.0-37.0	S-11	SS	16	--	6 7	12 17	19	35	Glacial Deposits	Brown coarse to fine sand, and silt, trace coarse to fine gravel, wet, medium dense (SM)	
40.0-42.0	S-12	SS	14	--	21 36	25 32	61	40		Brown coarse to fine sand, some silt, little coarse to fine gravel, wet, very dense (SM)	
45.0-45.8	S-13	SS	8	--	55 --	50/3 --	50/3	45		Brown coarse to fine sand, little coarse to fine gravel, little silt, wet, very dense (SM)	
										Boring B-11 was terminated at approximately 45.8 feet below the ground surface.	

Laboratory Test Results

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	2.3	3.4	32.7	58.4	3.2
□	0.0	0.0	0.0	0.2	5.5	59.0	35.3
△	0.0	0.0	12.6	14.4	34.9	28.1	10.0

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	B-1	S-7	15'-17'	8/12/2020	SP	Brown coarse to fine sand, trace silt, trace fine gravel	20.8	NV	NP
□	B-2	S-4	6'-8'	8/12/2020	SM	Orange to brown coarse to fine sand and silt	24.5	NV	NP
△	B-3	S-5	8'-10'	8/12/2020	SW-SM	Orangish brown coarse to fine sand, little fine gravel, trace silt	8.6	NV	NP

Client Treetop Development, LLC

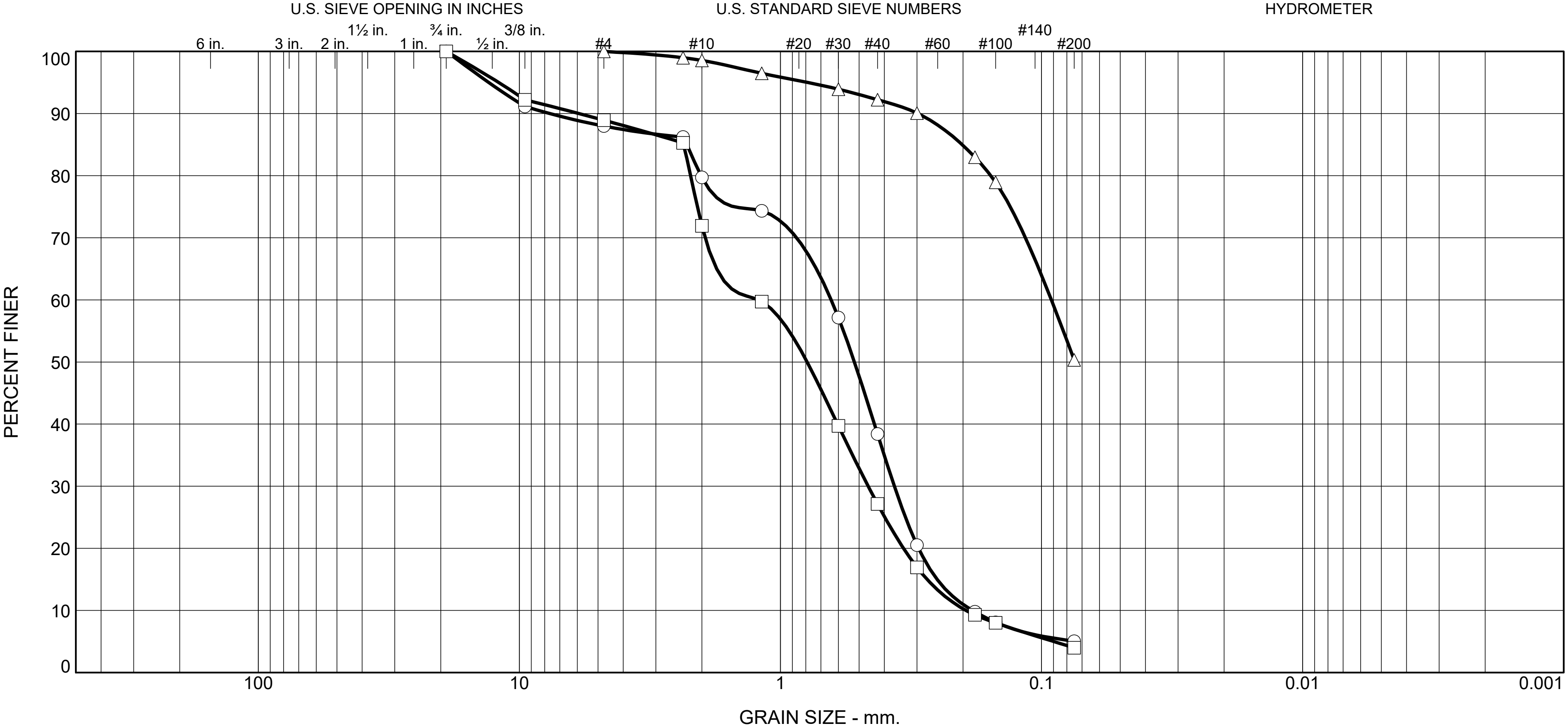
Project Proposed Warehouse

Road and Hemion Road (CR93), Suffern, NY

Project No. 2803-99-005E Figure 1

DYNAMIC EARTH

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	12.0	8.3	41.3	33.4	5.0
□	0.0	0.0	11.1	17.0	44.8	23.1	4.0
△	0.0	0.0	0.0	1.4	6.4	41.9	50.3

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	B-4	S-4	6'-8'	8/13/2020	SP-SM	Brown coarse to fine sand, little fine gravel, trace silt	19.5	NV	NP
□	B-4	S-8	20'-22'	8/13/2020	SP	Brown coarse to fine sand, little fine gravel, trace silt	16.5	NV	NP
△	B-4	S-13	45'-47'	8/13/2020	ML	Brown silt and coarse to fine sand	17.8	NV	NP

Client Treetop Development, LLC

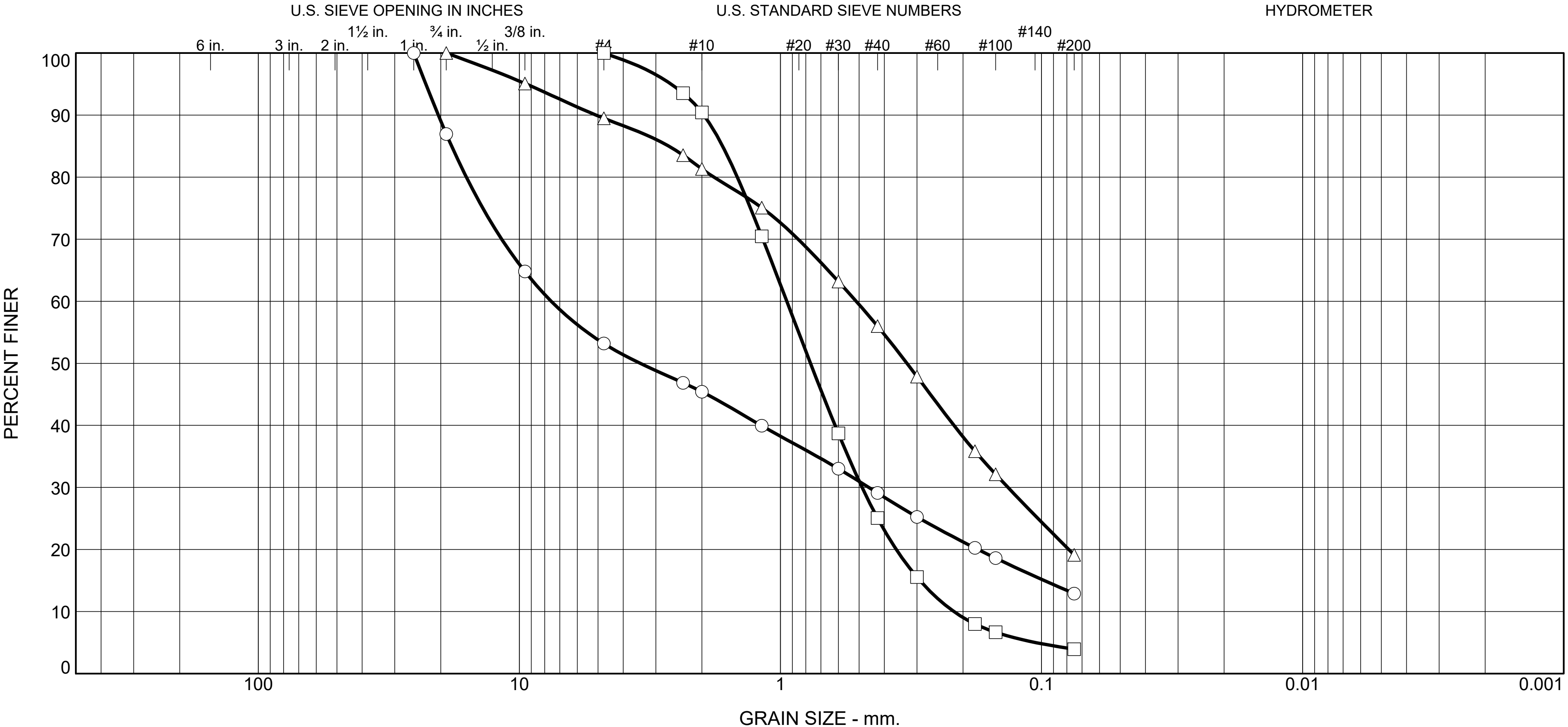
Project Proposed Warehouse

Road and Hemion Road (CR93), Suffern, NY

Project No. 2803-99-005E Figure 2

DYNAMIC EARTH

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	13.1	33.7	7.8	16.3	16.2	12.9
□	0.0	0.0	0.0	9.6	65.3	21.2	3.9
△	0.0	0.0	10.5	8.2	25.3	36.9	19.1

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	B-6	S-7	15'-17'	8/14/2020	GM	Brown coarse to fine gravel and coarse to fine sand, little silt	7.9	NV	NP
□	B-7	S-8	20'-22'	8/14/2020	SP	Brown coarse to fine sand, trace silt	16.3	NV	NP
△	B-8A	S-2	30'-32'	8/17/2020	SM	Brown coarse to fine sand, litte silt, little fine gravel	14.1	NV	NP

Client Treetop Development, LLC

Project Proposed Warehouse

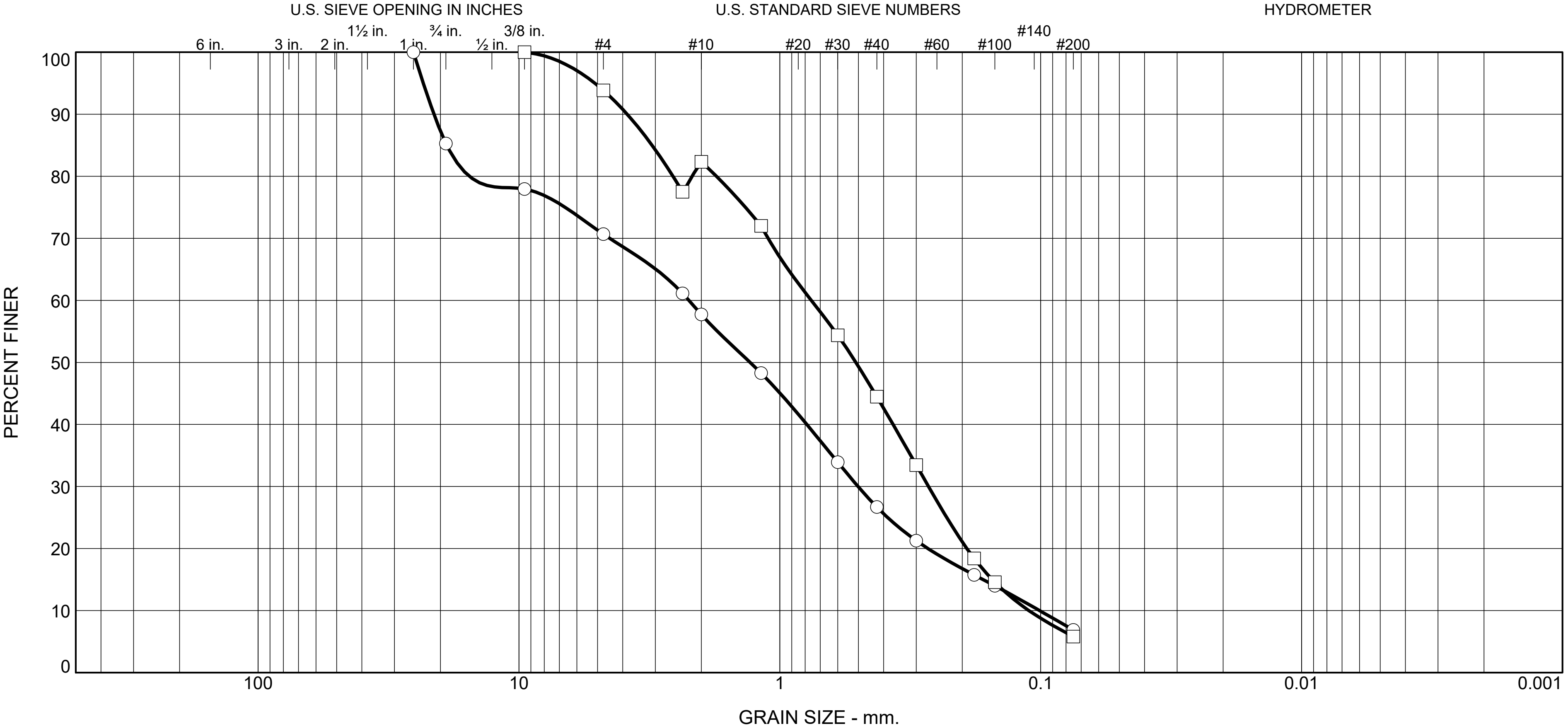
Road and Hemion Road (CR93), Suffern, NY

Project No. 2803-99-005E

Figure 3

DYNAMIC
EARTH

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	14.7	14.6	13.0	31.0	19.8	6.9
☐	0.0	0.0	6.1	11.6	37.8	38.7	5.8

	Source	Sample #	Depth/Elev.	Date Sampled	USCS	Material Description	NM %	LL	PL
○	B-9	S-5	8'-10'	8/14/2020	SW-SM	Light brown c-f sand, some c-f gravel, trace silt	13.2	NV	NP
☐	B-11	S-3	4'-6'	8/18/2020	SP-SM	Brown coarse to fine sand, trace fine gravel, trace silt	4.6	NV	NP

Client Treetop Development, LLC

Project Proposed Warehouse

Road and Hemion Road (CR93), Suffern, NY

Project No. 2803-99-005E Figure 4

DYNAMIC EARTH

Geotechnical Terms and Symbols

DYNAMIC EARTH

245 Main Street; Suite 110
Chester, NJ 07930
908-879-7095: Fax 908-879-0222

GEOTECHNICAL TERMS AND SYMBOLS

SAMPLE IDENTIFICATION

The Unified Soil Classification System is used to identify the soil unless otherwise noted.

SOIL PROPERTY SYMBOLS

N: Standard Penetration Value: Blows per ft. or a 140 lb. hammer falling 30” on a 2” O.D. split-spoon.
Qu: Unconfined compressive strength, TSF.
Qp: Penetrometer value, unconfined compressive strength, TSF.
Mc: Moisture content, %
LL: Liquid limit, %
PI: Plasiticity index, %
δd: Natural dry density, PCF.
▼: Apparent groundwater level at time noted after completion of boring.
=

DRILLING AND SAMPLING SYMBOLS

NE: Not Encountered (Groundwater was not encountered)
SS: Split-Spoon – 1⅜” I.D., 2” O.D., except where noted
ST: Shelby Tube – 3” O.D., except where noted
AU: Auger Sample
OB: Diamond Bit
CB: Carbide Bit
WS: Washed Sample

RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

Term (Non-Cohesive Soils)	Standard Penetration Resistance
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Over 50

Term (Cohesive Soils)	Qu (TSF)
Very Soft	0-0.25
Soft	0.25-0.50
Firm (Medium)	0.50-1.00
Stiff	1.00-2.00
Very Stiff	2.00-4.00
Hard	4.00 +

PARTICLE SIZE

Boulders	8 in. +	Coarse Sand	5mm-0.6mm	Silt	0.074mm-0.005mm
Cobbles	8 in. – 3 in.	Medium Sand	0.6mm-0.2mm	Clay	- 0.005mm
Gravel	3 in. – 5mm	Fine Sand	0.2mm – 0.074mm		

USCS Standard Classification System

UNIFIED SOIL CLASSIFICATION SYSTEM - ASTM D2488

MAJOR DIVISION			GROUP SYMBOL	LETTER SYMBOL	GROUP NAME
COARSE GRAINED SOILS CONTAINS MORE THAN 50% FINES	**GRAVEL AND GRAVELLY SOILS** MORE THAN 50% OF COARSE FRACTION <u>RETAINED</u> ON NO. 4 SIEVE	GRAVEL WITH <u>* 5% FINES</u>	●	GW	Well-graded GRAVEL
			○	GP	Poorly graded GRAVEL
		GRAVEL WITH BETWEEN 5% AND 15% FINES	●▥	GW-GM	Well-graded GRAVEL with silt
			●▨	GW-GC	Well-graded GRAVEL with clay
			○▥	GP-GM	Poorly graded GRAVEL with silt
			○▨	GP-GC	Poorly graded GRAVEL with clay
		GRAVEL WITH ≥ 15% FINES	○▥	GM	Silty GRAVEL
			○▨	GC	Clayey GRAVEL
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION <u>PASSING</u> ON NO. 4 SIEVE	SAND WITH <u>* 5% FINES</u>	⁙	SW	Well-graded SAND
			░	SP	Poorly graded SAND
		SAND WITH BETWEEN 5% AND 15% FINES	⁙▥	SW-SM	Well-graded SAND with silt
			⁙▨	SW-SC	Well-graded SAND with clay
			░▥	SP-SM	Poorly graded SAND with silt
			░▨	SP-SC	Poorly graded SAND with clay
		SAND WITH ≥ 15% FINES	░▥	SM	Silty SAND
			▨	SC	Clayey SAND
FINE GRAINED SOILS CONTAINS MORE THAN 50% FINES	SILT AND CLAY	LIQUID LIMIT <u>LESS</u> THAN 50	▥	ML	Inorganic SILT with low plasticity
			▨	CL	Lean inorganic CLAY with low plasticity
			☰	OL	Organic SILT with low plasticity
		LIQUID LIMIT <u>GREATER</u> THAN 50	▥	MH	Elastic inorganic SILT with moderate to high plasticity
			▨	CH	Fat inorganic CLAY with moderate to high plasticity
			≈	OH	Organic SILT or CLAY with moderate to high plasticity
HIGHLY ORGANIC SOILS			ψ	PT	PEAT soils with high organic contents

NOTES:

1) Sample descriptions are based on visual field and laboratory observations using classification methods of ASTM D2488. Where laboratory data are available, classifications are in accordance with ASTM D2487.

2) Solid lines between soil descriptions indicate change in interpreted geologic unit. Dashed lines indicate stratigraphic change within the unit.

3) Fines are material passing the U.S. Std. #200 Sieve.

STORMWATER BASIN AREA INVESTIGATION REPORT

PROPOSED INDUSTRIAL PARK
Old Mill Road and Hemion Road (CR 93)
Section 55.22, Block 1, Lot 1; Village of Suffern
Rockland County, New York

Prepared for:

TREETOP DEVELOPMENT, LLC
500 Frank W Burr Boulevard # 47
Teaneck, NJ 07666

Prepared by:

DYNAMIC
EARTH

245 Main Street, Suite 110
Chester, New Jersey 07930

P. Granitzki

Patrick J. Granitzki, P.E.
Principal
NY PE License No. 99342

Francis Van Cleve

Francis Van Cleve
Principal

Project No.: 2803-99-005E
January 7, 2022
Updated: December 9, 2022

STORMWATER BASIN AREA INVESTIGATION REPORT
Proposed Industrial Park
Old Mill Road and Hemion Road (CR 93)
Section 55.22, Block 1, Lot 1; Village of Suffern
Rockland County, New York

APPENDICES

Test Location Plan
Records of Subsurface Exploration
NRCS - USDA Custom Soil Resource Report for Rockland County, New York
Infiltration Test Results

1.0 PROJECT DESCRIPTION

Dynamic Earth, LLC (Dynamic Earth) has completed a subsurface investigation for the proposed stormwater management facilities located at Old Mill Road and Hemion Road (CR93) in the Village of Suffern, Rockland County, New York. The subject site is further identified as Section 55.22, Block 1, Lot 1. The subject site is shown on the *Test Location Plan* included in the Appendix of this report.

At the time of our investigation, the site was developed with an existing industrial building (former Novartis Pharmaceuticals facility) with associated pavement, utilities, landscaped areas, and wooded areas. Based on a December 17, 2021 *Overall Site Plan* prepared by Dynamic Engineering Consultants, PC (Dynamic), the proposed overall site redevelopment will include demolition of the existing structures and construction of three warehouse buildings with associated new pavements, utilities, and landscaping. Conceptual site grading plans were not finalized at the time of this report; however, we preliminarily anticipate earth fills will be required to achieve proposed grades throughout the majority of the site; and earth cuts will likely be required within the eastern and southern portions of the site.

Topographic information was provided on an August 16, 2021 *ALTA/NSPS Land Title Survey* prepared by Dynamic Survey, LLC. Existing site elevations range between approximately 365 feet within the southern portion of the site and 300 feet within the northern portion of the site. Elevations provided in this report are referenced to the 1988 North American Vertical Datum (NAVD88), unless otherwise noted.

The subject site is bound to the north by Old Mill Road and New York State Thruway Route I-87; to the east by Hemion Road; to the south by a wooded area with Lafayette Avenue beyond; and to the west by a wooded area, with Union Hill Quarry beyond.

Dynamic Earth previously completed a subsurface investigation at the site and the results were provided in a September 1, 2020 *Report of Preliminary Geotechnical Investigation*.

2.0 SCOPE OF SERVICES

Dynamic Earth's scope of services pertaining to this report included evaluating the subsurface conditions at soil profile pit locations to estimate the apparent seasonal high groundwater level and performing in-situ infiltration testing at corresponding soil profile pit locations. Twenty-nine soil profile pits (identified as SPP-101 through SPP-129) were excavated at the site using a rubber-tire backhoe; and 29 infiltration tests (identified as IT-1 through IT-29) were performed at corresponding offset soil profile pit locations. Test locations were located within the area of potential stormwater management facilities and were backfilled to the surface with excavated soils at completion. The test locations are shown on the attached *Test Location Plan* in the Appendix of this report.

The soils encountered within the area of the proposed/anticipated stormwater management areas were classified using the United States Department of Agriculture (USDA) Classification System. Observations were made for groundwater and/or soil mottling and mineral deposits potentially indicative of zones of saturation or seasonal high groundwater.

In-situ infiltration testing was performed at soil profile pit locations in general accordance with the January *New York State Stormwater Management Design Manual 2015 – Appendix D: Infiltration Testing*. Detailed results of the infiltration testing are included herein.

3.0 UNITED STATES DEPARTMENT OF AGRICULTURE (USDA) SOIL SURVEY

Based on a review of the United States Department of Agriculture – Natural Resources Conservation Services (USDA-NRCS) soil survey, the following soil resources are mapped within the area of the proposed site improvements and are described below:

Holyoke-Rock outcrop complex, hilly (HoD): This soil series is mapped underlying the northwestern portion of the subject site. The typical soil profile (as detailed in the survey) consists of slightly decomposed plant material to a depth of two inches; silt loam to a depth of 18 inches; underlain by unweathered bedrock to a depth of 28 inches below the ground surface. The depth to the water table is reported to be more than 80 inches below the natural ground surface (limit of report).

Wethersfield gravelly silt loam, 15 to 25 percent slopes (WeD): This soil series is mapped underlying a relatively small area within the southeastern portion of the site. The typical soil profile (as detailed in the survey) consists of gravelly silt loam to a depth of 13 inches; gravelly loam to a depth of 22 inches; underlain by gravelly fine sandy loam to a depth of 60 inches below the natural ground surface. The depth to the water table is reported to be about 18 to 30 inches below the natural ground surface.

Wethersfield gravelly silt loam, 3 to 8 percent slopes (WeB): This soil series is mapped underlying the southern portion of the site. The typical soil profile is generally similar to WeD, as detailed above.
Urban Land (Ux): This soil series is mapped underlying the northern/central portions of the site. The subsurface profile is not detailed in the survey.

Udorthents, Smoothed (Us): Urban Land is mapped underlying the central/southern portions of the site. The typical soil profile (as detailed in the survey) consists of channery loam to a depth of 20 inches; underlain by very gravelly loam to a depth of 70 inches below the natural ground surface. The depth to the water table is reported to be about 36 to 72 inches below the natural ground surface (limit of report).

Pits, gravel (Pt): This soil series is mapped underlying a relatively small area within the western portion of the site. The typical soil profile (as detailed in the survey) consists of very gravelly sand to a depth of 6 inches; underlain by very gravelly coarse sand to a depth of 60 inches below the natural ground surface. The depth to the water table is not reported in the survey.

Water (W): Water is mapped underlying a relatively small area within the central/southeastern portion of the site (within the area of the existing wet pond).

4.0 RESULTS

4.1 Subsurface Soil Profile

The soil profile pits were performed within accessible areas of the site and encountered approximately eight to 16 inches of topsoil at the surface. Beneath the surface cover, existing fill material was occasionally encountered that consisted of loamy sand with variable amounts of debris (brick). The existing fill material was encountered to depths ranging between approximately 2.2 feet and 4.5 feet below the ground surface; corresponding to elevations ranging between 308.3 feet and 301.5 feet. Beneath the existing fill material (where encountered), natural glacial deposits were encountered that generally consisted of sand, loamy sand, sandy loam, loam, and silty clay loam with variable amounts of gravel and cobbles. The natural glacial deposits were encountered to termination/refusal depths typically ranging up to approximately three feet to 15 feet below the ground surface; corresponding to elevations ranging between 314.2 feet and 292.0 feet.

4.2 Seasonal High Groundwater and Infiltration

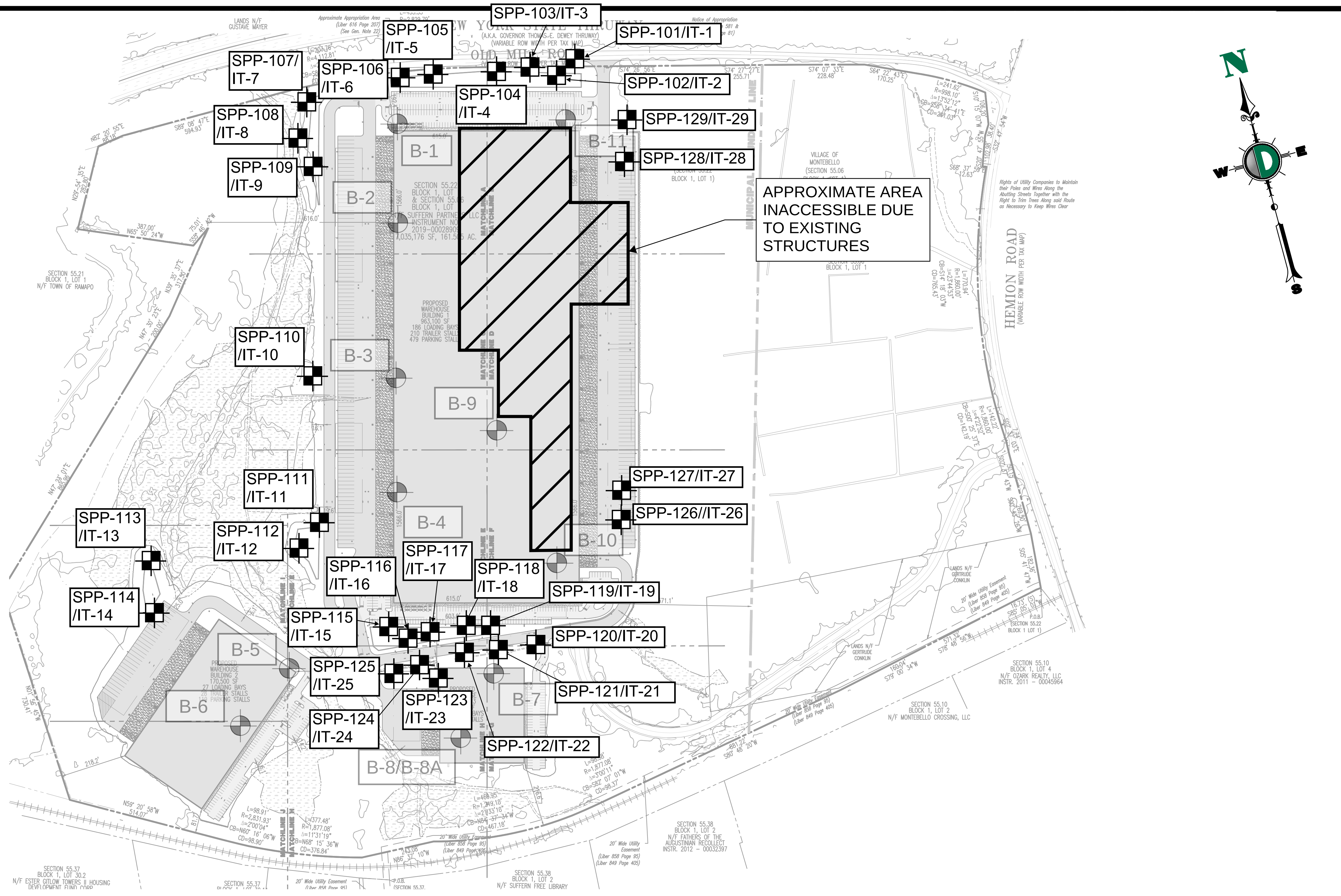
Indicators of seasonal high groundwater (i.e. soil mottling) were observed within the soil profile pit at depths ranging between approximately one foot and 5.4 feet below the ground surface; corresponding to elevations ranging between 309.0 feet and 299.7 feet. Groundwater was encountered within the soil profile pits at depths ranging between approximately 0.5 feet and 8.6 feet below the ground surface; corresponding to elevations ranging between 308.5 feet and 297.0 feet. Groundwater was encountered as part of our previous preliminary geotechnical investigation at depths ranging between approximately six feet and 20.0 feet below the ground surface.

A summary of the soil mottling, groundwater levels, and infiltration test results is presented in the table below. A summary of the seasonal high groundwater levels and infiltration test results is presented in the following table:

MOTTLING, GROUNDWATER AND INFILTRATION SUMMARY							
Location	Approximate Surface Elevation	Mottling		Groundwater		Infiltration Testing	
		Depth (Feet)	Elevation (Feet)	Depth (Feet)	Elevation (Feet)	Depth (inches)	Rate (inches/hour)
SPP-101	310.0	5.0	305.0	7.5	302.5	48	24.0
SPP-102	308.0	2.2	305.8	6.7	301.3	31	24.0
SPP-103	306.0	4.5	301.5	5.9	300.1	36	24.0
SPP-104	307.0	5.4	301.6	8.6	298.4	36	12.0
SPP-105	307.0	3.7	303.3	6.8	300.2	50	12.0
SPP-106	306.0	3.3	302.7	6.8	299.2	42	18.0
SPP-107	304.0	3.7	300.3	4.3	299.7	10	8.0
SPP-108	302.0	NE[1]	--	4.6	297.4	24	5.0
SPP-109	302.5	2.8	299.7	5.0	297.5	24	8.0
SPP-110	303.0	2.8	300.2	5.0	298.0	19	4.0
SPP-111	305.0	1.3	303.7	4.0	301.0	18	5.0
SPP-112	306.5	1.0	305.5	4.4	302.1	12	5.0
SPP-113	302.0	NE[1]	--	5.0	297.0	36	15.0
SPP-114	304.5	NE[1]	--	6.3	298.2	36	18.0
SPP-115	308.0	NE[1]	--	7.0	301.0	36	15.0
SPP-116	310.0	2.1	307.9	5.8	304.2	24	19.0
SPP-117	310.0	NE[1]	--	7.0	303.0	36	5.0
SPP-118	312.0	NE[1]	--	8.0	304.0	36	24.0
SPP-119	309.0	NE[1]	--	0.5	308.5	12	5.0
SPP-120	313.0	NE[1]	--	6.0	307.0	36	10.0
SPP-121	311.0	4.0	307.0	8.3	302.7	36	15.0
SPP-122	310.0	NE[1]	--	7.3	302.7	36	19.0
SPP-123	311.0	3.3	307.7	6.4	304.6	30	15.0
SPP-124	307.0	NE[1]	--	7.1	299.9	48	12.0
SPP-125	307.0	NE[1]	--	6.0	301.0	30	11.0
SPP-126	317.0	NE[1]	--	NE	--	36	24.0
SPP-127	315.0	NE[1]	--	NE	--	30	24.0
SPP-128	312.5	3.5	309.0	6.5	306.0	36	24.0
SPP-129	308.0	NE[1]	--	NE	--	36	24.0

[1] Since mottling was not encountered, the depth to the seasonal high groundwater can be estimated based on the published soil series and/or through direct readings during the wet season.

Test Location Plan



SCALE: N.T.S.

JOB No: 2803-99-005E

SHEET No: **1** OF 1

DRAWN BY: GS

DESIGNED BY: -

CHECKED BY: FVC

DATE: 12/06/2022

TITLE:

TEST LOCATION PLAN

PROJECT: **TREETOP DEVELOPMENT, LLC**
Proposed Industrial Park
Old Mill Road and Hemion Road (CR 93)
Section 55.22 Block 1, Lot 1; Village of Suffern
Rockland County, New York

Rev. # 0

DEC Client Code: 2803

LEGEND:

B-X APPROXIMATE LOCATION OF SOIL BORING (AUGUST 2020)

SPP-X/IT-X APPROXIMATE LOCATION OF SOIL PROFILE PIT AND INFILTRATION TEST

NOTES:
1. THIS PLAN IS NOT FOR CONSTRUCTION AND WAS PREPARED TO ILLUSTRATE TEST LOCATIONS ONLY AND MAY NOT REFLECT THE MOST CURRENT REVISION OF THE BASE PLAN.
2. THIS PLAN HAS BEEN PREPARED BASED ON A DECEMBER 17, 2021 OVERALL *SITE PLAN* PREPARED BY DYNAMIC ENGINEERING CONSULTANTS, PC.

DYNAMIC EARTH, LLC
245 Main Street - Suite 110
Chester, NJ 07930
T: 908.879.7095 - F: 908.879.0222
www.dynamic-earth.com

Records of Subsurface Exploration

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-101

Page 1 of 1

Project: Proposed Industrial Park | **Project No.:** 2803-99-005E

Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY | **Client:** Treetop Development, LLC

Surface Elevation (ft): 310.0

Termination Depth (ft): 10.0

Proposed Location: SWM

Excavation / Test Method: Visual Observation

Date Started: 10/19/21

Date Completed: 10/19/21

Logged by: J. Scardigno

Contractor: Neighbors Property Management

Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	NE	-	Light gray (10 YR 7/1) mottling 60" - 90"
Groundwater	7.5	302.5	
Mottling	**5.0**	305.0	

DEPTH (IN)	COLOR	SOIL TEXTURE	COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
			GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-12	Very Dark Brown (10YR 2/2)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	FEW (5% MAX)	FINE	NONE			BAG	6	S-1	
12-60	Dark Yellowish Brown (10YR 3/4)	LOAMY SAND	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	26	S-2	IT-1 = 24.0 IPH
60-90	Very Dark Grayish Brown (10YR 3/2)	GRAVELLY SAND	15	0	0	0	SINGLE GRAIN	STRUCTURELESS		MOIST	LOOSE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		FEW 2%	FINE <5MM	FAINT	BAG	48	S-3	
90-120	Dark Brown (10YR 3/3)	GRAVELLY SAND	15	0	0	0	SINGLE GRAIN	STRUCTURELESS		WET	LOOSE	NONSTICKY	NONPLASTIC			NONE		NONE			BAG	100	S-4	

Additional Remarks: Topsoil encountered between 0 and 12 inches. Fill encountered between 12 and 40 inches. Refusal due to wet cave-in at approximately 10 feet below the ground surface

DYNAMIC EARTH

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-102

Page 1 of 1

Project: Proposed Industrial Park
Project No.: 2803-99-005E
Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY
Client: Treetop Development, LLC

Surface Elevation (ft): 308.0
Termination Depth (ft): 9.2
Proposed Location: SWM
Excavation / Test Method: Visual Observation
Date Started: 10/19/21
Date Completed: 10/19/21
Logged by: J. Scardigno
Contractor: Neighbors Property Management
Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	6.7	301.3	Light gray (10 YR 7/1) mottling 26" - 80"
Groundwater	6.7	301.3	
Mottling	2.2	305.8	

DEPTH (IN)	COLOR	SOIL TEXTURE		COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
				GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-12	Very Dark Brown (10YR 2/2)		LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	FEW (5% MAX)	FINE	NONE			BAG	6	S-1	
12-26	Dark Yellowish Brown (10YR 3/4)		LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	20	S-2	
26-68	Dark Yellowish Brown (10YR 3/4)	GRAVELLY	SAND	15	0	0	0	SINGLE GRAIN	STRUCTURELESS		MOIST	LOOSE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		FEW 2%	FINE <5MM	FAINT	BAG	40	S-3	IT-2 = 24.0 IPH
68-80	Dark Yellowish Brown (10YR 3/4)	GRAVELLY	SAND	15	0	0	0	SINGLE GRAIN	STRUCTURELESS		MOIST	LOOSE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		FEW 2%	FINE <5MM	FAINT	BAG	70	S-4	
80-110	Dark Yellowish Brown (10YR 3/4)	GRAVELLY	SAND	15	0	0	0	SINGLE GRAIN	STRUCTURELESS		WET	LOOSE	NONSTICKY	NONPLASTIC			NONE		NONE			BAG	100	S-5	

Additional Remarks: Topsoil encountered between 0 and 12 inches. Fill encountered between 12 and 26 inches. Refusal due to wet cave-in at approximately 9.2 feet below the ground surface

DYNAMIC EARTH

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-103

Page 1 of 1

Project: Proposed Industrial Park
Project No.: 2803-99-005E
Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY
Client: Treetop Development, LLC

Surface Elevation (ft):	306.0	**Date Started:**	10/19/21	**Groundwater Data**	**Depth (ft)**	**El. (ft)**	**Groundwater Comments**
Termination Depth (ft):	9.2	**Date Completed:**	10/19/21	**Seepage**	5.9	300.1	Light gray (10 YR 7/1) mottling 54" - 71"
Proposed Location:	SWM	**Logged by:**	J. Scardigno	**Groundwater**	5.9	300.1	
Excavation / Test Method:	Visual Observation	**Contractor:**	Neighbors Property Management	**Mottling**	**4.5**	301.5	
		Rig Type:	JD 310 SG Backhoe				

DEPTH (IN)	COLOR	SOIL TEXTURE	COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
			GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-12	Very Dark Brown (10YR 2/2)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	FEW (5% MAX)	FINE	NONE			BAG	6	S-1	
12-24	Dark Yellowish Brown (10YR 3/4)	LOAMY SAND	0	0	0	0	SUBANGULAR BLOCKY	MODERATE	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	16	S-2	
24-54	Dark Brown (10YR 3/3)	GRAVELLY SAND	15	0	0	0	SINGLE GRAIN	STRUCTURELESS		MOIST	LOOSE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	42	S-3	IT-3 = 24.0 IPH
54-71	Dark Brown (10YR 3/3)	GRAVELLY SAND	15	0	0	0	SINGLE GRAIN	STRUCTURELESS		MOIST	LOOSE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		FEW 2%	FINE <5MM	FAINT	BAG	60	S-4	
71-110	Dark Brown (10YR 3/3)	GRAVELLY SAND	15	0	0	0	SINGLE GRAIN	STRUCTURELESS		WET	LOOSE	NONSTICKY	NONPLASTIC			NONE		NONE			BAG	85	S-5	

Additional Remarks: Topsoil encountered between 0 and 12 inches. Fill encountered between 12 and 54 inches consisted of debris (asphalt and brick). Refusal due to wet cave-in at approximately 9.2 feet below the ground surface

SOIL PROFILE PIT LOG

Soil Profile Pit: <u>SPP-104</u>

Page <u>1</u> of <u>1</u>

Project: **Proposed Industrial Park**
Project No.: **2803-99-005E**
Location: **Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY**
Client: **Treetop Development, LLC**

Surface Elevation (ft): 307.0
Termination Depth (ft): 10.0
Proposed Location: SWM
Excavation / Test Method: Visual Observation

Date Started: 10/19/21
Date Completed: 10/19/21
Logged by: J. Scardigno
Contractor: Neighbors Property Management
Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	NE	-	
Groundwater	8.6	298.4	Light gray (10 YR 7/1) mottling 65" - 103"
Mottling	**5.4**	301.6	

DEPTH (IN)	COLOR	SOIL TEXTURE		COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
				GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-14	Dark Grayish Brown (10YR 4/2)		LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	FEW (5% MAX)	FINE	NONE			BAG	7	S-1	
14-65	Dark Yellowish Brown (10YR 4/4)	GRAVELLY	SAND	10	0	0	0	SINGLE GRAIN	STRUCTURELESS		MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	40	S-2	
65-103	Dark Yellowish Brown (10YR 4/4)	GRAVELLY	SAND	10	0	0	0	SINGLE GRAIN	STRUCTURELESS		MOIST	LOOSE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		FEW 2%	FINE <5MM	FAINT	BAG	80	S-3	IT-4 = 12.0 IPH
103-120	Dark Yellowish Brown (10YR 4/4)	GRAVELLY	SAND	10	0	0	0	SINGLE GRAIN	STRUCTURELESS		WET	LOOSE	NONSTICKY	NONPLASTIC			NONE		NONE			BAG	110	S-4	

Additional Remarks: Topsoil encountered between 0 and 14 inches. Refusal due to wet cave-in at approximately 10 feet below the ground surface.

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-105

Page 1 of 1

Project: Proposed Industrial Park
Project No.: 2803-99-005E
Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY
Client: Treetop Development, LLC

Surface Elevation (ft): 307.0
Termination Depth (ft): 9.2
Proposed Location: SWM
Excavation / Test Method: Visual Observation

Date Started: 10/19/21
Date Completed: 10/19/21
Logged by: J. Scardigno
Contractor: Neighbors Property Management
Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	NE	-	Light gray (10 YR 7/1) mottling 44" - 82"
Groundwater	6.8	300.2	
Mottling	3.7	303.3	

DEPTH (IN)	COLOR	SOIL TEXTURE	COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
			GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-13	Very Dark Brown (10YR 2/2)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	FEW (5% MAX)	FINE	NONE			BAG	6	S-1	
13-24	Dark Yellowish Brown (10YR 3/4)	LOAMY SAND	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	20	S-2	
24-44	Dark Yellowish Brown (10YR 3/6)	GRAVELLY SAND	15	0	0	0	SINGLE GRAIN	STRUCTURELESS		MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	36	S-3	
44-82	Gray (10YR 5/1)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	MODERATE	FINE	MOIST	FRIABLE	NONSTICKY	SLIGHTLY PLASTIC	CLEAR <2.5"	SMOOTH	NONE		FEW 2%	FINE <5MM	FAINT	BAG	44	S-4	IT-5 = 12.0 IPH
82-110	Dark Brown (10YR 3/3)	GRAVELLY SAND	15	5	0	0	SINGLE GRAIN	STRUCTURELESS		WET	LOOSE	NONSTICKY	NONPLASTIC			NONE		NONE			BAG	107	S-5	

Additional Remarks: Topsoil encountered between 0 and 13 inches. Refusal due to wet cave-in at approximately 9.2 feet below the ground surface.

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-106

Page 1 of 1

Project: Proposed Industrial Park
Project No.: 2803-99-005E
Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY
Client: Treetop Development, LLC

Surface Elevation (ft): 306.0
Termination Depth (ft): 9.2
Proposed Location: SWM
Excavation / Test Method: Visual Observation

Date Started: 10/19/21
Date Completed: 10/19/21
Logged by: J. Scardigno
Contractor: Neighbors Property Management
Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	NE	-	Light gray (10 YR 7/1) mottling 40" - 80"
Groundwater	6.8	299.2	
Mottling	3.3	302.7	

DEPTH (IN)	COLOR	SOIL TEXTURE	COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
			GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-12	Very Dark Brown (10YR 2/2)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	FEW (5% MAX)	FINE	NONE			BAG	6	S-1	
12-28	Dark Yellowish Brown (10YR 3/4)	GRAVELLY SAND	10	0	0	0	SINGLE GRAIN	STRUCTURELESS		MOIST	LOOSE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	20	S-2	
28-32	Grayish Brown (10YR 5/2)	SANDY LOAM	0	0	0	0	SUBANGULAR BLOCKY	MODERATE	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	30	S-3	
32-40	Dark Yellowish Brown (10YR 3/6)	GRAVELLY SAND	15	0	0	0	SINGLE GRAIN	STRUCTURELESS		MOIST	LOOSE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	40	S-4	IT-6 = 18.0 IPH
40-80	Gray (10YR 5/1)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	MODERATE	FINE	MOIST	FRIABLE	NONSTICKY	SLIGHTLY PLASTIC	CLEAR <2.5"	SMOOTH	FEW (5% MAX)	FINE	FEW 2%	FINE <5MM	FAINT	BAG	50	S-5	
80-110	Dark Yellowish Brown (10YR 3/6)	GRAVELLY SAND	15	0	0	0	SINGLE GRAIN	STRUCTURELESS		WET	LOOSE	NONSTICKY	NONPLASTIC			NONE		NONE			BAG	90	S-6	

Additional Remarks: Topsoil encountered between 0 and 12 inches. Refusal due to wet cave-in at approximately 9.2 feet below the ground surface.

DYNAMIC EARTH

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-107

Page 1 of 1

Project: Proposed Industrial Park
Project No.: 2803-99-005E
Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY
Client: Treetop Development, LLC

Surface Elevation (ft): 304.0
Termination Depth (ft): 10.0
Proposed Location: SWM
Excavation / Test Method: Visual Observation

Date Started: 10/19/21
Date Completed: 10/19/21
Logged by: J. Scardigno
Contractor: Neighbors Property Management
Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	NE	-	
Groundwater	4.3	299.7	Light gray (10 YR 7/1) mottling 44" - 52"
Mottling	3.7	300.3	

DEPTH (IN)	COLOR	SOIL TEXTURE	COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
			GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-8	Very Dark Brown (10YR 2/2)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	FEW (5% MAX)	FINE	NONE						
8-22	Very Dark Grayish Brown (10YR 3/2)	LOAMY SAND	10	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	18	S-1	IT-7 = 8.0 IPH
22-44	Very Dark Gray (10YR 3/1)	SANDY LOAM	0	0	0	0	SUBANGULAR BLOCKY	MODERATE	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	FEW (5% MAX)	MEDIUM	NONE			BAG	36	S-2	
44-52	Gray (10YR 5/1)	LOAM	5	0	0	0	SUBANGULAR BLOCKY	MODERATE	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		MNY >20%	MEDIUM 5MM-15MM	DISTINCT	BAG	47	S-3	
52-120	Dark Yellowish Brown (10YR 3/6)	GRAVELLY SAND	10	5	0	0	SINGLE GRAIN	STRUCTURELESS		WET	FRIABLE	NONSTICKY	SLIGHTLY PLASTIC			NONE		NONE			BAG	80	S-4	

Additional Remarks: Topsoil encountered between 0 and 8 inches. Refusal due to wet cave-in at approximately 10 feet below the ground surface.

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-108

Page 1 of 1

Project: Proposed Industrial Park
Project No.: 2803-99-005E
Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY
Client: Treetop Development, LLC

Surface Elevation (ft): 302.0
Termination Depth (ft): 10.0
Proposed Location: SWM
Excavation / Test Method: Visual Observation

Date Started: 10/20/21
Date Completed: 10/20/21
Logged by: J. Scardigno
Contractor: Neighbors Property Management
Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	NE	-	
Groundwater	4.6	297.4	
Mottling	NE	-	

DEPTH (IN)	COLOR	SOIL TEXTURE	COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
			GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-8	Very Dark Brown (10YR 2/2)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	CMN (20% MAX)	FINE	NONE						
8-20	Very Dark Grayish Brown (10YR 3/2)	LOAMY SAND	10	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	20	S-1	
20-55	Very Dark Gray (10YR 3/1)	SANDY LOAM	5	0	0	0	SUBANGULAR BLOCKY	MODERATE	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	40	S-2	IT-8 = 5.0 IPH
55-120	Dark Brown (10YR 3/3)	LOAM	10	5	0	0	SINGLE GRAIN	STRUCTURELESS		WET	LOOSE	NONSTICKY	NONPLASTIC			NONE		NONE			BAG	100	S-3	

Additional Remarks: Topsoil encountered between 0 and 8 inches. Refusal due to wet cave-in at approximately 10 feet below the ground surface.

DYNAMIC EARTH

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-109

Page 1 of 1

Project: Proposed Industrial Park

Project No.: 2803-99-005E

Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY

Client: Treetop Development, LLC

Surface Elevation (ft): 302.5

Termination Depth (ft): 10.0

Proposed Location: SWM

Excavation / Test Method: Visual Observation

Date Started: 10/20/21

Date Completed: 10/20/21

Logged by: J. Scardigno

Contractor: Neighbors Property Management

Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	NE	-	Light gray (10 YR 7/1) mottling 34" - 60"
Groundwater	5.0	297.5	
Mottling	**2.8**	299.7	

DEPTH (IN)	COLOR	SOIL TEXTURE	COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
			GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-10	Very Dark Brown (10YR 2/2)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	MNY (>20% MAX)	MEDIUM	NONE						
10-34	Dark Grayish Brown (10YR 4/2)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	VERY FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	20	S-1	IT-9 = 8.0 IPH
34-60	Very Dark Grayish Brown (10YR 3/2)	LOAMY SAND	0	0	0	0	SUBANGULAR BLOCKY	WEAK	MEDIUM	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		FEW (5% MAX)	FINE <5MM	FAINT	BAG	40	S-2	
60-120	Dark Brown (10YR 3/3)	GRAVELLY SAND	10	0	0	0	STRUCTURELESS SINGLE GRAIN			WET	LOOSE	NONSTICKY	NONPLASTIC			NONE		NONE			BAG	80	S-3	

Additional Remarks: Topsoil encountered between 0 and 10 inches. Refusal due to wet cave-in at approximately 10 feet below the ground surface.

DYNAMIC EARTH

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-110

Page 1 of 1

Project: Proposed Industrial Park
Project No.: 2803-99-005E
Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY
Client: Treetop Development, LLC

Surface Elevation (ft): 303.0
Termination Depth (ft): 10.0
Proposed Location: SWM
Excavation / Test Method: Visual Observation

Date Started: 10/20/21
Date Completed: 10/20/21
Logged by: J. Scardigno
Contractor: Neighbors Property Management
Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	NE	-	Light gray (10 YR 7/1) mottling 34" - 60"
Groundwater	5.0	298.0	
Mottling	2.8	300.2	

DEPTH (IN)	COLOR	SOIL TEXTURE	COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
			GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-12	Very Dark Brown (10YR 2/2)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	CMN (20% MAX)	VERY FINE	NONE						
12-20	Dark Grayish Brown (10YR 4/2)	SANDY LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	16	S-1	IT-10 = 4.0 IPH
20-34	Dark Brown (10YR 3/3)	LOAMY SAND	10	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	26	S-2	
34-60	Very Dark Grayish Brown (10YR 3/2)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC			NONE		CMN (20% MAX)	MEDIUM 5MM-15MM	DISTINCT	BAG	42	S-3	
60-120	Dark Brown (10YR 3/3)	GRAVELLY SAND	15	10	0	0	SINGLE GRAIN	STRUCTURELESS		WET	LOOSE	NONSTICKY	NONPLASTIC			NONE		NONE			BAG	80	S-4	

Additional Remarks: Topsoil encountered between 0 and 12 inches. Refusal due to wet cave-in at approximately 10 feet below the ground surface.

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-111

Page 1 of 1

Project: Proposed Industrial Park
Project No.: 2803-99-005E
Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY
Client: Treetop Development, LLC

Surface Elevation (ft): 305.0
Termination Depth (ft): 9.2
Proposed Location: SWM
Excavation / Test Method: Visual Observation

Date Started: 10/21/21
Date Completed: 10/21/21
Logged by: J. Scardigno
Contractor: Neighbors Property Management
Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	NE	-	Light gray (10 YR 7/1) mottling 16" - 48"
Groundwater	4.0	301.0	
Mottling	1.3	303.7	

DEPTH (IN)	COLOR	SOIL TEXTURE	COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
			GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-16	Very Dark Brown (10YR 2/2)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	MNY (>20% MAX)	FINE	NONE						
16-48	Very Dark Grayish Brown (10YR 3/2)	SANDY LOAM	5	0	0	0	SUBANGULAR BLOCKY	MODERATE	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		CMN (20% MAX)	MEDIUM 5MM-15MM	DISTINCT	BAG	40	S-1	IT-11 = 5.0 IPH
48-110	Dark Brown (10YR 3/3)	GRAVELLY SAND	10	0	0	0	SINGLE GRAIN	STRUCTURELESS		WET	LOOSE	NONSTICKY	NONPLASTIC			NONE		NONE			BAG	90	S-2	

Additional Remarks: Topsoil encountered between 0 and 10 inches. Refusal due to wet cave-in at approximately 9.2 feet below the ground surface.

SOIL PROFILE PIT LOG

Soil Profile Pit: **SPP-112**

Page 1 of 1

Project: **Proposed Industrial Park**
Project No.: **2803-99-005E**
Location: **Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY**
Client: **Treetop Development, LLC**

Surface Elevation (ft):	306.5	**Date Started:**	10/21/21
Termination Depth (ft):	9.2	**Date Completed:**	10/21/21
Proposed Location:	SWM	**Logged by:**	J. Scardigno
Excavation / Test Method:	Visual Observation	**Contractor:**	Neighbors Property Management
		Rig Type:	JD 310 SG Backhoe

Groundwater Data	**Depth (ft)**	**El. (ft)**	**Groundwater Comments**
Seepage	NE	-	Light gray (10 YR 7/1) mottling 12" - 53"
Groundwater	4.4	302.1	
Mottling	**1.0**	305.5	

DEPTH (IN)	**COLOR**	**SOIL TEXTURE**		**COARSE FRAGMENTS (%)**				**STRUCTURE**			**WATER CONTENT**	**CONSISTENCY**			**BOUNDARY**		**ROOTS**		**MOTTLING**			**SAMPLING**			**LAB RESULTS**
				GRAVEL	COBBLES	STONES	BOULDERS	**Shape**	**Grade**	**Size**		**Resistance to Rupture**	**Stickiness**	**Plasticity**	**Distinctness**	**Topography**			**Quantity**	**Size**	**Contrast**	**Type**	**Depth (in)**	**No.**	
0-12	**Very Dark Brown (10YR 2/2)**		**LOAM**	0	0	0	0	**SUBANGULAR BLOCKY**	**WEAK**	**FINE**	**MOIST**	**FRIABLE**	**NONSTICKY**	**NONPLASTIC**	**CLEAR <2.5"**	**SMOOTH**	**MNY (>20% MAX)**	**FINE**	**NONE**						
12-28	**Very Dark Grayish Brown (10YR 3/2)**		**LOAMY SAND**	0	0	0	0	**SUBANGULAR BLOCKY**	**WEAK**	**FINE**	**MOIST**	**FRIABLE**	**NONSTICKY**	**NONPLASTIC**	**CLEAR <2.5"**	**SMOOTH**	**NONE**		**CMN (20% MAX)**	**MEDIUM 5MM-15MM**	**DISTINCT**	**BAG**	**20**	**S-1**	**IT-12 = 5.0 IPH**
28-53	**Dark Grayish Brown (10YR 4/2)**		**SANDY LOAM**	10	0	0	0	**SUBANGULAR BLOCKY**	**MODERATE**	**MEDIUM**	**MOIST**	**FRIABLE**	**NONSTICKY**	**NONPLASTIC**	**CLEAR <2.5"**	**SMOOTH**	**NONE**		**CMN (20% MAX)**	**FINE <5MM**	**FAINT**	**BAG**	**36**	**S-2**	
53-110	**Dark Brown (10YR 3/3)**	**GRAVELLY**	**SAND**	10	0	0	0	**SINGLE GRAIN**	**STRUCTURELESS**		**WET**	**LOOSE**	**NONSTICKY**	**NONPLASTIC**			**NONE**		**NONE**			**BAG**	**70**	**S-3**	

Additional Remarks: Refusal due to wet cave-in at approximately 9.2 feet below the ground surface.

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-113

Page 1 of 1

Project: Proposed Industrial Park
Project No.: 2803-99-005E
Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY
Client: Treetop Development, LLC

Surface Elevation (ft): 302.0
Termination Depth (ft): 10.0
Proposed Location: SWM
Excavation / Test Method: Visual Observation

Date Started: 10/21/21
Date Completed: 10/21/21
Logged by: J. Scardigno
Contractor: Neighbors Property Management
Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	NE	-	
Groundwater	5.0	297.0	
Mottling	NE	-	

DEPTH (IN)	COLOR	SOIL TEXTURE	COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
			GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-12	Very Dark Brown (10YR 2/2)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	CMN (20% MAX)	FINE	NONE						
12-30	Dark Brown (10YR 3/3)	SANDY LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	MEDIUM	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	20	S-1	
30-60	Very Dark Grayish Brown (10YR 3/2)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	FEW (5% MAX)	FINE	NONE			BAG	40	S-2	IT-13 = 15.0 IPH
60-120	Black (10YR 2/1)	SILTY CLAY LOAM	0	0	0	0	SUBANGULAR BLOCKY	MODERATE	FINE	WET	FRIABLE	NONSTICKY	NONPLASTIC			NONE		NONE			BAG	80	S-3	

Additional Remarks: Refusal due to wet cave-in at approximately 10 feet below the ground surface.

DYNAMIC EARTH

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-114

Page 1 of 1

Project: Proposed Industrial Park
Project No.: 2803-99-005E
Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY
Client: Treetop Development, LLC

Surface Elevation (ft): 304.5
Termination Depth (ft): 8.3
Proposed Location: SWM
Excavation / Test Method: Visual Observation

Date Started: 10/21/21
Date Completed: 10/21/21
Logged by: J. Scardigno
Contractor: Neighbors Property Management
Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	NE	-	
Groundwater	6.3	298.2	
Mottling	NE	-	

DEPTH (IN)	COLOR	SOIL TEXTURE	COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
			GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-12	Very Dark Brown (10YR 2/2)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	FEW (5% MAX)	MEDIUM	NONE						
12-24	Dark Yellowish Brown (10YR 3/4)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	16	S-1	
24-60	Dark Brown (10YR 3/3)	SANDY LOAM	0	0	0	0	SUBANGULAR BLOCKY	MODERATE	MEDIUM	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	30	S-2	IT-14 = 18.0 IPH
60-75	Very Dark Grayish Brown (10YR 3/2)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	66	S-3	
75-100	Dark Brown (10YR 3/3)	SANDY LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	WET	FRIABLE	NONSTICKY	NONPLASTIC			NONE		NONE			BAG	90	S-4	

Additional Remarks: Refusal due to wet cave-in at approximately 8.3 feet below the ground surface.

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-115

Page 1 of 1

Project: Proposed Industrial Park
Project No.: 2803-99-005E
Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY
Client: Treetop Development, LLC

Surface Elevation (ft): 308.0
Termination Depth (ft): 10.0
Proposed Location: SWM
Excavation / Test Method: Visual Observation
Date Started: 10/21/21
Date Completed: 10/21/21
Logged by: J. Scardigno
Contractor: Neighbors Property Management
Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	NE	-	
Groundwater	7.0	301.0	
Mottling	NE	-	

DEPTH (IN)	COLOR	SOIL TEXTURE	COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
			GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-14	Very Dark Brown (10YR 2/2)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	MNY (>20% MAX)	MEDIUM	NONE						
14-48	Very Dark Grayish Brown (10YR 3/2)	SANDY LOAM	10	5	0	0	SUBANGULAR BLOCKY	MODERATE	MEDIUM	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	36	S-1	IT-15 = 15.0 IPH
48-84	Dark Brown (10YR 3/3)	GRAVELLY SAND	10	5	0	0	SINGLE GRAIN	STRUCTURELESS		MOIST	LOOSE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	56	S-2	
84-120	Dark Brown (10YR 3/3)	GRAVELLY SAND	15	10	0	0	SINGLE GRAIN	STRUCTURELESS		WET	LOOSE	NONSTICKY	NONPLASTIC			NONE		NONE			BAG	90	S-3	

Additional Remarks: Topsoil encountered between 0 and 14 inches. Refusal due to wet cave-in at approximately 10 feet below the ground surface.

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-116

Page 1 of 1

Project: Proposed Industrial Park
Project No.: 2803-99-005E
Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY
Client: Treetop Development, LLC

Surface Elevation (ft): 310.0
Termination Depth (ft): 10.0
Proposed Location: SWM
Excavation / Test Method: Visual Observation

Date Started: 10/22/21
Date Completed: 10/22/21
Logged by: J. Scardigno
Contractor: Neighbors Property Management
Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	NE	-	Light gray (10 YR 7/1) mottling 25" - 43"
Groundwater	5.8	304.2	
Mottling	2.1	307.9	

DEPTH (IN)	COLOR	SOIL TEXTURE		COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
				GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-16	Very Dark Brown (10YR 2/2)		LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	CMN (20% MAX)	FINE	NONE						
16-25	Dark Grayish Brown (10YR 4/2)		LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	22	S-1	IT-16 = 19.0 IPH
25-43	Very Dark Grayish Brown (10YR 3/2)		LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	FEW (5% MAX)	FINE	FEW (5% MAX)	FINE <5MM	FAINT	BAG	32	S-2	
43-70	Dark Brown (10YR 3/3)	GRAVELLY	SAND	15	10	0	0	SINGLE GRAIN	STRUCTURELESS		MOIST	LOOSE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	50	S-3	
70-120	Dark Brown (10YR 3/3)	GRAVELLY	SAND	15	10	0	0	SINGLE GRAIN	STRUCTURELESS		WET	LOOSE	NONSTICKY	NONPLASTIC			NONE		NONE			BAG	80	S-4	

Additional Remarks: Topsoil encountered between 0 and 16 inches. SPP-16 was terminated at approximately 10 feet below the ground surface.

DYNAMIC EARTH

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-117

Page 1 of 1

Project: Proposed Industrial Park
Project No.: 2803-99-005E
Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY
Client: Treetop Development, LLC

Surface Elevation (ft): 310.0
Termination Depth (ft): 10.0
Proposed Location: SWM
Excavation / Test Method: Visual Observation
Date Started: 10/22/21
Date Completed: 10/22/21
Logged by: J. Scardigno
Contractor: Neighbors Property Management
Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	NE	-	
Groundwater	7.0	303.0	
Mottling	NE	-	

DEPTH (IN)	COLOR	SOIL TEXTURE	COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
			GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-10	Very Dark Brown (10YR 2/2)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	CMN (20% MAX)	FINE	NONE						
10-16	Dark Grayish Brown (10YR 4/2)	LOAMY SAND	10	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	12	S-1	
16-47	Very Dark Grayish Brown (10YR 3/2)	SAND	0	0	0	0	SUBANGULAR BLOCKY	WEAK	MEDIUM	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	CMN (20% MAX)	MEDIUM	NONE			BAG	30	S-2	IT-17 = 5.0 IPH
47-84	Dark Brown (10YR 3/3)	SAND	10	5	0	0	SINGLE GRAIN	STRUCTURELESS		MOIST	LOOSE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	50	S-3	
84-120	Dark Brown (10YR 3/3)	GRAVELLY SAND	15	10	0	0	SINGLE GRAIN	STRUCTURELESS		WET	LOOSE	NONSTICKY	NONPLASTIC			NONE		NONE			BAG	90	S-4	

Additional Remarks: Topsoil encountered between 0 and 10 inches. Refusal due to wet cave-in at approximately 10 feet below the ground surface.

DYNAMIC EARTH

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-118

Page 1 of 1

Project: Proposed Industrial Park
Project No.: 2803-99-005E
Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY
Client: Treetop Development, LLC

Surface Elevation (ft): 312.0
Termination Depth (ft): 10.0
Proposed Location: SWM
Excavation / Test Method: Visual Observation
Date Started: 10/22/21
Date Completed: 10/22/21
Logged by: J. Scardigno
Contractor: Neighbors Property Management
Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	NE	-	
Groundwater	8.0	304.0	
Mottling	NE	-	

DEPTH (IN)	COLOR	SOIL TEXTURE	COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
			GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-12	Very Dark Brown (10YR 2/2)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	CMN (20% MAX)	FINE	NONE						
12-20	Very Dark Grayish Brown (10YR 3/2)	SANDY LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	MEDIUM	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	18	S-1	
20-96	Dark Brown (10YR 3/3)	GRAVELLY SAND	15	10	0	0	SINGLE GRAIN	STRUCTURELESS		MOIST	LOOSE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	35	S-2	IT-18 = 24.0 IPH
96-120	Dark Brown (10YR 3/3)	GRAVELLY SAND	15	10	0	0	SINGLE GRAIN	STRUCTURELESS		WET	LOOSE	NONSTICKY	NONPLASTIC			NONE		NONE			BAG	106	S-3	

Additional Remarks: Topsoil encountered between 0 and 12 inches. SPP-18 was terminated at approximately 10 feet below the ground surface.

DYNAMIC EARTH

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-119

Page 1 of 1

Project: Proposed Industrial Park
Project No.: 2803-99-005E
Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY
Client: Treetop Development, LLC

Surface Elevation (ft): 309.0
Termination Depth (ft): 3.0
Proposed Location: SWM
Excavation / Test Method: Visual Observation

Date Started: 10/25/21
Date Completed: 10/25/21
Logged by: J. Scardigno
Contractor: Neighbors Property Management
Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	NE	-	
Groundwater	0.5	308.5	
Mottling	NE	-	

DEPTH (IN)	COLOR	SOIL TEXTURE	COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
			GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-6	Very Dark Brown (10YR 2/2)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	FEW (5% MAX)	FINE	NONE						
6-36	Dark Yellowish Brown (10YR 3/4)	LOAM	10	0	0	0	SUBANGULAR BLOCKY	MODERATE	FINE	WET	FRIABLE	NONSTICKY	NONPLASTIC			NONE		NONE			BAG	18	S-1	IT-19 = 5.0 IPH

Additional Remarks: Refusal due to wet cave-in approximately three feet below the ground surface.

DYNAMIC EARTH

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-120

Page 1 of 1

Project: Proposed Industrial Park
Project No.: 2803-99-005E
Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY
Client: Treetop Development, LLC

Surface Elevation (ft): 313.0
Termination Depth (ft): 10.0
Proposed Location: SWM
Excavation / Test Method: Visual Observation

Date Started: 10/25/21
Date Completed: 10/25/21
Logged by: J. Scardigno
Contractor: Neighbors Property Management
Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	NE	-	
Groundwater	6.0	307.0	
Mottling	NE	-	

DEPTH (IN)	COLOR	SOIL TEXTURE		COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
				GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-12	Very Dark Brown (10YR 2/2)		LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	MNY (>20% MAX)	FINE	NONE						
12-32	Very Dark Grayish Brown (10YR 3/2)		SANDY LOAM	10	5	0	0	SUBANGULAR BLOCKY	MODERATE	MEDIUM	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	FEW (5% MAX)	FINE	NONE			BAG	28	S-1	
32-72	Dark Brown (10YR 3/3)		LOAMY SAND	10	5	0	0	SUBANGULAR BLOCKY	MODERATE	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	36	S-2	IT-20 = 10.0 IPH
72-120	Dark Brown (10YR 3/3)	GRAVELLY	SAND	15	10	0	0	SINGLE GRAIN	STRUCTURELESS		WET	LOOSE	NONSTICKY	NONPLASTIC			NONE		NONE			BAG	80	S-3	

Additional Remarks: SPP-20 was terminated at approximately 10 feet below the ground surface.

DYNAMIC EARTH

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-121

Page 1 of 1

Project: Proposed Industrial Park
Project No.: 2803-99-005E
Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY
Client: Treetop Development, LLC

Surface Elevation (ft): 311.0
Termination Depth (ft): 15.0
Proposed Location: SWM
Excavation / Test Method: Visual Observation
Date Started: 10/25/21
Date Completed: 10/25/21
Logged by: J. Scardigno
Contractor: Neighbors Property Management
Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	NE	-	Light gray (10 YR 7/1) mottling 48" - 100"
Groundwater	8.3	302.7	
Mottling	4.0	307.0	

DEPTH (IN)	COLOR	SOIL TEXTURE		COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
				GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-11	Very Dark Brown (10YR 2/2)		LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	MNY (>20% MAX)	FINE	NONE						
11-32	Very Dark Grayish Brown (10YR 3/2)		SANDY LOAM	10	5	0	0	SUBANGULAR BLOCKY	MODERATE	MEDIUM	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	FEW (5% MAX)	FINE	NONE			BAG	20	S-1	
32-48	Dark Grayish Brown (10YR 4/2)		LOAMY SAND	10	5	0	0	SUBANGULAR BLOCKY	MODERATE	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	MNY (>20% MAX)	MEDIUM	NONE			BAG	40	S-2	IT-21 = 15.0 IPH
48-100	Dark Brown (10YR 3/3)	GRAVELLY	SAND	15	10	0	0	SINGLE GRAIN	STRUCTURELESS		MOIST	LOOSE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		FEW (5% MAX)	FINE <5MM	FAINT	BAG	88	S-3	
100-180	Dark Brown (10YR 3/3)	GRAVELLY	SAND	15	10	0	0	SINGLE GRAIN	STRUCTURELESS		WET	LOOSE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	110	S-4	

Additional Remarks: Topsoil encountered between 0 and 11 inches. Fill encountered between 11 and 32 inches. Buried root mat encountered 32" - 48". SPP-21 was terminated at approximately 15 feet below the ground surface.

DYNAMIC EARTH

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-122

Page 1 of 1

Project: Proposed Industrial Park
Project No.: 2803-99-005E
Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY
Client: Treetop Development, LLC

Surface Elevation (ft): 310.0
Termination Depth (ft): 10.0
Proposed Location: SWM
Excavation / Test Method: Visual Observation
Date Started: 10/22/21
Date Completed: 10/22/21
Logged by: J. Scardigno
Contractor: Neighbors Property Management
Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	NE	-	
Groundwater	7.3	302.7	
Mottling	NE	-	

DEPTH (IN)	COLOR	SOIL TEXTURE		COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
				GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-12	Very Dark Brown (10YR 2/2)		LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	CMN (20% MAX)	FINE	NONE						
12-24	Dark Yellowish Brown (10YR 4/6)		LOAM	0	0	0	0	SUBANGULAR BLOCKY	MODERATE	VERY FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	18	S-1	
24-88	Brown (10YR 4/3)	GRAVELLY	SAND	10	5	0	0	SINGLE GRAIN	STRUCTURELESS		MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	36	S-2	IT-22 = 19.0 IPH
88-120	Brown (10YR 4/3)	GRAVELLY	SAND	15	10	0	0	SINGLE GRAIN	STRUCTURELESS		WET	LOOSE	NONSTICKY	NONPLASTIC			NONE		NONE			BAG	100	S-3	

Additional Remarks: Topsoil encountered between 0 and 12 inches. SPP-22 was terminated at approximately 10 feet below the ground surface.

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-123

Page 1 of 1

Project: Proposed Industrial Park
Project No.: 2803-99-005E
Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY
Client: Treetop Development, LLC

Surface Elevation (ft): 311.0
Termination Depth (ft): 10.0
Proposed Location: SWM
Excavation / Test Method: Visual Observation
Date Started: 10/22/21
Date Completed: 10/22/21
Logged by: J. Scardigno
Contractor: Neighbors Property Management
Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	NE	-	Light gray (10 YR 7/1) mottling 40" - 77"
Groundwater	6.4	304.6	
Mottling	3.3	307.7	

DEPTH (IN)	COLOR	SOIL TEXTURE		COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
				GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-16	Dark Grayish Brown (10YR 4/2)		LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	CMN (20% MAX)	FINE	NONE						
16-40	Very Dark Grayish Brown (10YR 3/2)		LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	CMN (20% MAX)	MEDIUM	NONE			BAG	25	S-1	IT-23 = 15.0 IPH
40-77	Gray (10YR 6/1)		SANDY CLAY LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		CMN (20% MAX)	FINE <5MM	DISTINCT	BAG	50	S-2	
77-120	Dark Brown (10YR 3/3)	GRAVELLY	SAND	10	5	0	0	SINGLE GRAIN	STRUCTURELESS		WET	LOOSE	NONSTICKY	NONPLASTIC			NONE		NONE			BAG	90	S-3	

Additional Remarks: Topsoil encountered between 0 and 16 inches. Refusal due to wet cave-in at approximately 10 feet below the ground surface.

DYNAMIC EARTH

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-124

Page 1 of 1

Project: Proposed Industrial Park
Project No.: 2803-99-005E
Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY
Client: Treetop Development, LLC

Surface Elevation (ft): 307.0
Termination Depth (ft): 10.0
Proposed Location: SWM
Excavation / Test Method: Visual Observation
Date Started: 10/21/21
Date Completed: 10/21/21
Logged by: J. Scardigno
Contractor: Neighbors Property Management
Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	NE	-	
Groundwater	7.1	299.9	
Mottling	NE	-	

DEPTH (IN)	COLOR	SOIL TEXTURE	COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
			GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-13	Very Dark Brown (10YR 2/2)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	CMN (20% MAX)	MEDIUM	NONE						
13-85	Very Dark Grayish Brown (10YR 3/2)	SANDY LOAM	10	5	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	30	S-1	IT-24 = 12.0 IPH
85-120	Dark Brown (10YR 3/3)	GRAVELLY SAND	15	10	0	0	SINGLE GRAIN	STRUCTURELESS		WET	LOOSE	NONSTICKY	NONPLASTIC			NONE		NONE			BAG	100	S-2	

Additional Remarks: Topsoil encountered between 0 and 13 inches. Refusal due to wet cave-in at approximately 10 feet below the ground surface.

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-125

Page 1 of 1

Project:	**Proposed Industrial Park**	**Project No.:**	**2803-99-005E**
Location:	**Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY**	**Client:**	**Treetop Development, LLC**

Surface Elevation (ft):	307.0	**Date Started:**	10/21/21
Termination Depth (ft):	3.3	**Date Completed:**	10/21/21
Proposed Location:	SWM	**Logged by:**	J. Scardigno
Excavation / Test Method:	Visual Observation	**Contractor:**	Neighbors Property Management
		Rig Type:	JD 310 SG Backhoe

Groundwater Data	**Depth (ft)**	**El. (ft)**	**Groundwater Comments**
Seepage	NE	-	
Groundwater	6.0	301.0	
Mottling	NE	-	

DEPTH (IN)	COLOR	SOIL TEXTURE		COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
				GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-16	Dark Grayish Brown (10YR 4/2)		LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	MNY (>20% MAX)	MEDIUM	NONE						
16-34	Very Dark Grayish Brown (10YR 3/2)		SANDY LOAM	0	0	0	0	SUBANGULAR BLOCKY	MODERATE	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	25	S-1	IT-25 = 11.0 IPH
34-72	Gray (10YR 6/1)		LOAMY SAND	10	5	0	0	SUBANGULAR BLOCKY	WEAK	MEDIUM	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	44	S-2	
72-90	Dark Brown (10YR 3/3)	GRAVELLY	SAND	15	10	0	0	SINGLE GRAIN	STRUCTURELESS		WET	LOOSE	NONSTICKY	NONPLASTIC			NONE		NONE			BAG	90	S-3	

Additional Remarks: Topsoil encountered between 0 and 16 inches. Refusal due to wet cave-in at approximately 7.5 feet below the ground surface.

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-126

Page 1 of 1

Project: Proposed Industrial Park
Project No.: 2803-99-005E
Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY
Client: Treetop Development, LLC

Surface Elevation (ft): 317.0
Termination Depth (ft): 3.0
Proposed Location: SWM
Excavation / Test Method: Visual Observation

Date Started: 10/25/21
Date Completed: 10/25/21
Logged by: J. Scardigno
Contractor: Neighbors Property Management
Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	NE	-	
Groundwater	NE	-	
Mottling	NE	-	

DEPTH (IN)	COLOR	SOIL TEXTURE	COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS	MOTTLING			SAMPLING			LAB RESULTS
			GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography		Quantity	Size	Contrast	Type	Depth (in)	No.	
0-16	Very Dark Brown (10YR 2/2)	EXTREMELY GRAVELLY SAND	60	0	0	0	SINGLE GRAIN	STRUCTURELESS		MOIST	LOOSE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE	NONE						
16-36	Yellowish Brown (10YR 5/4)	SAND	10	0	0	0	SINGLE GRAIN	STRUCTURELESS		MOIST	LOOSE	NONSTICKY	NONPLASTIC			NONE	NONE			BAG	20	S-1	IT-26 = 24.0 IPH

Additional Remarks: Terminated at approximately three feet below the ground surface.

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-127

Page 1 of 1

Project: Proposed Industrial Park
Project No.: 2803-99-005E
Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY
Client: Treetop Development, LLC

Surface Elevation (ft): 315.0
Termination Depth (ft): 4.0
Proposed Location: SWM
Excavation / Test Method: Visual Observation

Date Started: 10/25/21
Date Completed: 10/25/21
Logged by: J. Scardigno
Contractor: Neighbors Property Management
Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	NE	-	
Groundwater	NE	-	
Mottling	NE	-	

DEPTH (IN)	COLOR	SOIL TEXTURE	COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS	MOTTLING			SAMPLING			LAB RESULTS
			GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography		Quantity	Size	Contrast	Type	Depth (in)	No.	
0-12	Very Dark Brown (10YR 2/2)	EXTREMELY GRAVELLY SAND	60	0	0	0	SINGLE GRAIN	STRUCTURELESS		MOIST	LOOSE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE	NONE						
12-48	Dark Yellowish Brown (10YR 4/4)	SAND	10	0	0	0	SINGLE GRAIN	STRUCTURELESS		MOIST	LOOSE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE	NONE			BAG	30	S-1	IT-27 = 24.0 IPH

Additional Remarks: Fill encountered between 0 and 48 inches. Terminated at approximately four feet below the ground surface.

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-128

Page 1 of 1

Project: Proposed Industrial Park
Project No.: 2803-99-005E
Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY
Client: Treetop Development, LLC

Surface Elevation (ft): 312.5
Termination Depth (ft): 10.0
Proposed Location: SWM
Excavation / Test Method: Visual Observation

Date Started: 10/20/21
Date Completed: 10/20/21
Logged by: J. Scardigno
Contractor: Neighbors Property Management
Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	6.5	306.0	Light gray (10 YR 7/1) mottling 42" - 78"
Groundwater	6.5	306.0	
Mottling	3.5	309.0	

DEPTH (IN)	COLOR	SOIL TEXTURE	COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
			GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-12	Very Dark Brown (10YR 2/2)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	MNY (>20% MAX)	FINE	NONE						
12-42	Dark Brown (7.5YR 3/3)	GRAVELLY SAND	15	5	0	0	SINGLE GRAIN	STRUCTURELESS		MOIST	LOOSE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		NONE			BAG	30	S-1	IT-28 = 24.0 IPH
42-54	Olive Brown (2.5Y 4/3)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	MODERATE	VERY FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		FEW (5% MAX)	FINE <5MM	FAINT	BAG	50	S-2	
54-78	Dark Brown (10YR 3/3)	GRAVELLY SAND	15	10	0	0	SINGLE GRAIN	STRUCTURELESS		MOIST	LOOSE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	NONE		FEW (5% MAX)	FINE <5MM	FAINT	BAG	60	S-3	
78-120	Dark Brown (10YR 3/3)	GRAVELLY SAND	15	10	0	0	SINGLE GRAIN	STRUCTURELESS		WET	LOOSE	NONSTICKY	NONPLASTIC			NONE		NONE			BAG	90	S-4	

Additional Remarks: Refusal due to wet cave-in at approximately four feet below the ground surface.

SOIL PROFILE PIT LOG

Soil Profile Pit: SPP-129

Page 1 of 1

Project: Proposed Industrial Park
Project No.: 2803-99-005E
Location: Old Mill Road and Hemion Road, Village of Suffern, Rockland County NY
Client: Treetop Development, LLC

Surface Elevation (ft): 308.0
Termination Depth (ft): 7.5
Proposed Location: SWM
Excavation / Test Method: Visual Observation

Date Started: 10/20/21
Date Completed: 10/20/21
Logged by: J. Scardigno
Contractor: Neighbors Property Management
Rig Type: JD 310 SG Backhoe

Groundwater Data	Depth (ft)	El. (ft)	Groundwater Comments
Seepage	NE	-	
Groundwater	NE	-	
Mottling	NE	-	

DEPTH (IN)	COLOR	SOIL TEXTURE	COARSE FRAGMENTS (%)				STRUCTURE			WATER CONTENT	CONSISTENCY			BOUNDARY		ROOTS		MOTTLING			SAMPLING			LAB RESULTS
			GRAVEL	COBBLES	STONES	BOULDERS	Shape	Grade	Size		Resistance to Rupture	Stickiness	Plasticity	Distinctness	Topography			Quantity	Size	Contrast	Type	Depth (in)	No.	
0-12	Very Dark Brown (10YR 2/2)	LOAM	0	0	0	0	SUBANGULAR BLOCKY	WEAK	FINE	MOIST	FRIABLE	NONSTICKY	NONPLASTIC	CLEAR <2.5"	SMOOTH	FEW (5% MAX)	FINE	NONE						
12-90	Brown (10YR 4/3)	GRAVELLY SAND	20	10	5	0	SINGLE GRAIN	STRUCTURELESS		MOIST	LOOSE	NONSTICKY	NONPLASTIC			NONE		NONE			BAG	50	S-1	IT-29 = 24.0 IPH

Additional Remarks: Concrete pipe encountered at 48 inches. Refusal due to wet cave-in at approximately 7.5 feet below the ground surface.

NRCS - USDA Custom Soil Resource Report for Rockland County, New York

United States
Department of
Agriculture

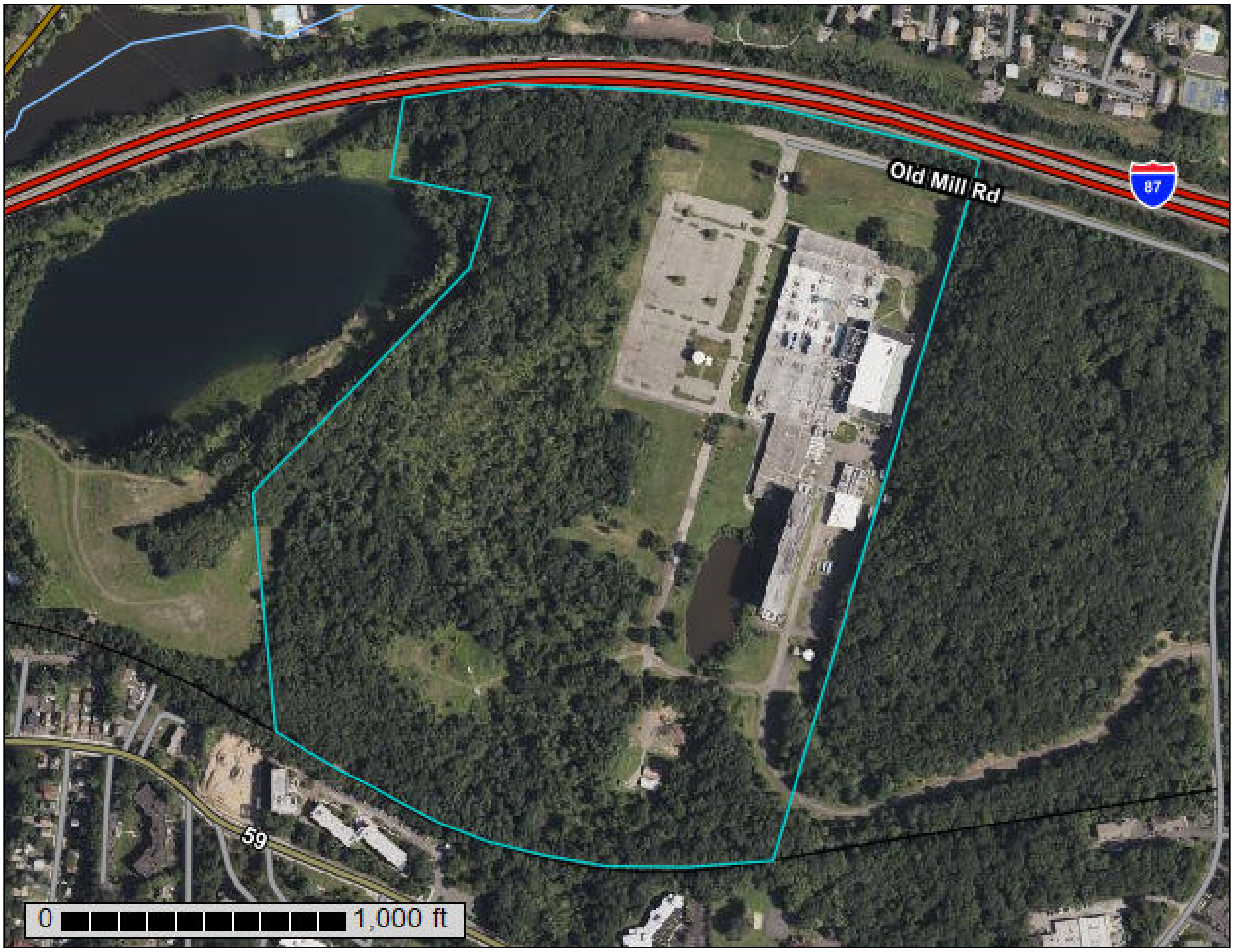
NRCS

Natural
Resources
Conservation
Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Rockland County, New York



January 6, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

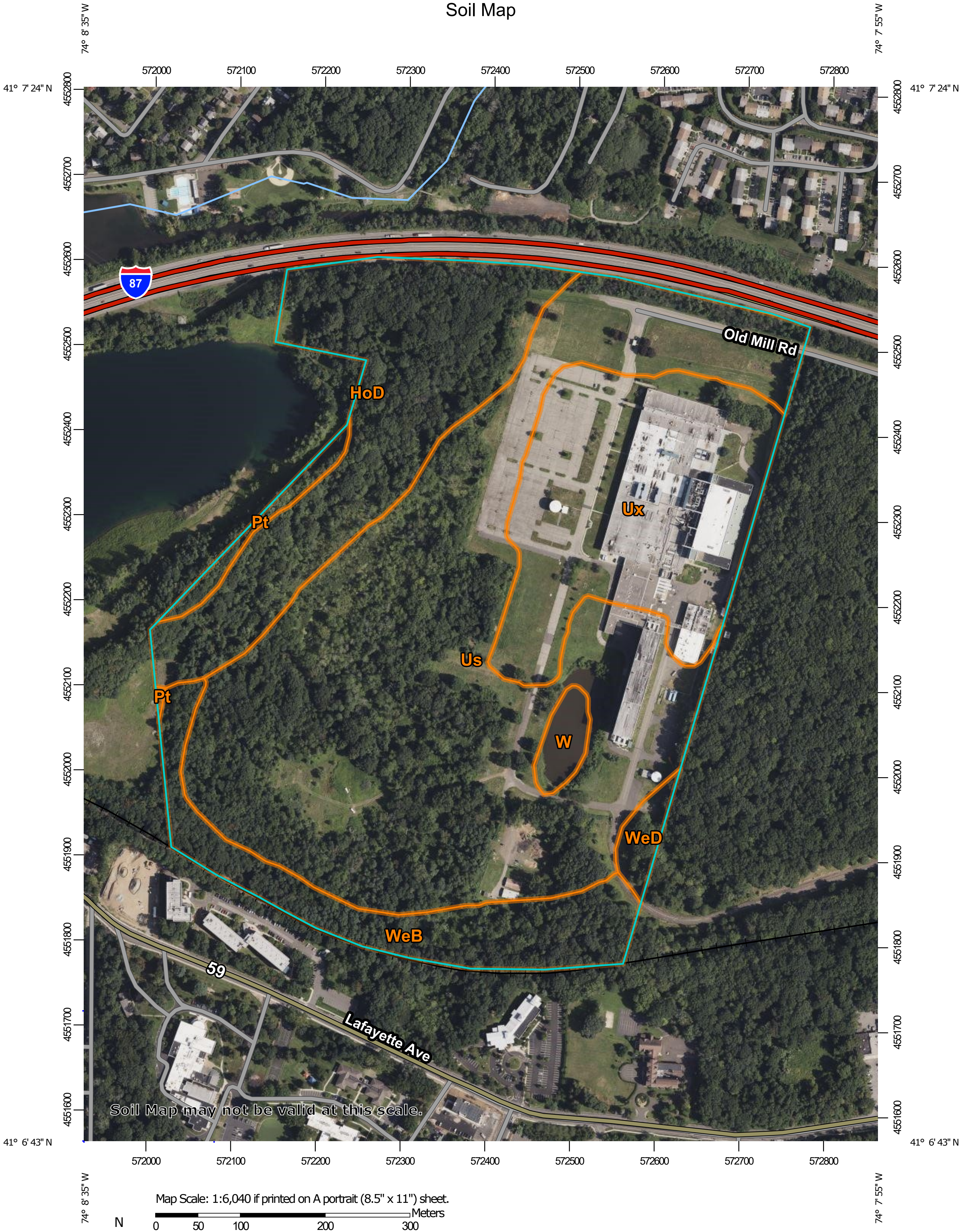
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:6,040 if printed on A portrait (8.5" x 11") 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 Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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: Rockland 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: Apr 13, 2021—Sep 14, 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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
HoD	Holyoke-Rock outcrop complex, hilly	20.2	17.7%
Pt	Pits, gravel	1.4	1.2%
Us	Udorthents, smoothed	58.8	51.5%
Ux	Urban land	21.5	18.8%
W	Water	1.3	1.2%
WeB	Wethersfield gravelly silt loam, 3 to 8 percent slopes	9.8	8.6%
WeD	Wethersfield gravelly silt loam, 15 to 25 percent slope s	1.2	1.1%
Totals for Area of Interest		**114.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Rockland County, New York

HoD—Holyoke-Rock outcrop complex, hilly

Map Unit Setting

National map unit symbol: 9v4q
Elevation: 0 to 740 feet
Mean annual precipitation: 47 to 50 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Holyoke and similar soils: 55 percent
Rock outcrop: 20 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Holyoke

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy till

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
H1 - 2 to 6 inches: silt loam
H2 - 6 to 18 inches: silt loam
H3 - 18 to 28 inches: unweathered bedrock

Properties and qualities

Slope: 10 to 30 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F145XY011CT - Well Drained Shallow Till Uplands
Hydric soil rating: No

Description of Rock Outcrop

Typical profile

H1 - 0 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 10 to 30 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydric soil rating: Unranked

Minor Components

Charlton

Percent of map unit: 10 percent
Hydric soil rating: No

Chatfield

Percent of map unit: 10 percent
Hydric soil rating: No

Watchaug

Percent of map unit: 5 percent
Hydric soil rating: No

Pt—Pits, gravel

Map Unit Setting

National map unit symbol: 9v50
Mean annual precipitation: 47 to 50 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Pits, gravel: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pits, Gravel

Typical profile

H1 - 0 to 6 inches: very gravelly sand
H2 - 6 to 60 inches: very gravelly coarse sand

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Minor Components

Riverhead

Percent of map unit: 5 percent
Hydric soil rating: No

Udorthents

Percent of map unit: 5 percent
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Hydric soil rating: No

Fredon

Percent of map unit: 4 percent
Landform: Depressions
Hydric soil rating: Yes

Water

Percent of map unit: 1 percent
Hydric soil rating: Unranked

Us—Udorthents, smoothed

Map Unit Setting

National map unit symbol: 9v5d
Elevation: 0 to 890 feet
Mean annual precipitation: 47 to 50 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents, smoothed, and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Smoothed

Typical profile

H1 - 0 to 20 inches: channery loam
H2 - 20 to 70 inches: very gravelly loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 5.95 in/hr)
Depth to water table: About 36 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Available water supply, 0 to 60 inches: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Udorthents, wet substratum

Percent of map unit: 5 percent
Hydric soil rating: No

Urban land

Percent of map unit: 4 percent
Hydric soil rating: Unranked

Alden

Percent of map unit: 2 percent
Landform: Depressions
Hydric soil rating: Yes

Wallington

Percent of map unit: 2 percent
Hydric soil rating: No

Wethersfield

Percent of map unit: 2 percent
Hydric soil rating: No

Riverhead

Percent of map unit: 2 percent
Hydric soil rating: No

Hollis

Percent of map unit: 2 percent
Hydric soil rating: No

Rock outcrop

Percent of map unit: 1 percent
Hydric soil rating: Unranked

Ux—Urban land

Map Unit Setting

National map unit symbol: 9v5g
Mean annual precipitation: 47 to 50 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Typical profile

H1 - 0 to 6 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: Unranked

Minor Components

Riverhead

Percent of map unit: 5 percent
Hydric soil rating: No

Yalesville

Percent of map unit: 5 percent
Hydric soil rating: No

Holyoke

Percent of map unit: 5 percent
Hydric soil rating: No

Udorthents

Percent of map unit: 5 percent
Hydric soil rating: No

Udorthents, wet substratum

Percent of map unit: 5 percent
Hydric soil rating: No

W—Water

Map Unit Setting

National map unit symbol: 9v5s
Mean annual precipitation: 47 to 50 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

WeB—Wethersfield gravelly silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9v5l
Elevation: 30 to 690 feet
Mean annual precipitation: 47 to 50 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 215 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Wethersfield and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wethersfield

Setting

Landform: Till plains, hills
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy acid till derived mainly from reddish sandstone, shale, and conglomerate, with some basalt

Typical profile

H1 - 0 to 13 inches: gravelly silt loam
H2 - 13 to 22 inches: gravelly loam
H3 - 22 to 60 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 38 inches to densic material

Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F145XY012CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Cheshire

Percent of map unit: 5 percent
Hydric soil rating: No

Charlton

Percent of map unit: 5 percent
Hydric soil rating: No

Riverhead

Percent of map unit: 5 percent
Hydric soil rating: No

Wallington

Percent of map unit: 5 percent
Hydric soil rating: No

WeD—Wethersfield gravelly silt loam, 15 to 25 percent slope s

Map Unit Setting

National map unit symbol: 9v5n
Elevation: 0 to 640 feet
Mean annual precipitation: 47 to 50 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 215 days
Farmland classification: Not prime farmland

Map Unit Composition

Wethersfield and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wethersfield

Setting

Landform: Till plains, hills

Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy acid till derived mainly from reddish sandstone, shale, and conglomerate, with some basalt

Typical profile

H1 - 0 to 13 inches: gravelly silt loam
H2 - 13 to 22 inches: gravelly loam
H3 - 22 to 60 inches: gravelly fine sandy loam

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 20 to 38 inches to densic material
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: F145XY012CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Riverhead

Percent of map unit: 5 percent
Hydric soil rating: No

Charlton

Percent of map unit: 5 percent
Hydric soil rating: No

Cheshire

Percent of map unit: 5 percent
Hydric soil rating: No

Wallington

Percent of map unit: 3 percent
Hydric soil rating: No

Yalesville

Percent of map unit: 2 percent
Hydric soil rating: No

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

Infiltration Test Results

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-101/IT-1

Project: Proposed Warehouse **Date: 10/19/2021**

Location: Suffern, Rockland County, NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 310.0 feet **Test Depth: 48”**

Reading No.	**Water Level (Inches)**		**Water Level Fall (Inches)**	**Time Interval (Hours)**	**Rate of Flow (Inches/ Hour)**
	Start	**Finish**			
1	24	0	24	1	24
2	24	0	24	1	24
3	24	0	24	1	24
4	24	0	24	1	24

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-102/IT-2

Project: Proposed Warehouse **Date: 10/19/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 308.0 feet **Test Depth: 31”**

Reading No.	**Water Level (Inches)**		**Water Level Fall (Inches)**	**Time Interval (Hours)**	**Rate of Flow (Inches/ Hour)**
	Start	**Finish**			
1	24	0	24	1	24
2	24	0	24	1	24
3	24	0	24	1	24
4	24	0	24	1	24

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-103/IT-3

Project: Proposed Warehouse **Date: 10/19/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 306.0 feet **Test Depth: 36”**

Reading No.	Water Level (Inches)		Water Level Fall (Inches)	Time Interval (Hours)	Rate of Flow (Inches/ Hour)
	Start	Finish			
1	24	0	24	1	24
2	24	0	24	1	24
3	24	0	24	1	24
4	24	0	24	1	24

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-104/IT-4

Project: Proposed Warehouse **Date: 10/19/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 307.0 feet **Test Depth: 36”**

Reading No.	Water Level (Inches)		Water Level Fall (Inches)	Time Interval (Hours)	Rate of Flow (Inches/ Hour)
	Start	Finish			
1	24	8	16	1	16
2	24	10	14	1	14
3	24	10	14	1	14
4	24	12	12	1	12

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-105/IT-5

Project: Proposed Warehouse **Date: 10/19/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 307.0 feet **Test Depth: 50”**

Reading No.	**Water Level (Inches)**		**Water Level Fall (Inches)**	**Time Interval (Hours)**	**Rate of Flow (Inches/ Hour)**
	Start	**Finish**			
1	24	10	14	1	14
2	24	11	13	1	13
3	24	12	12	1	12
4	24	12	12	1	12

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-106/IT-6

Project: Proposed Warehouse **Date: 10/19/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 306.0 feet **Test Depth: 42”**

Reading No.	Water Level (Inches)		Water Level Fall (Inches)	Time Interval (Hours)	Rate of Flow (Inches/ Hour)
	Start	Finish			
1	24	6	18	1	18
2	24	5	19	1	19
3	24	6	18	1	18
4	24	6	18	1	18

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-107/IT-7

Project: Proposed Warehouse **Date: 10/20/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 304.0 feet **Test Depth: 10”**

Reading No.	Water Level (Inches)		Water Level Fall (Inches)	Time Interval (Hours)	Rate of Flow (Inches/ Hour)
	Start	Finish			
1	24	13	11	1	11
2	24	15	9	1	9
3	24	16	8	1	8
4	24	16	8	1	8

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-108/IT-8

Project: Proposed Warehouse **Date: 10/20/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 302.0 feet **Test Depth: 24"**

Reading No.	**Water Level (Inches)**		**Water Level Fall (Inches)**	**Time Interval (Hours)**	**Rate of Flow (Inches/ Hour)**
	Start	**Finish**			
1	24	19	5	1	5
2	24	19	5	1	5
3	24	19	5	1	5
4	24	19	5	1	5

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-109/IT-9

Project: Proposed Warehouse **Date: 10/20/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 302.5 feet **Test Depth: 24”**

Reading No.	**Water Level (Inches)**		**Water Level Fall (Inches)**	**Time Interval (Hours)**	**Rate of Flow (Inches/ Hour)**
	Start	**Finish**			
1	24	16	8	1	8
2	24	16	8	1	8
3	24	16	8	1	8
4	24	16	8	1	8

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-110/IT-10

Project: Proposed Warehouse **Date: 10/20/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 303.0 feet **Test Depth: 19”**

Reading No.	**Water Level (Inches)**		**Water Level Fall (Inches)**	**Time Interval (Hours)**	**Rate of Flow (Inches/ Hour)**
	Start	**Finish**			
1	24	3	21	1	3
2	24	3	21	1	3
3	24	4	20	1	4
4	24	4	20	1	4

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-111/IT-11

Project: Proposed Warehouse **Date: 10/21/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 305.0 feet **Test Depth: 18”**

Reading No.	**Water Level (Inches)**		**Water Level Fall (Inches)**	**Time Interval (Hours)**	**Rate of Flow (Inches/ Hour)**
	Start	**Finish**			
1	24	17	7	1	7
2	24	19	5	1	5
3	24	19	5	1	5
4	24	19	5	1	5

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-112/IT-12

Project: Proposed Warehouse **Date: 10/21/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 306.5 feet **Test Depth: 12”**

Reading No.	**Water Level (Inches)**		**Water Level Fall (Inches)**	**Time Interval (Hours)**	**Rate of Flow (Inches/ Hour)**
	Start	**Finish**			
1	24	18	6	1	6
2	24	18	6	1	6
3	24	19	5	1	5
4	24	19	5	1	5

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-113/IT-13

Project: Proposed Warehouse **Date: 10/21/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 302.0 feet **Test Depth: 36”**

Reading No.	Water Level (Inches)		Water Level Fall (Inches)	Time Interval (Hours)	Rate of Flow (Inches/ Hour)
	Start	Finish			
1	24	7	17	1	17
2	24	8	16	1	16
3	24	9	15	1	15
4	24	9	15	1	15

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-114/IT-14

Project: Proposed Warehouse **Date: 10/21/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 304.5 feet **Test Depth: 36”**

Reading No.	**Water Level (Inches)**		**Water Level Fall (Inches)**	**Time Interval (Hours)**	**Rate of Flow (Inches/ Hour)**
	Start	**Finish**			
1	24	5	19	1	19
2	24	6	18	1	18
3	24	6	18	1	18
4	24	6	18	1	18

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-115/IT-15

Project: Proposed Warehouse **Date: 10/22/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 308.0 feet **Test Depth: 36”**

Reading No.	**Water Level (Inches)**		**Water Level Fall (Inches)**	**Time Interval (Hours)**	**Rate of Flow (Inches/ Hour)**
	Start	**Finish**			
1	24	9	15	1	15
2	24	9	15	1	15
3	24	9	15	1	15
4	24	9	15	1	15

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-116/IT-16

Project: Proposed Warehouse **Date: 10/22/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 310.0 feet **Test Depth: 24”**

Reading No.	**Water Level (Inches)**		**Water Level Fall (Inches)**	**Time Interval (Hours)**	**Rate of Flow (Inches/ Hour)**
	Start	**Finish**			
1	24	6	18	1	18
2	24	5	19	1	19
3	24	5	19	1	19
4	24	5	19	1	19

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-117/IT-17

Project: Proposed Warehouse **Date: 10/22/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 310.0 feet **Test Depth: 36”**

Reading No.	Water Level (Inches)		Water Level Fall (Inches)	Time Interval (Hours)	Rate of Flow (Inches/ Hour)
	Start	Finish			
1	24	18	6	1	6
2	24	18	6	1	6
3	24	19	5	1	5
4	24	19	5	1	5

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-118/IT-18

Project: Proposed Warehouse **Date: 10/22/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 312.0 feet **Test Depth: 36”**

Reading No.	Water Level (Inches)		Water Level Fall (Inches)	Time Interval (Hours)	Rate of Flow (Inches/ Hour)
	Start	Finish			
1	24	0	24	1	24
2	24	0	24	1	24
3	24	0	24	1	24
4	24	0	24	1	24

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-119/IT-19

Project: Proposed Warehouse **Date: 10/25/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 309.0 feet **Test Depth: 12”**

Reading No.	Water Level (Inches)		Water Level Fall (Inches)	Time Interval (Hours)	Rate of Flow (Inches/ Hour)
	Start	Finish			
1	24	19	5	1	5
2	24	19	5	1	5
3	24	19	5	1	5
4	24	19	5	1	5

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-120/IT-20

Project: Proposed Warehouse **Date: 10/25/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: **313.0 feet** **Test Depth:** **36”**

Reading No.	**Water Level (Inches)**		**Water Level Fall (Inches)**	**Time Interval (Hours)**	**Rate of Flow (Inches/ Hour)**
	Start	**Finish**			
1	24	12	12	1	12
2	24	13	11	1	11
3	24	14	10	1	10
4	24	14	10	1	10

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-121/IT-21

Project: Proposed Warehouse **Date: 10/25/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 311.0 feet **Test Depth/Elevation: 36”**

Reading No.	Water Level (Inches)		Water Level Fall (Inches)	Time Interval (Hours)	Rate of Flow (Inches/ Hour)
	Start	Finish			
1	24	15	9	1	15
2	24	15	9	1	15
3	24	15	9	1	15
4	24	15	9	1	15

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-122/IT-22

Project: Proposed Warehouse **Date: 10/22/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 310.0 feet **Test Depth: 36”**

Reading No.	**Water Level (Inches)**		**Water Level Fall (Inches)**	**Time Interval (Hours)**	**Rate of Flow (Inches/ Hour)**
	Start	**Finish**			
1	24	4	20	1	20
2	24	5	19	1	19
3	24	5	19	1	19
4	24	5	19	1	19

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-123/IT-23

Project: Proposed Warehouse **Date: 10/22/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: **311.0 feet** **Test Depth:** 30"

Reading No.	Water Level (Inches)		Water Level Fall (Inches)	Time Interval (Hours)	Rate of Flow (Inches/ Hour)
	Start	Finish			
1	24	9	15	1	15
2	24	9	15	1	15
3	24	9	15	1	15
4	24	9	15	1	15

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-124/IT-24

Project: Proposed Warehouse **Date: 10/21/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 307.0 feet **Test Depth: 48”**

Reading No.	**Water Level (Inches)**		**Water Level Fall (Inches)**	**Time Interval (Hours)**	**Rate of Flow (Inches/ Hour)**
	Start	**Finish**			
1	24	12	12	1	12
2	24	12	12	1	12
3	24	12	12	1	12
4	24	12	12	1	12

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-125/IT-25

Project: Proposed Warehouse **Date: 10/21/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: **307.0 feet** **Test Depth:** **30”**

Reading No.	Water Level (Inches)		Water Level Fall (Inches)	Time Interval (Hours)	Rate of Flow (Inches/ Hour)
	Start	Finish			
1	24	12	12	1	12
2	24	12	12	1	12
3	24	13	11	1	11
4	24	13	11	1	11

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-126/IT-26

Project: Proposed Warehouse **Date: 10/25/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 317.0 feet **Test Depth: 36”**

Reading No.	**Water Level (Inches)**		**Water Level Fall (Inches)**	**Time Interval (Hours)**	**Rate of Flow (Inches/ Hour)**
	Start	**Finish**			
1	24	0	24	1	24
2	24	0	24	1	24
3	24	0	24	1	24
4	24	0	24	1	24

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-127/IT-27

Project: Proposed Warehouse **Date: 10/25/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 315.0 feet **Test Depth: 48”**

Reading No.	**Water Level (Inches)**		**Water Level Fall (Inches)**	**Time Interval (Hours)**	**Rate of Flow (Inches/ Hour)**
	Start	**Finish**			
1	24	0	24	1	24
2	24	0	24	1	24
3	24	0	24	1	24
4	24	0	24	1	24

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-128/IT-28

Project: Proposed Warehouse **Date: 10/20/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 312.5 feet **Test Depth: 36”**

Reading No.	Water Level (Inches)		Water Level Fall (Inches)	Time Interval (Hours)	Rate of Flow (Inches/ Hour)
	Start	Finish			
1	24	0	24	1	24
2	24	0	24	1	24
3	24	0	24	1	24
4	24	0	24	1	24

INFILTRATION TEST REPORT

Client: Treetop Development, LLC **Test Hole No.:** SPP-129/IT-29

Project: Proposed Warehouse **Date: 10/20/2021**

Location: Suffern, Rockland County NY **Weather: Sunny, 72ºF**

Project No.: 2803-99-005E **Project Manager: F. Van Cleve**

Surface Elevation: 308.0 feet **Test Depth: 36”**

Reading No.	Water Level (Inches)		Water Level Fall (Inches)	Time Interval (Hours)	Rate of Flow (Inches/ Hour)
	Start	Finish			
1	24	0	24	1	24
2	24	0	24	1	24
3	24	0	24	1	24
4	24	0	24	1	24

Geotechnical Terms and Symbols

DYNAMIC EARTH

245 Main Street; Suite 110
Chester, NJ 07930
908-879-9229: Fax 908-879-0222

GEOTECHNICAL TERMS AND SYMBOLS

SAMPLE IDENTIFICATION

The Unified Soil Classification System is used to identify the soil unless otherwise noted.

SOIL PROPERTY SYMBOLS

N: Standard Penetration Value: Blows per ft. or a 140 lb. hammer falling 30” on a 2” O.D. split-spoon.
Qu: Unconfined compressive strength, TSF.
Qp: Penetrometer value, unconfined compressive strength, TSF.
Mc: Moisture content, %
LL: Liquid limit, %
PI: Plasiticity index, %
δd: Natural dry density, PCF.
▼: Apparent groundwater level at time noted after completion of boring.
=

DRILLING AND SAMPLING SYMBOLS

NE: Not Encountered (Groundwater was not encountered)
SS: Split-Spoon – 1⅜” I.D., 2” O.D., except where noted
ST: Shelby Tube – 3” O.D., except where noted
AU: Auger Sample
OB: Diamond Bit
CB: Carbide Bit
WS: Washed Sample

RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

Term (Non-Cohesive Soils)	Standard Penetration Resistance
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Over 50

Term (Cohesive Soils)	Qu (TSF)
Very Soft	0-0.25
Soft	0.25-0.50
Firm (Medium)	0.50-1.00
Stiff	1.00-2.00
Very Stiff	2.00-4.00
Hard	4.00 +

PARTICLE SIZE

Boulders	8 in. +	Coarse Sand	5mm-0.6mm	Silt	0.074mm-0.005mm
Cobbles	8 in. – 3 in.	Medium Sand	0.6mm-0.2mm	Clay	- 0.005mm
Gravel	3 in. – 5mm	Fine Sand	0.2mm – 0.074mm		

USCS Standard Classification System

UNIFIED SOIL CLASSIFICATION SYSTEM - ASTM D2488

MAJOR DIVISION			GROUP SYMBOL	LETTER SYMBOL	GROUP NAME
COARSE GRAINED SOILS CONTAINS MORE THAN 50% FINES	**GRAVEL AND GRAVELLY SOILS** MORE THAN 50% OF COARSE FRACTION <u>RETAINED</u> ON NO. 4 SIEVE	GRAVEL WITH <u>* 5% FINES</u>	●	GW	Well-graded GRAVEL
			○	GP	Poorly graded GRAVEL
		GRAVEL WITH BETWEEN 5% AND 15% FINES	●▥	GW-GM	Well-graded GRAVEL with silt
			●▨	GW-GC	Well-graded GRAVEL with clay
			○▥	GP-GM	Poorly graded GRAVEL with silt
			○▨	GP-GC	Poorly graded GRAVEL with clay
		GRAVEL WITH <u>≥</u> 15% FINES	○▥	GM	Silty GRAVEL
			○▨	GC	Clayey GRAVEL
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION <u>PASSING</u> ON NO. 4 SIEVE	SAND WITH <u>* 5% FINES</u>	⁘	SW	Well-graded SAND
			∴	SP	Poorly graded SAND
		SAND WITH BETWEEN 5% AND 15% FINES	⁘▥	SW-SM	Well-graded SAND with silt
			⁘▨	SW-SC	Well-graded SAND with clay
			∴▥	SP-SM	Poorly graded SAND with silt
			∴▨	SP-SC	Poorly graded SAND with clay
		SAND WITH <u>≥</u> 15% FINES	∴▥	SM	Silty SAND
			∴▨	SC	Clayey SAND
FINE GRAINED SOILS CONTAINS MORE THAN 50% FINES	SILT AND CLAY	LIQUID LIMIT <u>LESS</u> THAN 50	▥	ML	Inorganic SILT with low plasticity
			▨	CL	Lean inorganic CLAY with low plasticity
			☰	OL	Organic SILT with low plasticity
		LIQUID LIMIT <u>GREATER</u> THAN 50	▥	MH	Elastic inorganic SILT with moderate to high plasticity
			▨	CH	Fat inorganic CLAY with moderate to high plasticity
			≋	OH	Organic SILT or CLAY with moderate to high plasticity
HIGHLY ORGANIC SOILS			⺌	PT	PEAT soils with high organic contents

NOTES:

1) Sample descriptions are based on visual field and laboratory observations using classification methods of ASTM D2488. Where laboratory data are available, classifications are in accordance with ASTM D2487.

2) Solid lines between soil descriptions indicate change in interpreted geologic unit. Dashed lines indicate stratigraphic change within the unit.

3) Fines are material passing the U.S. Std. #200 Sieve.

EXISTING AND PROPOSED CURVE NUMBER (CN) CALCULATIONS

DYNAMIC ENGINEERING

Existing Drainage Area Summary and Average Curve Number (CN) Calculations

Project: Brookfield Suffern
Job #: 3709-99-004
Location: Suffern, NY

Computed By: TJB
Checked By: RDM
Date: 5/3/2022

Drainage Area	Impervious Area (acre)	Impervious Area (sf)	Curve Number (CN) Used	HSG A - Open Space Area (acre)	HSG A - Open Space Area (sf)	Curve Number (CN) Used	HSG A - Wooded Area (acre)	HSG A - Wooded Area (sf)	Curve Number (CN) Used	HSG C - Open Space Area (acre)	HSG C - Open Space Area (sf)	Curve Number (CN) Used	HSG C - Wooded Area (acre)	HSG C - Wooded Area (sf)	Curve Number (CN) Used	HSG D - Open Space Area (acre)	HSG D - Open Space Area (sf)	Curve Number (CN) Used	HSG D - Wooded Area (acre)	HSG D - Wooded Area (sf)	Curve Number (CN) Used	Avg. Perv. Curve Number	Total PerviousArea (acres)	Total Area (acres)	TC (Min.)
Ex. Study Area Pond	2.80	121,841	98	3.59	156,429	39	0.00	-	30	0.00	-	74	0.00	-	70	0.00		80	0.00	-	77	39	3.59	6.39	10
Ex. Study Area Stream	22.56	982,776	98	19.24	838,125	39	12.55	546,728	30	0.11	4,866	74	0.63	27,337	70	0.41	18,058	80	0.07	3,181	77	37	33.02	55.58	16
Total	**25.36**	**1104617.00**		**22.83**	**994554.00**		**12.55**	**546728.00**		**0.11**	**4866.00**		**0.63**	**27337.00**		**0.41**	**18058.00**		**0.07**	**3181.00**			**36.61**	**61.97**	

Per County Soil Survey -	Us	HSG	A	Udorthents, smoothec
Per County Soil Survey -	Ux	HSG	N/S	Urban land
Per County Soil Survey -	WeB	HSG	C	Wethersfield gravelly silt loan
Per County Soil Survey -	WeD	HSG	C	Wethersfield gravelly silt loam, 15 to 25 percent slope
Per County Soil Survey -	HoD	HSG	D	Holyoke-Rock outcrop complex, hill

Description	Runoff Curve Number (CN) (HSG A)	Runoff Curve Number (CN) (HSG B)	Runoff Curve Number (CN) (HSG C)	Runoff Curve Number (CN) (HSG D)
Impervious Surface	98	98	98	98
Open Space (lawn) (good	39	61	74	80
Woods (good)	30	55	70	77

DYNAMIC
ENGINEERING

PROPOSED DRAINAGE AREA SUMMARY AND AVERAGE CURVE NUMBER (CN) CALCULATIONS

Project: Brookfield Suffern
Job #: 3709-99-004
Location: Suffern, NY

Computed By: TJB
Checked By: RDM
Date: 5/3/2022

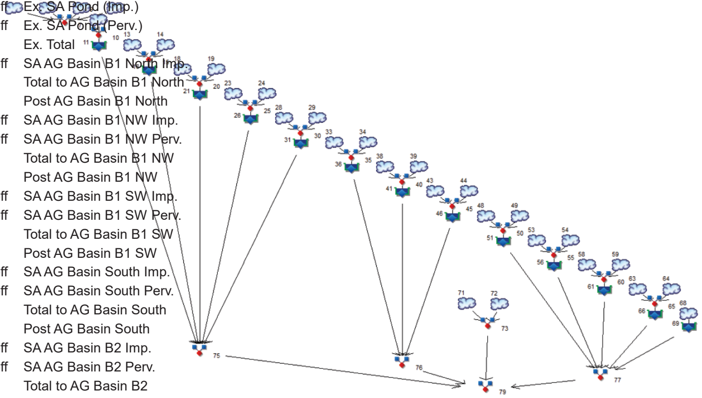
Drainage Area	Impervious Area (acre)	Impervious Area (sf)	Curve Number (CN) Used	HSG A - Open Space Area (acre)	HSG A - Open Space Area (sf)	Curve Number (CN) Used	HSG C - Open Space Area (acre)	HSG C - Open Space Area (sf)	Curve Number (CN) Used	HSG D - Open Space Area (acre)	HSG D - Open Space Area (sf)	Curve Number (CN) Used	Avg. Perv. Curve Number	Total PerviousArea (acres)	Total Area (acres)	TC (Min.)
SA. AG Basin B1 North	2.10	91,642	98	0.89	38,758.00	39	0.00	-	74	0.00	-	80	39	0.89	2.99	10
SA AG Basin B1 NW	1.01	43,963	98	0.23	9,943.00	39	0.00	-	74	0.29	12,800	80	62	0.52	1.53	10
SA AG Basin B1 SW	0.42	18,082	98	0.31	13,344.00	39	0.00	-	74	0.00	-	80	39	0.31	0.72	10
SA AG Basin South	2.06	89,589	98	0.92	39,957.00	39	0.00	-	74	0.00	-	80	39	0.92	2.97	10
SA AG Basin B2	3.44	149,673	98	0.62	27,022.00	39	0.07	3,049	74	0.00	-	80	43	0.69	4.13	10
SA UG Barrels B1 NE	8.08	352,014	98	0.29	12,623.00	39	0.00	-	74	0.00	-	80	39	0.29	8.37	10
SA UG Barrels B1 SE	9.29	404,723	98	0.35	15,342.00	39	0.09	3,803	74	0.00	-	80	46	0.44	9.73	10
SA UG Barrels South	1.42	62,018	98	0.04	1,815.00	39	0.10	4,451	74	0.00	-	80	64	0.14	1.57	10
SA UG Inf B1 NW	9.31	405,741	98	0.26	11,269.00	39	0.00	-	74	0.00	-	80	39	0.26	9.57	10
SA UG Inf B1 SW	5.50	239,582	98	0.30	12,869.00	39	0.00	-	74	0.00	-	80	39	0.30	5.80	10
SA UG Inf B1 South	0.42	18,140	98	0.10	4,214.00	39	0.04	1,697	74	0.00	-	80	49	0.14	0.55	10
SA UG Inf B2	6.01	261,917	98	0.10	4,281.00	39	0.00	-	74	0.00	-	80	39	0.10	6.11	10
SA UG Inf B3	2.02	88,200	98	0.00	-	39	0.00	-	74	0.00	-	80	N/A	0.00	2.02	10
SA Stream Undetained	0.29	12,578	98	5.36	233,663	39	0.05	2,061	74	0.20	8,518	80	41	5.61	5.90	10
Total	**51.37**	**2237862.00**		**9.76**	**425100.00**		**0.35**	**15061.00**		**0.49**	**21318.00**			**10.59**	**61.97**	

Per County Soil Survey -	Us	HSG	A	Udorthents, smoothed
Per County Soil Survey -	Ux	HSG	N/S	Urban land
Per County Soil Survey -	WeB	HSG	C	Wethersfield gravelly silt loam
Per County Soil Survey -	WeD	HSG	C	Wethersfield gravelly silt loam, 15 to 25 percent slopes
Per County Soil Survey -	HoD	HSG	D	Holyoke-Rock outcrop complex, hilly

Description	Runoff Curve Number (CN) (HSG A)	Runoff Curve Number (CN) (HSG B)	Runoff Curve Number (CN) (HSG C)	Runoff Curve Number (CN) (HSG D)
Impervious Surface	98	98	98	98
Open Space (lawn) (good)	39	61	74	80
Woods (good)	30	55	70	77

EXISTING AND PROPOSED HYDROGRAPHS
1-, 10-, 25- & 100-YEAR STORM EVENTS

Watershed Model Schematic



Legend

Hyd.	Origin	Description
1	SCS Runoff	Ex. SA Stream (Imp.)
2	SCS Runoff	Ex. SA Stream (Perv.)
4	SCS Runoff	Ex. SA Pond (Imp.)
5	SCS Runoff	Ex. SA Pond (Perv.)
7	Combine	Ex. Total
9	SCS Runoff	SA AG Basin B1 North Imp.
10	Combine	Total to AG Basin B1 North
11	Reservoir	Post AG Basin B1 North
13	SCS Runoff	SA AG Basin B1 NW Imp.
14	SCS Runoff	SA AG Basin B1 NW Perv.
15	Combine	Total to AG Basin B1 NW
16	Reservoir	Post AG Basin B1 NW
18	SCS Runoff	SA AG Basin B1 SW Imp.
19	SCS Runoff	SA AG Basin B1 SW Perv.
20	Combine	Total to AG Basin B1 SW
21	Reservoir	Post AG Basin B1 SW
23	SCS Runoff	SA AG Basin South Imp.
24	SCS Runoff	SA AG Basin South Perv.
25	Combine	Total to AG Basin South
26	Reservoir	Post AG Basin South
28	SCS Runoff	SA AG Basin B2 Imp.
29	SCS Runoff	SA AG Basin B2 Perv.
30	Combine	Total to AG Basin B2
31	Reservoir	Post AG Basin B2
33	SCS Runoff	SA UG Barrels B1 NE Imp.
34	SCS Runoff	SA UG Barrels B1 NE Perv.
35	Combine	Total to UG Barrels B1 NE
36	Reservoir	Post UG Barrels B1 NE
38	SCS Runoff	SA UG Barrels B1 SE Imp.
39	SCS Runoff	SA UG Barrels B1 SE Perv.
40	Combine	Total to UG Barrels B1 SE
41	Reservoir	Post UG Barrels B1 SE
43	SCS Runoff	SA UG Barrels South Imp.
44	SCS Runoff	SA UG Barrels South Perv.
45	Combine	Total to UG Barrels South
46	Reservoir	Post UG Barrels South
48	SCS Runoff	SA UG Inf B1 NW Imp.
49	SCS Runoff	SA UG Inf B1 NW Perv.
50	Combine	Total to UG Inf B1 NW
51	Reservoir	Post Ug Inf B1 NW
53	SCS Runoff	SA UG Inf B1 SW Imp.
54	SCS Runoff	SA UG Inf B1 SW Perv.
55	Combine	Total to UG Inf B1 SW
56	Reservoir	Post Ug Inf B1 SW
58	SCS Runoff	SA UG Inf B1 South Imp.
59	SCS Runoff	SA UG Inf B1 South Perv.
60	Combine	Total to UG Inf B1 South
61	Reservoir	Post UG Inf B1 South
63	SCS Runoff	SA UG Inf B2 Imp.
64	SCS Runoff	SA UG Inf B2 Perv.
65	Combine	Total to SA UG Inf B2
66	Reservoir	Post Ug Inf B2
68	SCS Runoff	SA UG Inf B3 Imp.
69	Reservoir	Post UG Inf B3
71	SCS Runoff	SA Stream Undetained Imp.
72	SCS Runoff	SA Stream Undetained Perv.
73	Combine	Total to Stream Undetained
75	Combine	Total AG Basins
76	Combine	Total UG Barrels
77	Combine	Total UG Inf Basins
79	Combine	Prop. POA Stream / Site

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
1	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Ex. SA Stream (Imp.)
2	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Ex. SA Stream (Perv.)
4	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Ex. SA Pond (Imp.)
5	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Ex. SA Pond (Perv.)
7	Combine	1, 2, 4, 5,	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Ex. Total
9	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA AG Basin B1 North Imp.
10	Combine	9	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Total to AG Basin B1 North
11	Reservoir	10	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Post AG Basin B1 North
13	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA AG Basin B1 NW Imp.
14	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA AG Basin B1 NW Perv.
15	Combine	13, 14	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Total to AG Basin B1 NW
16	Reservoir	15	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Post AG Basin B1 NW
18	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA AG Basin B1 SW Imp.
19	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA AG Basin B1 SW Perv.
20	Combine	18, 19	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Total to AG Basin B1 SW
21	Reservoir	20	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Post AG Basin B1 SW
23	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA AG Basin South Imp.
24	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA AG Basin South Perv.
25	Combine	23, 24	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Total to AG Basin South
26	Reservoir	25	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Post AG Basin South
28	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA AG Basin B2 Imp.
29	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA AG Basin B2 Perv.
30	Combine	28, 29	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Total to AG Basin B2
31	Reservoir	30	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Post AG Basin B2
33	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA UG Barrels B1 NE Imp.
34	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA UG Barrels B1 NE Perv.
35	Combine	33, 34	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Total to UG Barrels B1 NE
36	Reservoir	35	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Post UG Barrels B1 NE
38	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA UG Barrels B1 SE Imp.
39	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA UG Barrels B1 SE Perv.

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
40	Combine	38, 39	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Total to UG Barrels B1 SE
41	Reservoir	40	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Post UG Barrels B1 SE
43	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA UG Barrels South Imp.
44	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA UG Barrels South Perv.
45	Combine	43, 44	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Total to UG Barrels South
46	Reservoir	45	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Post UG Barrels South
48	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA UG Inf B1 NW Imp.
49	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA UG Inf B1 NW Perv.
50	Combine	48, 49	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Total to UG Inf B1 NW
51	Reservoir	50	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Post Ug Inf B1 NW
53	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA UG Inf B1 SW Imp.
54	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA UG Inf B1 SW Perv.
55	Combine	53, 54	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Total to UG Inf B1 SW
56	Reservoir	55	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Post Ug Inf B1 SW
58	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA UG Inf B1 South Imp.
59	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA UG Inf B1 South Perv.
60	Combine	58, 59	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Total to UG Inf B1 South
61	Reservoir	60	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Post UG Inf B1 South
63	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA UG Inf B2 Imp.
64	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA UG Inf B2 Perv.
65	Combine	63, 64	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Total to SA UG Inf B2
66	Reservoir	65	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Post Ug Inf B2
68	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA UG Inf B3 Imp.
69	Reservoir	68	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Post UG Inf B3
71	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA Stream Undetained Imp.
72	SCS Runoff	-------	0.000	-------	-------	-------	0.000	0.000	-------	0.000	SA Stream Undetained Perv.
73	Combine	71, 72	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Total to Stream Undetained
75	Combine	11, 16, 21, 26, 31,	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Total AG Basins
76	Combine	36, 41, 46,	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Total UG Barrels
77	Combine	51, 56, 61, 66, 69,	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Total UG Inf Basins

---

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow Hyd(s)	Peak Outflow (cfs)								Hydrograph description
			1-Yr	2-Yr	3-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	
79	Combine	73, 75, 76, 77,	0.000	-------	-------	-------	0.000	0.000	-------	0.000	Prop. POA Stream / Site

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	0.000	5	n/a	0	----	------	------	Ex. SA Stream (Imp.)
2	SCS Runoff	0.000	5	n/a	0	----	------	------	Ex. SA Stream (Perv.)
4	SCS Runoff	0.000	5	n/a	0	----	------	------	Ex. SA Pond (Imp.)
5	SCS Runoff	0.000	5	n/a	0	----	------	------	Ex. SA Pond (Perv.)
7	Combine	0.000	5	n/a	0	1, 2, 4, 5,	------	------	Ex. Total
9	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B1 North Imp.
10	Combine	0.000	5	n/a	0	9	------	------	Total to AG Basin B1 North
11	Reservoir	0.000	5	n/a	0	10	0.00	0.000	Post AG Basin B1 North
13	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B1 NW Imp.
14	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B1 NW Perv.
15	Combine	0.000	5	n/a	0	13, 14	------	------	Total to AG Basin B1 NW
16	Reservoir	0.000	5	n/a	0	15	0.00	0.000	Post AG Basin B1 NW
18	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B1 SW Imp.
19	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B1 SW Perv.
20	Combine	0.000	5	n/a	0	18, 19	------	------	Total to AG Basin B1 SW
21	Reservoir	0.000	5	n/a	0	20	0.00	0.000	Post AG Basin B1 SW
23	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin South Imp.
24	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin South Perv.
25	Combine	0.000	5	n/a	0	23, 24	------	------	Total to AG Basin South
26	Reservoir	0.000	5	n/a	0	25	0.00	0.000	Post AG Basin South
28	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B2 Imp.
29	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B2 Perv.
30	Combine	0.000	5	n/a	0	28, 29	------	------	Total to AG Basin B2
31	Reservoir	0.000	5	n/a	0	30	0.00	0.000	Post AG Basin B2
33	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Barrels B1 NE Imp.
34	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Barrels B1 NE Perv.
35	Combine	0.000	5	n/a	0	33, 34	------	------	Total to UG Barrels B1 NE
36	Reservoir	0.000	5	n/a	0	35	0.00	0.000	Post UG Barrels B1 NE
38	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Barrels B1 SE Imp.
39	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Barrels B1 SE Perv.

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
40	Combine	0.000	5	n/a	0	38, 39	------	------	Total to UG Barrels B1 SE
41	Reservoir	0.000	5	n/a	0	40	0.00	0.000	Post UG Barrels B1 SE
43	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Barrels South Imp.
44	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Barrels South Perv.
45	Combine	0.000	5	n/a	0	43, 44	------	------	Total to UG Barrels South
46	Reservoir	0.000	5	n/a	0	45	0.00	0.000	Post UG Barrels South
48	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B1 NW Imp.
49	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B1 NW Perv.
50	Combine	0.000	5	n/a	0	48, 49	------	------	Total to UG Inf B1 NW
51	Reservoir	0.000	5	n/a	0	50	0.00	0.000	Post Ug Inf B1 NW
53	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B1 SW Imp.
54	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B1 SW Perv.
55	Combine	0.000	5	n/a	0	53, 54	------	------	Total to UG Inf B1 SW
56	Reservoir	0.000	5	n/a	0	55	0.00	0.000	Post Ug Inf B1 SW
58	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B1 South Imp.
59	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B1 South Perv.
60	Combine	0.000	5	n/a	0	58, 59	------	------	Total to UG Inf B1 South
61	Reservoir	0.000	5	n/a	0	60	0.00	0.000	Post UG Inf B1 South
63	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B2 Imp.
64	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B2 Perv.
65	Combine	0.000	5	n/a	0	63, 64	------	------	Total to SA UG Inf B2
66	Reservoir	0.000	5	n/a	0	65	0.00	0.000	Post Ug Inf B2
68	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B3 Imp.
69	Reservoir	0.000	5	n/a	0	68	0.00	0.000	Post UG Inf B3
71	SCS Runoff	0.000	5	n/a	0	----	------	------	SA Stream Undetained Imp.
72	SCS Runoff	0.000	5	n/a	0	----	------	------	SA Stream Undetained Perv.
73	Combine	0.000	5	n/a	0	71, 72	------	------	Total to Stream Undetained
75	Combine	0.000	5	n/a	0	11, 16, 21, 26, 31,	------	------	Total AG Basins
76	Combine	0.000	5	n/a	0	36, 41, 46,	------	------	Total UG Barrels
77	Combine	0.000	5	n/a	0	51, 56, 61, 66, 69,	------	------	Total UG Inf Basins

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
79	Combine	0.000	5	n/a	0	73, 75, 76, 77,	------	------	Prop. POA Stream / Site

---

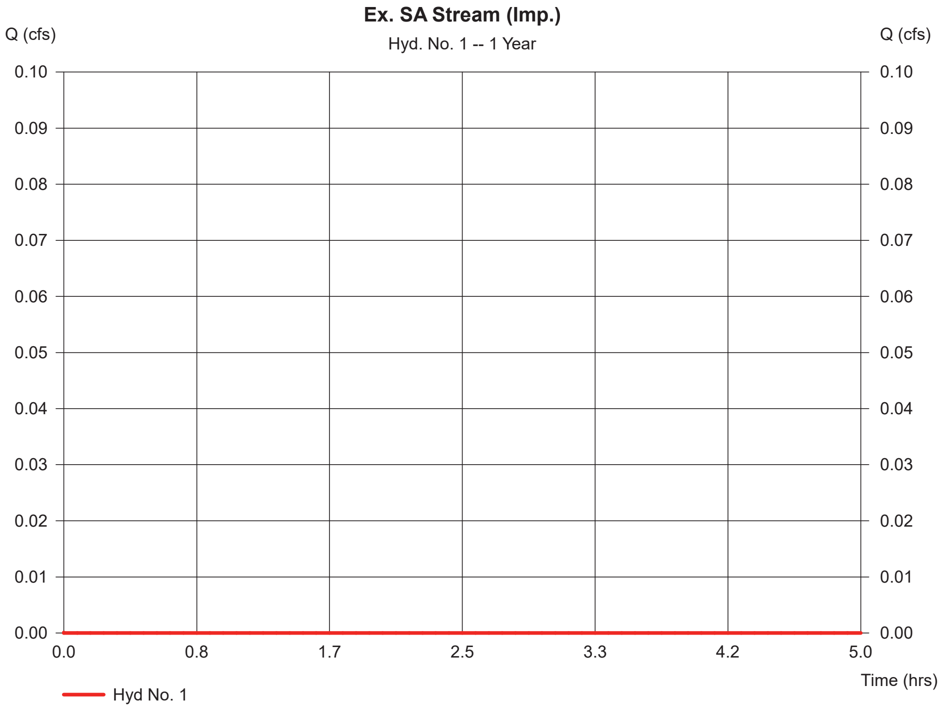
Hydrograph Report

Hyd. No. 1

Ex. SA Stream (Imp.)

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 22.560 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 16.20 min
Distribution = Type III
Shape factor = 484



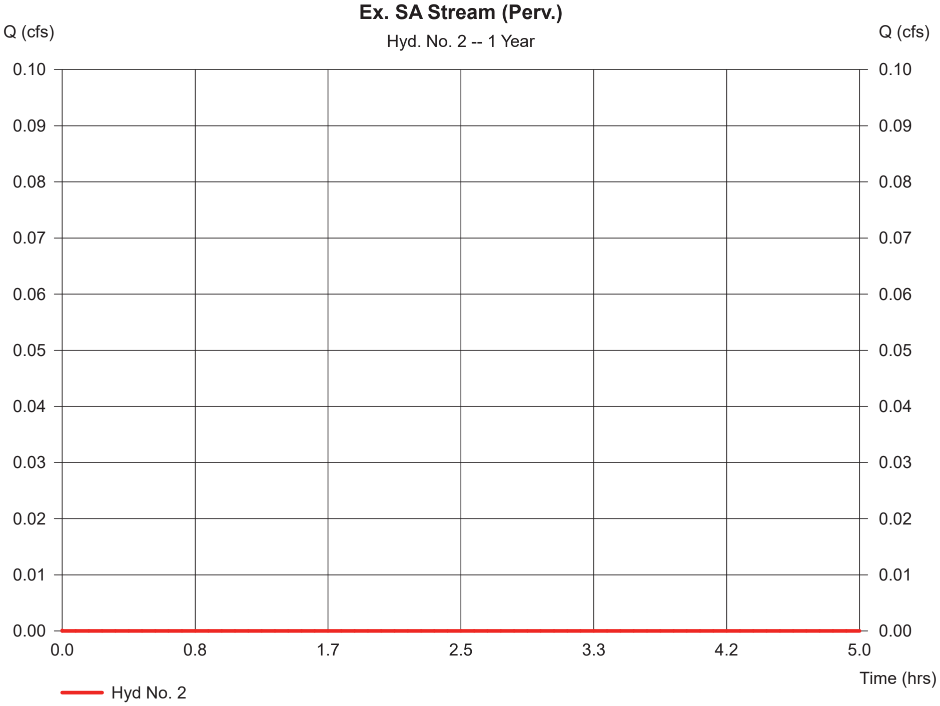
Hydrograph Report

Hyd. No. 2

Ex. SA Stream (Perv.)

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 33.110 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 37
Hydraulic length = 0 ft
Time of conc. (Tc) = 16.20 min
Distribution = Type III
Shape factor = 484



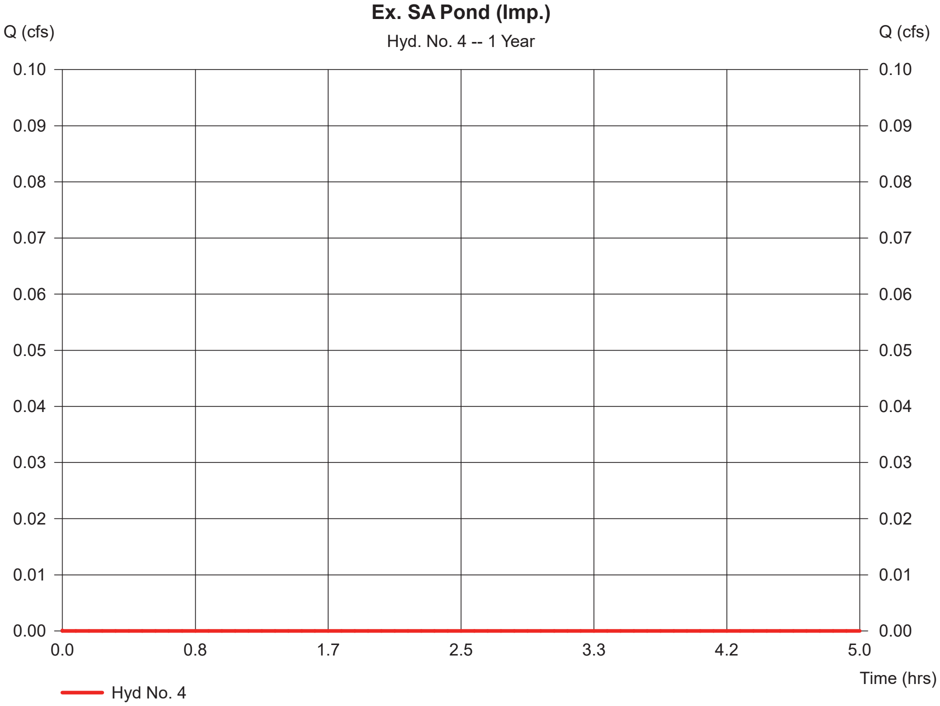
Hydrograph Report

Hyd. No. 4

Ex. SA Pond (Imp.)

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 2.800 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484

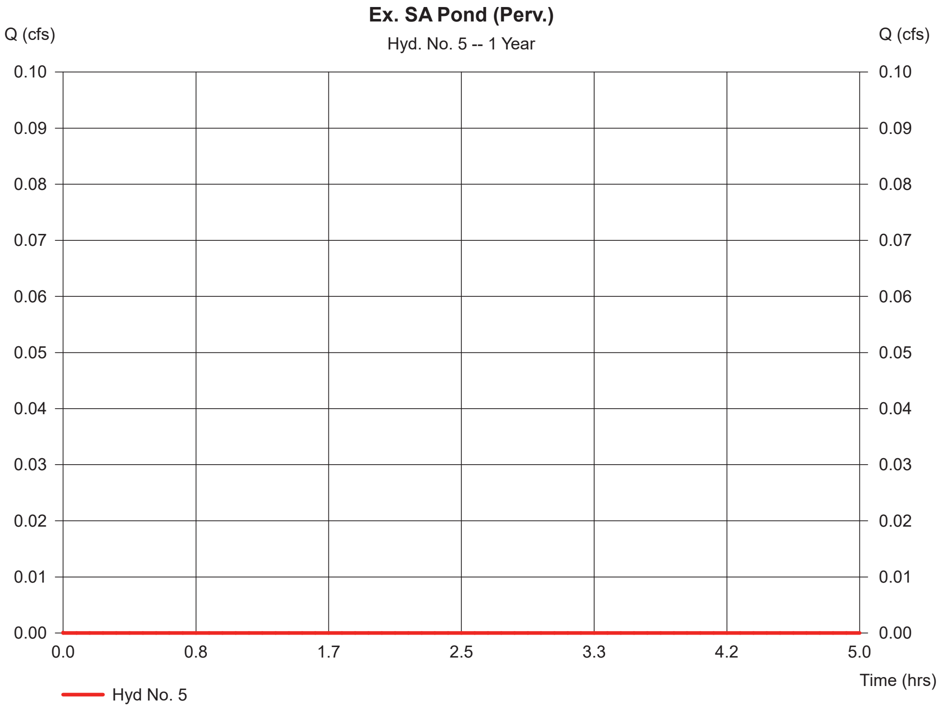


Hyd. No. 5

Ex. SA Pond (Perv.)

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 3.590 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 39
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484

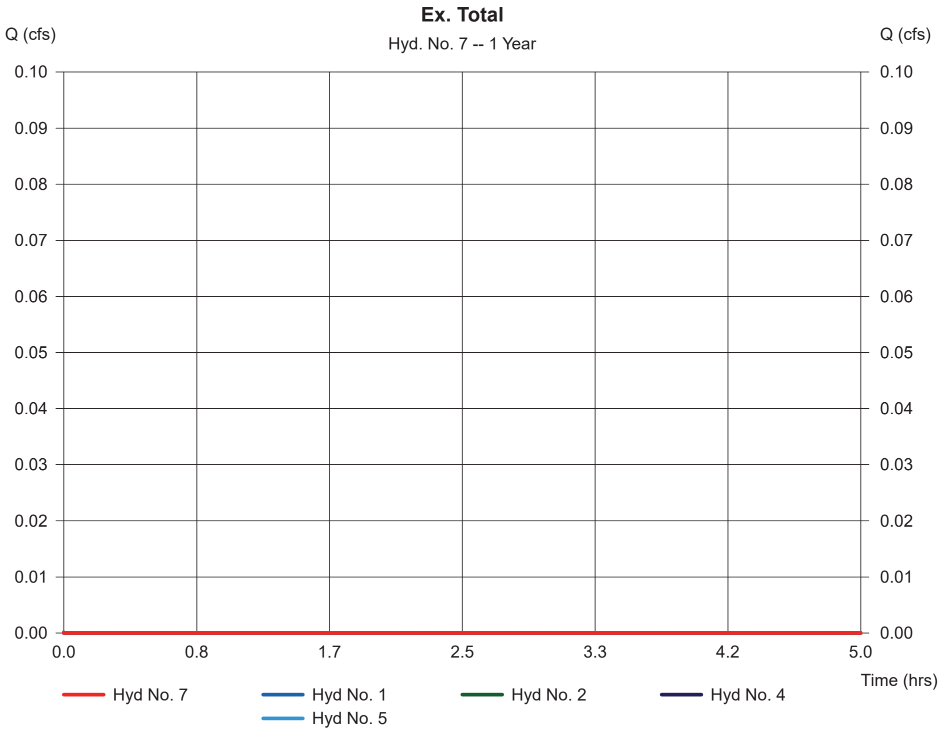


Hyd. No. 7

Ex. Total

Hydrograph type = Combine
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyds. = 1, 2, 4, 5

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 62.060 ac

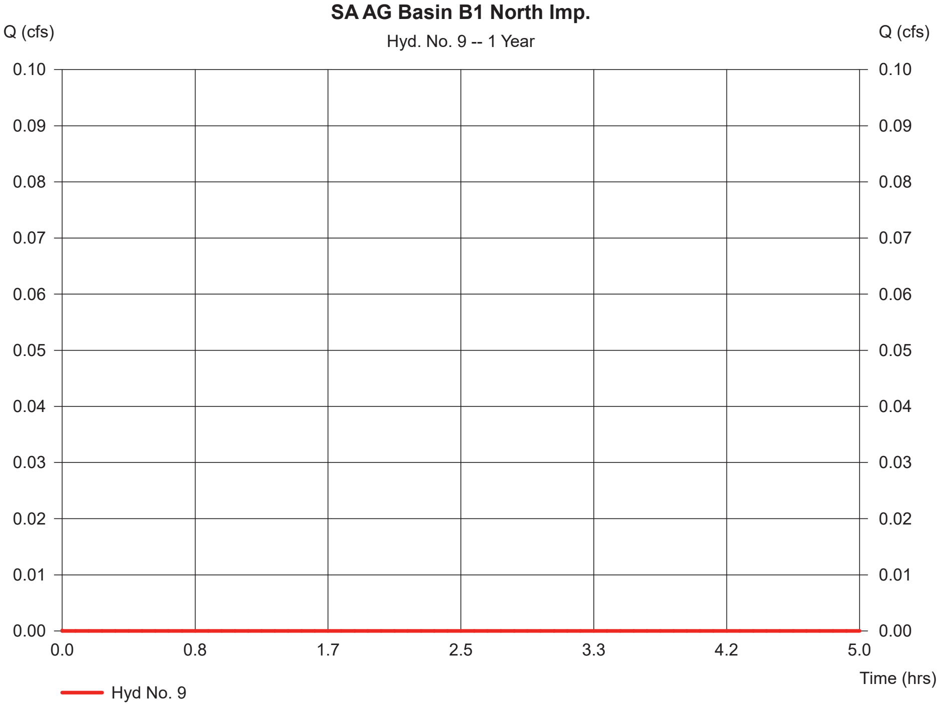


Hydrograph Report

Hyd. No. 9

SA AG Basin B1 North Imp.

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 2.100 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 2.90 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

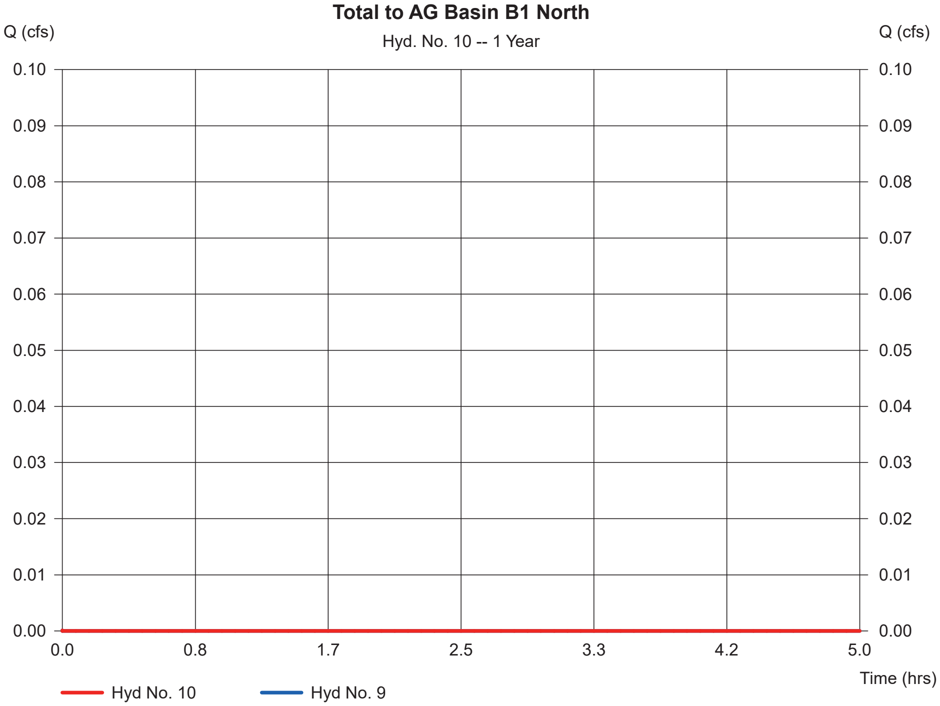


Hydrograph Report

Hyd. No. 10

Total to AG Basin B1 North

Hydrograph type	= Combine	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Inflow hyds.	= 9	Contrib. drain. area	= 2.100 ac



Hydrograph Report

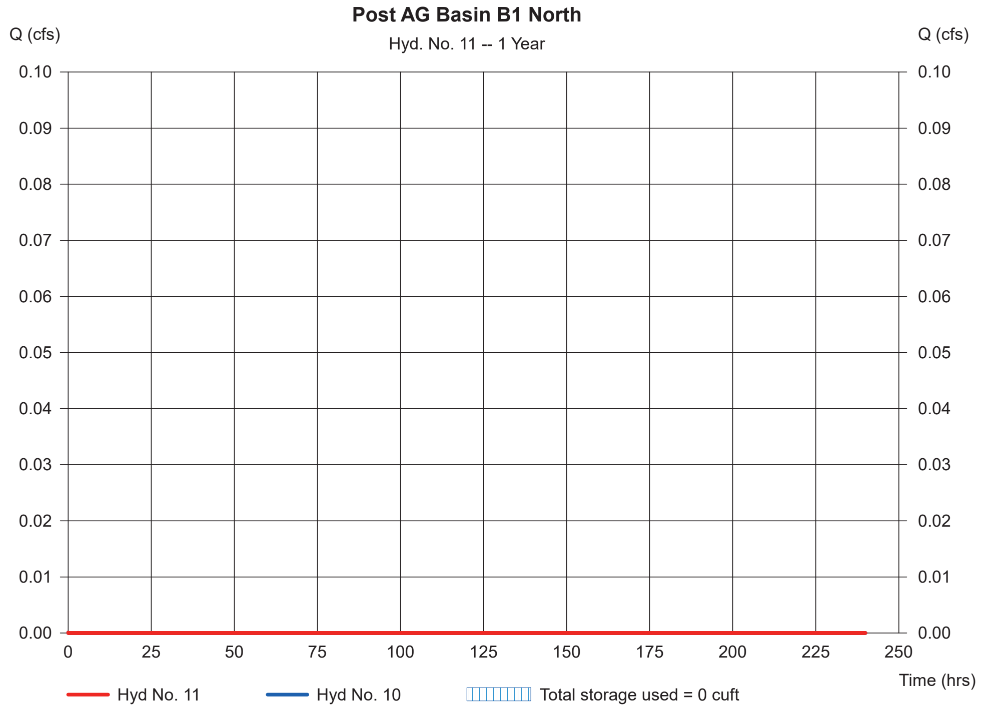
Hyd. No. 11

Post AG Basin B1 North

Hydrograph type = Reservoir
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyd. No. = 10 - Total to AG Basin B1 North
Reservoir name = AG Basin B1 North

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



Pond Report

Pond No. 13 - AG Basin B1 North

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 307.20 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	307.20	27,520	0	0
0.80	308.00	27,520	22,013	22,013
1.80	309.00	27,520	27,517	49,531
2.80	310.00	27,520	27,517	77,048
3.80	311.00	27,520	27,517	104,565
4.80	312.00	27,520	27,517	132,083

Culvert / Orifice Structures

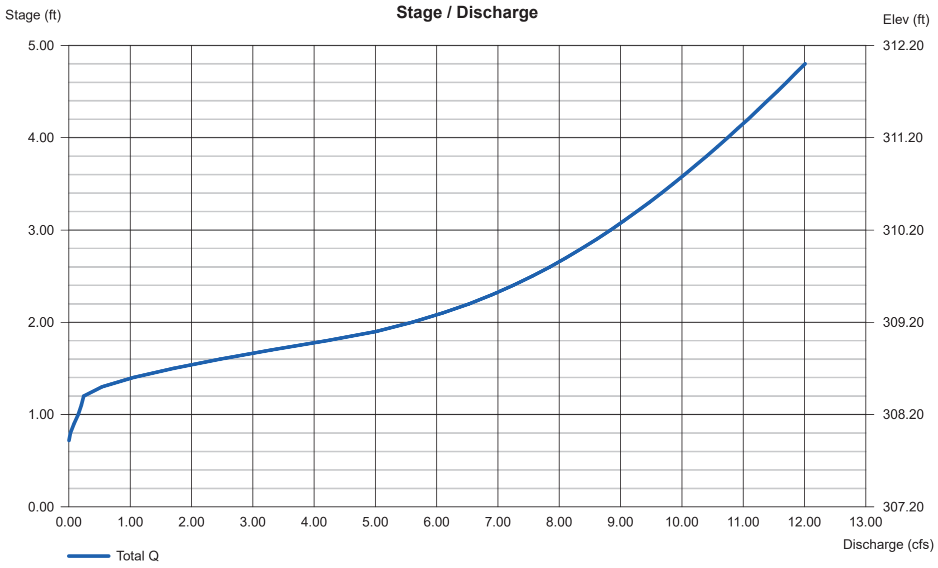
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	4.00	0.00	0.00
Span (in)	= 15.00	4.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 307.20	307.90	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 2.50	0.00	0.00	0.00
Crest El. (ft)	= 308.40	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



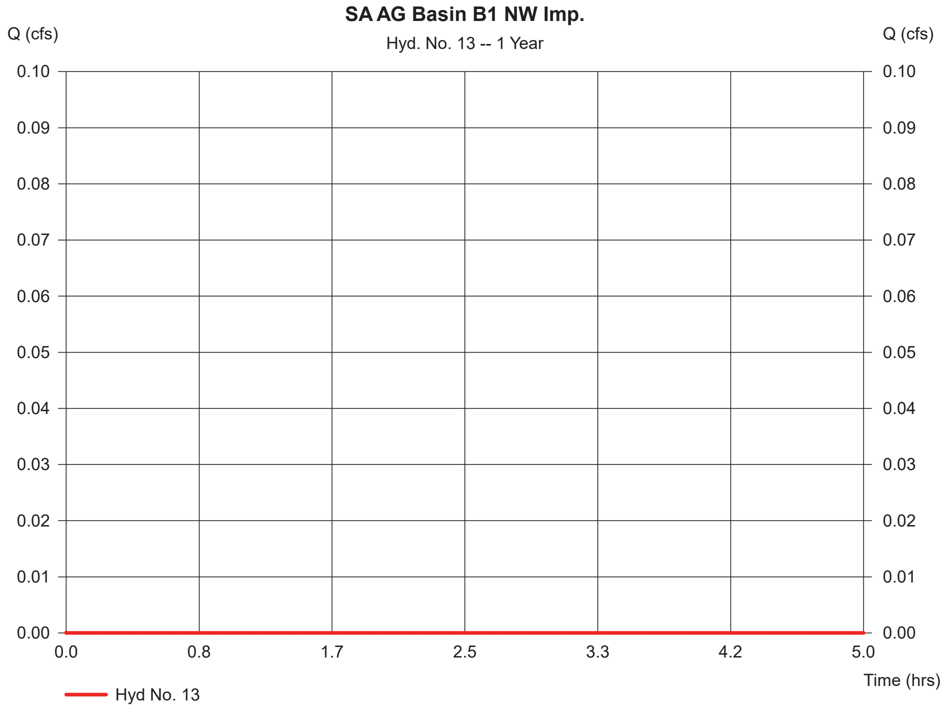
Hydrograph Report

Hyd. No. 13

SA AG Basin B1 NW Imp.

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 1.010 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



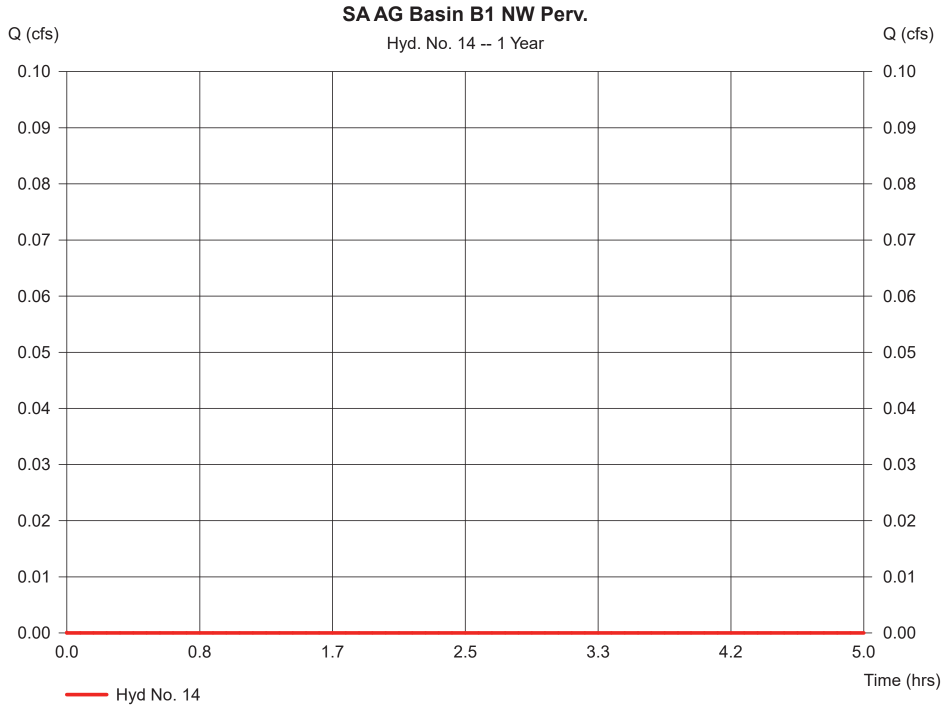
Hydrograph Report

Hyd. No. 14

SA AG Basin B1 NW Perv.

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 0.520 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 62
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

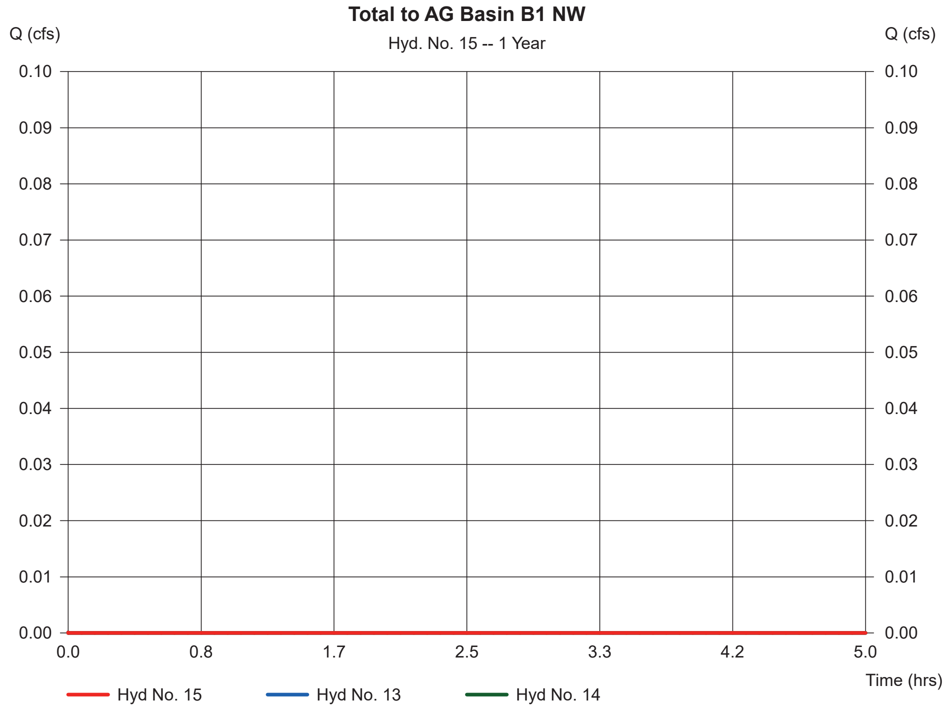
Hydraflow Hydrographs by Intelisolve v9.1 Friday, Jan 20, 2023

Hyd. No. 15

Total to AG Basin B1 NW

Hydrograph type = Combine
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyds. = 13, 14

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 1.530 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1 Friday, Jan 20, 2023

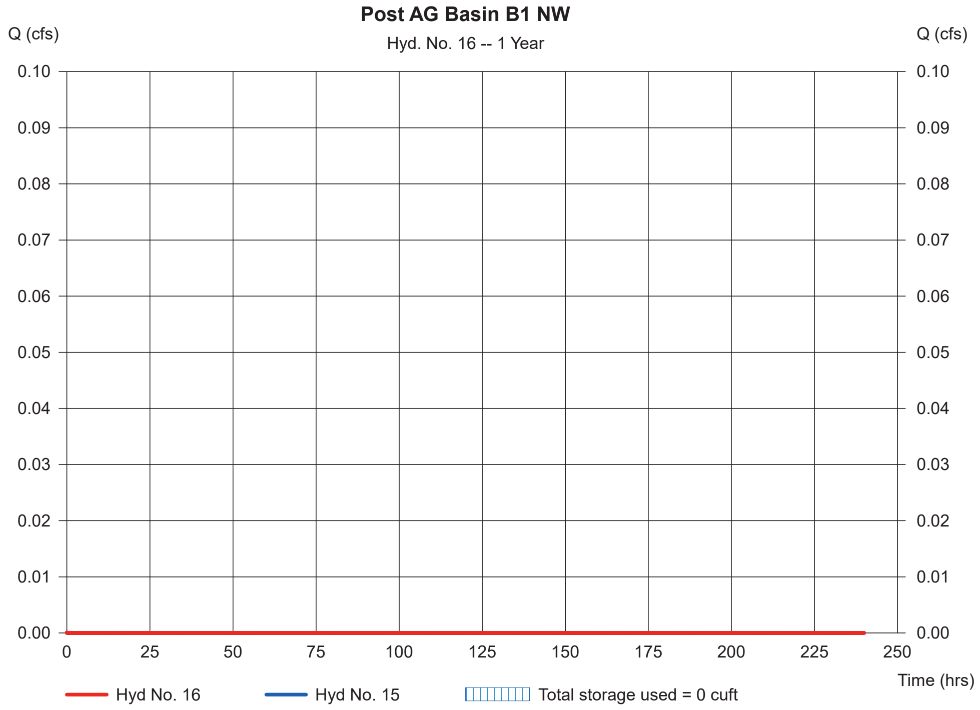
Hyd. No. 16

Post AG Basin B1 NW

Hydrograph type = Reservoir
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyd. No. = 15 - Total to AG Basin B1 NW
Reservoir name = AG Basin B1 Northwest

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



Pond Report

Pond No. 14 - AG Basin B1 Northwest

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 304.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	304.00	9,045	0	0
1.00	305.00	9,045	9,044	9,044
2.00	306.00	9,045	9,044	18,088
3.00	307.00	9,045	9,044	27,132
4.00	308.00	9,045	9,044	36,176
5.00	309.00	9,045	9,044	45,220
6.00	310.00	9,045	9,044	54,265

Culvert / Orifice Structures

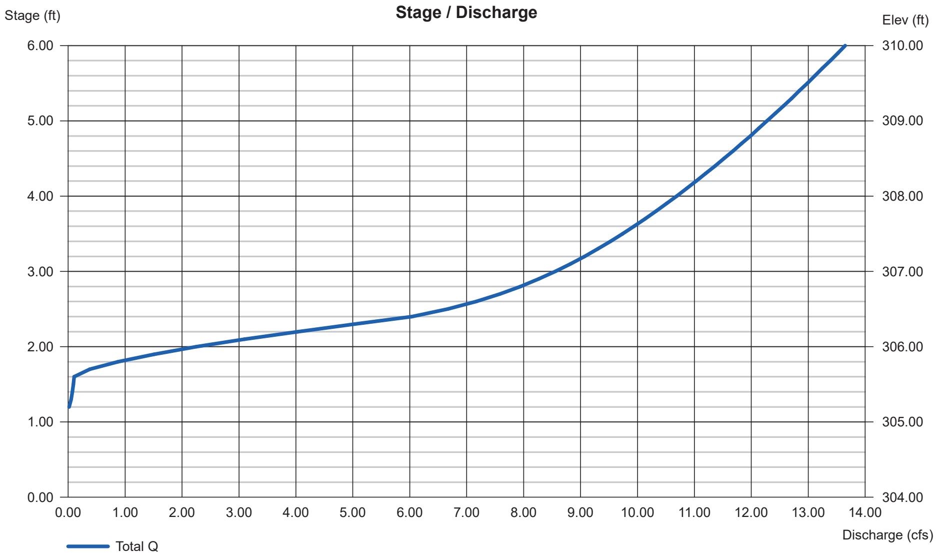
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	2.50	0.00	0.00
Span (in)	= 15.00	2.50	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 304.00	305.10	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 2.50	0.00	0.00	0.00
Crest El. (ft)	= 305.60	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



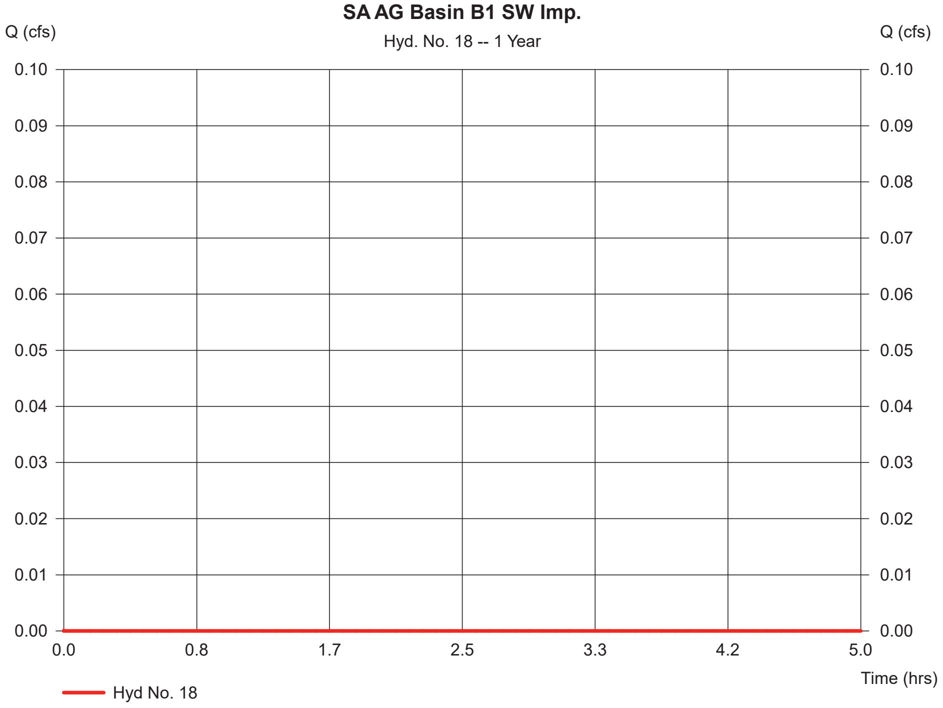
Hydrograph Report

Hyd. No. 18

SA AG Basin B1 SW Imp.

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 0.420 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



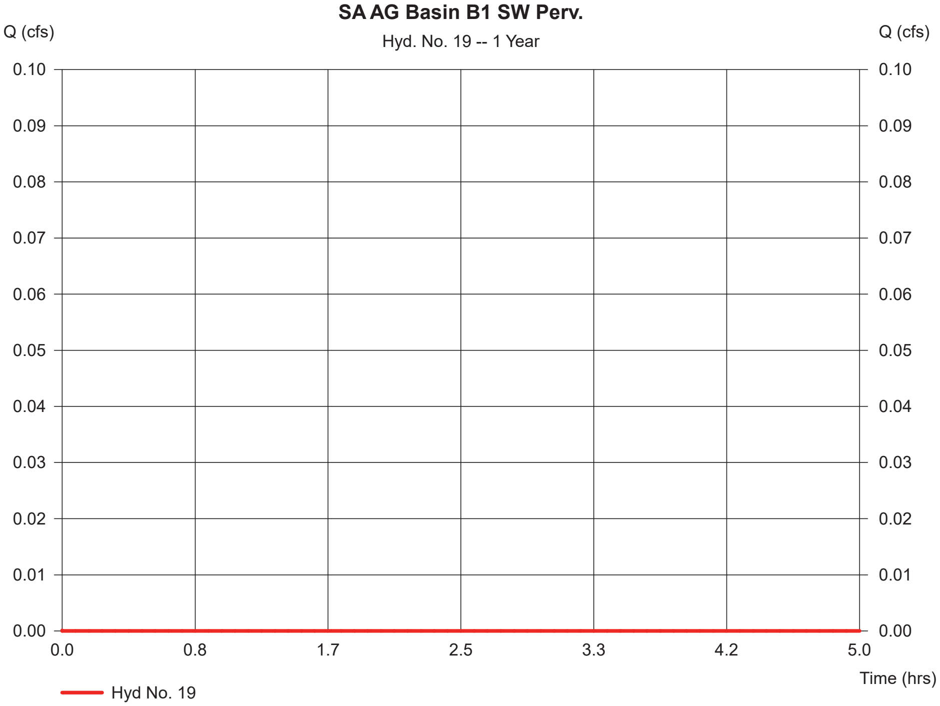
Hydrograph Report

Hyd. No. 19

SA AG Basin B1 SW Perv.

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 0.310 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 39
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



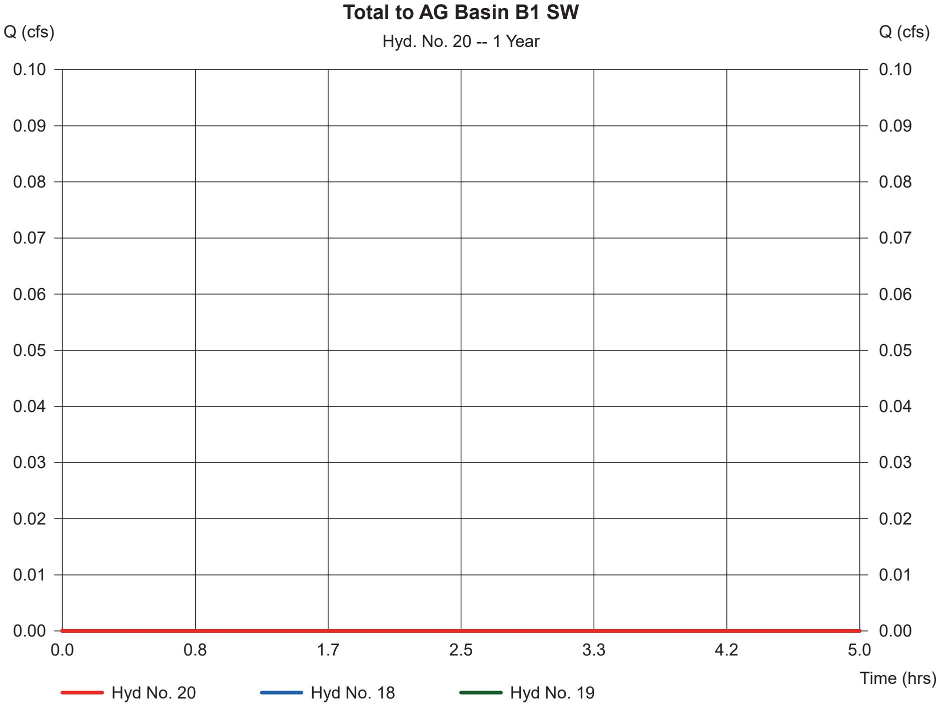
Hydrograph Report

Hyd. No. 20

Total to AG Basin B1 SW

Hydrograph type = Combine
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyds. = 18, 19

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 0.730 ac



Hydrograph Report

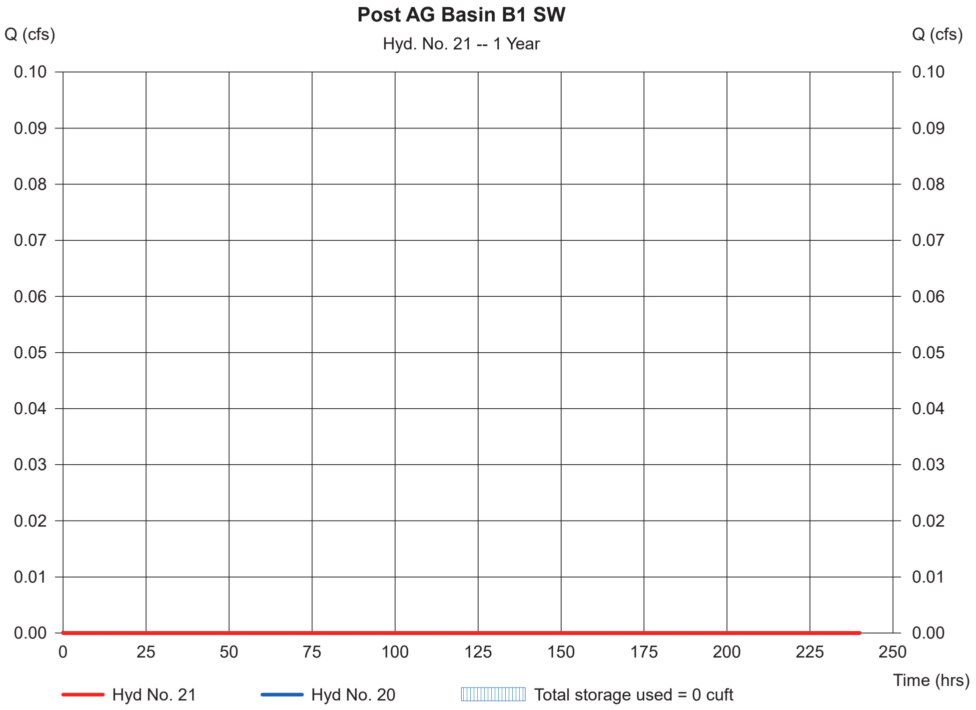
Hyd. No. 21

Post AG Basin B1 SW

Hydrograph type = Reservoir
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyd. No. = 20 - Total to AG Basin B1 SW
Reservoir name = AG Basin B1 Southwest

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



Pond Report

Pond No. 15 - AG Basin B1 Southwest

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 308.60 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	308.60	8,515	0	0
0.40	309.00	8,515	3,406	3,406
1.40	310.00	8,515	8,514	11,920
2.40	311.00	8,515	8,514	20,434

Culvert / Orifice Structures

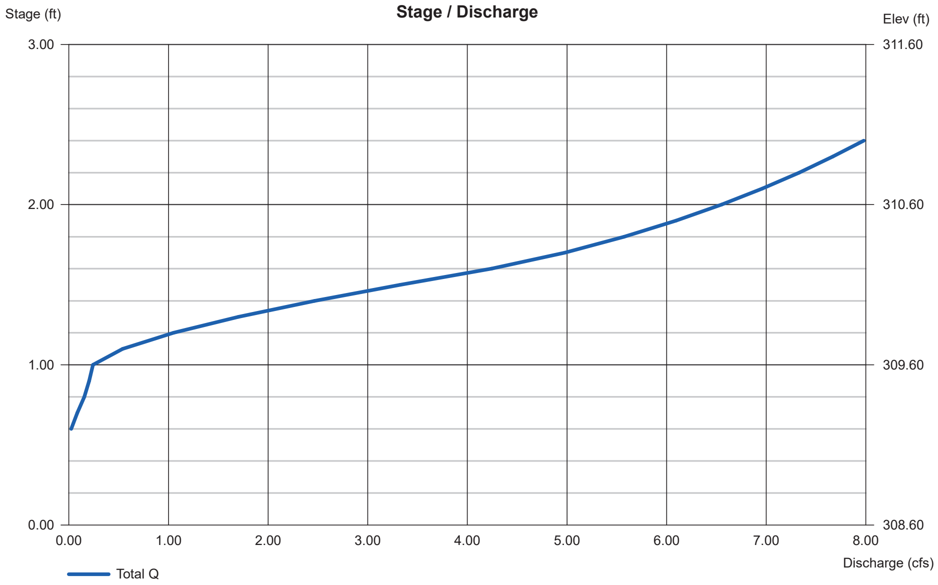
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	4.00	0.00	0.00
Span (in)	= 15.00	4.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 308.60	309.10	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 2.50	0.00	0.00	0.00
Crest El. (ft)	= 309.60	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



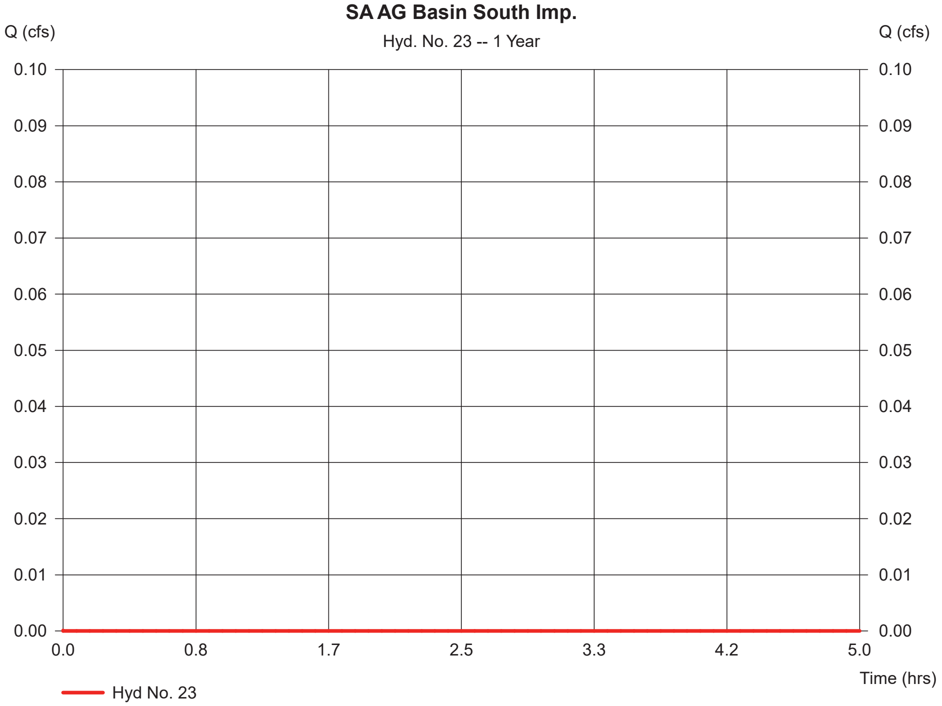
Hydrograph Report

Hyd. No. 23

SA AG Basin South Imp.

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 2.060 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



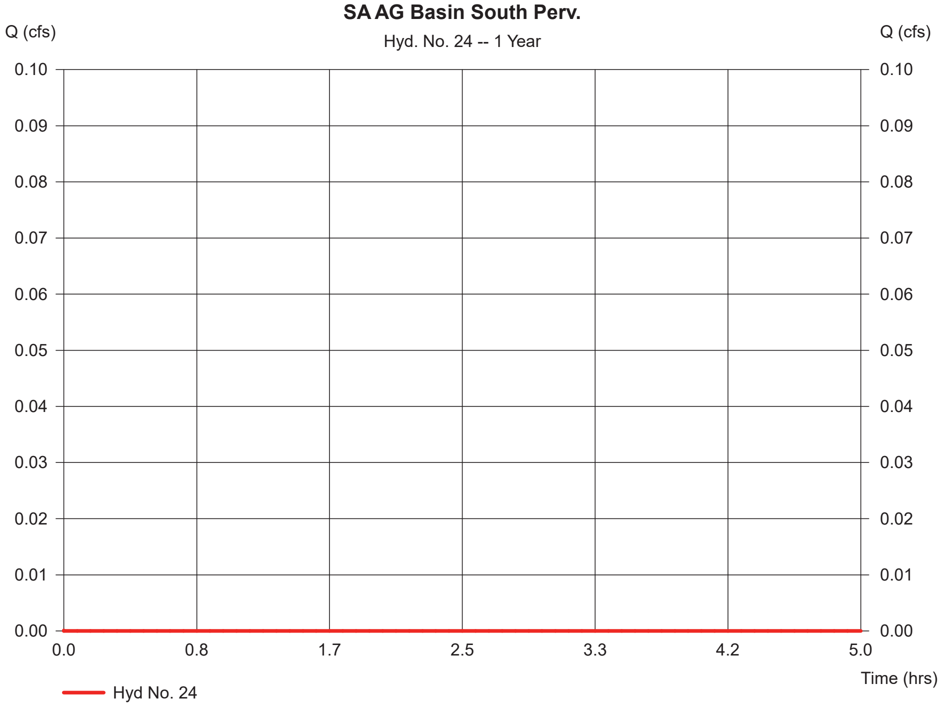
Hydrograph Report

Hyd. No. 24

SA AG Basin South Perv.

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 0.920 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 39
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



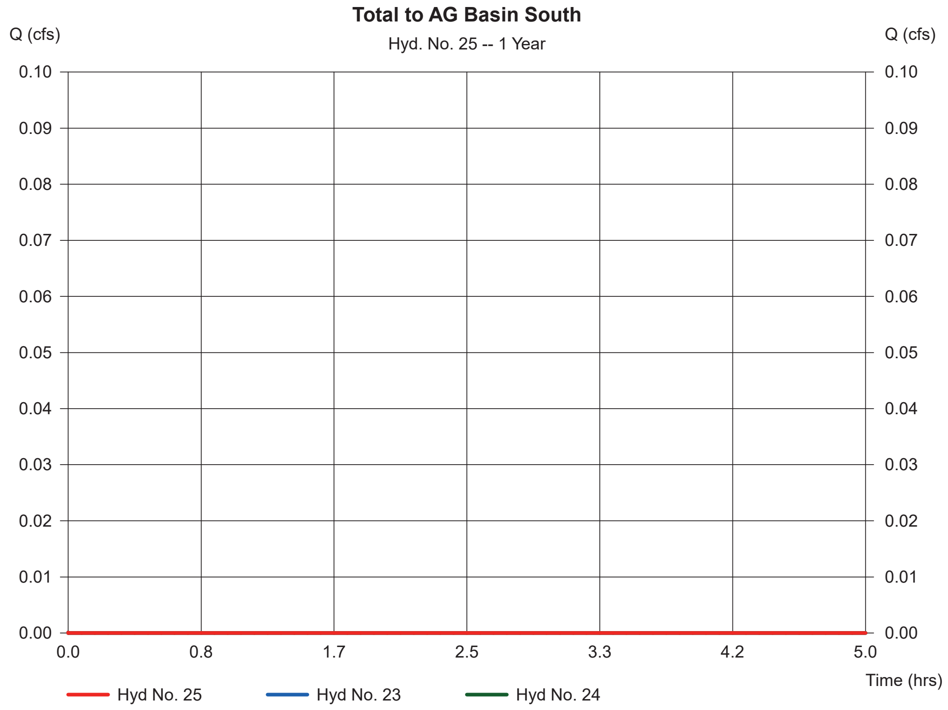
Hydrograph Report

Hyd. No. 25

Total to AG Basin South

Hydrograph type = Combine
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyds. = 23, 24

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 2.980 ac



Hydrograph Report

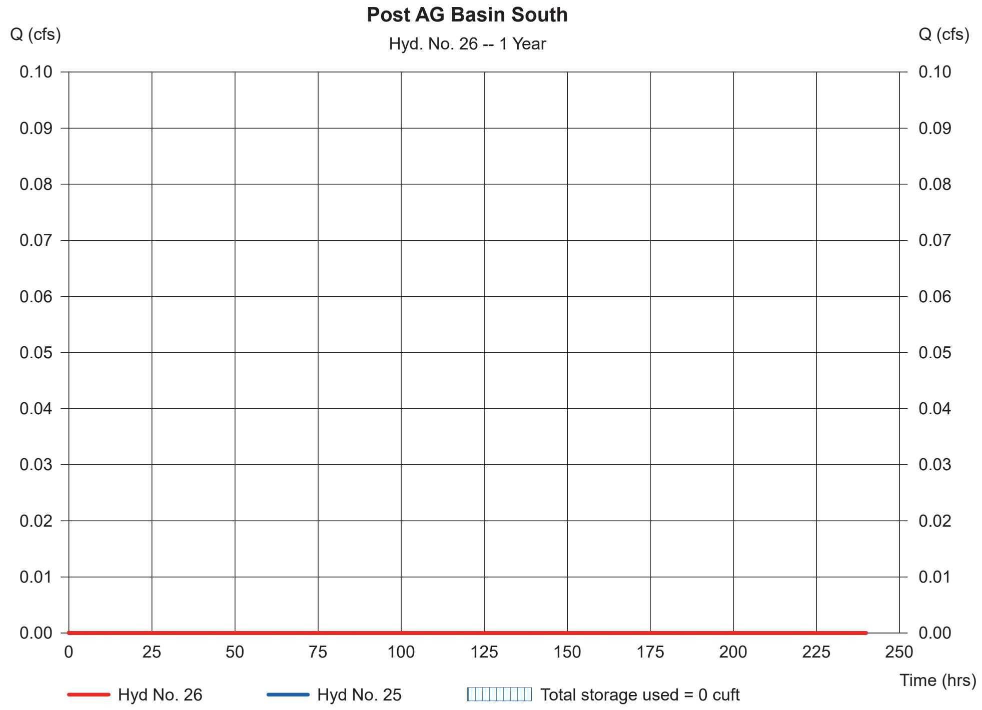
Hyd. No. 26

Post AG Basin South

Hydrograph type = Reservoir
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyd. No. = 25 - Total to AG Basin South
Reservoir name = AG Basin South

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



Pond Report

Pond No. 16 - AG Basin South

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 310.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	310.50	18,370	0	0
0.50	311.00	18,370	9,184	9,184
1.50	312.00	18,370	18,368	27,552
2.50	313.00	18,370	18,368	45,920
3.50	314.00	18,370	18,368	64,289

Culvert / Orifice Structures

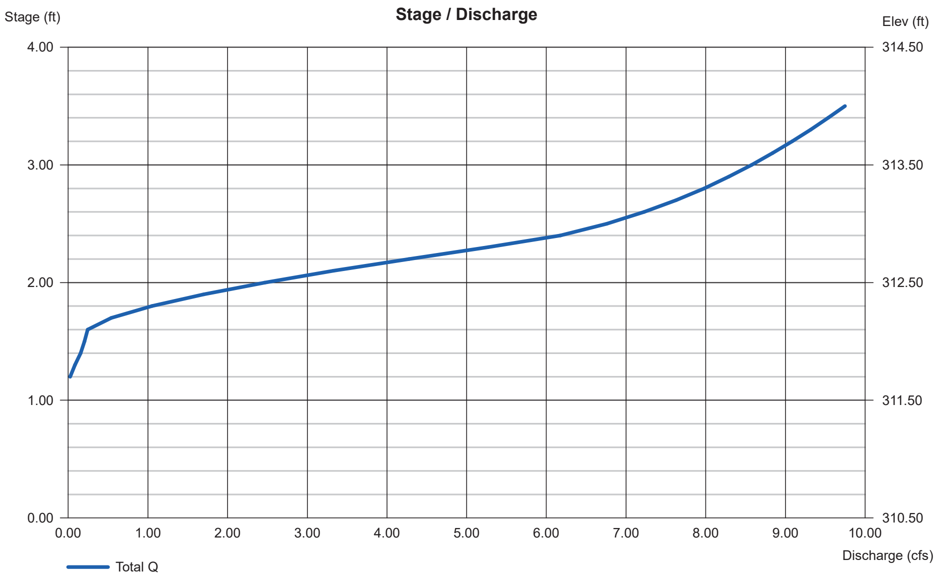
		[A]	[B]	[C]	[PrfRsr]
Rise (in)	=	15.00	4.00	0.00	0.00
Span (in)	=	15.00	4.00	0.00	0.00
No. Barrels	=	1	1	0	0
Invert El. (ft)	=	310.50	311.60	0.00	0.00
Length (ft)	=	0.00	0.00	0.00	0.00
Slope (%)	=	0.00	0.00	0.00	n/a
N-Value	=	.013	.013	.013	n/a
Orifice Coeff.	=	0.60	0.60	0.60	0.60
Multi-Stage	=	n/a	Yes	No	No

Weir Structures

		[A]	[B]	[C]	[D]
Crest Len (ft)	=	2.50	0.00	0.00	0.00
Crest El. (ft)	=	312.10	0.00	0.00	0.00
Weir Coeff.	=	3.33	3.33	3.33	3.33
Weir Type	=	Rect	---	---	---
Multi-Stage	=	Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



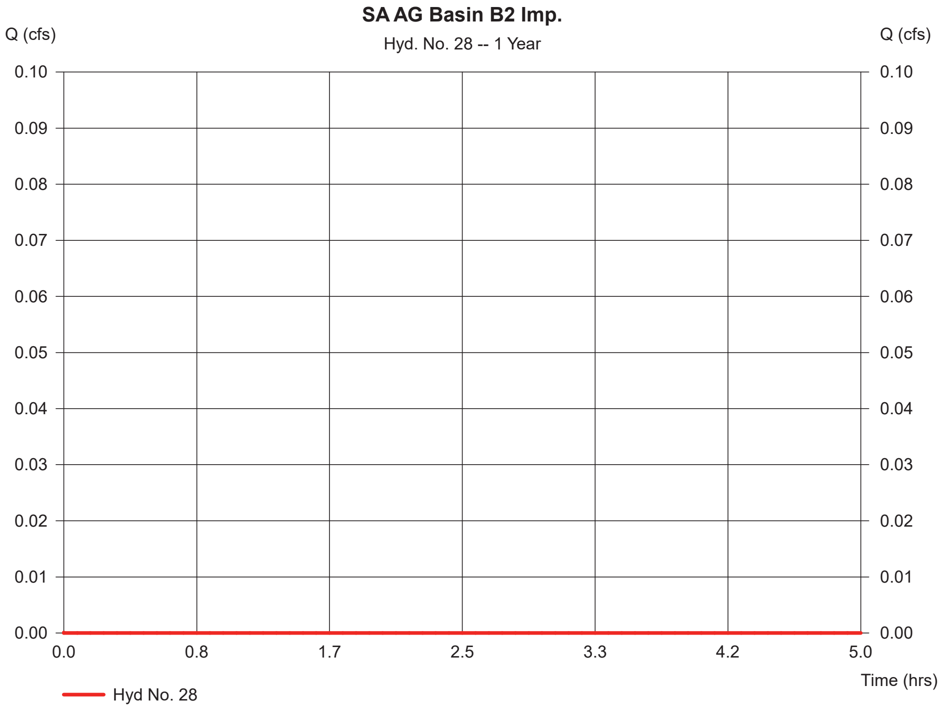
Hydrograph Report

Hyd. No. 28

SA AG Basin B2 Imp.

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 2.150 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484

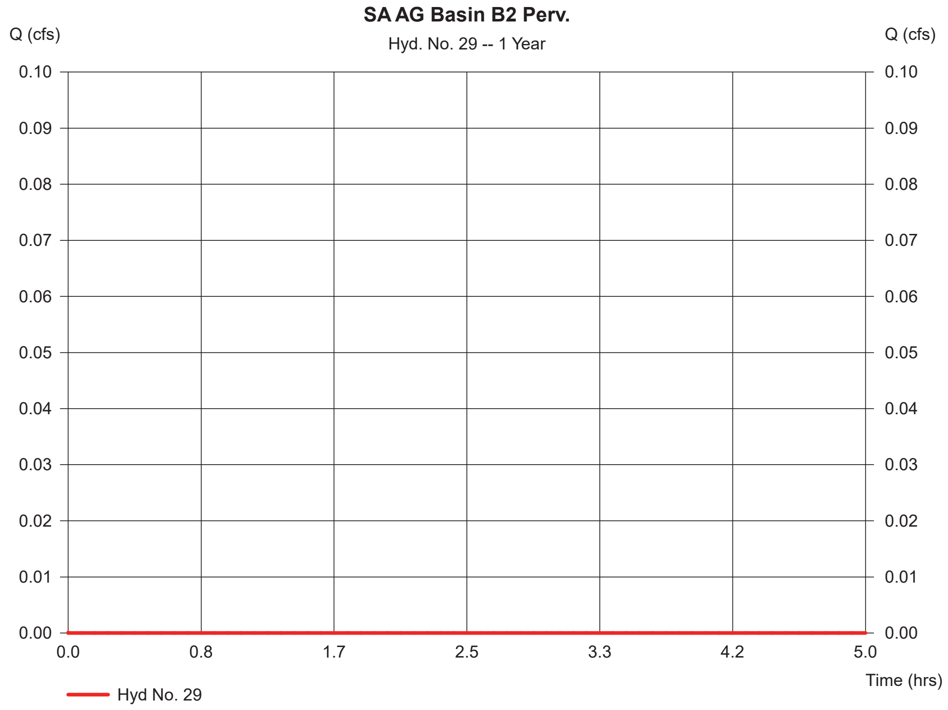


Hydrograph Report

Hyd. No. 29

SA AG Basin B2 Perv.

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 0.620 ac	Curve number	= 43
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 2.90 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

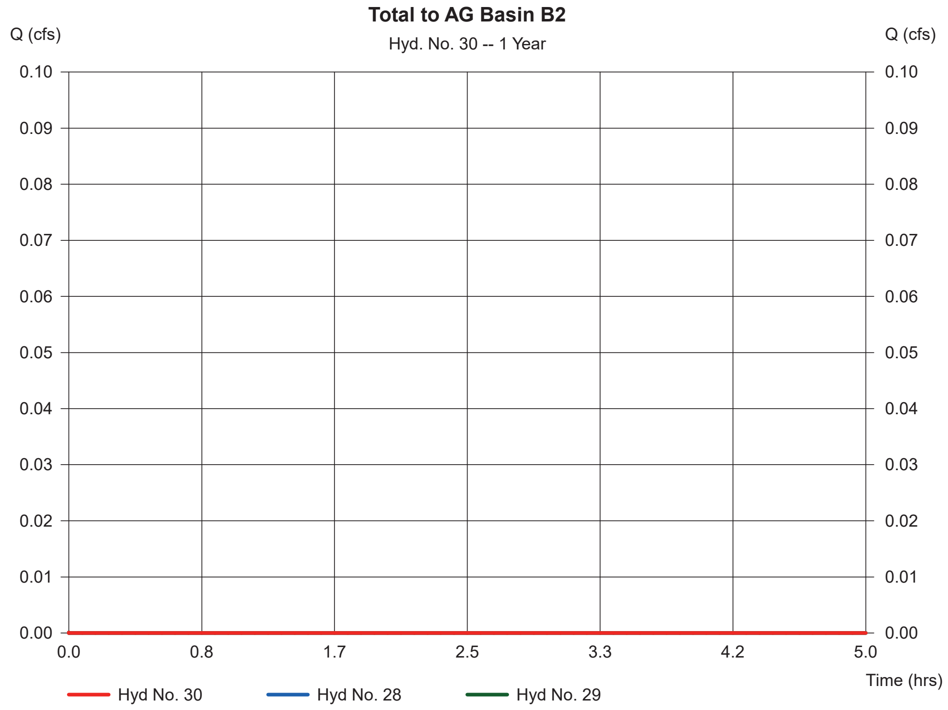


Hydrograph Report

Hyd. No. 30

Total to AG Basin B2

Hydrograph type	= Combine	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Inflow hyds.	= 28, 29	Contrib. drain. area	= 2.770 ac



Hydrograph Report

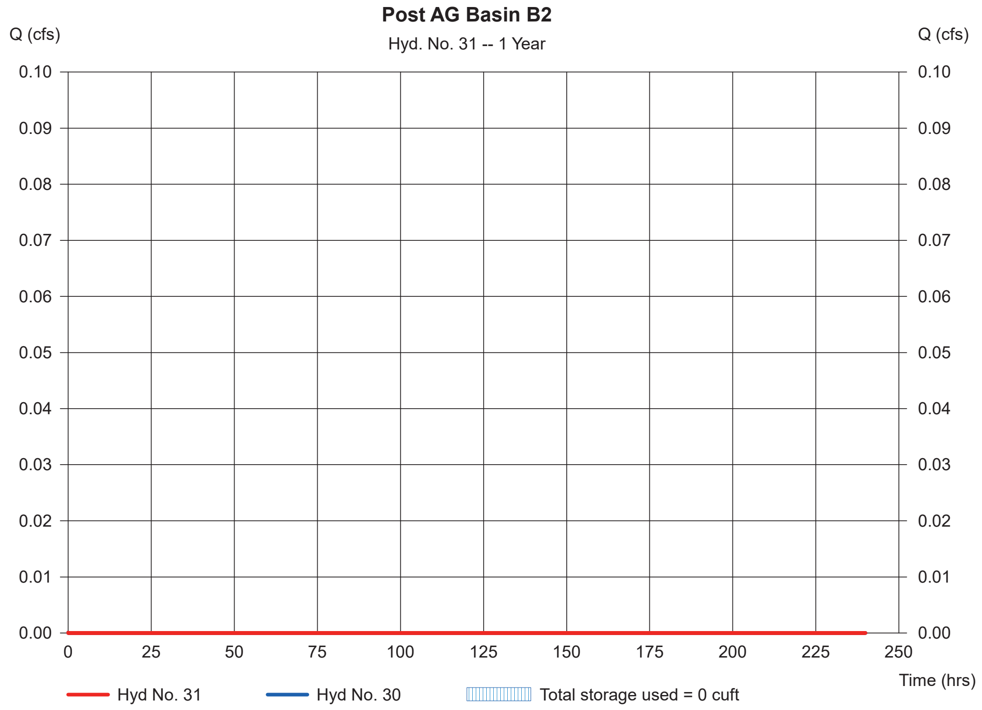
Hyd. No. 31

Post AG Basin B2

Hydrograph type = Reservoir
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyd. No. = 30 - Total to AG Basin B2
Reservoir name = AG Basin B2

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



Pond Report

Pond No. 17 - AG Basin B2

Pond Data

Contours - User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 303.40 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	303.40	5,630	0	0
0.60	304.00	5,630	3,378	3,378
1.60	305.00	5,630	5,629	9,007
2.60	306.00	5,630	5,629	14,637
3.60	307.00	5,630	5,629	20,266
4.90	308.30	5,630	7,318	27,584

Culvert / Orifice Structures

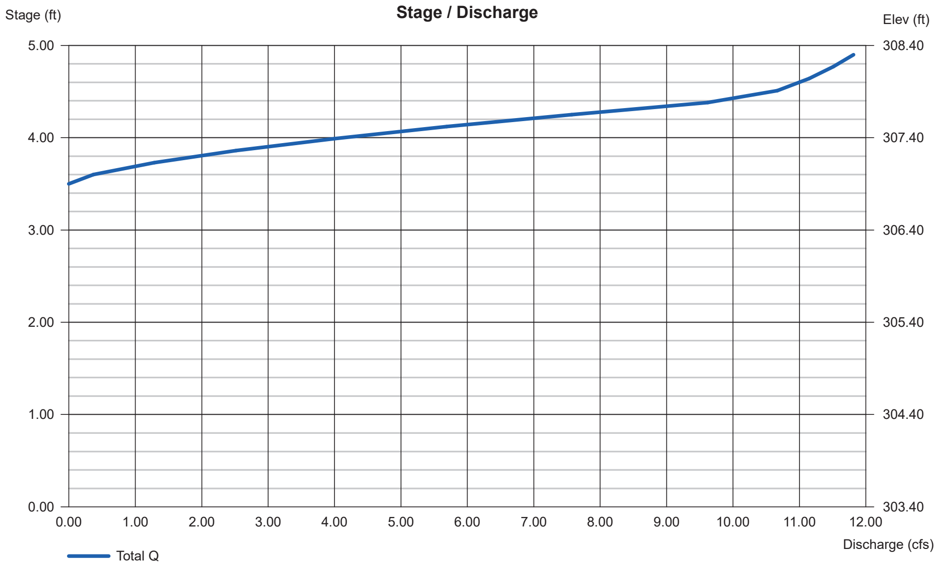
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	0.00	0.00	0.00
Span (in)	= 15.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 303.40	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 3.50	0.00	0.00	0.00
Crest El. (ft)	= 306.90	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



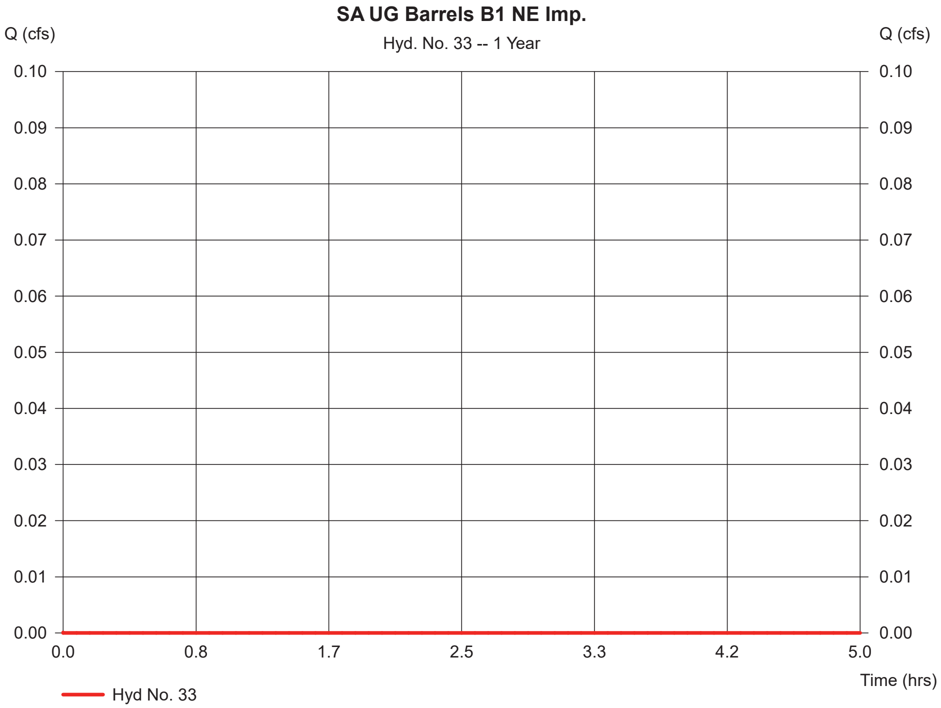
Hydrograph Report

Hyd. No. 33

SA UG Barrels B1 NE Imp.

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 8.080 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



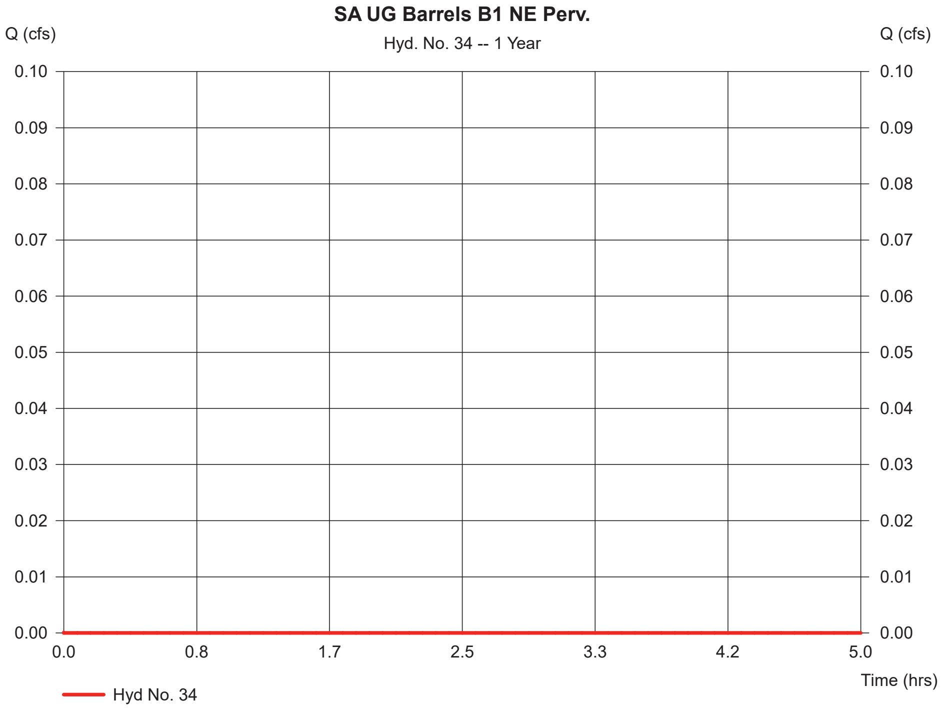
Hydrograph Report

Hyd. No. 34

SA UG Barrels B1 NE Perv.

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 0.140 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 64
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



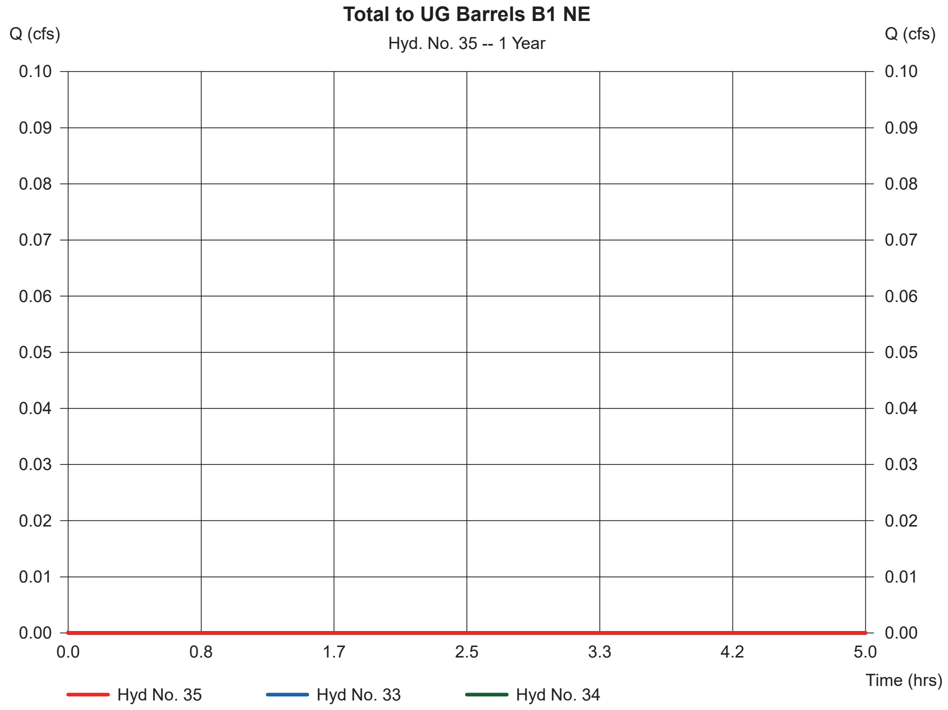
Hydrograph Report

Hyd. No. 35

Total to UG Barrels B1 NE

Hydrograph type = Combine
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyds. = 33, 34

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 8.220 ac



Total to UG Barrels B1 NE

Hyd. No. 35 -- 1 Year

Hydrograph Report

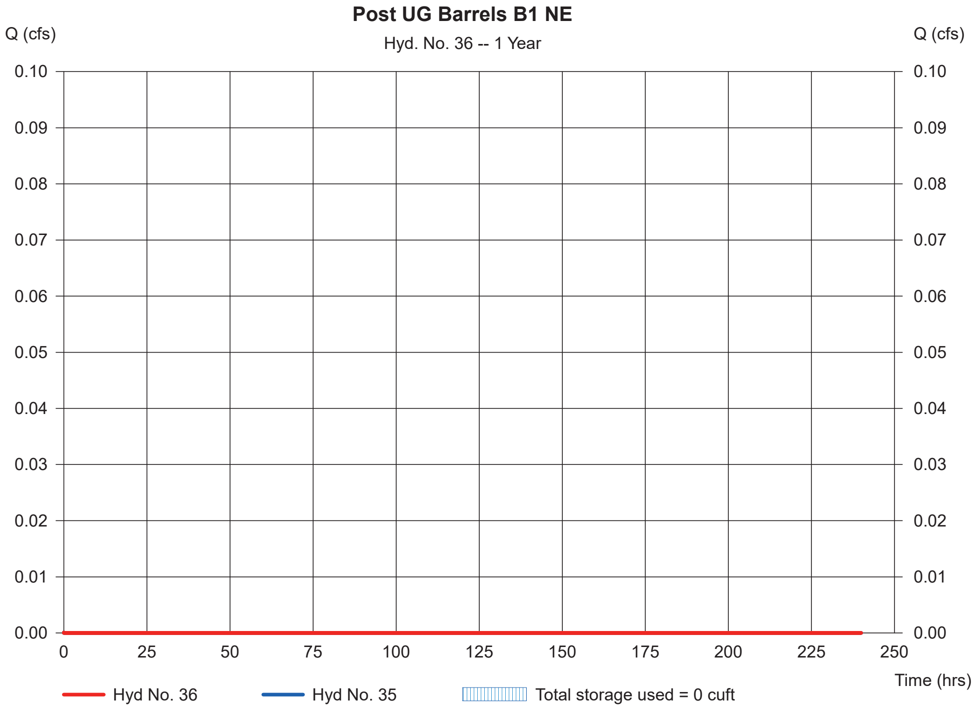
Hyd. No. 36

Post UG Barrels B1 NE

Hydrograph type = Reservoir
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyd. No. = 35 - Total to UG Barrels B1 NE
Reservoir name = UG BARRELS B1 Northeast

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



Post UG Barrels B1 NE

Hyd. No. 36 -- 1 Year

Pond Report

Pond No. 3 - UG BARRELS B1 Northeast

Pond Data

UG Chambers - Invert elev. = 305.50 ft, Rise x Span = 3.00 x 3.00 ft, Barrel Len = 675.00 ft, No. Barrels = 17, Slope = 0.00%, Headers = Yes
Encasement - Invert elev. = 305.50 ft, Width = 5.00 ft, Height = 4.50 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	305.50	n/a	0	0
0.45	305.95	n/a	15,131	15,131
0.90	306.40	n/a	18,304	33,435
1.35	306.85	n/a	19,583	53,018
1.80	307.30	n/a	19,868	72,886
2.25	307.75	n/a	19,269	92,154
2.70	308.20	n/a	17,572	109,726
3.15	308.65	n/a	13,050	122,776
3.60	309.10	n/a	10,483	133,259
4.05	309.55	n/a	10,483	143,741
4.50	310.00	n/a	10,483	154,224

Culvert / Orifice Structures

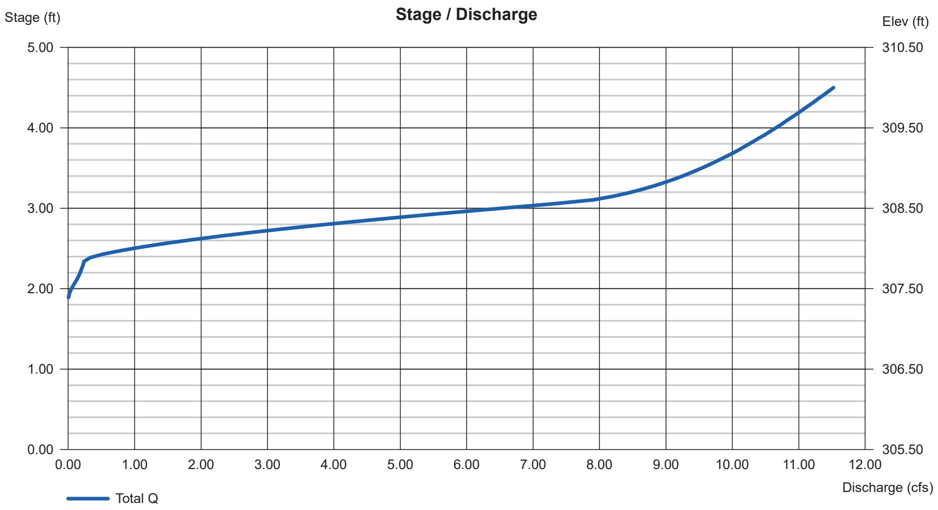
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	4.00	0.00	0.00
Span (in)	= 15.00	4.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 305.50	307.35	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 3.50	0.00	0.00	0.00
Crest El. (ft)	= 307.85	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



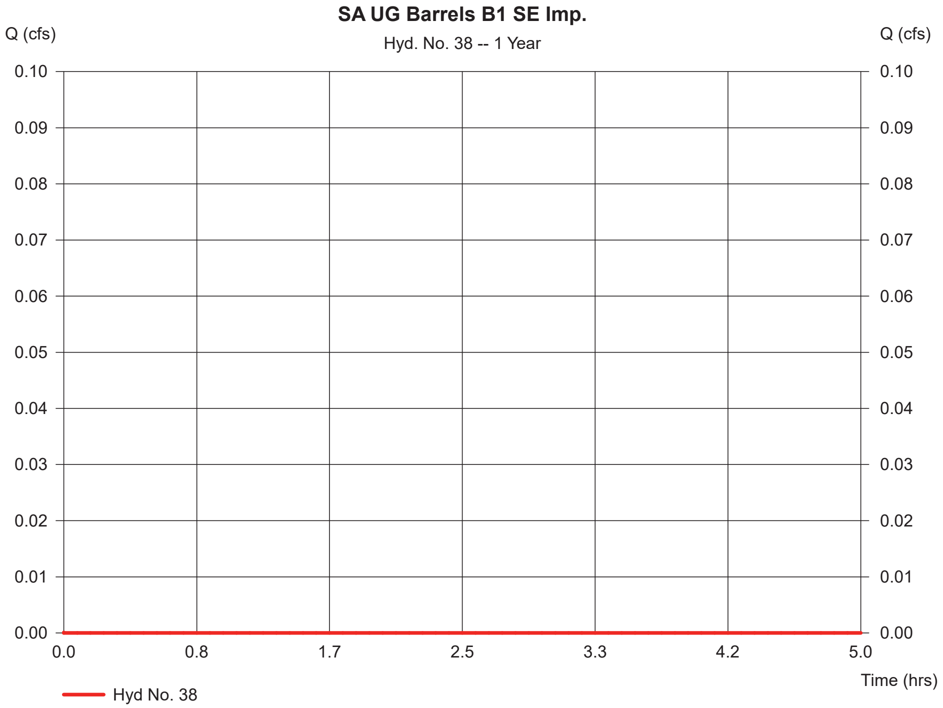
Hydrograph Report

Hyd. No. 38

SA UG Barrels B1 SE Imp.

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 9.290 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484

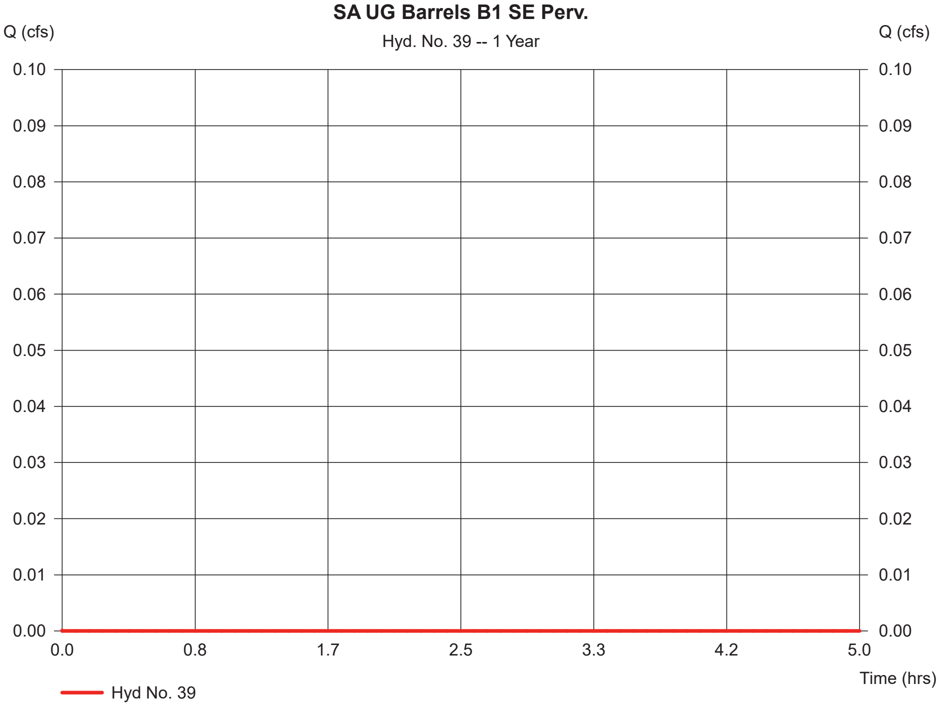


Hydrograph Report

Hyd. No. 39

SA UG Barrels B1 SE Perv.

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 0.440 ac	Curve number	= 46
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 2.90 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

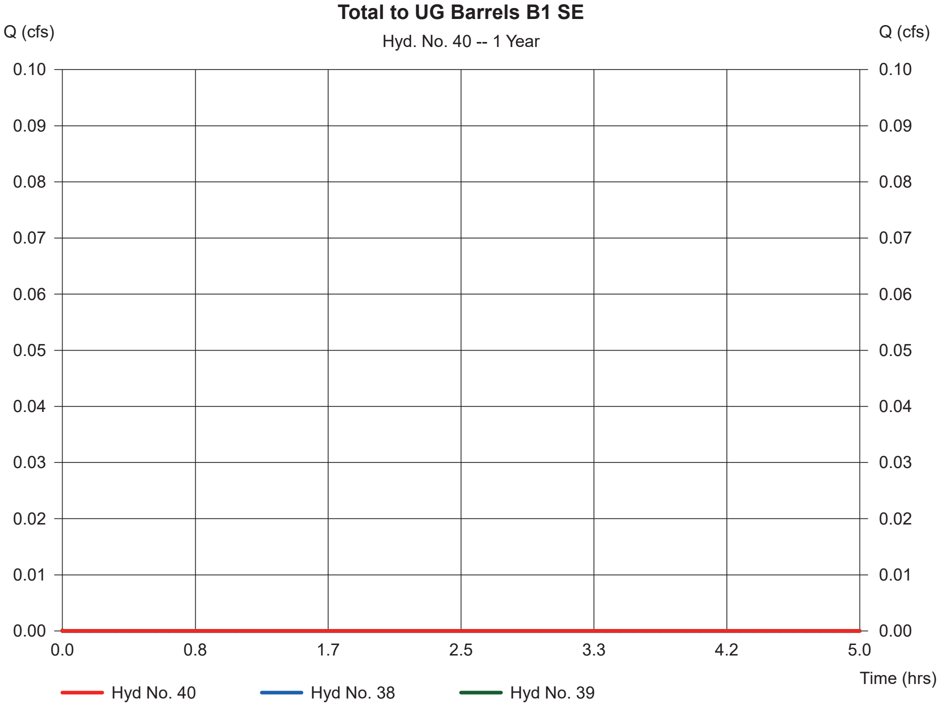


Hydrograph Report

Hyd. No. 40

Total to UG Barrels B1 SE

Hydrograph type	= Combine	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Inflow hyds.	= 38, 39	Contrib. drain. area	= 9.730 ac



Hydrograph Report

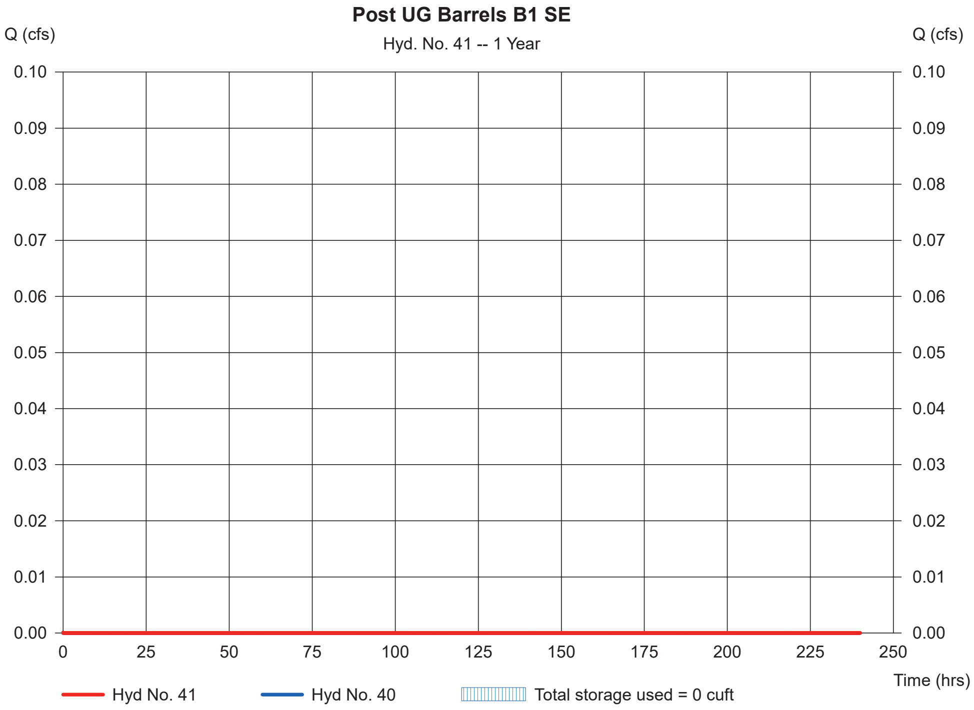
Hyd. No. 41

Post UG Barrels B1 SE

Hydrograph type = Reservoir
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyd. No. = 40 - Total to UG Barrels B1 SE
Reservoir name = UG BARRELS B1 Southeast

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - UG BARRELS B1 Southeast

Pond Data

UG Chambers - Invert elev. = 305.50 ft, Rise x Span = 3.00 x 3.00 ft, Barrel Len = 695.00 ft, No. Barrels = 17, Slope = 0.00%, Headers = Yes
Encasement - Invert elev. = 305.50 ft, Width = 5.00 ft, Height = 4.50 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	305.50	n/a	0	0
0.45	305.95	n/a	15,572	15,572
0.90	306.40	n/a	18,839	34,411
1.35	306.85	n/a	20,155	54,566
1.80	307.30	n/a	20,448	75,014
2.25	307.75	n/a	19,831	94,845
2.70	308.20	n/a	18,085	112,930
3.15	308.65	n/a	13,431	126,361
3.60	309.10	n/a	10,789	137,149
4.05	309.55	n/a	10,789	147,938
4.50	310.00	n/a	10,789	158,727

Culvert / Orifice Structures

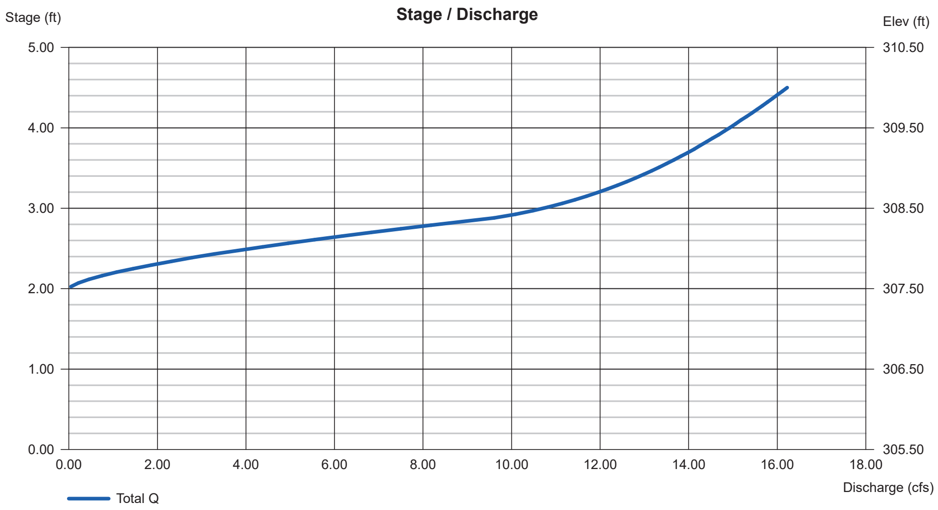
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	0.00	0.00	0.00
Span (in)	= 18.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 305.50	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 3.50	0.00	0.00	0.00
Crest El. (ft)	= 307.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



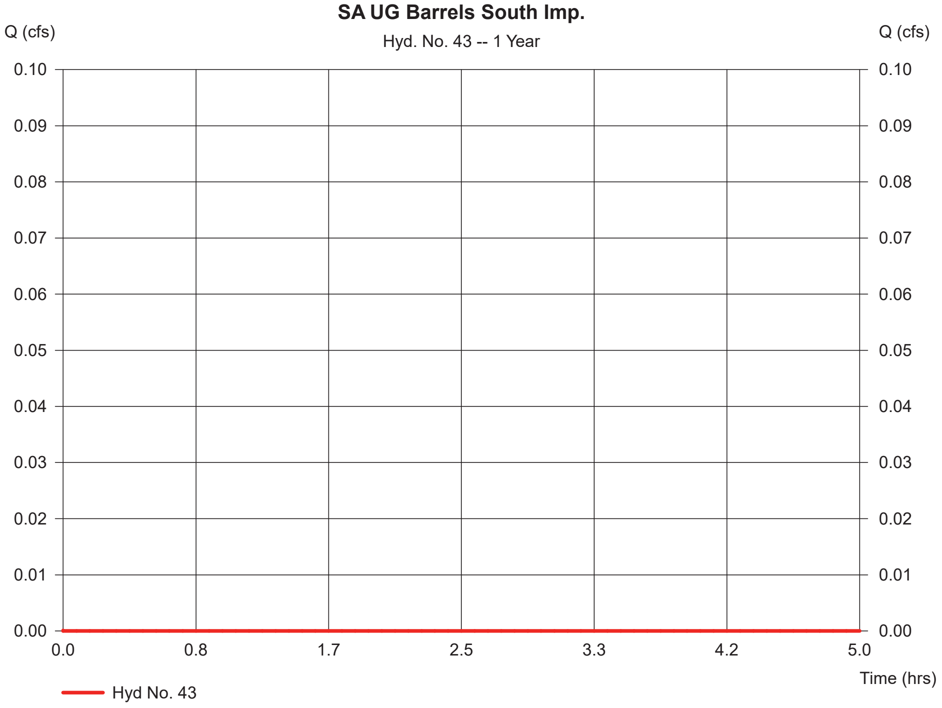
Hydrograph Report

Hyd. No. 43

SA UG Barrels South Imp.

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 1.420 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



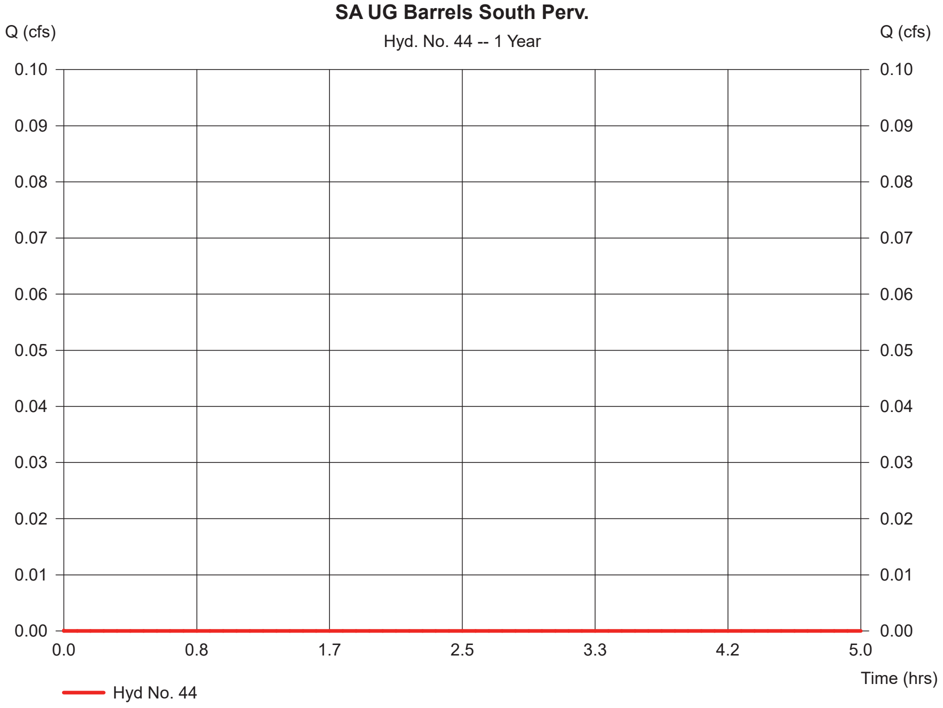
Hydrograph Report

Hyd. No. 44

SA UG Barrels South Perv.

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 0.140 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 64
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484

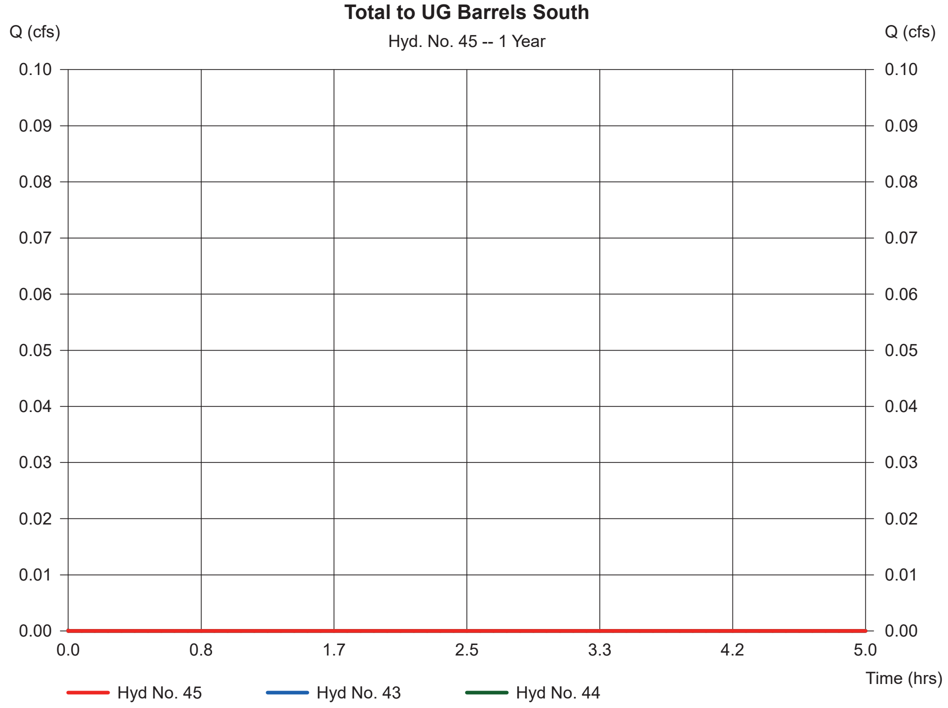


Hyd. No. 45

Total to UG Barrels South

Hydrograph type = Combine
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyds. = 43, 44

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 1.560 ac



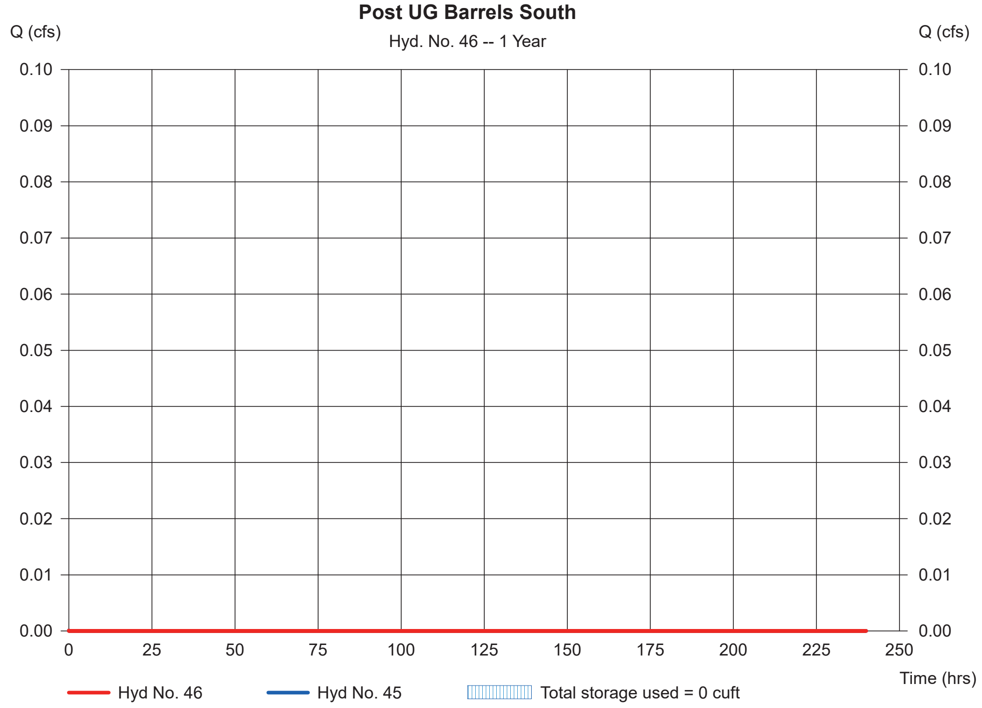
Hyd. No. 46

Post UG Barrels South

Hydrograph type = Reservoir
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyd. No. = 45 - Total to UG Barrels South
Reservoir name = UG BARRELS South Bldg

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



Pond Report

Pond No. 4 - UG BARRELS South Bldg

Pond Data

UG Chambers - Invert elev. = 311.00 ft, Rise x Span = 3.00 x 3.00 ft, Barrel Len = 550.00 ft, No. Barrels = 5, Slope = 0.00%, Headers = Yes
Encasement - Invert elev. = 311.00 ft, Width = 5.00 ft, Height = 4.00 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	311.00	n/a	0	0
0.40	311.40	n/a	3,183	3,183
0.80	311.80	n/a	3,842	7,025
1.20	312.20	n/a	4,133	11,158
1.60	312.60	n/a	4,249	15,408
2.00	313.00	n/a	4,208	19,616
2.40	313.40	n/a	4,014	23,630
2.80	313.80	n/a	3,591	27,221
3.20	314.20	n/a	2,580	29,801
3.60	314.60	n/a	2,240	32,042
4.00	315.00	n/a	2,240	34,282

Culvert / Orifice Structures

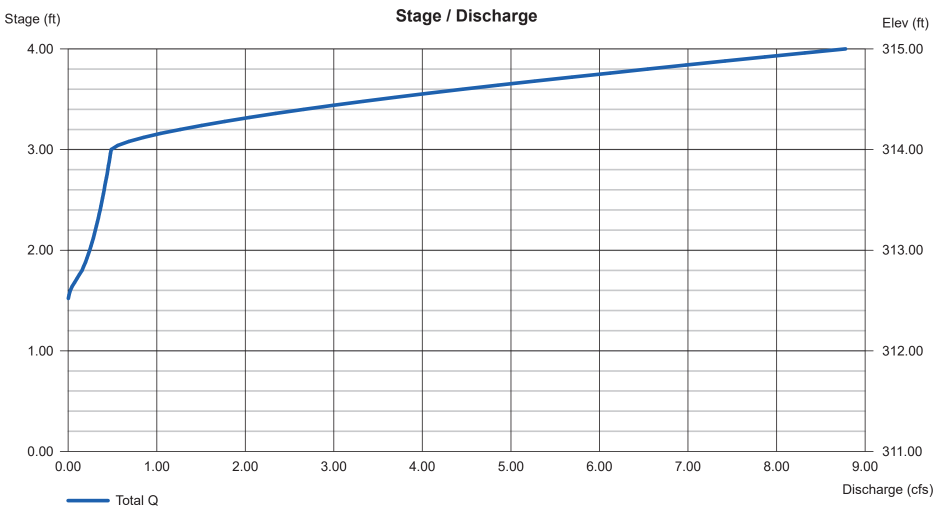
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	4.00	0.00	0.00
Span (in)	= 15.00	4.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 311.00	312.50	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 2.50	0.00	0.00	0.00
Crest El. (ft)	= 314.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



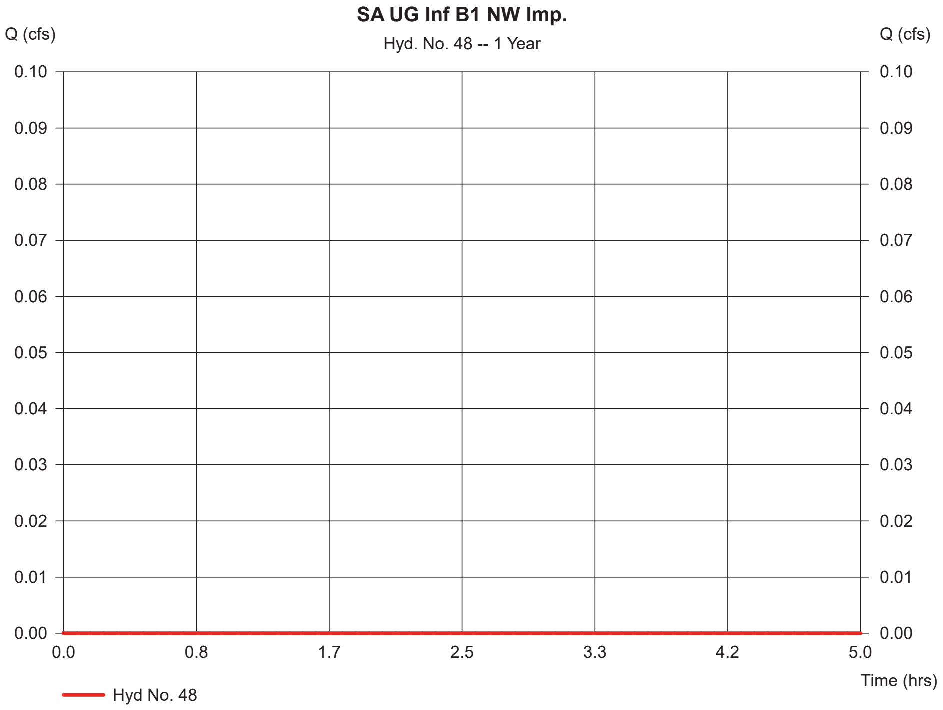
Hydrograph Report

Hyd. No. 48

SA UG Inf B1 NW Imp.

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 9.310 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



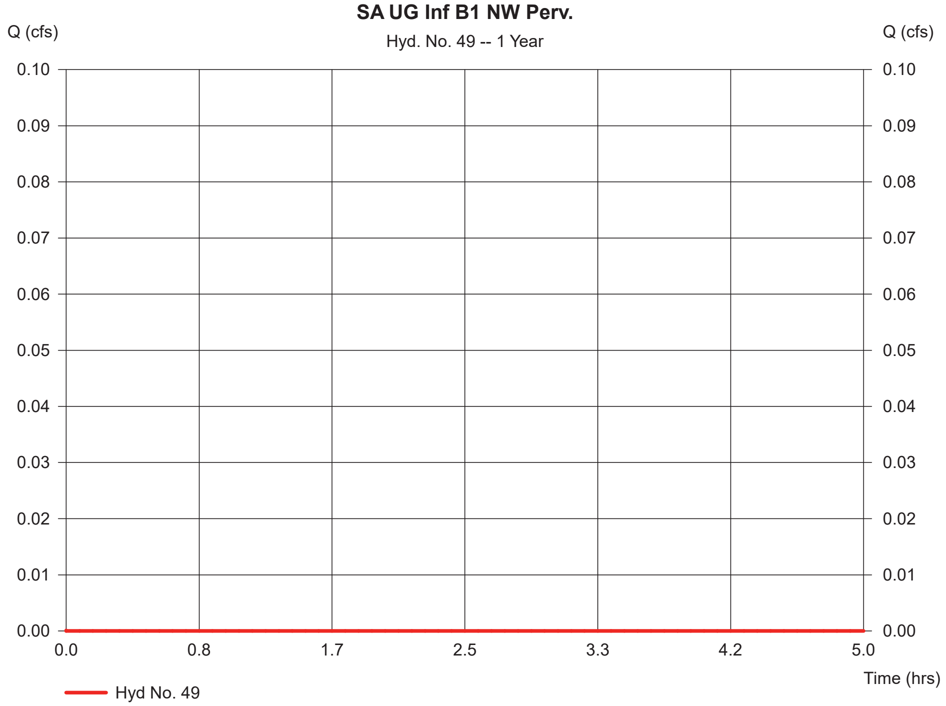
Hydrograph Report

Hyd. No. 49

SA UG Inf B1 NW Perv.

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 0.260 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 39
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



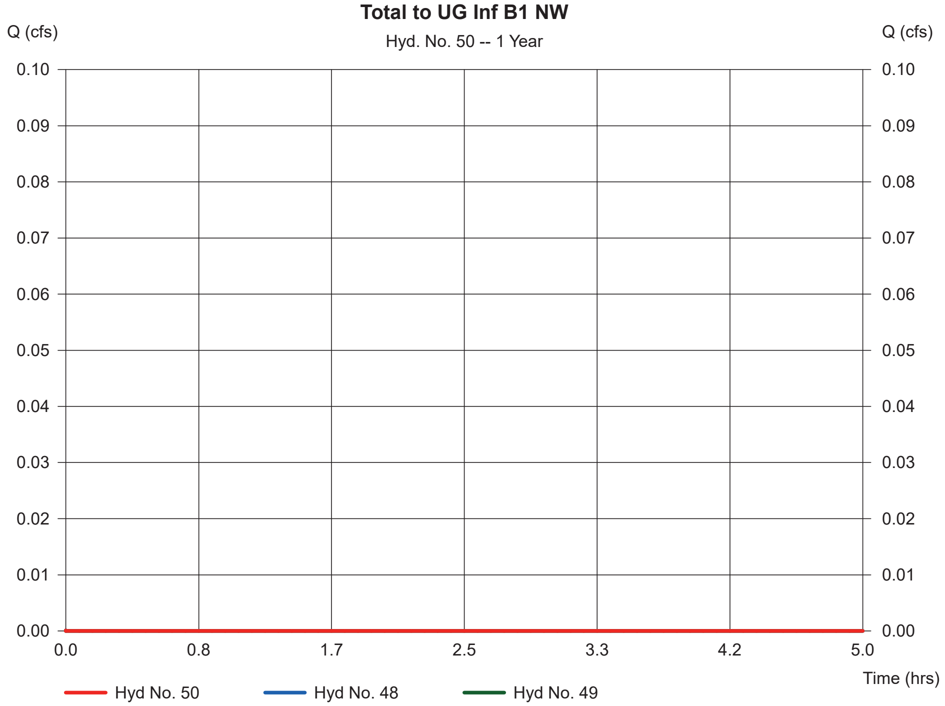
Hydrograph Report

Hyd. No. 50

Total to UG Inf B1 NW

Hydrograph type = Combine
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyds. = 48, 49

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 9.570 ac



Hydrograph Report

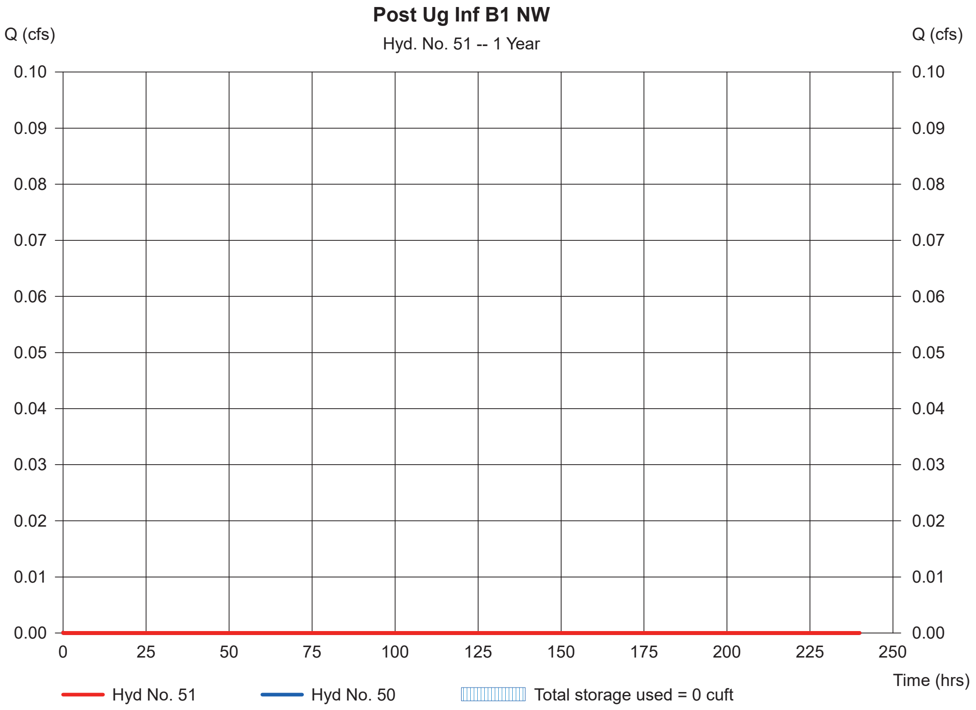
Hyd. No. 51

Post Ug Inf B1 NW

Hydrograph type = Reservoir
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyd. No. = 50 - Total to UG Inf B1 NW
Reservoir name = UG Inf B1 NW

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



Pond Report

Pond No. 7 - UG Inf B1 NW

Pond Data

UG Chambers - Invert elev. = 306.90 ft, Rise x Span = 2.54 x 4.33 ft, Barrel Len = 547.50 ft, No. Barrels = 20, Slope = 0.00%, Headers = Yes
Encasement - Invert elev. = 306.30 ft, Width = 7.83 ft, Height = 3.54 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	306.30	n/a	0	0
0.35	306.65	n/a	12,490	12,490
0.71	307.01	n/a	15,650	28,140
1.06	307.36	n/a	22,777	50,917
1.42	307.72	n/a	22,509	73,426
1.77	308.07	n/a	22,016	95,442
2.12	308.42	n/a	21,260	116,702
2.48	308.78	n/a	20,164	136,866
2.83	309.13	n/a	18,537	155,403
3.19	309.49	n/a	15,395	170,799
3.54	309.84	n/a	12,490	183,289

Culvert / Orifice Structures

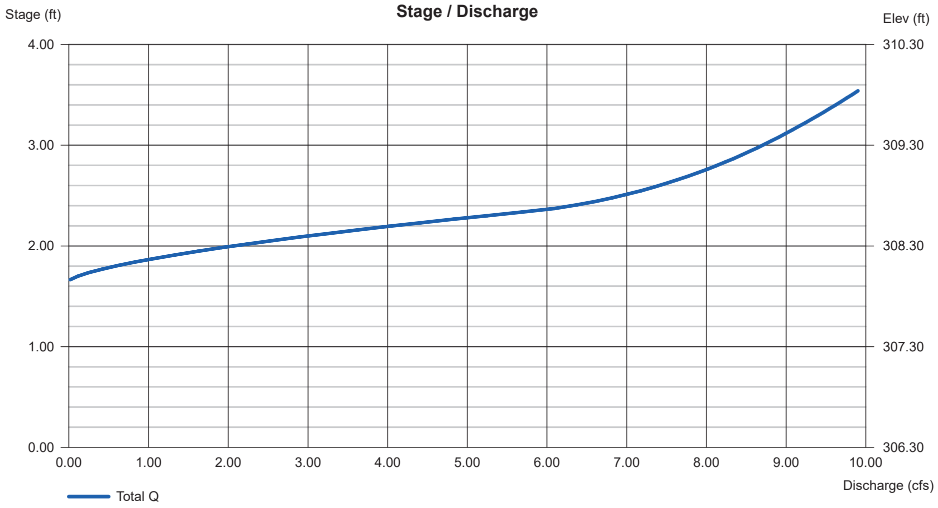
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	0.00	0.00	0.00
Span (in)	= 15.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 306.30	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 3.00	0.00	0.00	0.00
Crest El. (ft)	= 307.95	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



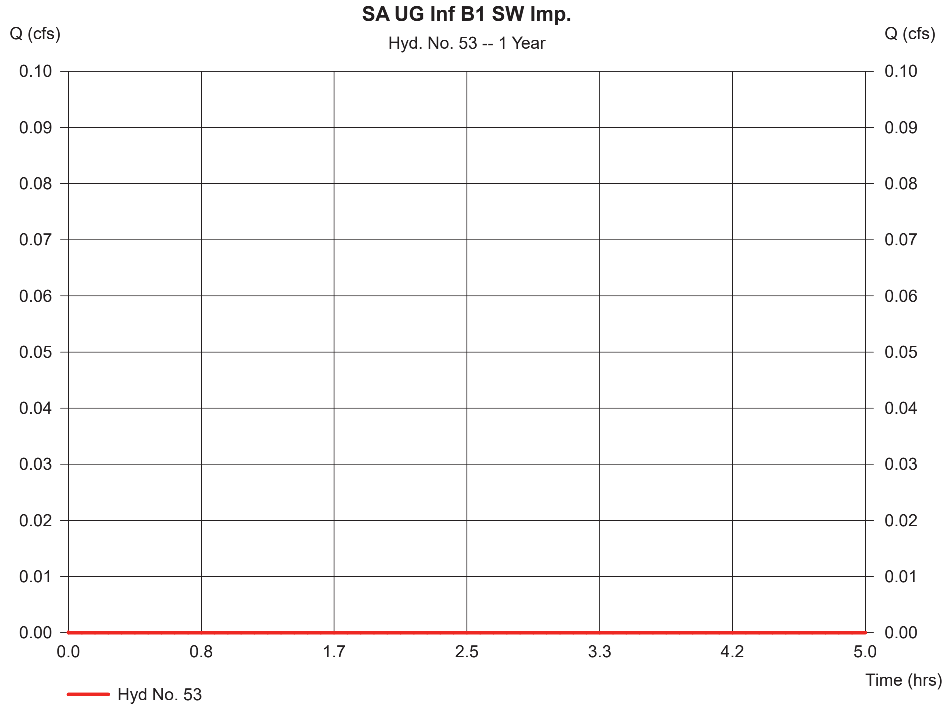
Hydrograph Report

Hyd. No. 53

SA UG Inf B1 SW Imp.

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 7.980 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



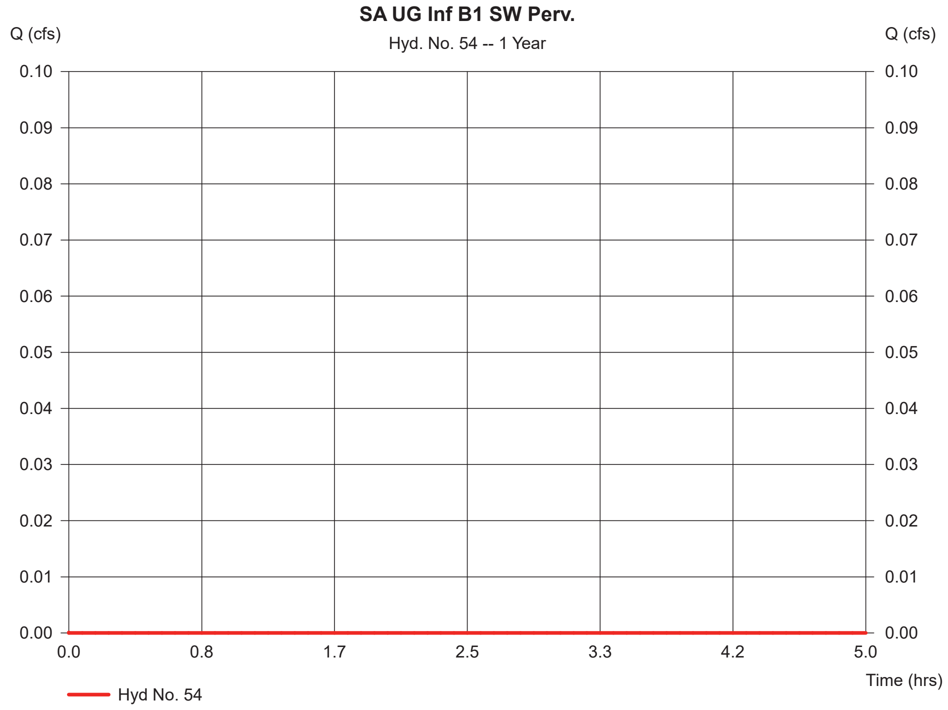
Hydrograph Report

Hyd. No. 54

SA UG Inf B1 SW Perv.

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 0.300 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 39
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



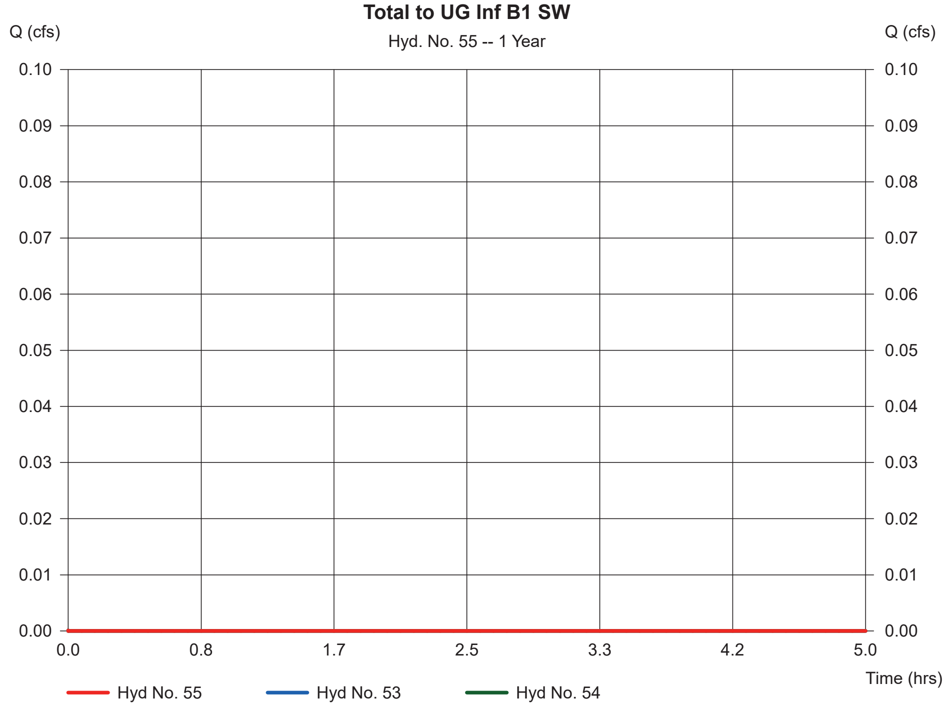
Hydrograph Report

Hyd. No. 55

Total to UG Inf B1 SW

Hydrograph type = Combine
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyds. = 53, 54

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 8.280 ac



Hydrograph Report

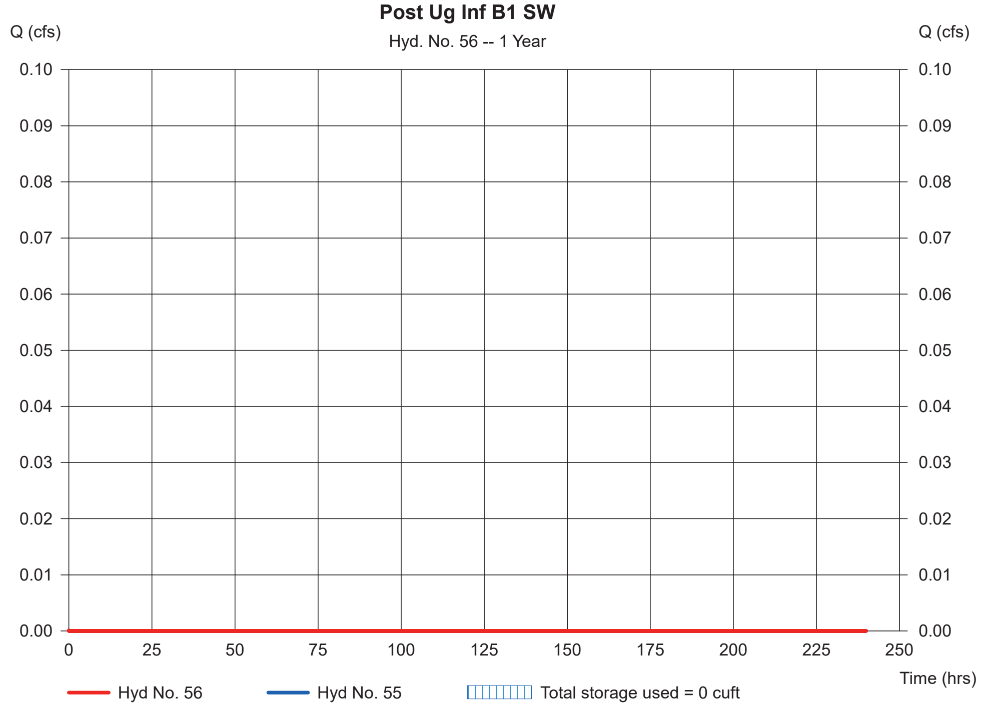
Hyd. No. 56

Post Ug Inf B1 SW

Hydrograph type = Reservoir
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyd. No. = 55 - Total to UG Inf B1 SW
Reservoir name = UG Inf B1 SW

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



Pond Report

Pond No. 8 - UG Inf B1 SW

Pond Data

UG Chambers - Invert elev. = 306.80 ft, Rise x Span = 2.54 x 4.33 ft, Barrel Len = 549.50 ft, No. Barrels = 20, Slope = 0.00%, Headers = Yes
Encasement - Invert elev. = 306.30 ft, Width = 7.83 ft, Height = 3.54 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	306.30	n/a	0	0
0.35	306.65	n/a	12,535	12,535
0.71	307.01	n/a	18,637	31,172
1.06	307.36	n/a	22,803	53,975
1.42	307.72	n/a	22,473	76,448
1.77	308.07	n/a	21,909	98,357
2.12	308.42	n/a	21,065	119,421
2.48	308.78	n/a	19,842	139,264
2.83	309.13	n/a	17,979	157,243
3.19	309.49	n/a	14,162	171,405
3.54	309.84	n/a	12,535	183,940

Culvert / Orifice Structures

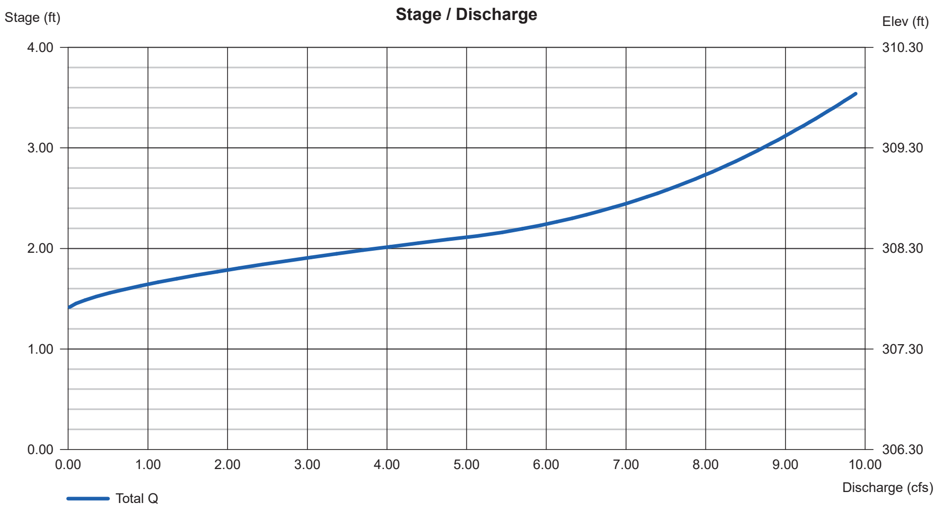
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	0.00	0.00	0.00
Span (in)	= 15.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 306.30	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 2.50	0.00	0.00	0.00
Crest El. (ft)	= 307.70	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



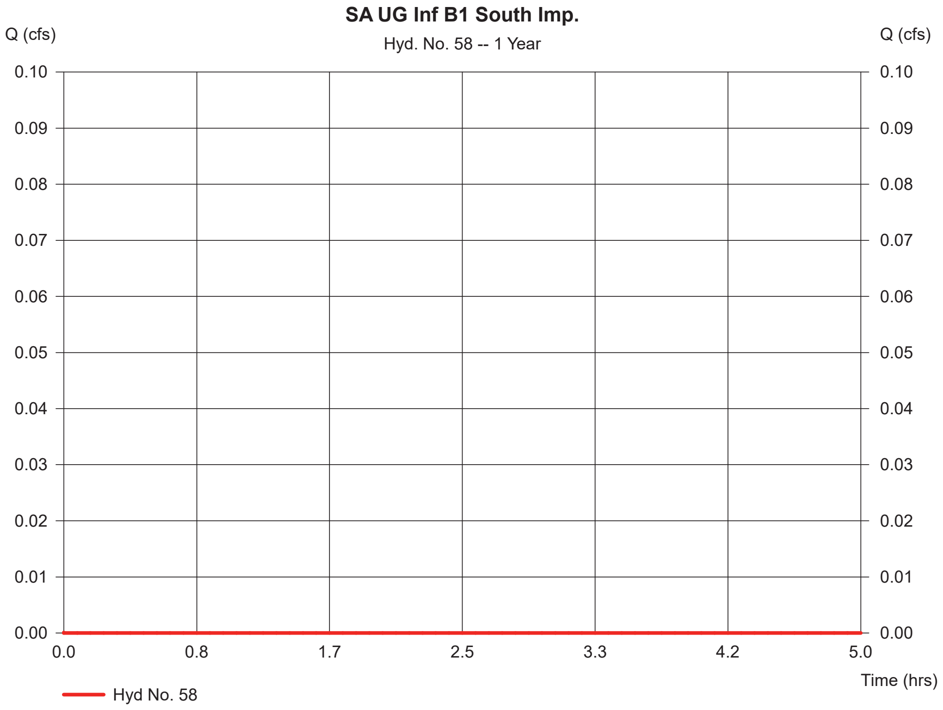
Hydrograph Report

Hyd. No. 58

SA UG Inf B1 South Imp.

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 0.420 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



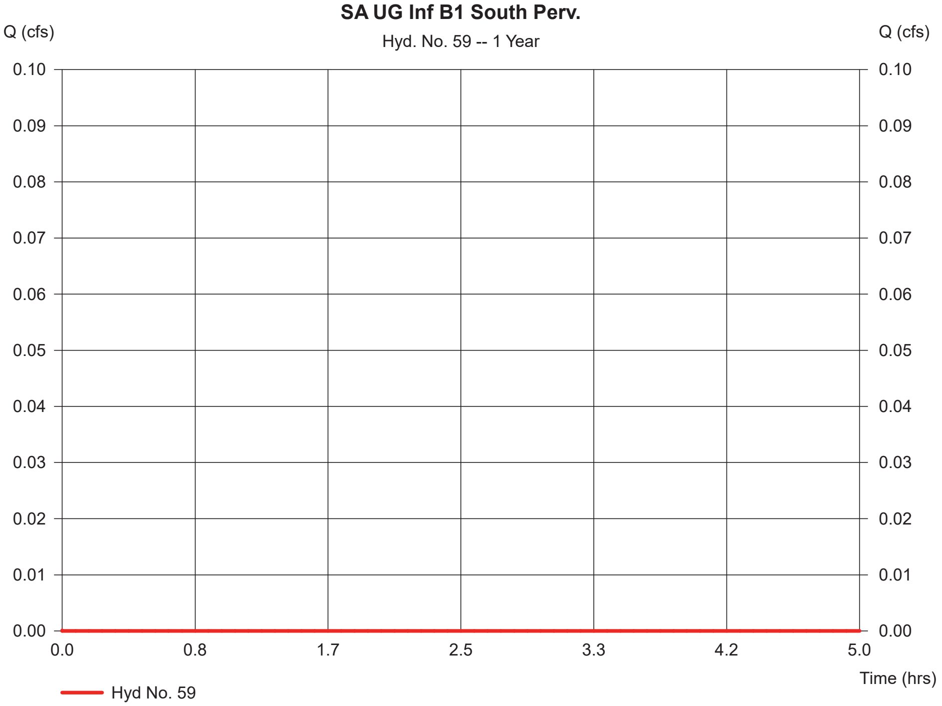
Hydrograph Report

Hyd. No. 59

SA UG Inf B1 South Perv.

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 0.490 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 49
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



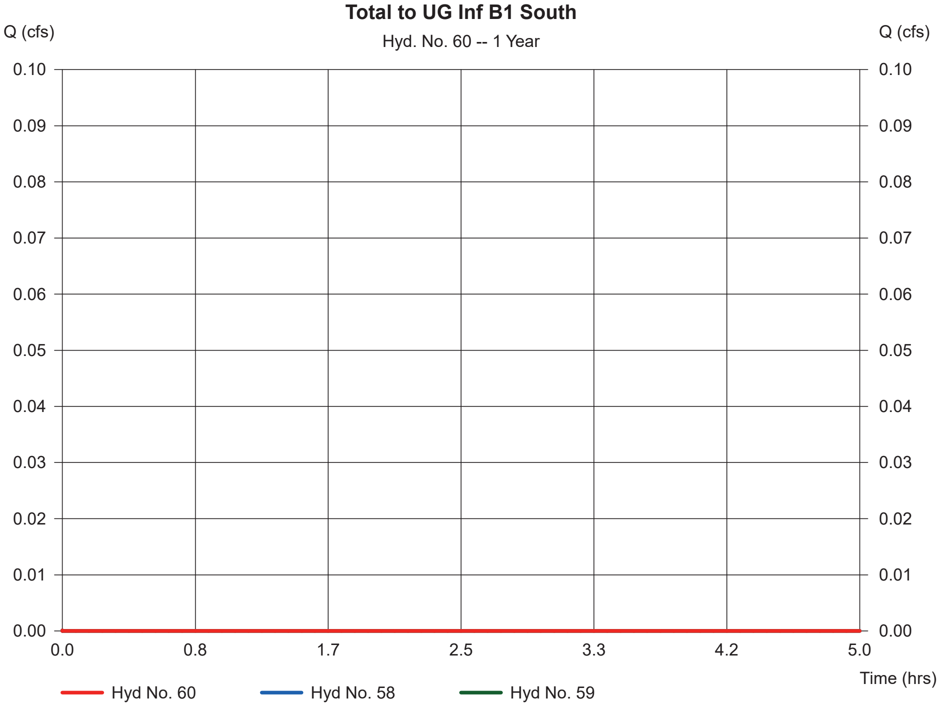
Hydrograph Report

Hyd. No. 60

Total to UG Inf B1 South

Hydrograph type = Combine
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyds. = 58, 59

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 0.910 ac



Hydrograph Report

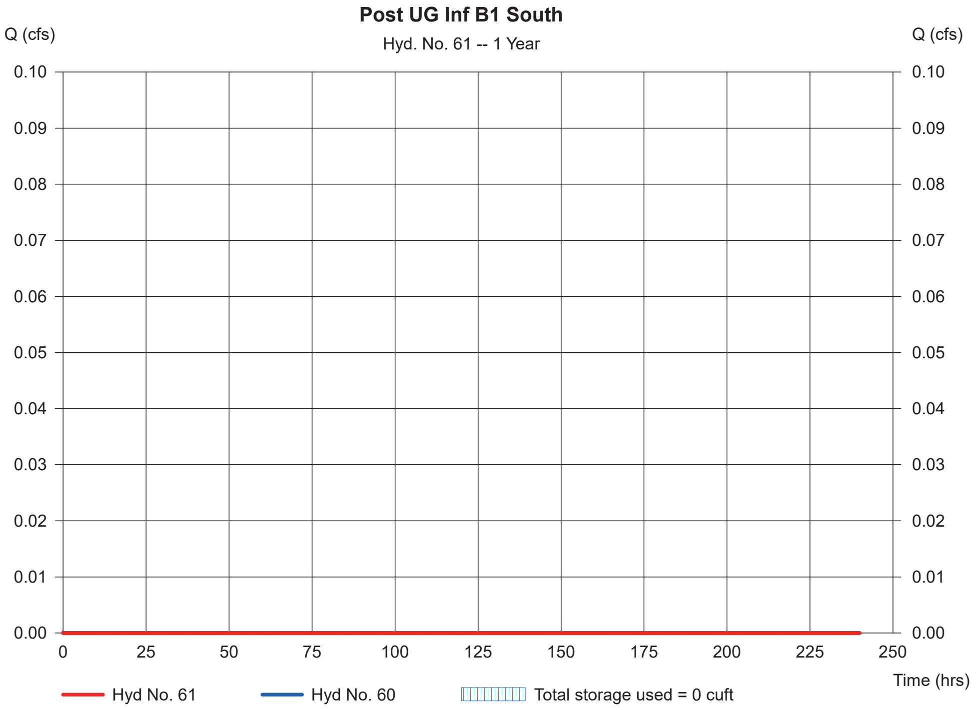
Hyd. No. 61

Post UG Inf B1 South

Hydrograph type = Reservoir
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyd. No. = 60 - Total to UG Inf B1 South
Reservoir name = UG Inf B1 South

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



Pond Report

Pond No. 9 - UG Inf B1 South

Pond Data

UG Chambers - Invert elev. = 311.00 ft, Rise x Span = 1.54 x 2.75 ft, Barrel Len = 564.50 ft, No. Barrels = 10, Slope = 0.00%, Headers = No

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	311.00	n/a	0	0
0.15	311.15	n/a	2,387	2,387
0.31	311.31	n/a	2,363	4,750
0.46	311.46	n/a	2,314	7,064
0.62	311.62	n/a	2,239	9,303
0.77	311.77	n/a	2,134	11,437
0.92	311.92	n/a	1,995	13,432
1.08	312.08	n/a	1,815	15,247
1.23	312.23	n/a	1,578	16,825
1.39	312.39	n/a	1,253	18,078
1.54	312.54	n/a	702	18,780

Culvert / Orifice Structures

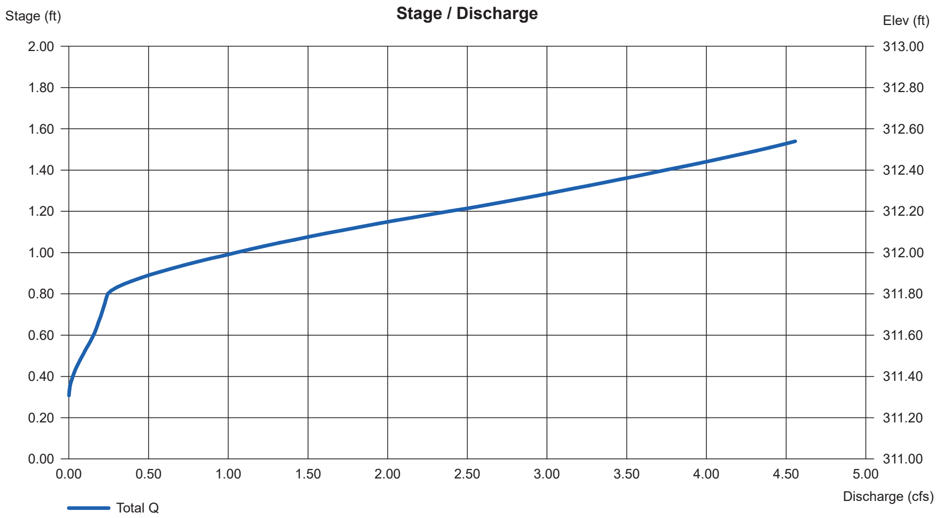
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	4.00	0.00	0.00
Span (in)	= 15.00	4.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 311.00	311.30	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 2.50	0.00	0.00	0.00
Crest El. (ft)	= 311.80	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



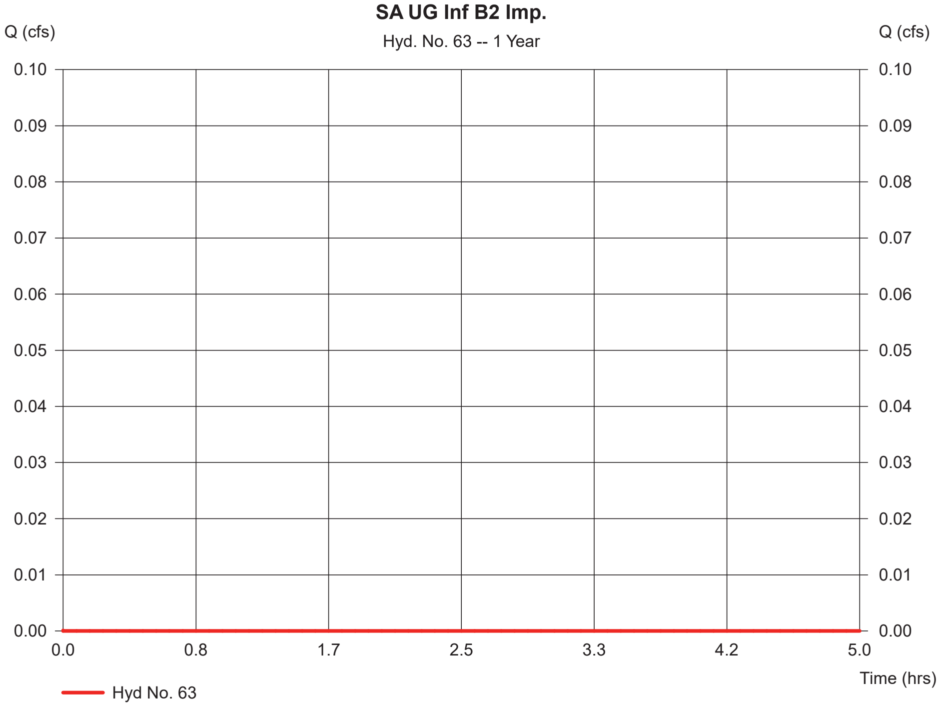
Hydrograph Report

Hyd. No. 63

SA UG Inf B2 Imp.

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 5.200 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



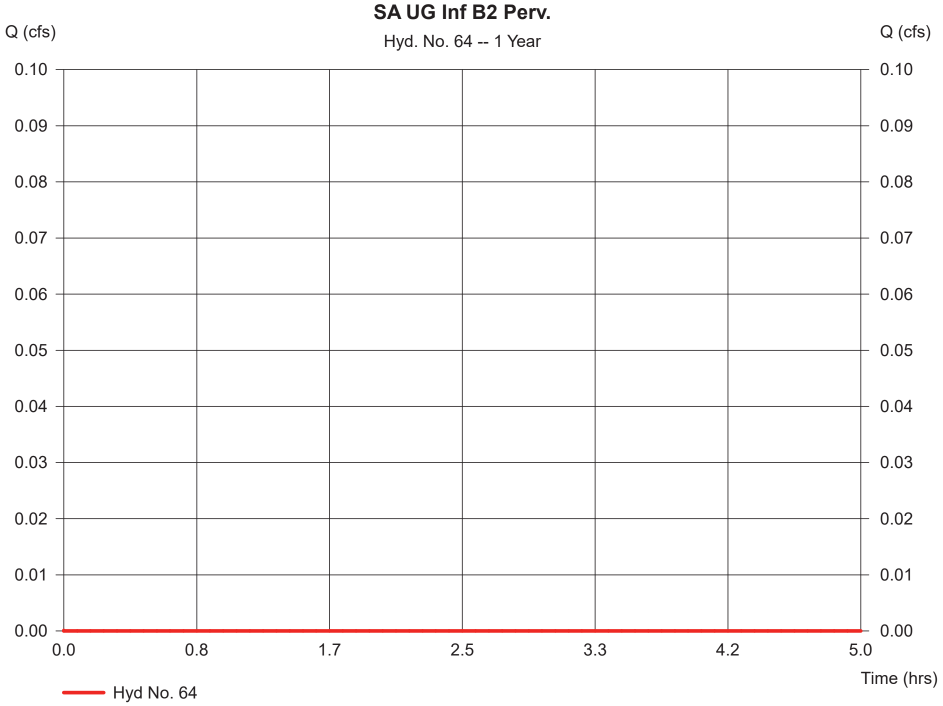
Hydrograph Report

Hyd. No. 64

SA UG Inf B2 Perv.

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 0.100 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 39
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



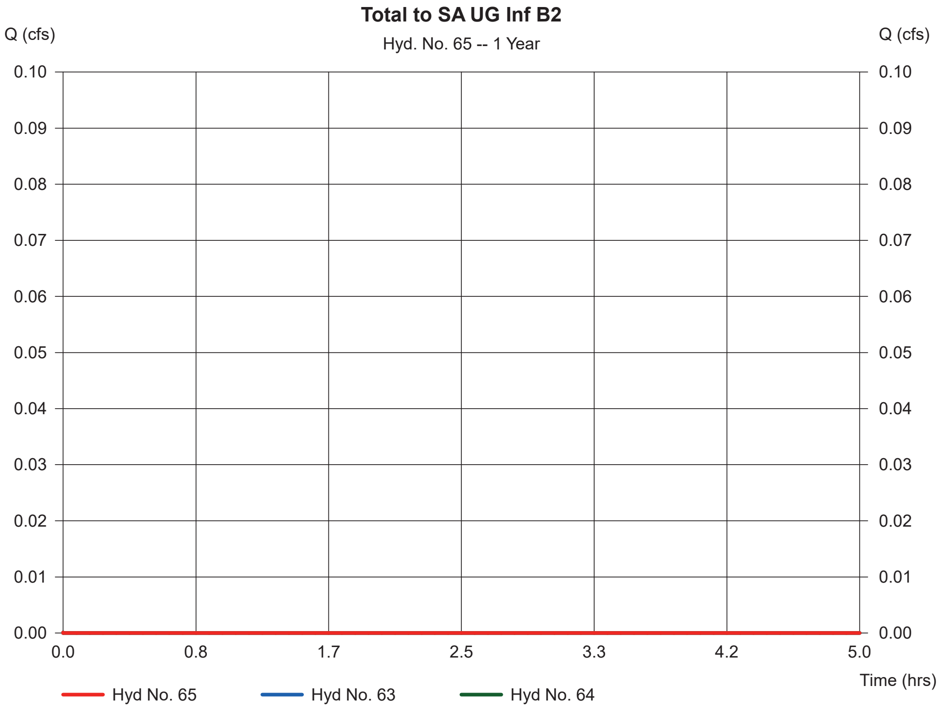
Hydrograph Report

Hyd. No. 65

Total to SA UG Inf B2

Hydrograph type = Combine
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyds. = 63, 64

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 5.300 ac



Hydrograph Report

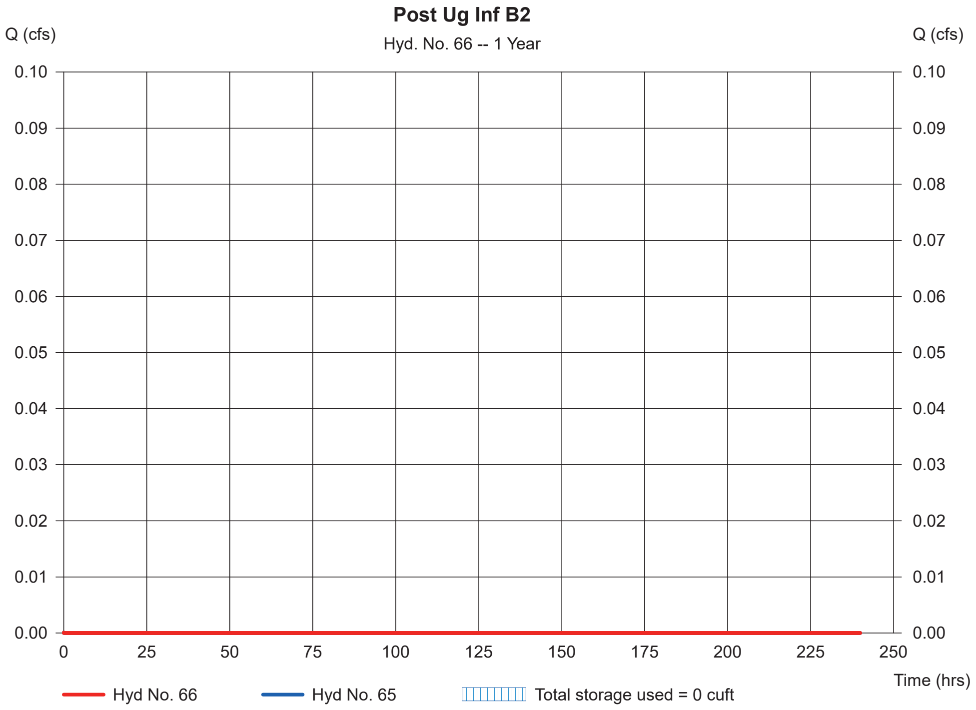
Hyd. No. 66

Post Ug Inf B2

Hydrograph type = Reservoir
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyd. No. = 65 - Total to SA UG Inf B2
Reservoir name = UG Inf B2

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



Pond Report

Pond No. 10 - UG Inf B2

Pond Data

UG Chambers - Invert elev. = 309.00 ft, Rise x Span = 3.00 x 5.00 ft, Barrel Len = 378.84 ft, No. Barrels = 21, Slope = 0.00%, Headers = Yes
Encasement - Invert elev. = 308.50 ft, Width = 8.50 ft, Height = 4.00 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	308.50	n/a	0	0
0.40	308.90	n/a	11,307	11,307
0.80	309.30	n/a	18,778	30,085
1.20	309.70	n/a	21,137	51,222
1.60	310.10	n/a	20,816	72,039
2.00	310.50	n/a	20,289	92,327
2.40	310.90	n/a	19,515	111,842
2.80	311.30	n/a	18,412	130,254
3.20	311.70	n/a	16,777	147,032
3.60	312.10	n/a	13,505	160,536
4.00	312.50	n/a	11,307	171,843

Culvert / Orifice Structures

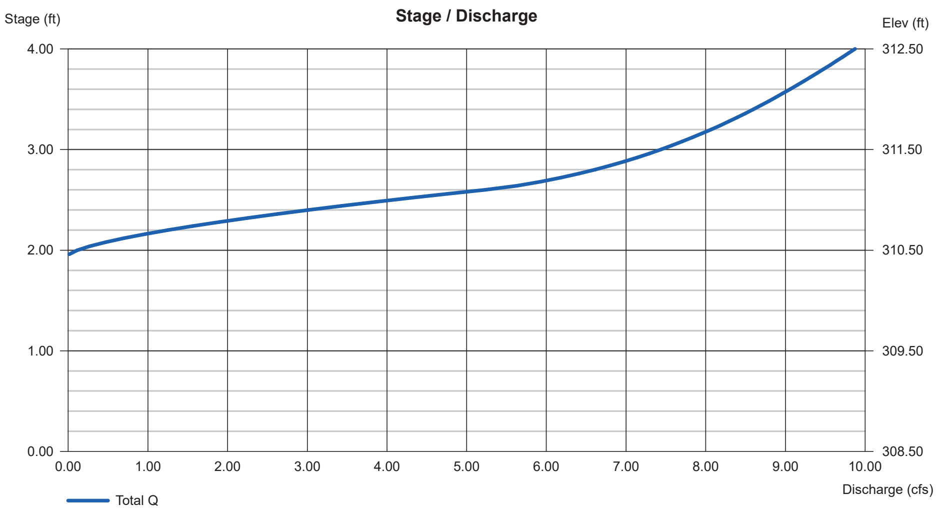
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	0.00	0.00	0.00
Span (in)	= 15.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 309.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 3.00	0.00	0.00	0.00
Crest El. (ft)	= 310.45	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



Stage / Discharge

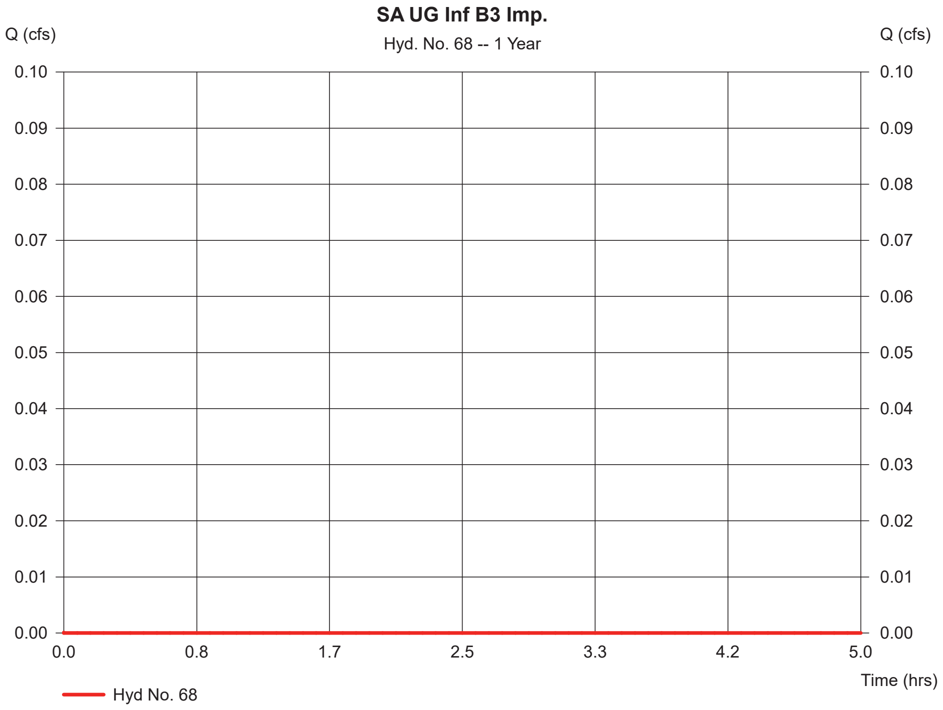
Hydrograph Report

Hyd. No. 68

SA UG Inf B3 Imp.

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 2.020 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



SA UG Inf B3 Imp.

Hyd. No. 68 -- 1 Year

Hydrograph Report

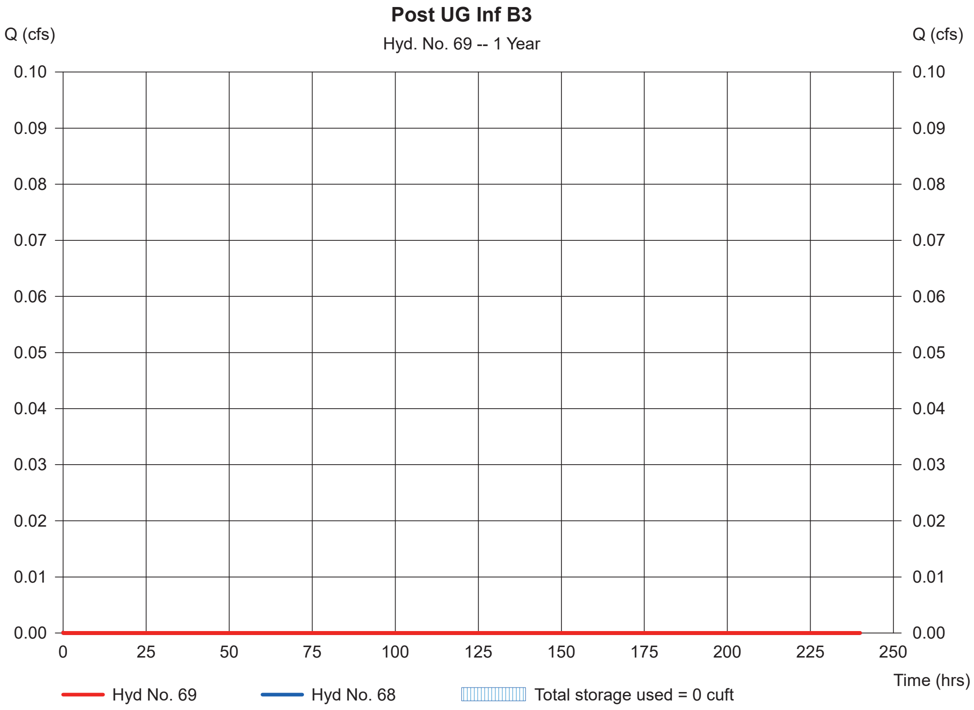
Hyd. No. 69

Post UG Inf B3

Hydrograph type = Reservoir
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyd. No. = 68 - SA UG Inf B3 Imp.
Reservoir name = UG Inf B3

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



Pond Report

Pond No. 11 - UG Inf B3

Pond Data

UG Chambers - Invert elev. = 312.50 ft, Rise x Span = 3.00 x 3.00 ft, Barrel Len = 165.50 ft, No. Barrels = 26, Slope = 0.00%, Headers = Yes

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	312.50	n/a	0	0
0.30	312.80	n/a	4,075	4,075
0.60	313.10	n/a	4,033	8,108
0.90	313.40	n/a	3,950	12,058
1.20	313.70	n/a	3,821	15,879
1.50	314.00	n/a	3,642	19,521
1.80	314.30	n/a	3,406	22,927
2.10	314.60	n/a	3,098	26,025
2.40	314.90	n/a	2,694	28,718
2.70	315.20	n/a	2,138	30,857
3.00	315.50	n/a	1,198	32,055

Culvert / Orifice Structures

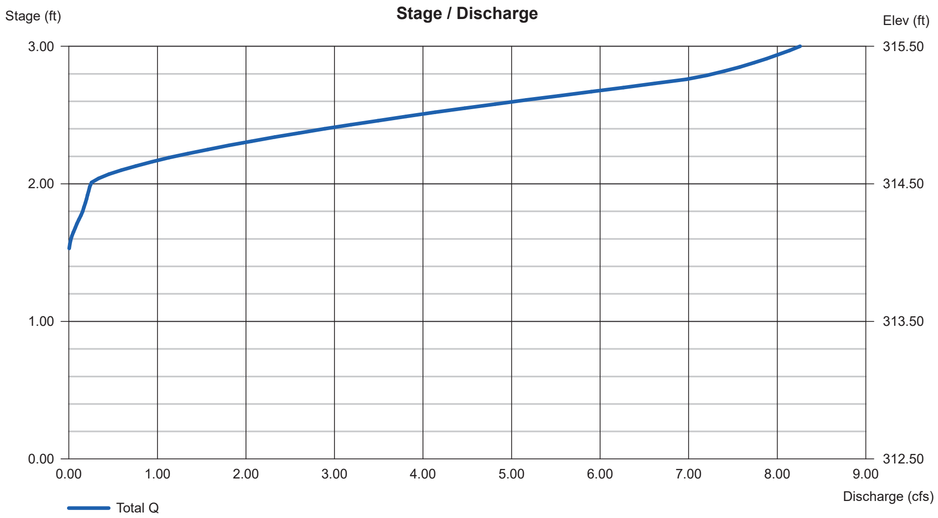
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 15.00	4.00	0.00	0.00
Span (in)	= 15.00	4.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 312.50	314.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 3.00	0.00	0.00	0.00
Crest El. (ft)	= 314.50	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= Yes	No	No	No

Exfil.(in/hr) = 0.000 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



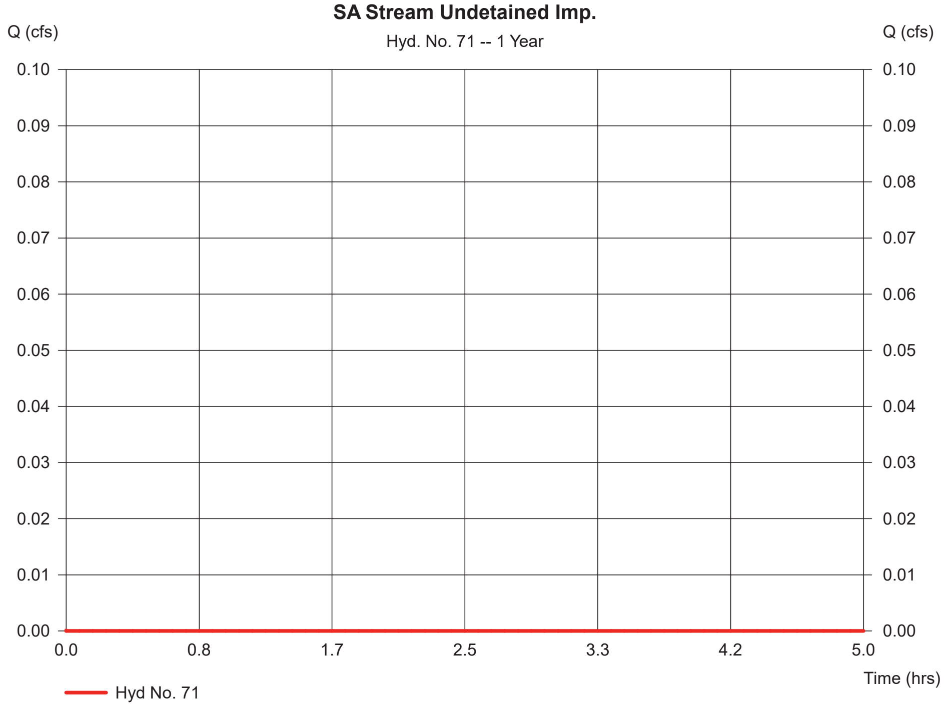
Hydrograph Report

Hyd. No. 71

SA Stream Undetained Imp.

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 0.290 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



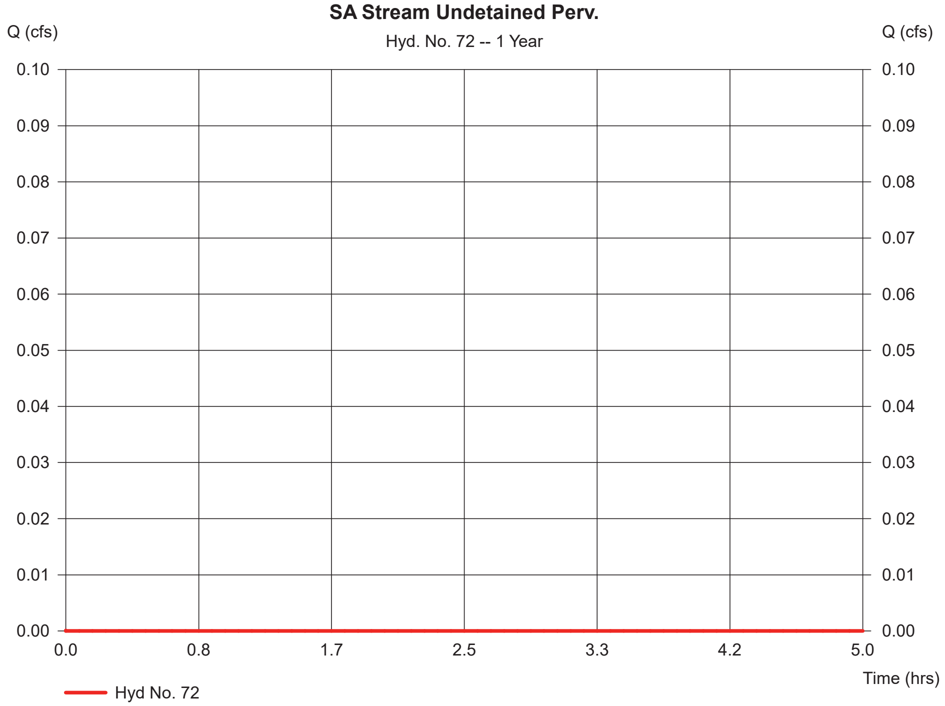
Hydrograph Report

Hyd. No. 72

SA Stream Undetained Perv.

Hydrograph type = SCS Runoff
Storm frequency = 1 yrs
Time interval = 5 min
Drainage area = 5.610 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 2.90 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 41
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484

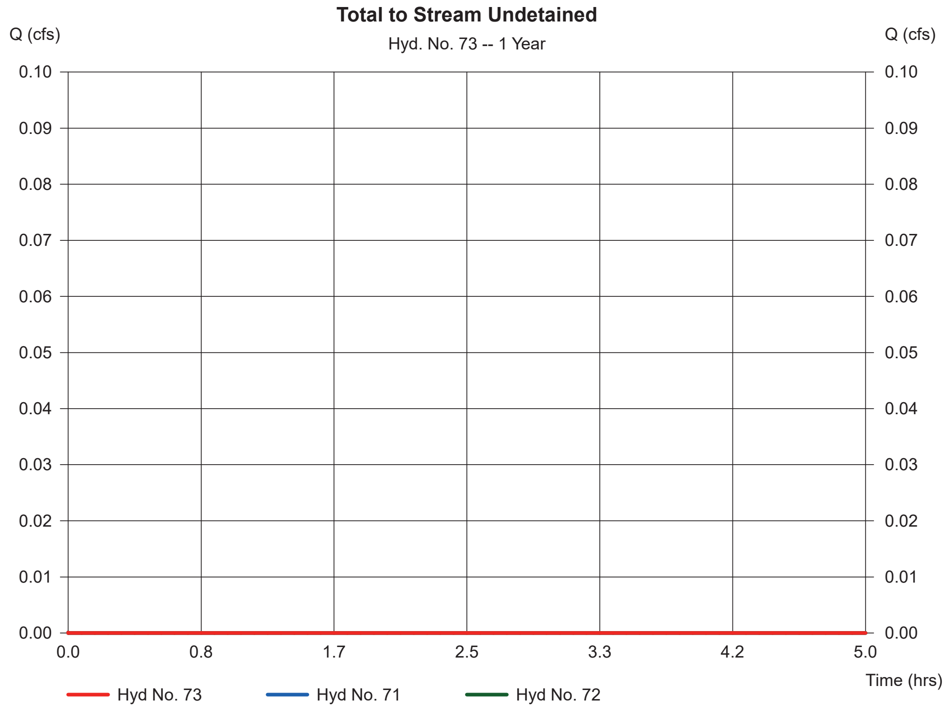


Hydrograph Report

Hyd. No. 73

Total to Stream Undetained

Hydrograph type	= Combine	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Inflow hyds.	= 71, 72	Contrib. drain. area	= 5.900 ac

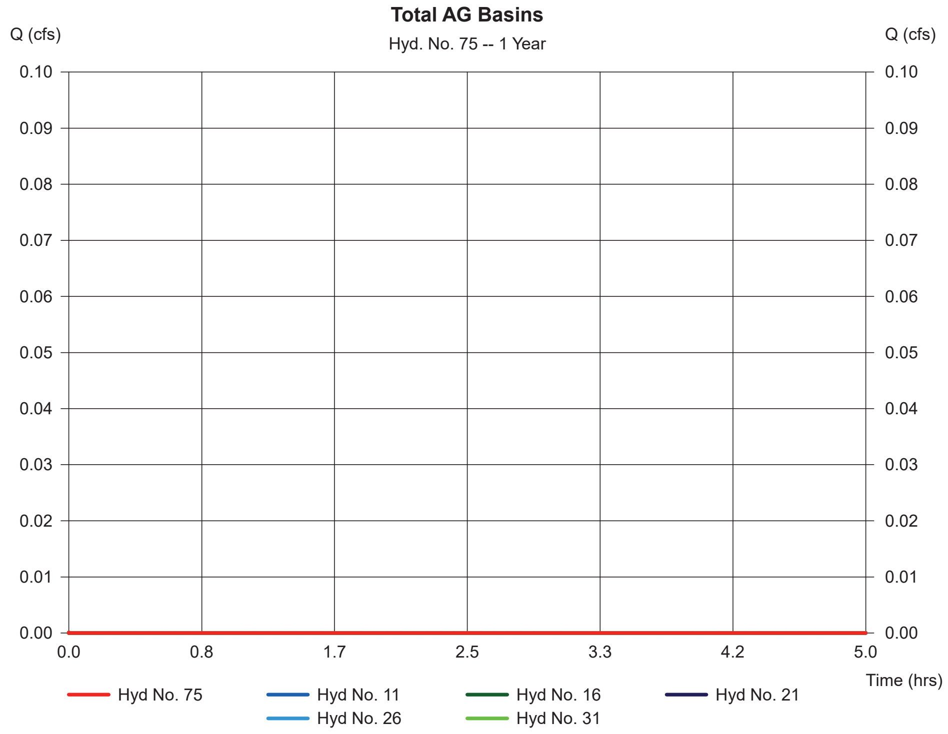


Hydrograph Report

Hyd. No. 75

Total AG Basins

Hydrograph type	= Combine	Peak discharge	= 0.000 cfs
Storm frequency	= 1 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Inflow hyds.	= 11, 16, 21, 26, 31	Contrib. drain. area	= 0.000 ac



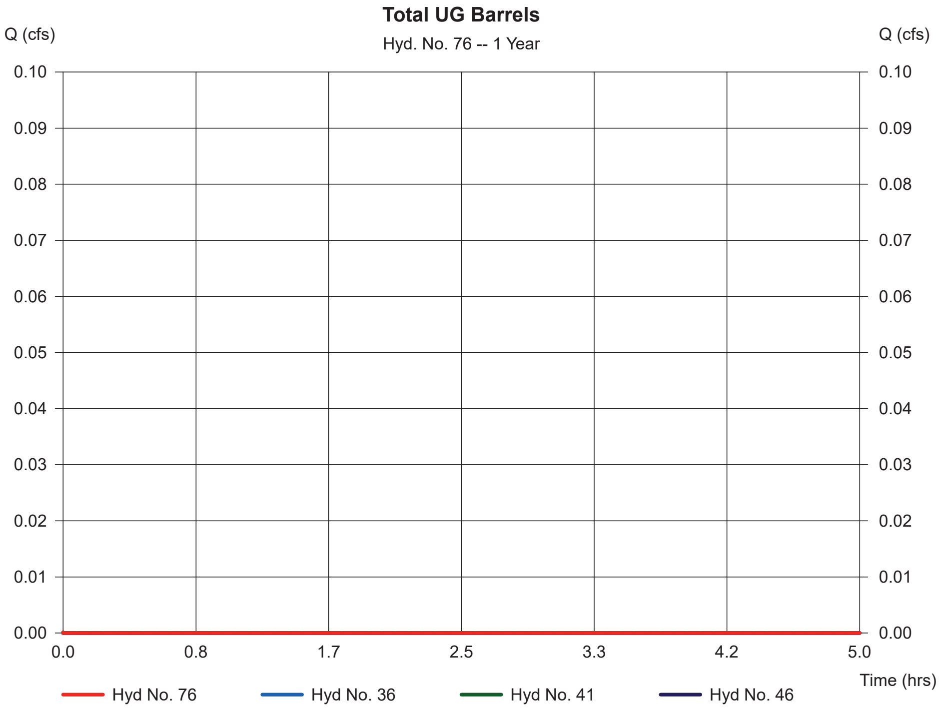
Hydrograph Report

Hyd. No. 76

Total UG Barrels

Hydrograph type = Combine
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyds. = 36, 41, 46

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 0.000 ac



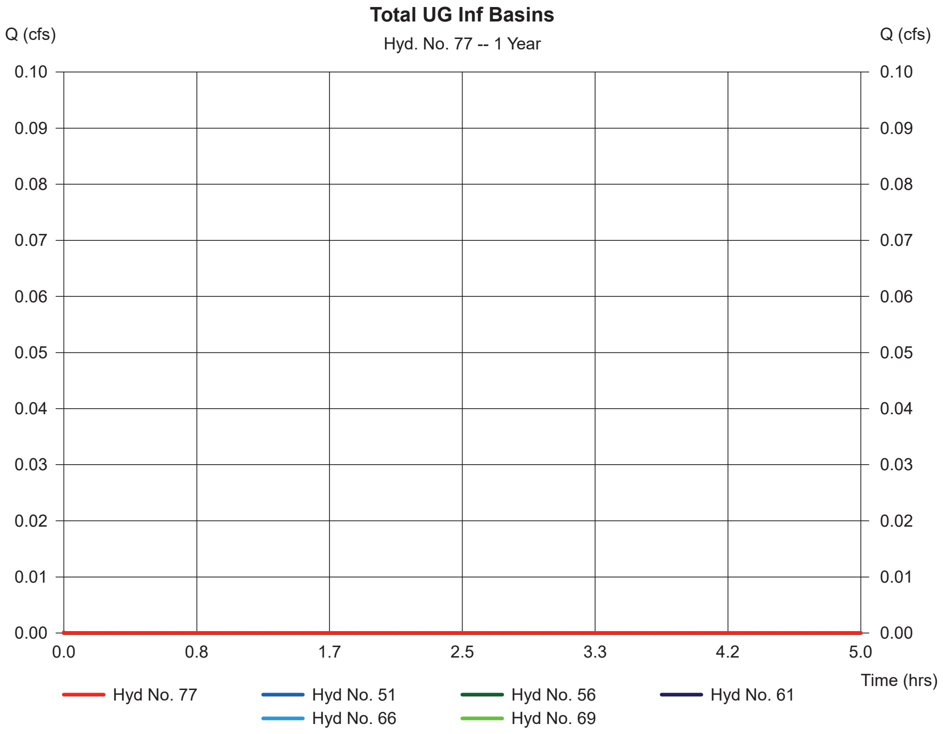
Hydrograph Report

Hyd. No. 77

Total UG Inf Basins

Hydrograph type = Combine
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyds. = 51, 56, 61, 66, 69

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 0.000 ac



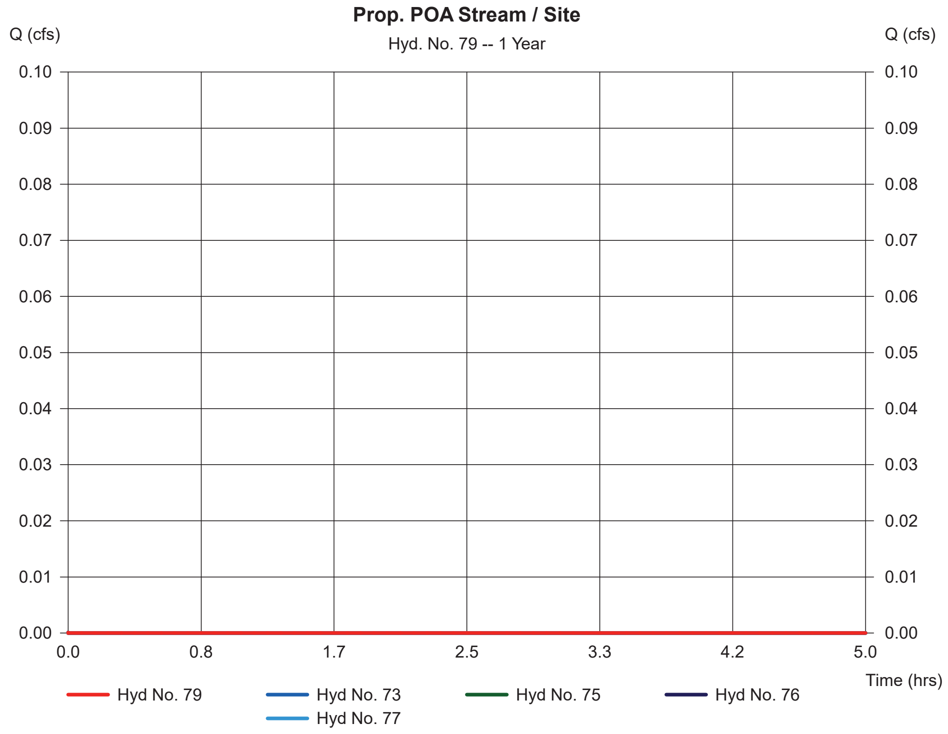
Hydrograph Report

Hyd. No. 79

Prop. POA Stream / Site

Hydrograph type = Combine
Storm frequency = 1 yrs
Time interval = 5 min
Inflow hyds. = 73, 75, 76, 77

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 0.000 ac



Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	0.000	5	n/a	0	----	------	------	Ex. SA Stream (Imp.)
2	SCS Runoff	0.000	5	n/a	0	----	------	------	Ex. SA Stream (Perv.)
4	SCS Runoff	0.000	5	n/a	0	----	------	------	Ex. SA Pond (Imp.)
5	SCS Runoff	0.000	5	n/a	0	----	------	------	Ex. SA Pond (Perv.)
7	Combine	0.000	5	n/a	0	1, 2, 4, 5,	------	------	Ex. Total
9	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B1 North Imp.
10	Combine	0.000	5	n/a	0	9	------	------	Total to AG Basin B1 North
11	Reservoir	0.000	5	n/a	0	10	0.00	0.000	Post AG Basin B1 North
13	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B1 NW Imp.
14	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B1 NW Perv.
15	Combine	0.000	5	n/a	0	13, 14	------	------	Total to AG Basin B1 NW
16	Reservoir	0.000	5	n/a	0	15	0.00	0.000	Post AG Basin B1 NW
18	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B1 SW Imp.
19	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B1 SW Perv.
20	Combine	0.000	5	n/a	0	18, 19	------	------	Total to AG Basin B1 SW
21	Reservoir	0.000	5	n/a	0	20	0.00	0.000	Post AG Basin B1 SW
23	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin South Imp.
24	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin South Perv.
25	Combine	0.000	5	n/a	0	23, 24	------	------	Total to AG Basin South
26	Reservoir	0.000	5	n/a	0	25	0.00	0.000	Post AG Basin South
28	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B2 Imp.
29	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B2 Perv.
30	Combine	0.000	5	n/a	0	28, 29	------	------	Total to AG Basin B2
31	Reservoir	0.000	5	n/a	0	30	0.00	0.000	Post AG Basin B2
33	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Barrels B1 NE Imp.
34	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Barrels B1 NE Perv.
35	Combine	0.000	5	n/a	0	33, 34	------	------	Total to UG Barrels B1 NE
36	Reservoir	0.000	5	n/a	0	35	0.00	0.000	Post UG Barrels B1 NE
38	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Barrels B1 SE Imp.
39	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Barrels B1 SE Perv.

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
40	Combine	0.000	5	n/a	0	38, 39	------	------	Total to UG Barrels B1 SE
41	Reservoir	0.000	5	n/a	0	40	0.00	0.000	Post UG Barrels B1 SE
43	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Barrels South Imp.
44	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Barrels South Perv.
45	Combine	0.000	5	n/a	0	43, 44	------	------	Total to UG Barrels South
46	Reservoir	0.000	5	n/a	0	45	0.00	0.000	Post UG Barrels South
48	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B1 NW Imp.
49	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B1 NW Perv.
50	Combine	0.000	5	n/a	0	48, 49	------	------	Total to UG Inf B1 NW
51	Reservoir	0.000	5	n/a	0	50	0.00	0.000	Post Ug Inf B1 NW
53	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B1 SW Imp.
54	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B1 SW Perv.
55	Combine	0.000	5	n/a	0	53, 54	------	------	Total to UG Inf B1 SW
56	Reservoir	0.000	5	n/a	0	55	0.00	0.000	Post Ug Inf B1 SW
58	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B1 South Imp.
59	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B1 South Perv.
60	Combine	0.000	5	n/a	0	58, 59	------	------	Total to UG Inf B1 South
61	Reservoir	0.000	5	n/a	0	60	0.00	0.000	Post UG Inf B1 South
63	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B2 Imp.
64	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B2 Perv.
65	Combine	0.000	5	n/a	0	63, 64	------	------	Total to SA UG Inf B2
66	Reservoir	0.000	5	n/a	0	65	0.00	0.000	Post Ug Inf B2
68	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B3 Imp.
69	Reservoir	0.000	5	n/a	0	68	0.00	0.000	Post UG Inf B3
71	SCS Runoff	0.000	5	n/a	0	----	------	------	SA Stream Undetained Imp.
72	SCS Runoff	0.000	5	n/a	0	----	------	------	SA Stream Undetained Perv.
73	Combine	0.000	5	n/a	0	71, 72	------	------	Total to Stream Undetained
75	Combine	0.000	5	n/a	0	11, 16, 21, 26, 31,	------	------	Total AG Basins
76	Combine	0.000	5	n/a	0	36, 41, 46,	------	------	Total UG Barrels
77	Combine	0.000	5	n/a	0	51, 56, 61, 66, 69,	------	------	Total UG Inf Basins

---

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
79	Combine	0.000	5	n/a	0	73, 75, 76, 77,	------	------	Prop. POA Stream / Site

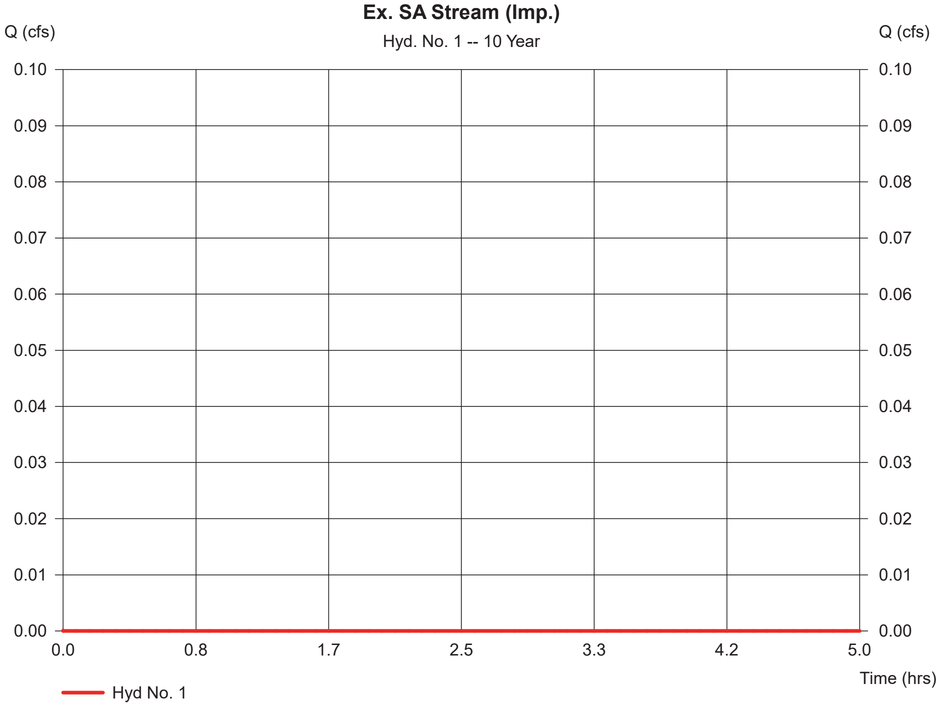
Hydrograph Report

Hyd. No. 1

Ex. SA Stream (Imp.)

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 5 min
Drainage area = 22.560 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.65 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 16.20 min
Distribution = Type III
Shape factor = 484



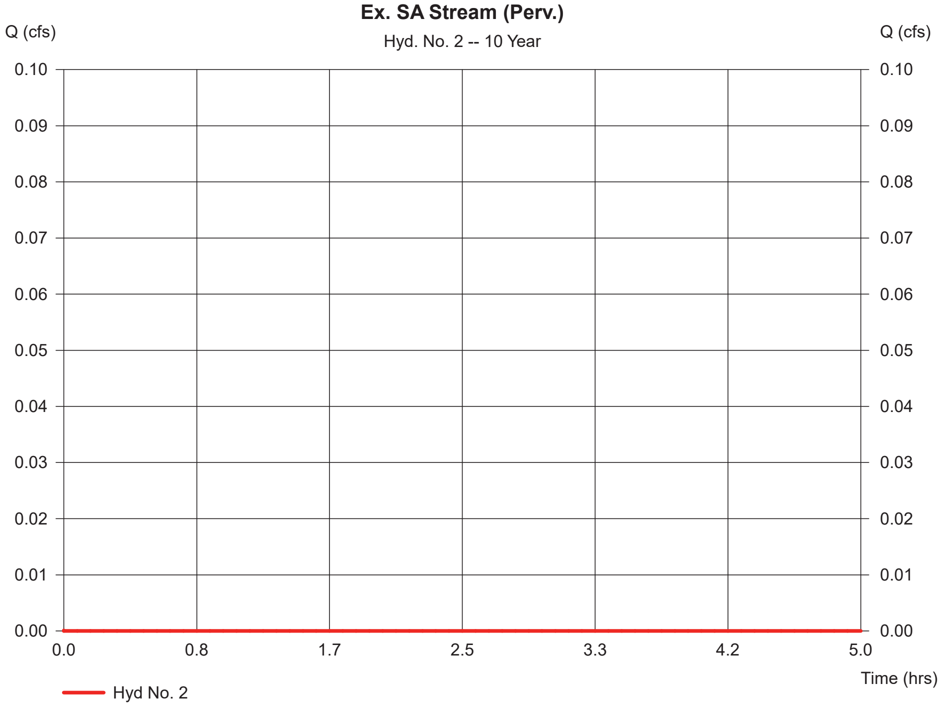
Hydrograph Report

Hyd. No. 2

Ex. SA Stream (Perv.)

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 5 min
Drainage area = 33.110 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.65 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 37
Hydraulic length = 0 ft
Time of conc. (Tc) = 16.20 min
Distribution = Type III
Shape factor = 484

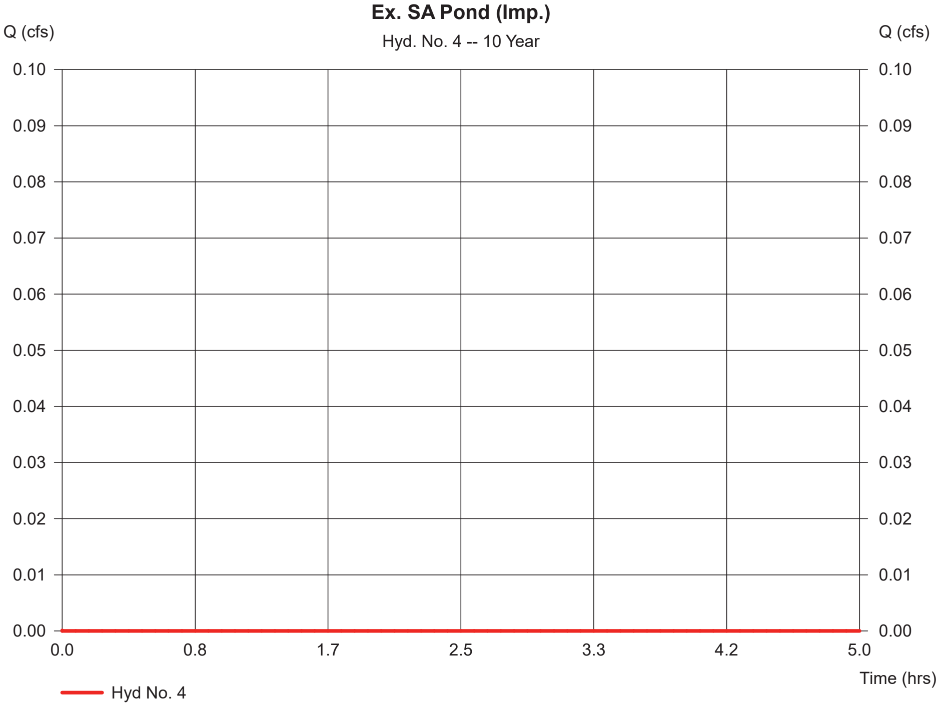


Hydrograph Report

Hyd. No. 4

Ex. SA Pond (Imp.)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 2.800 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.65 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

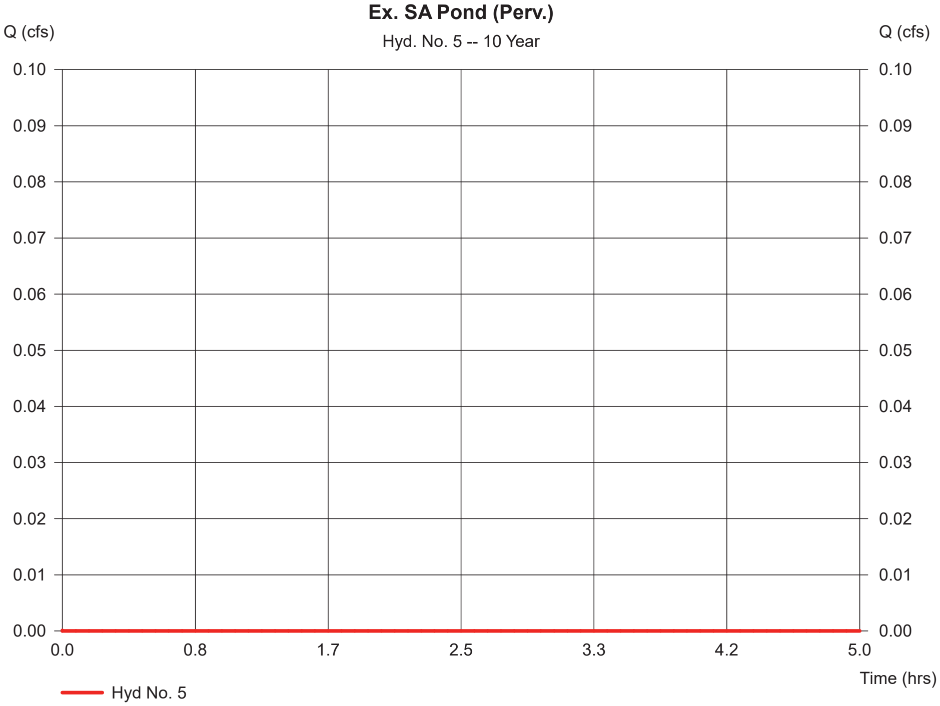


Hydrograph Report

Hyd. No. 5

Ex. SA Pond (Perv.)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 3.590 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.65 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



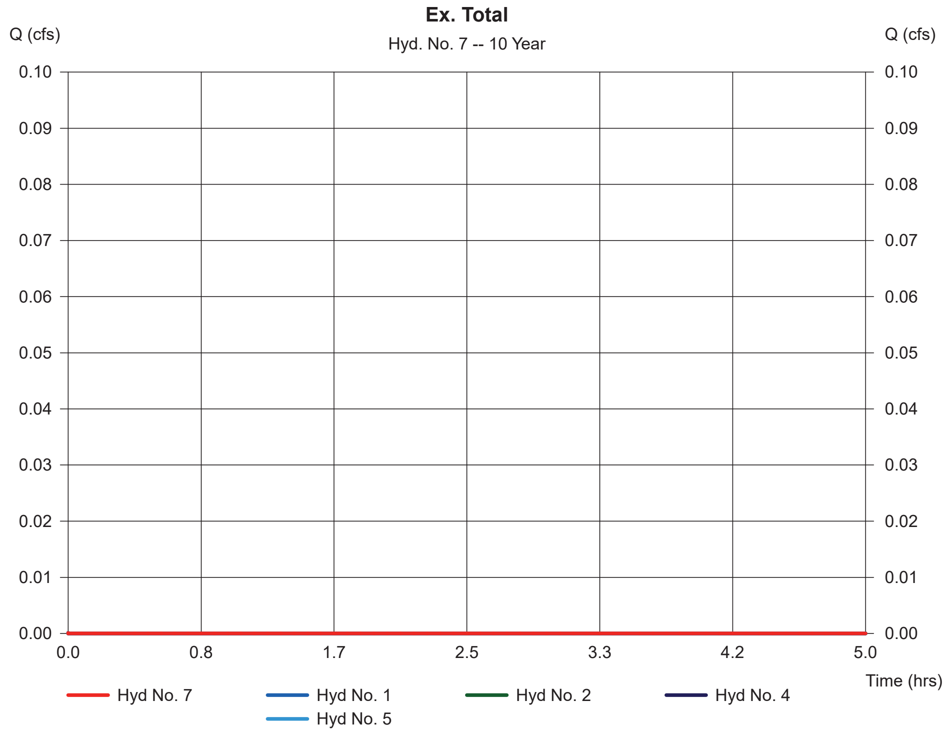
Hydrograph Report

Hyd. No. 7

Ex. Total

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyds. = 1, 2, 4, 5

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 62.060 ac



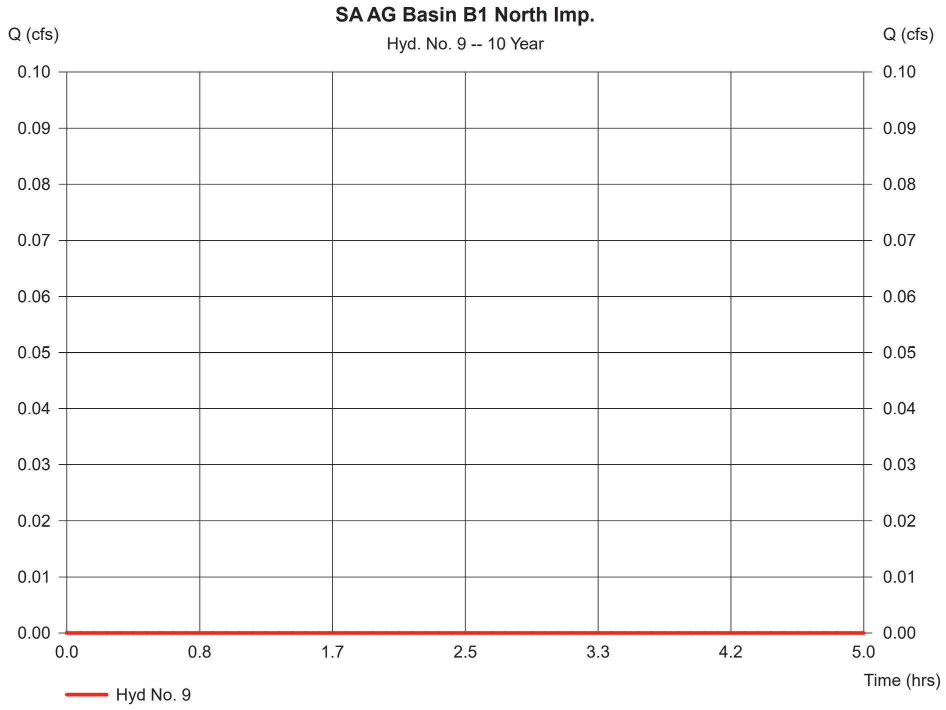
Hydrograph Report

Hyd. No. 9

SA AG Basin B1 North Imp.

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 5 min
Drainage area = 2.100 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.65 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



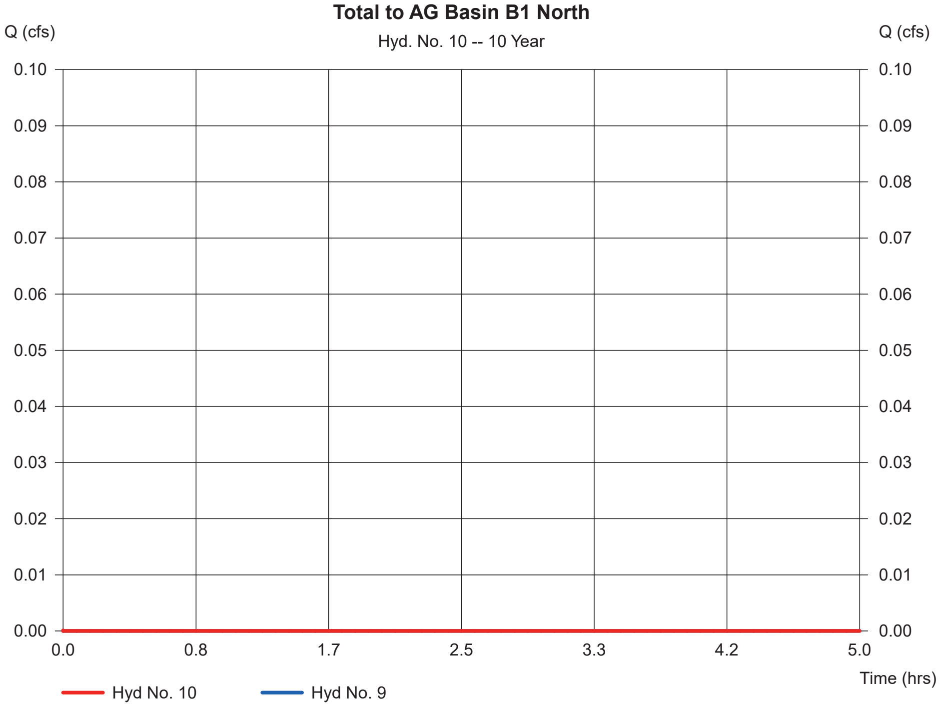
Hydrograph Report

Hyd. No. 10

Total to AG Basin B1 North

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyds. = 9

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 2.100 ac



Hydrograph Report

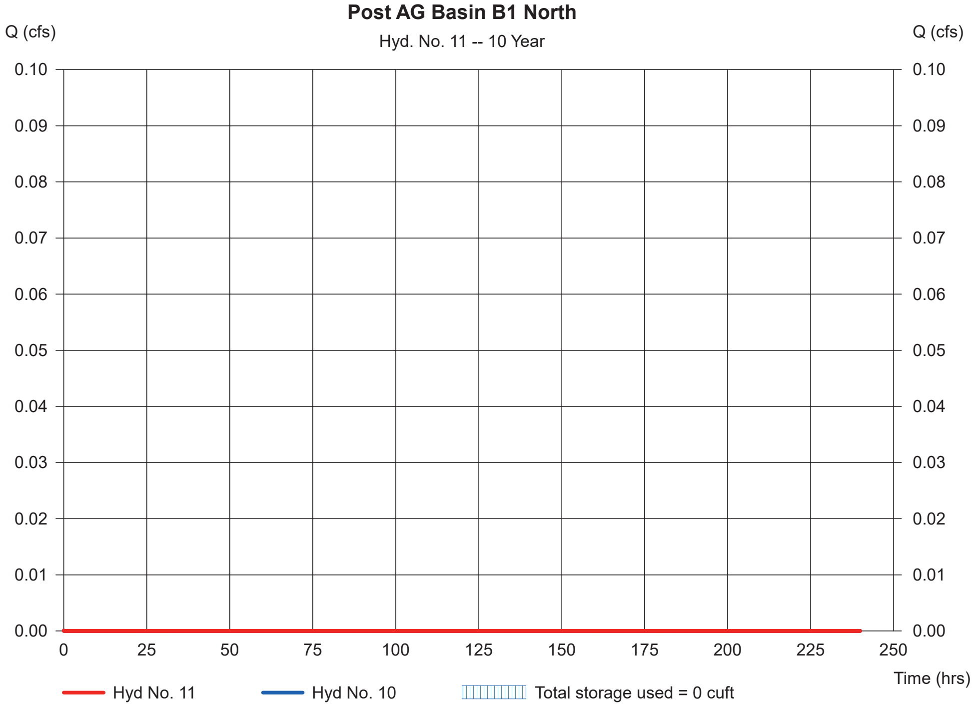
Hyd. No. 11

Post AG Basin B1 North

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyd. No. = 10 - Total to AG Basin B1 North
Reservoir name = AG Basin B1 North

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



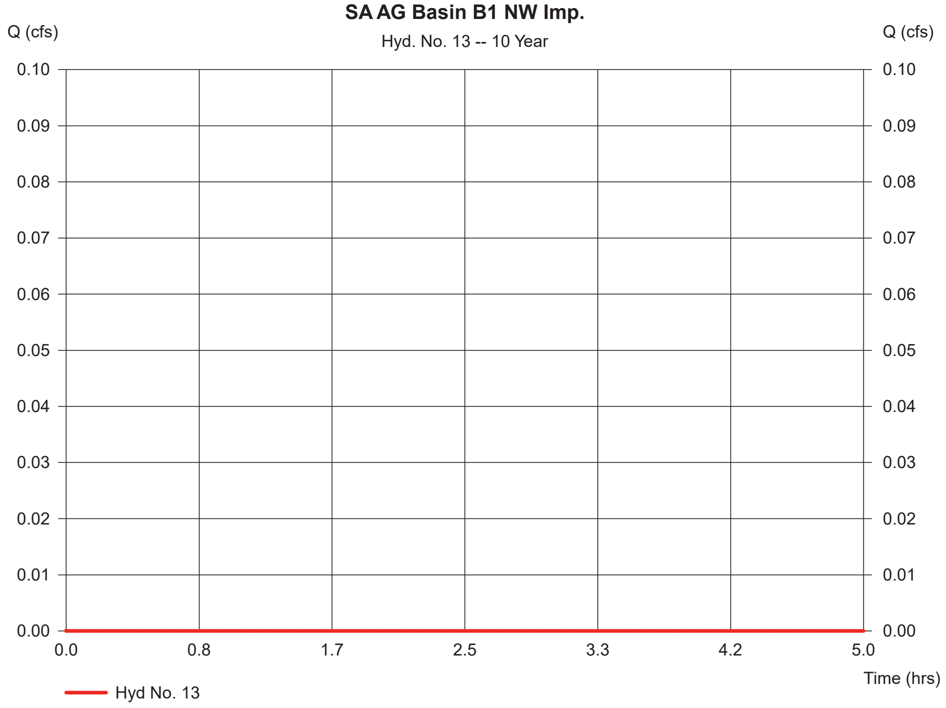
Hydrograph Report

Hyd. No. 13

SA AG Basin B1 NW Imp.

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 5 min
Drainage area = 1.010 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.65 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



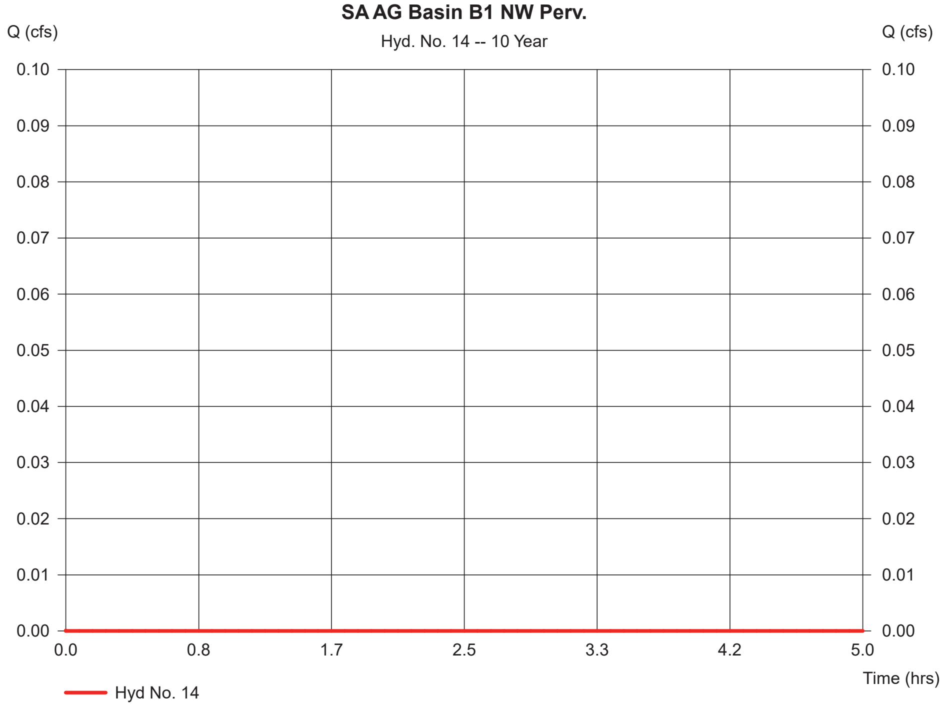
Hydrograph Report

Hyd. No. 14

SA AG Basin B1 NW Perv.

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 5 min
Drainage area = 0.520 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.65 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 62
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



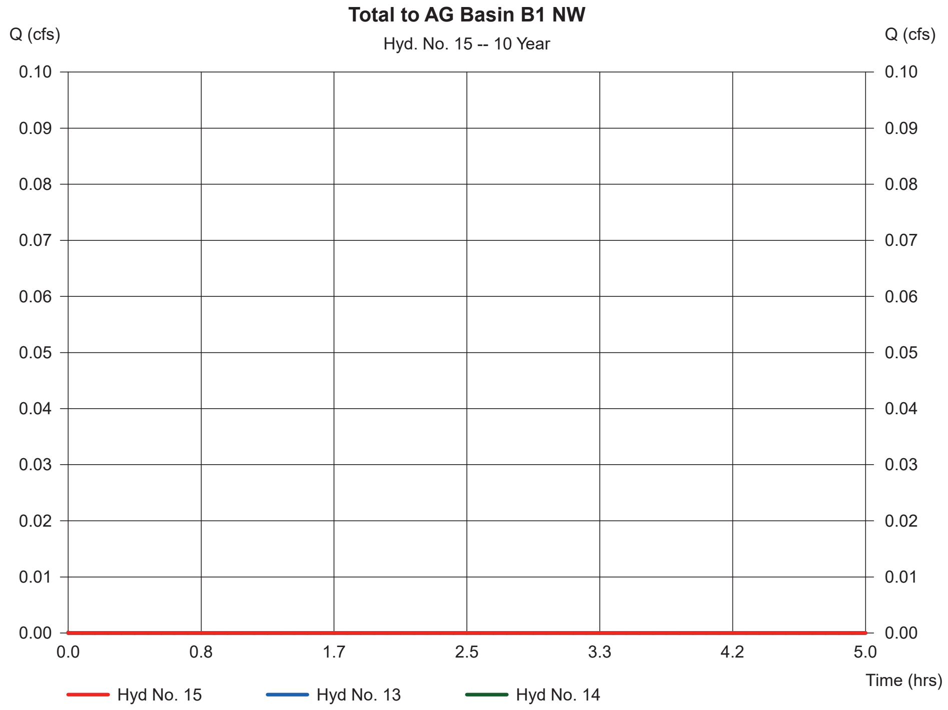
Hydrograph Report

Hyd. No. 15

Total to AG Basin B1 NW

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyds. = 13, 14

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 1.530 ac



Hydrograph Report

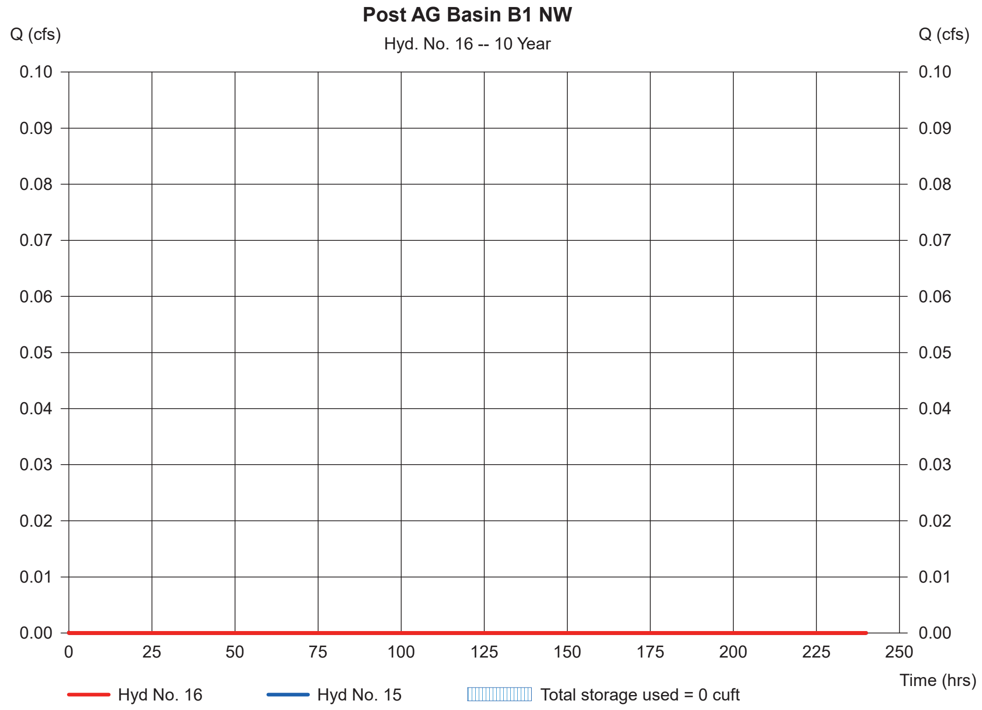
Hyd. No. 16

Post AG Basin B1 NW

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyd. No. = 15 - Total to AG Basin B1 NW
Reservoir name = AG Basin B1 Northwest

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.

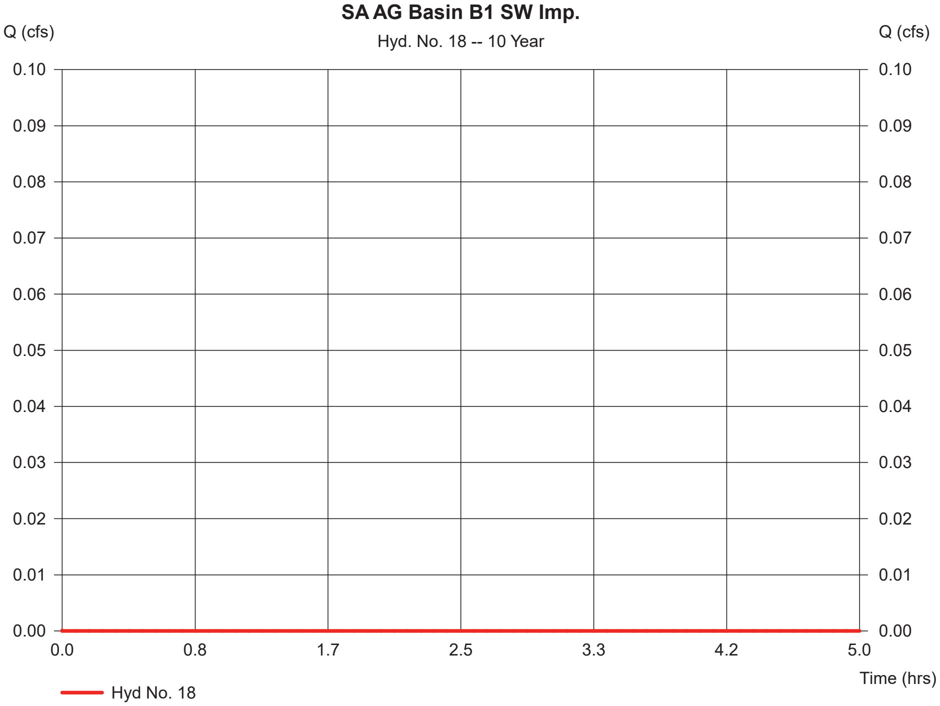


Hydrograph Report

Hyd. No. 18

SA AG Basin B1 SW Imp.

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 0.420 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.65 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

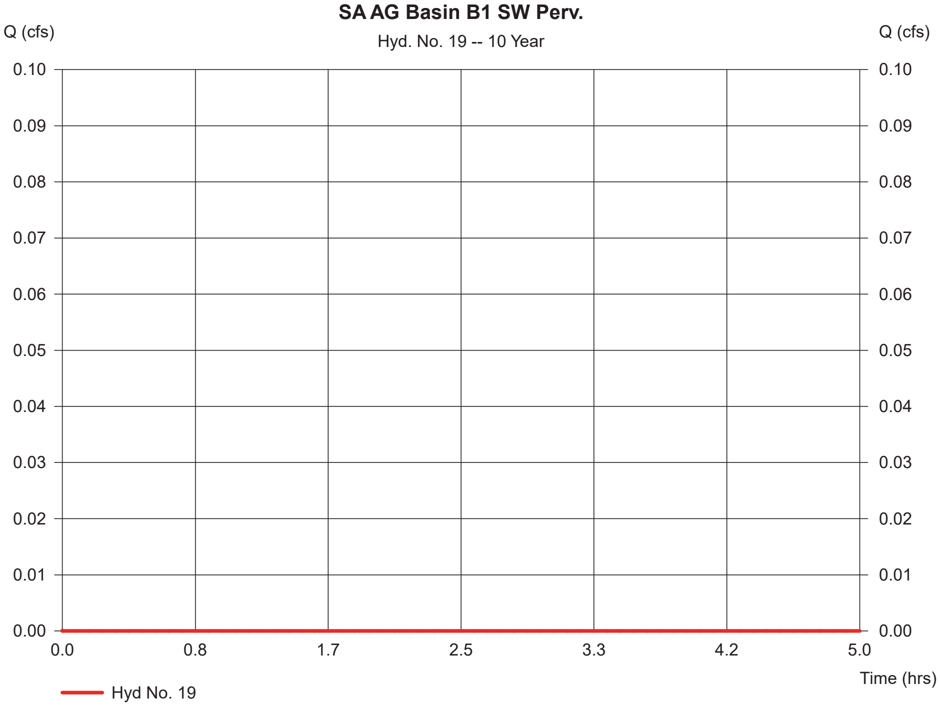


Hydrograph Report

Hyd. No. 19

SA AG Basin B1 SW Perv.

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 0.310 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.65 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

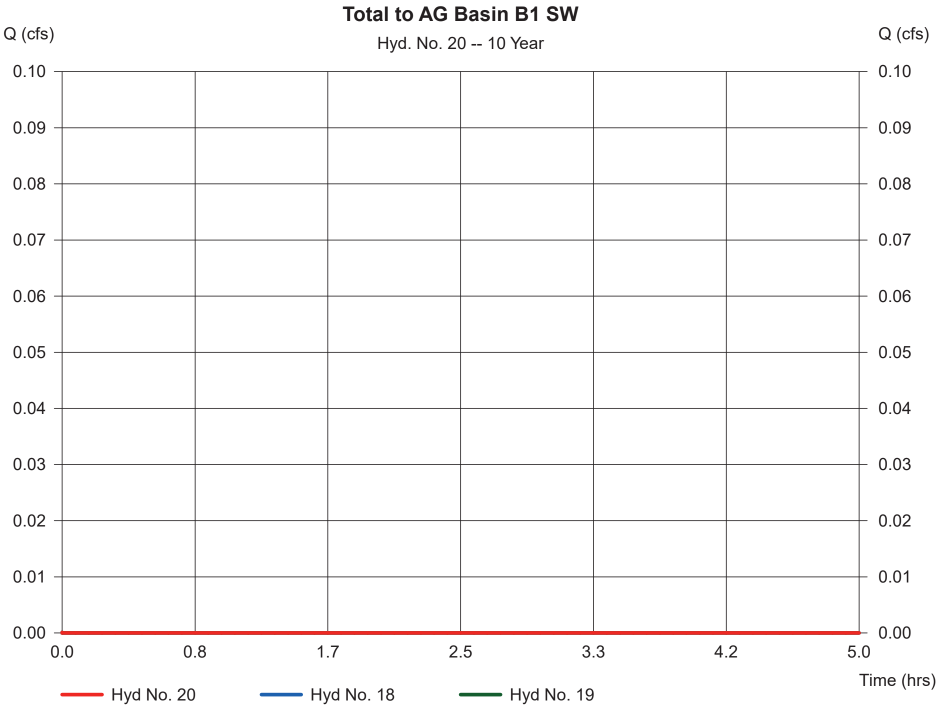
Friday, Jan 20, 2023

Hyd. No. 20

Total to AG Basin B1 SW

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyds. = 18, 19

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 0.730 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Friday, Jan 20, 2023

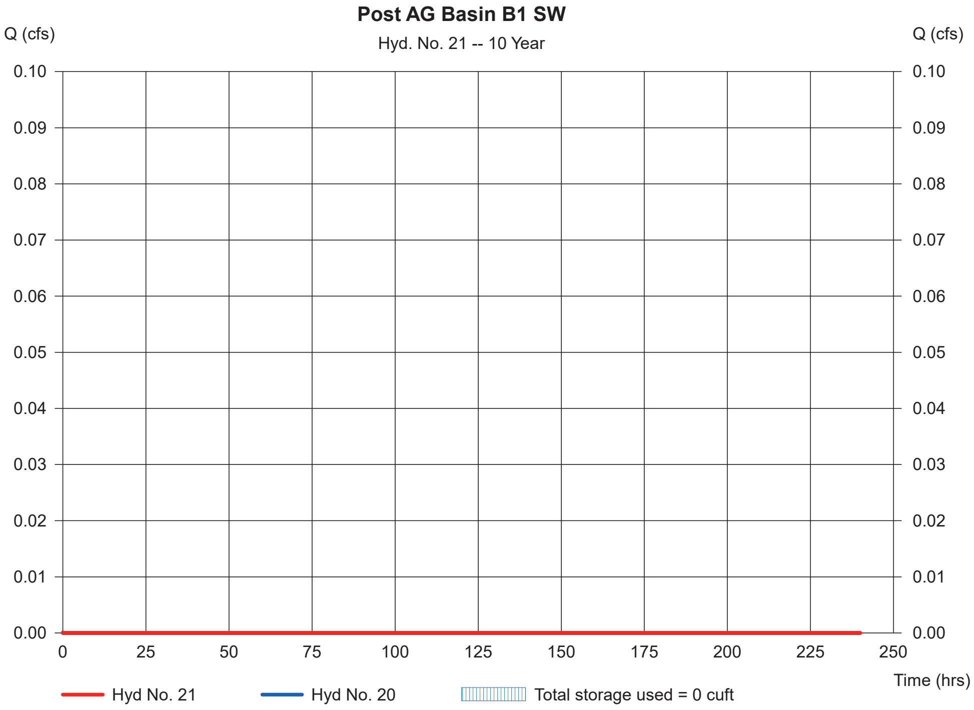
Hyd. No. 21

Post AG Basin B1 SW

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyd. No. = 20 - Total to AG Basin B1 SW
Reservoir name = AG Basin B1 Southwest

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



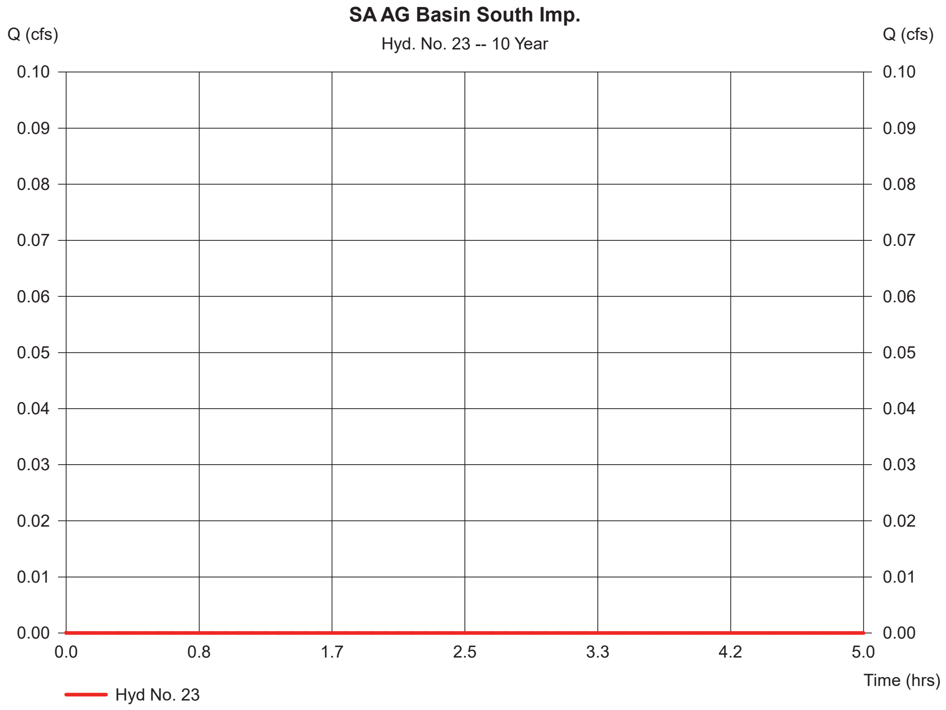
Hydrograph Report

Hyd. No. 23

SA AG Basin South Imp.

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 5 min
Drainage area = 2.060 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.65 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



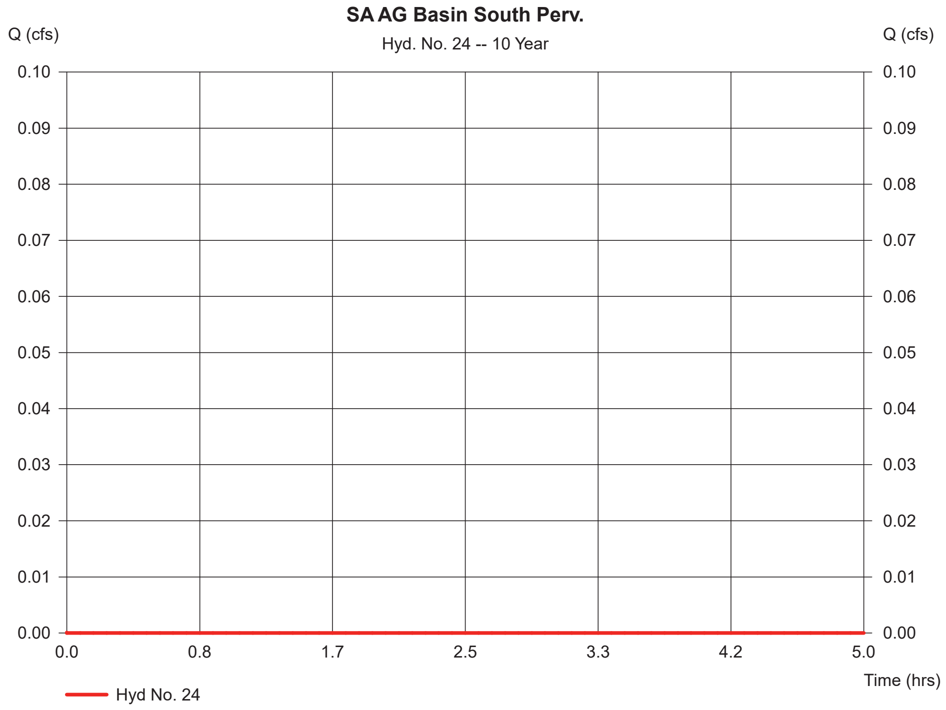
Hydrograph Report

Hyd. No. 24

SA AG Basin South Perv.

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 5 min
Drainage area = 0.920 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.65 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 39
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

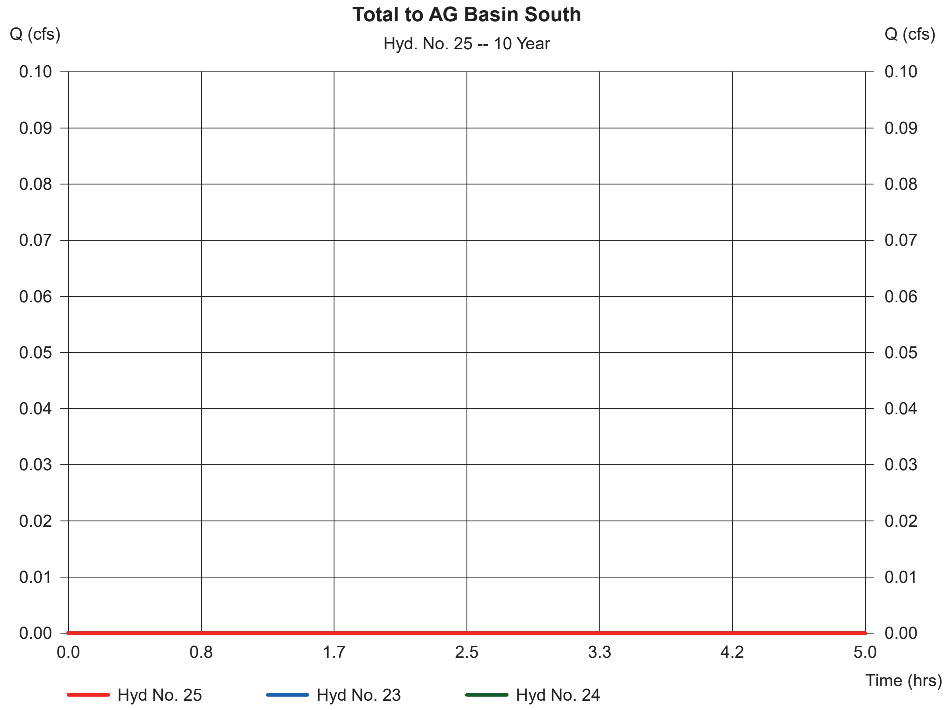
Hydraflow Hydrographs by Intelisolve v9.1 Friday, Jan 20, 2023

Hyd. No. 25

Total to AG Basin South

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyds. = 23, 24

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 2.980 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1 Friday, Jan 20, 2023

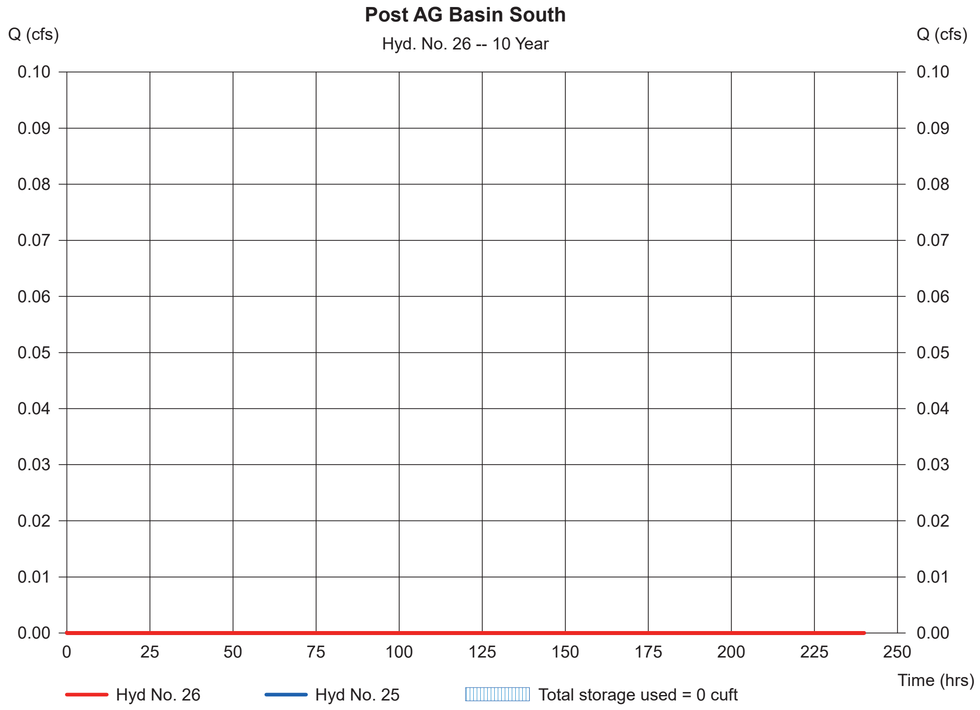
Hyd. No. 26

Post AG Basin South

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyd. No. = 25 - Total to AG Basin South
Reservoir name = AG Basin South

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



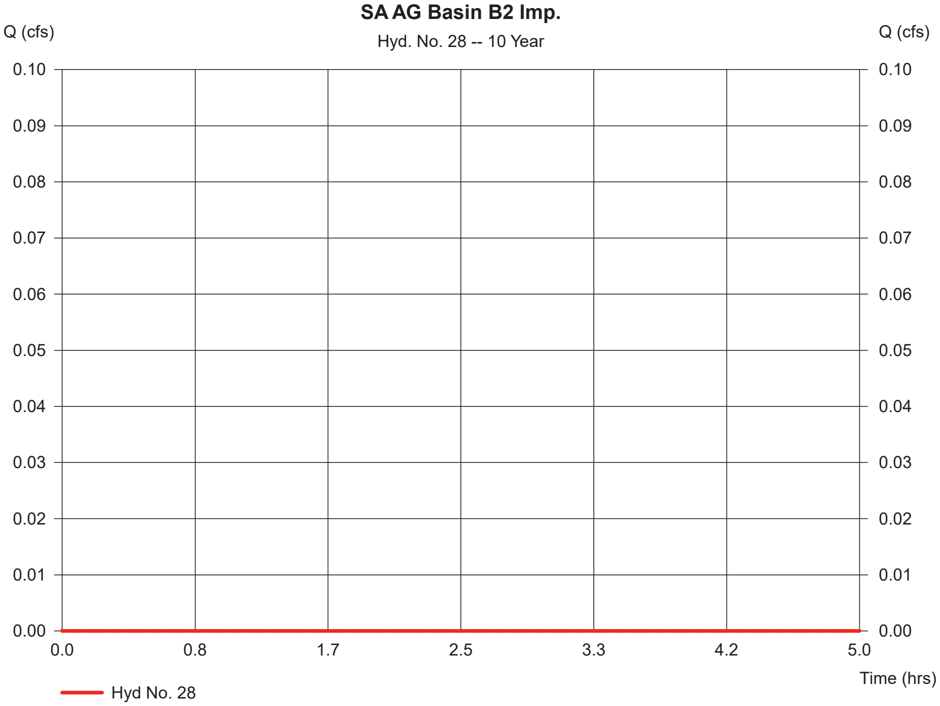
Hydrograph Report

Hyd. No. 28

SA AG Basin B2 Imp.

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 5 min
Drainage area = 2.150 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.65 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



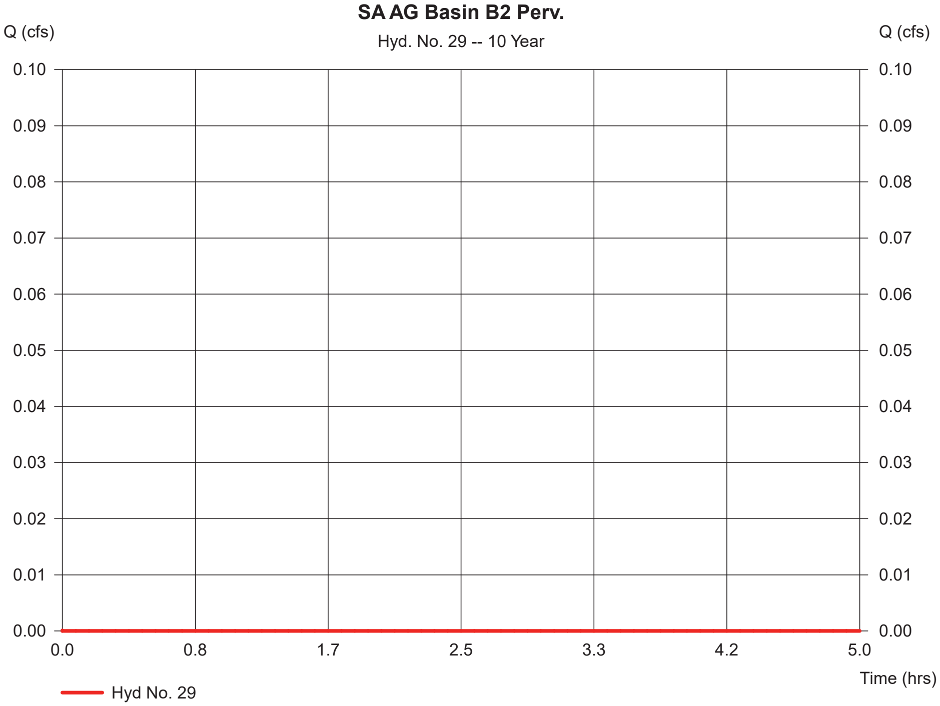
Hydrograph Report

Hyd. No. 29

SA AG Basin B2 Perv.

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 5 min
Drainage area = 0.620 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.65 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 43
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



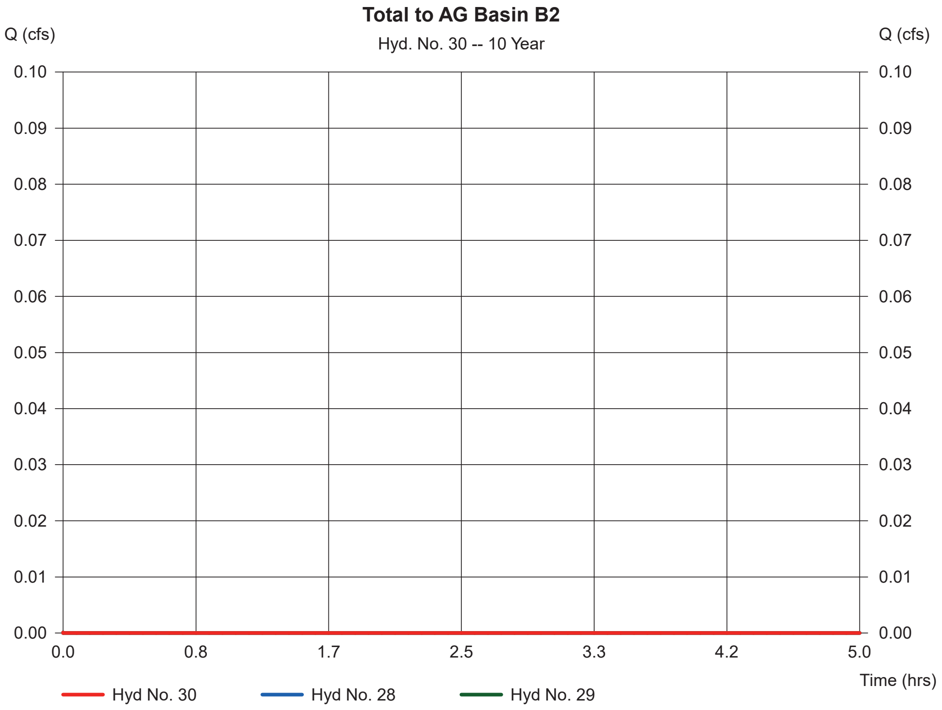
Hydrograph Report

Hyd. No. 30

Total to AG Basin B2

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyds. = 28, 29

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 2.770 ac



Hydrograph Report

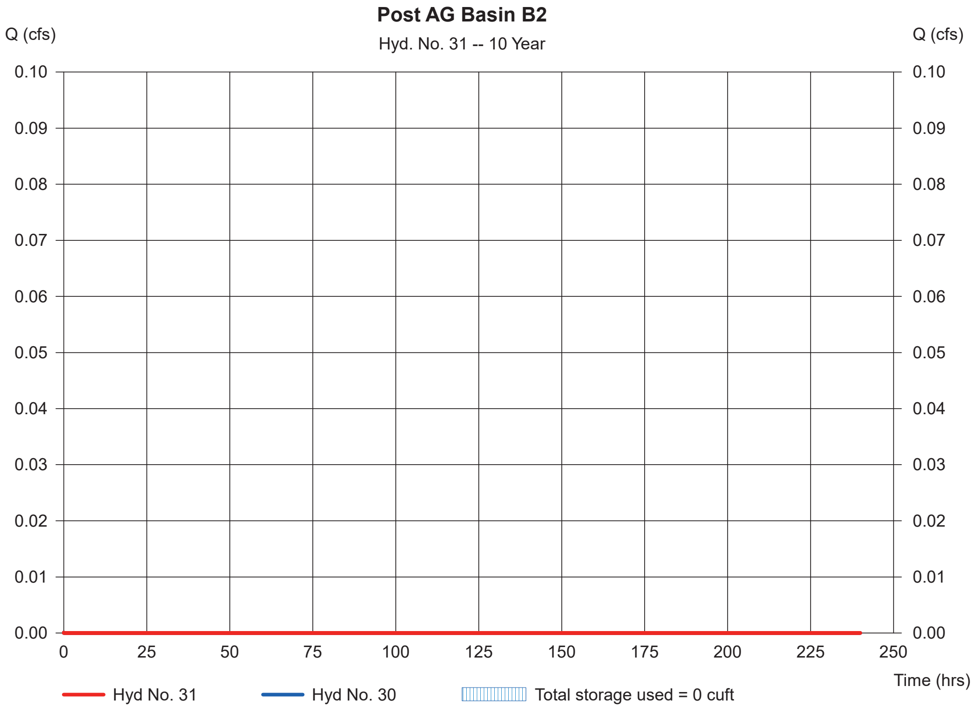
Hyd. No. 31

Post AG Basin B2

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyd. No. = 30 - Total to AG Basin B2
Reservoir name = AG Basin B2

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



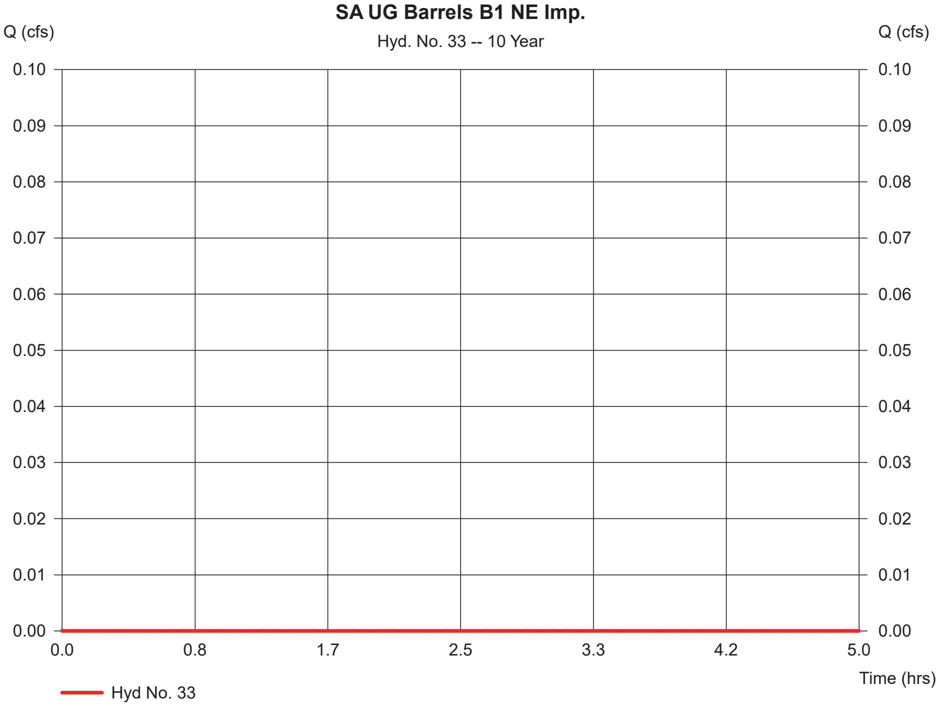
Hydrograph Report

Hyd. No. 33

SA UG Barrels B1 NE Imp.

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 5 min
Drainage area = 8.080 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.65 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



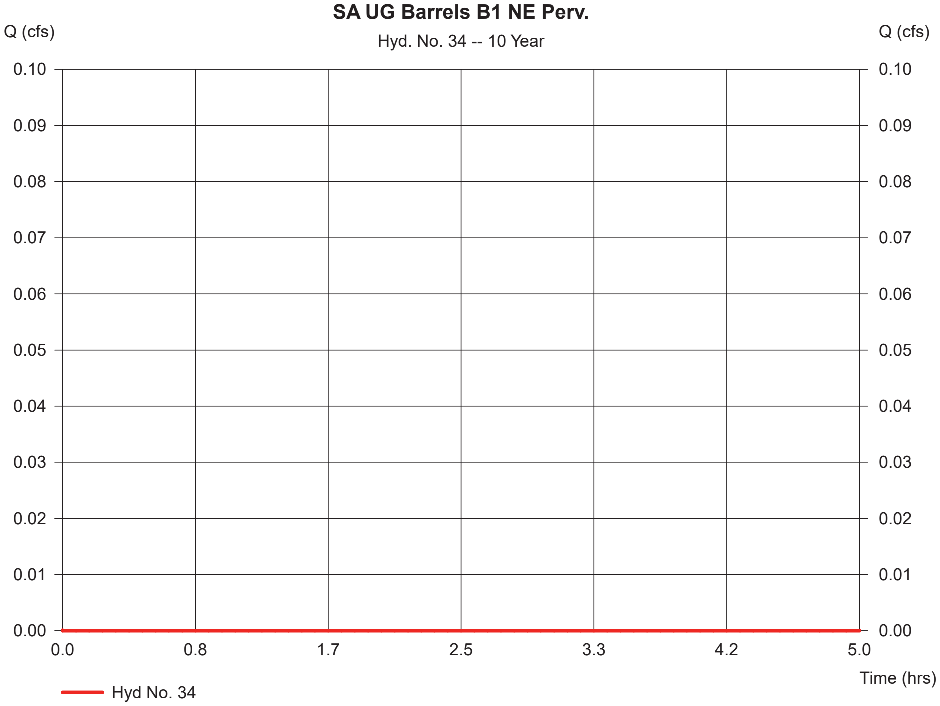
Hydrograph Report

Hyd. No. 34

SA UG Barrels B1 NE Perv.

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 5 min
Drainage area = 0.140 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.65 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 64
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



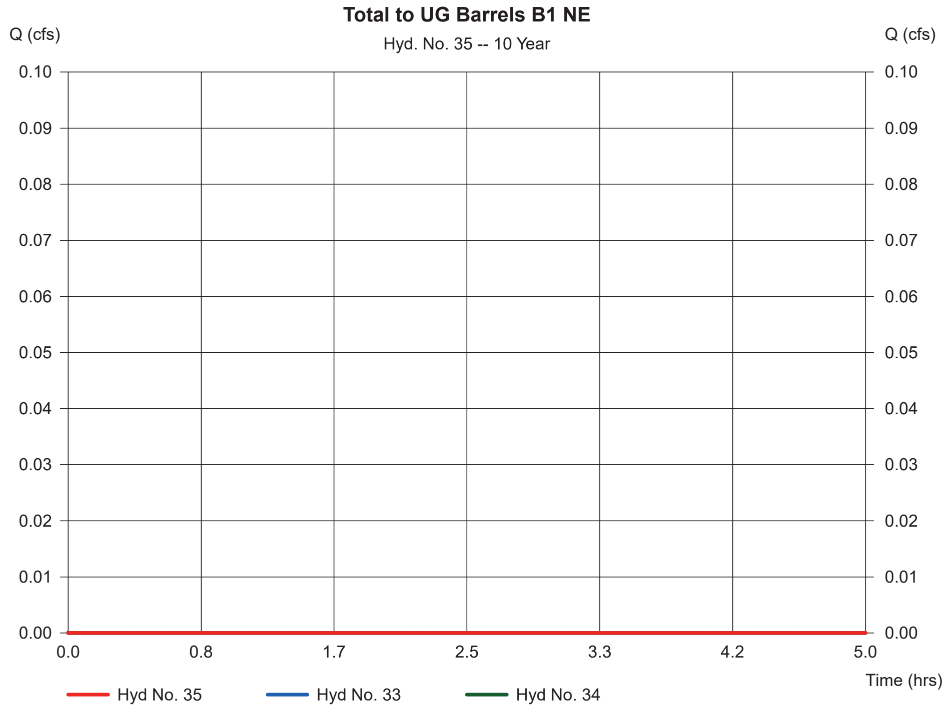
Hydrograph Report

Hyd. No. 35

Total to UG Barrels B1 NE

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyds. = 33, 34

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 8.220 ac



Hydrograph Report

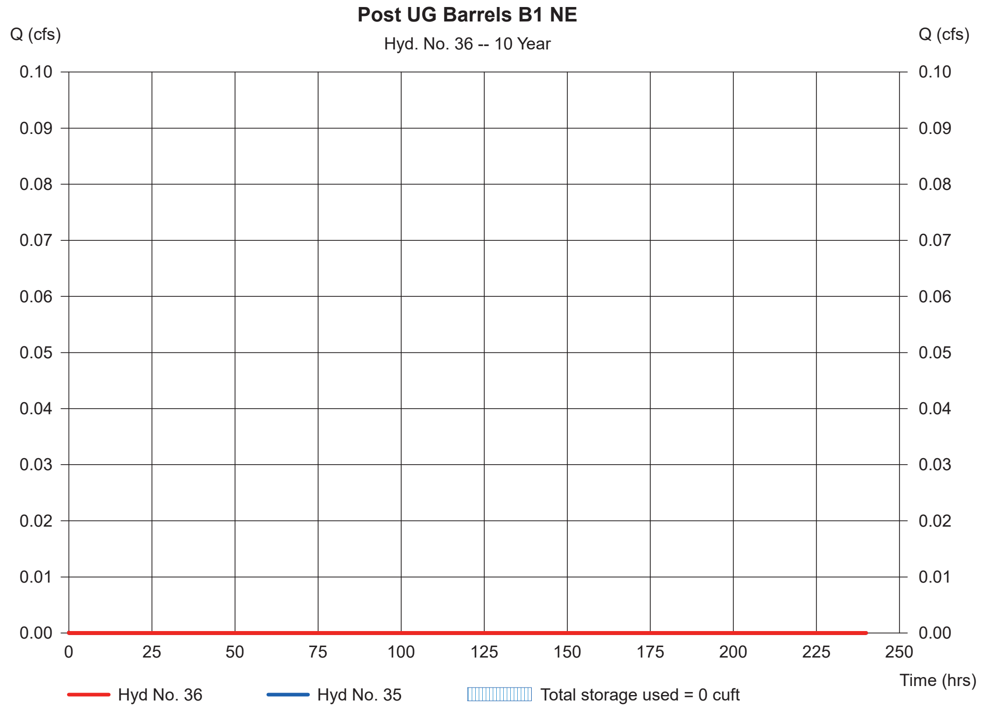
Hyd. No. 36

Post UG Barrels B1 NE

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyd. No. = 35 - Total to UG Barrels B1 NE
Reservoir name = UG BARRELS B1 Northeast

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



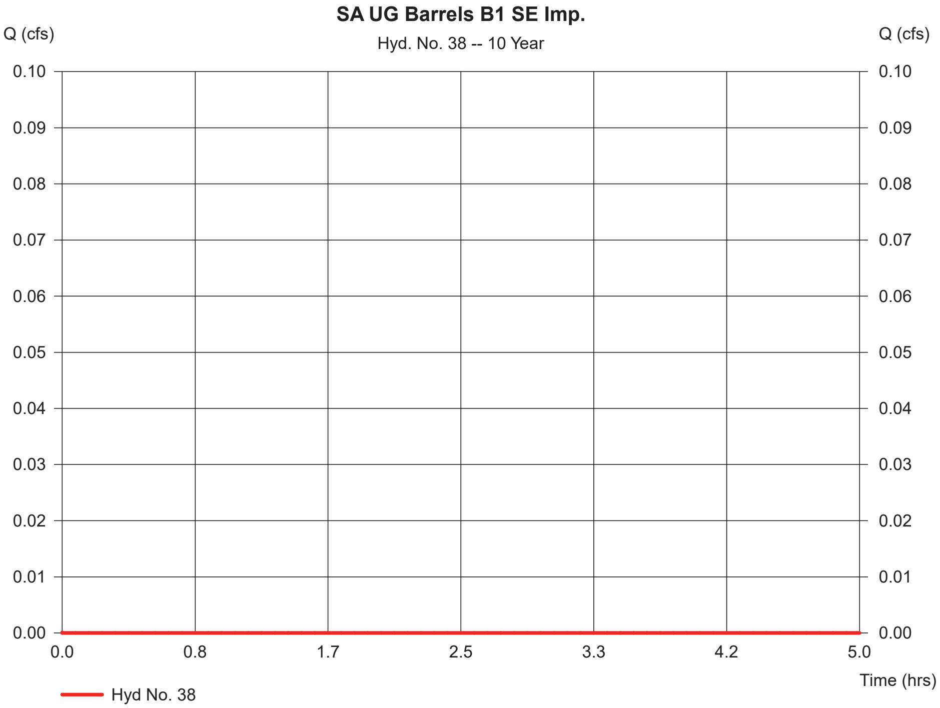
Hydrograph Report

Hyd. No. 38

SA UG Barrels B1 SE Imp.

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 5 min
Drainage area = 9.290 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.65 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



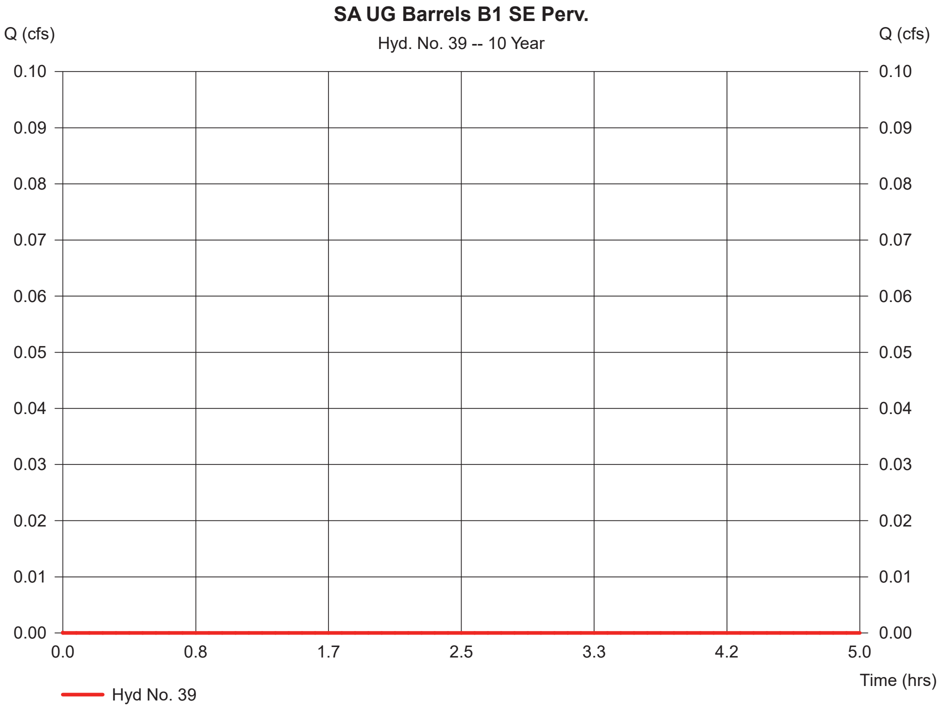
Hydrograph Report

Hyd. No. 39

SA UG Barrels B1 SE Perv.

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 5 min
Drainage area = 0.440 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.65 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 46
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



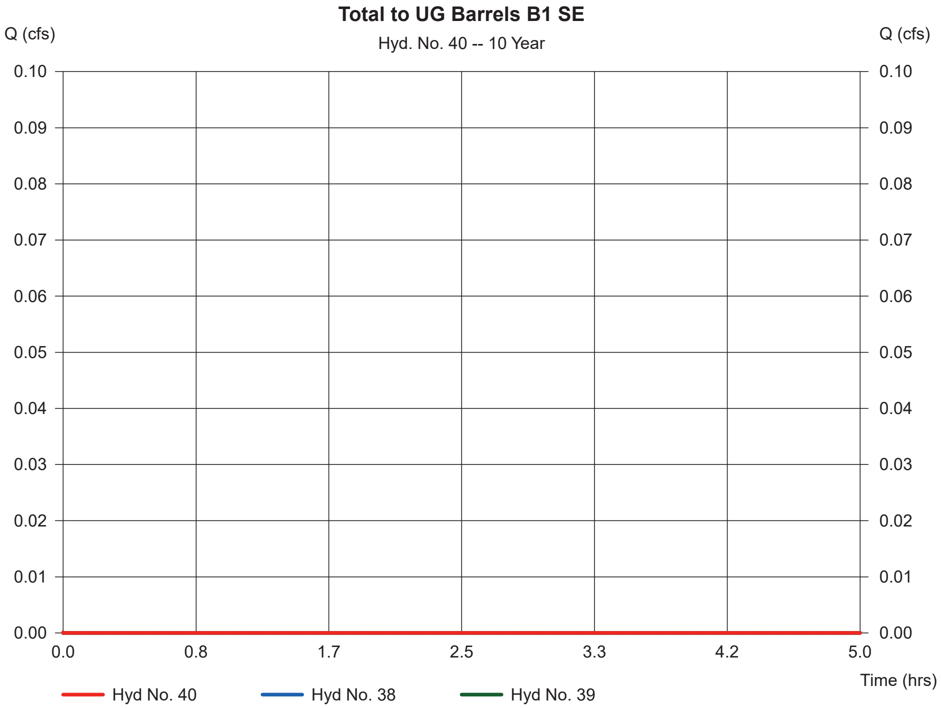
Hydrograph Report

Hyd. No. 40

Total to UG Barrels B1 SE

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyds. = 38, 39

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 9.730 ac



Hydrograph Report

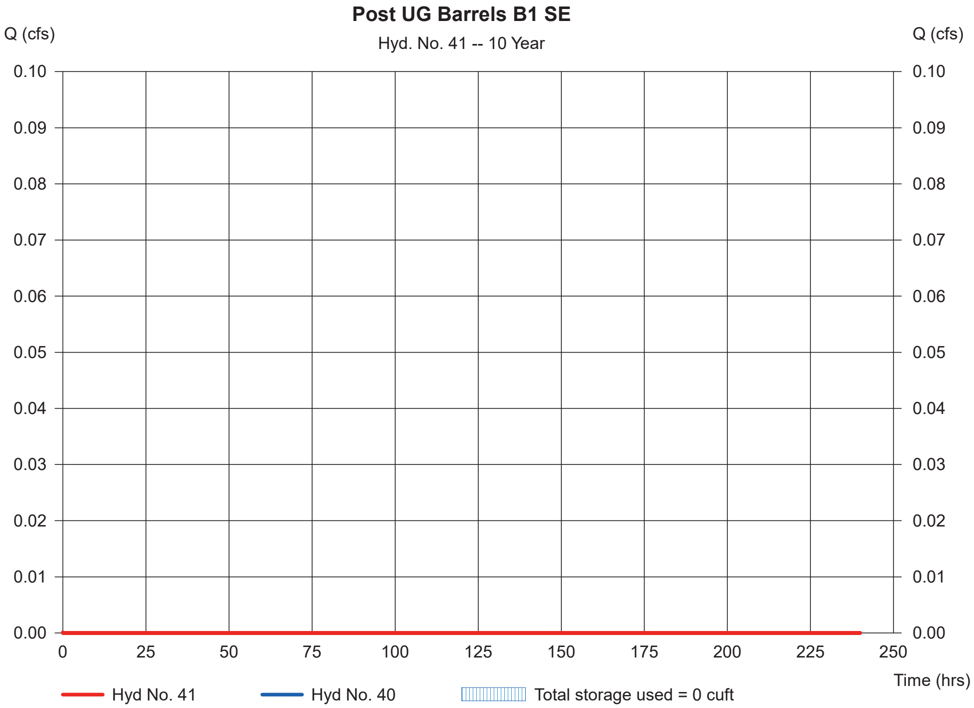
Hyd. No. 41

Post UG Barrels B1 SE

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyd. No. = 40 - Total to UG Barrels B1 SE
Reservoir name = UG BARRELS B1 Southeast

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



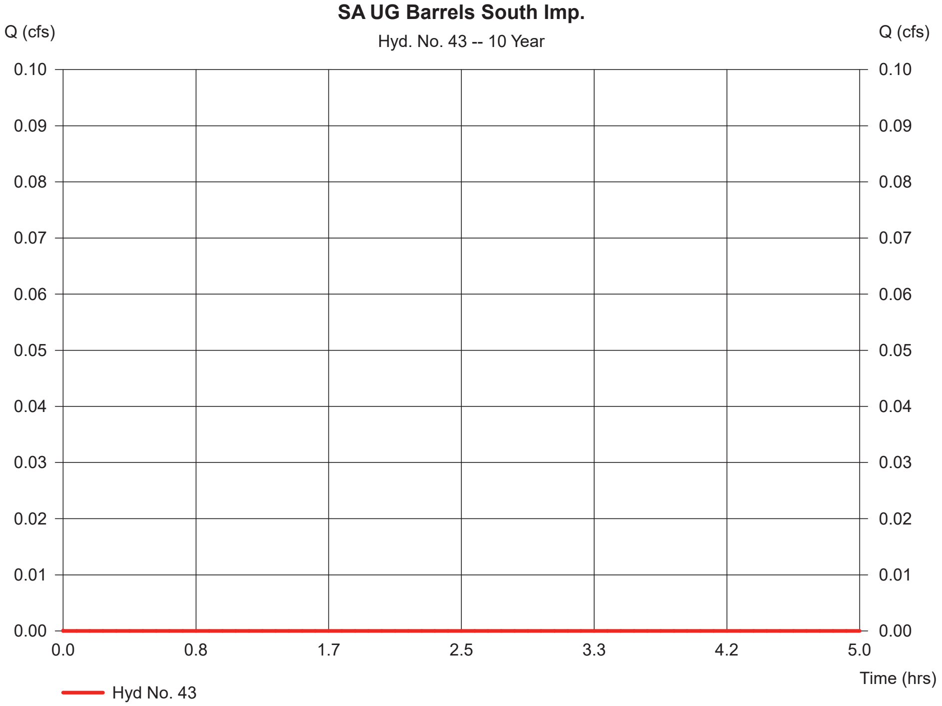
Hydrograph Report

Hyd. No. 43

SA UG Barrels South Imp.

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 5 min
Drainage area = 1.420 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.65 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



SA UG Barrels South Imp.

Hyd. No. 43 -- 10 Year

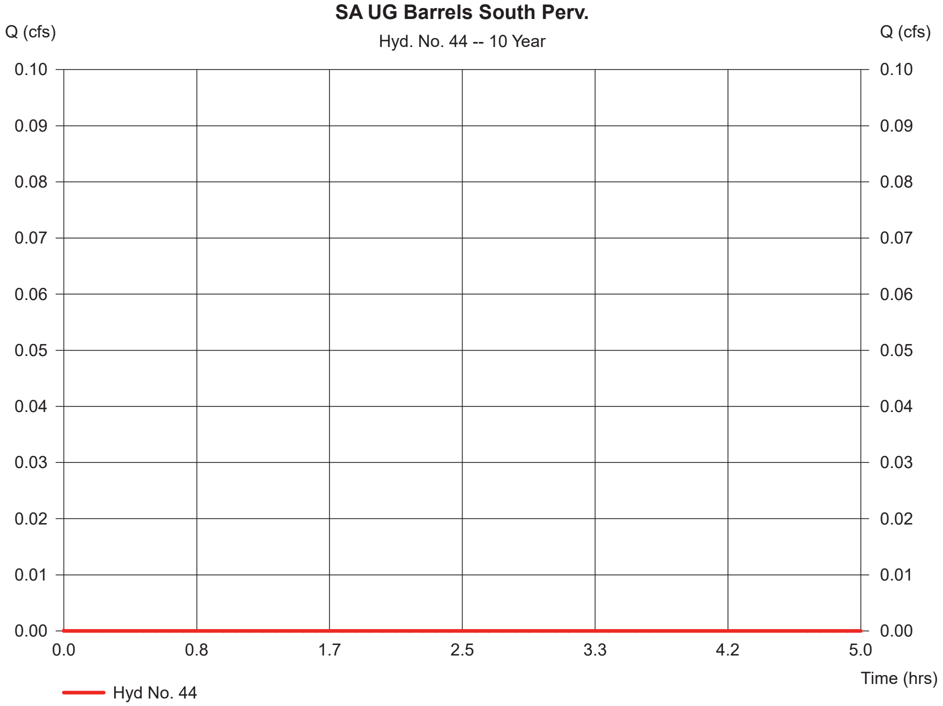
Hydrograph Report

Hyd. No. 44

SA UG Barrels South Perv.

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 5 min
Drainage area = 0.140 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.65 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 64
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



SA UG Barrels South Perv.

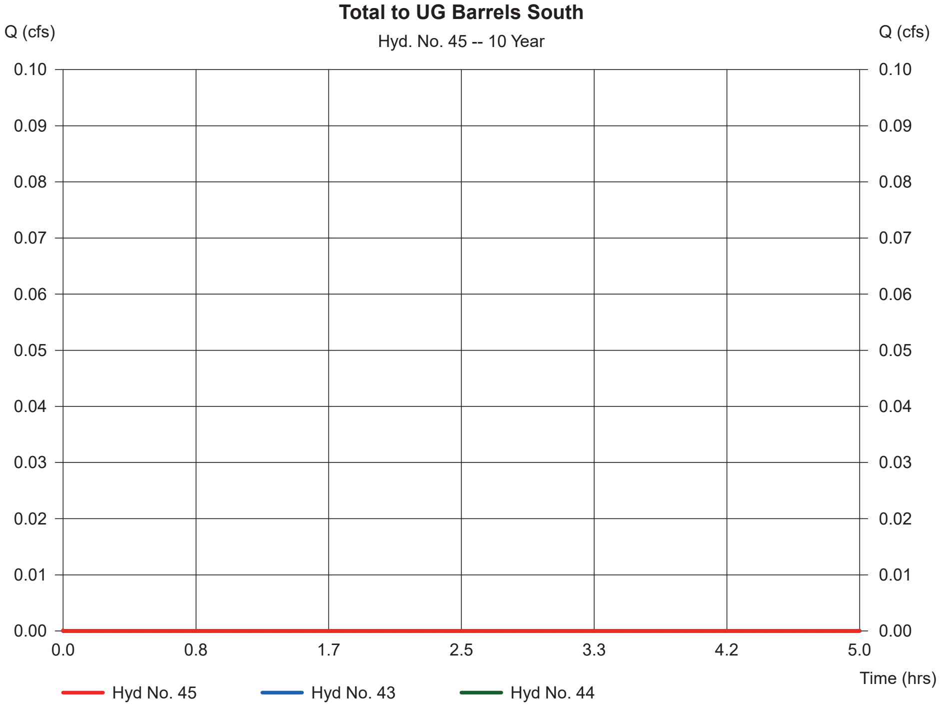
Hyd. No. 44 -- 10 Year

Hyd. No. 45

Total to UG Barrels South

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyds. = 43, 44

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 1.560 ac



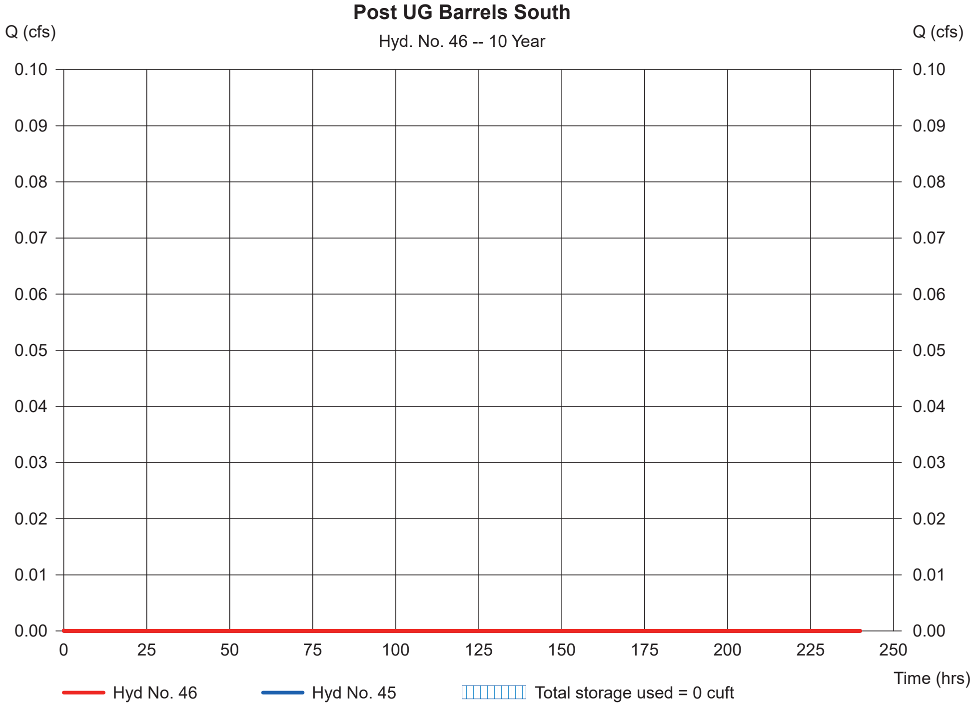
Hyd. No. 46

Post UG Barrels South

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyd. No. = 45 - Total to UG Barrels South
Reservoir name = UG BARRELS South Bldg

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



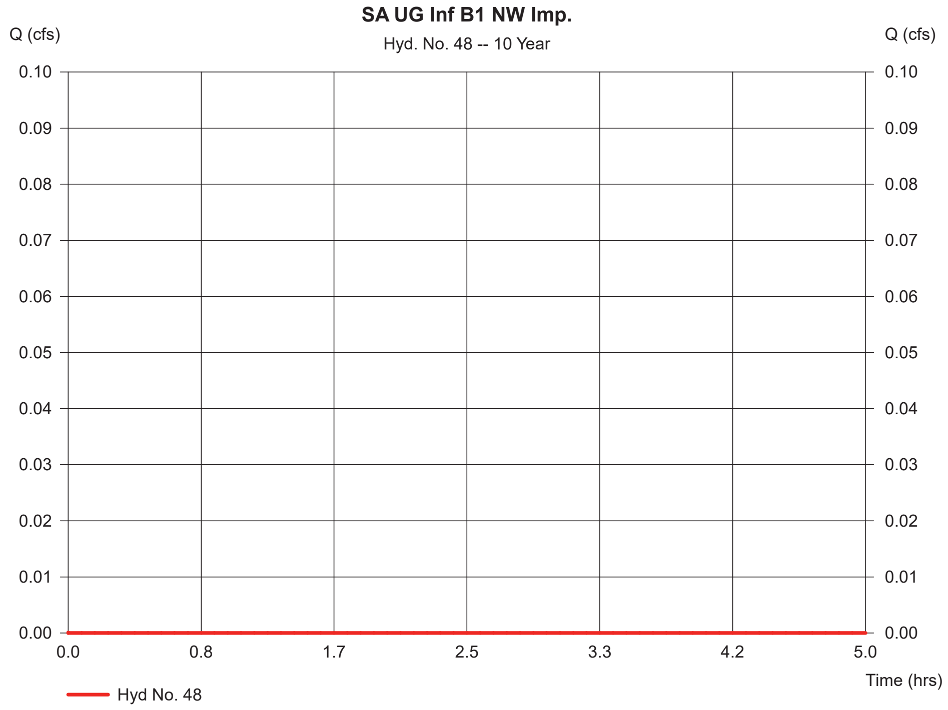
Hydrograph Report

Hyd. No. 48

SA UG Inf B1 NW Imp.

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 5 min
Drainage area = 9.310 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.65 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



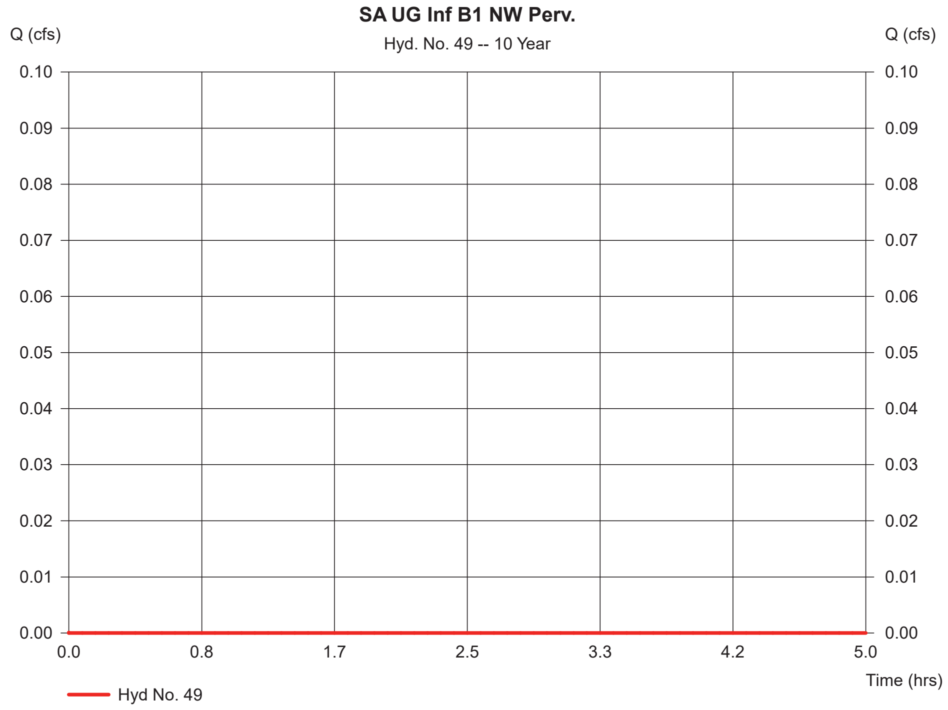
Hydrograph Report

Hyd. No. 49

SA UG Inf B1 NW Perv.

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 5 min
Drainage area = 0.260 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.65 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 39
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



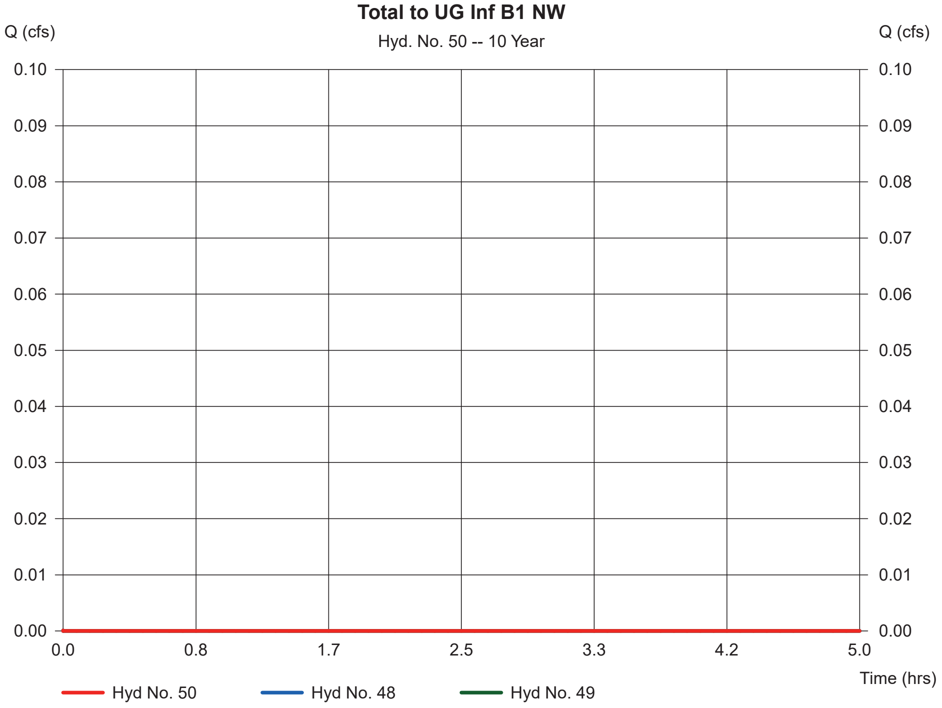
Hydrograph Report

Hyd. No. 50

Total to UG Inf B1 NW

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyds. = 48, 49

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 9.570 ac



Hydrograph Report

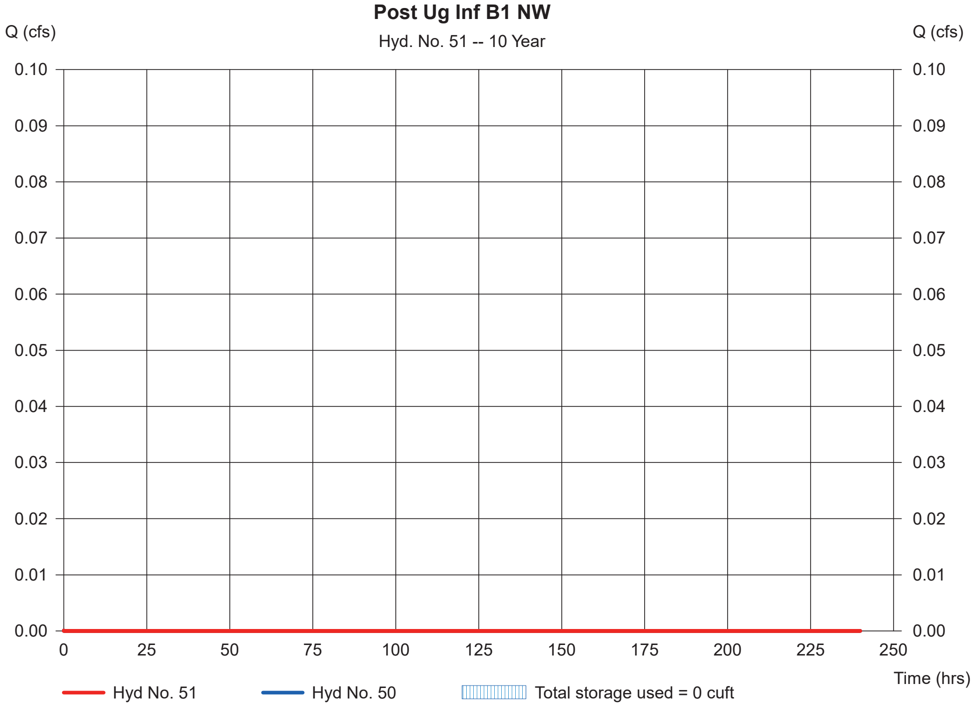
Hyd. No. 51

Post Ug Inf B1 NW

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyd. No. = 50 - Total to UG Inf B1 NW
Reservoir name = UG Inf B1 NW

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.

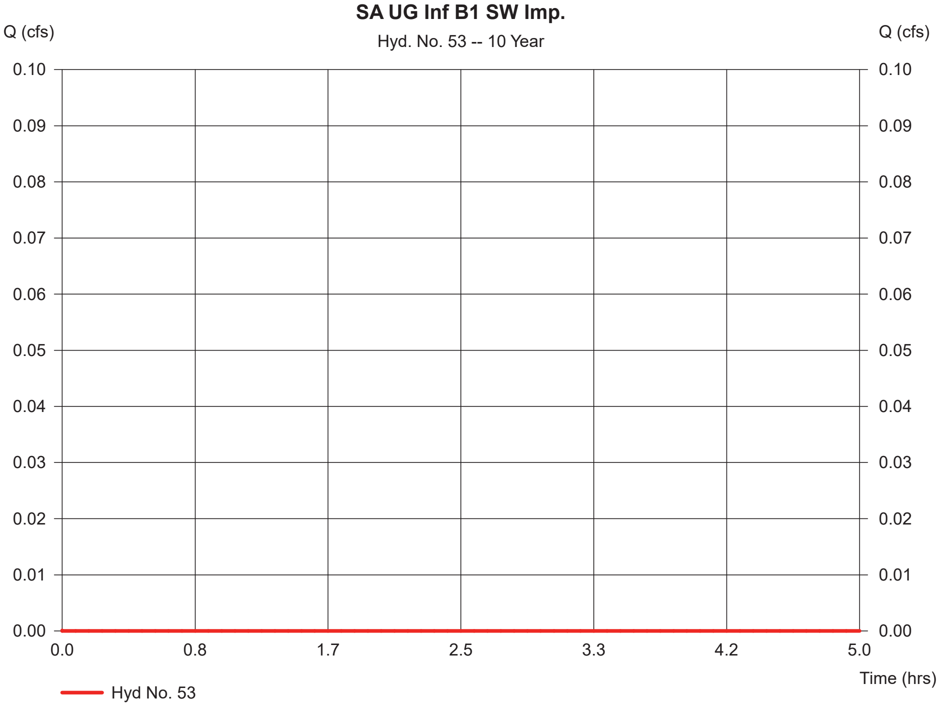


Hydrograph Report

Hyd. No. 53

SA UG Inf B1 SW Imp.

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 7.980 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.65 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

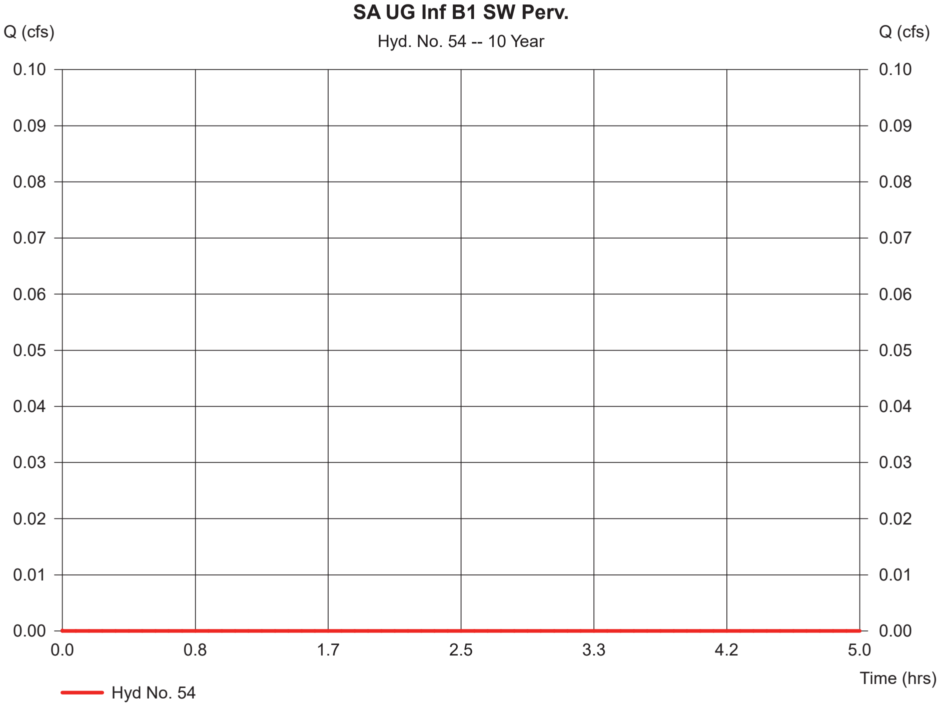


Hydrograph Report

Hyd. No. 54

SA UG Inf B1 SW Perv.

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 0.300 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.65 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



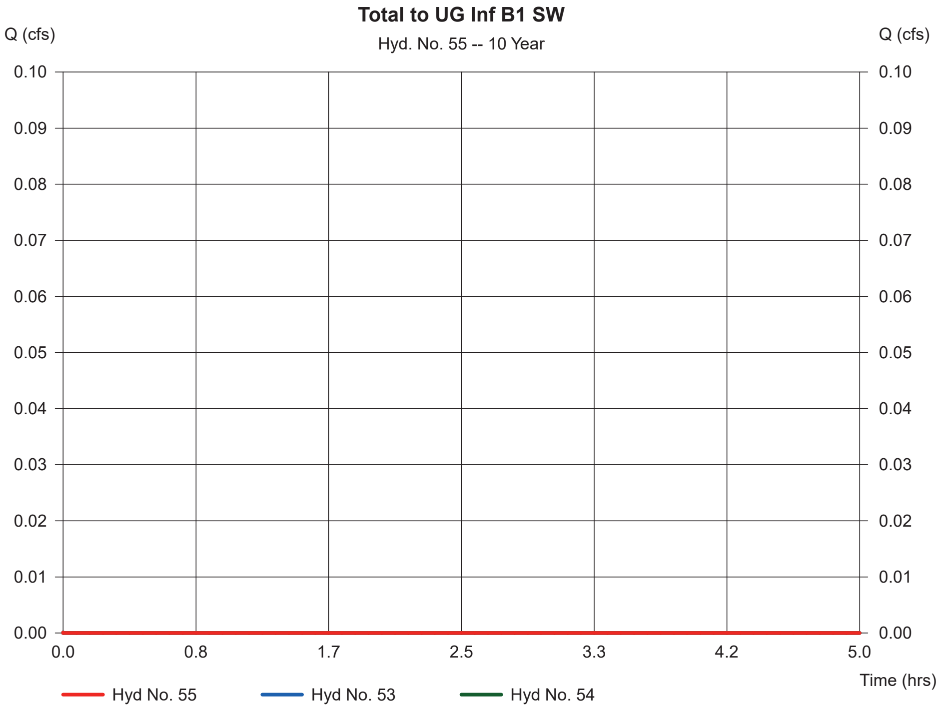
Hydrograph Report

Hyd. No. 55

Total to UG Inf B1 SW

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyds. = 53, 54

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 8.280 ac



Hydrograph Report

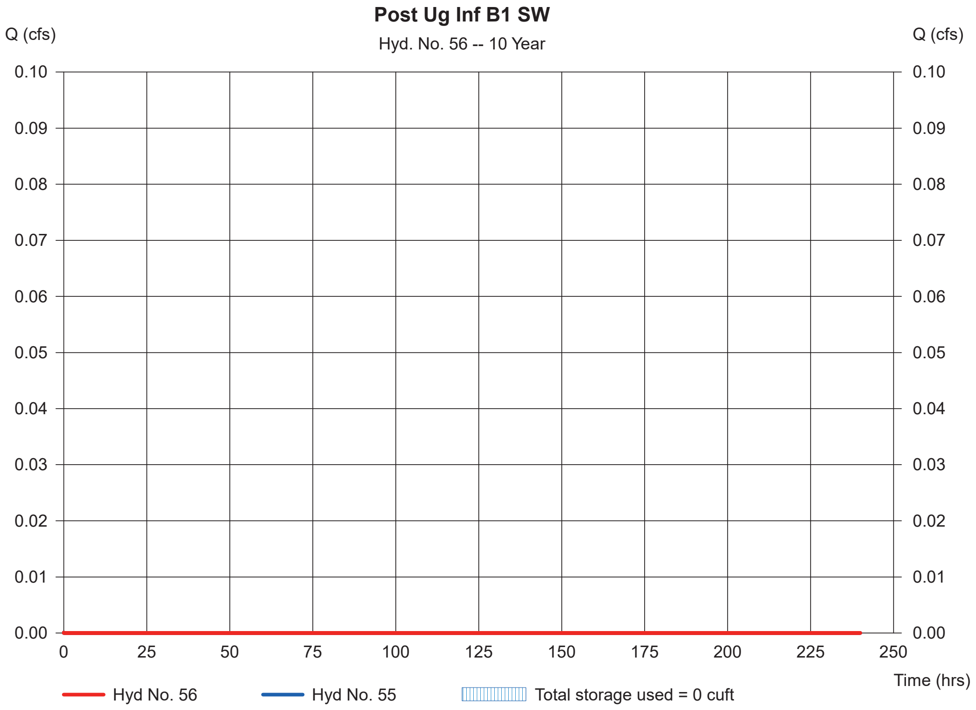
Hyd. No. 56

Post Ug Inf B1 SW

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyd. No. = 55 - Total to UG Inf B1 SW
Reservoir name = UG Inf B1 SW

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.

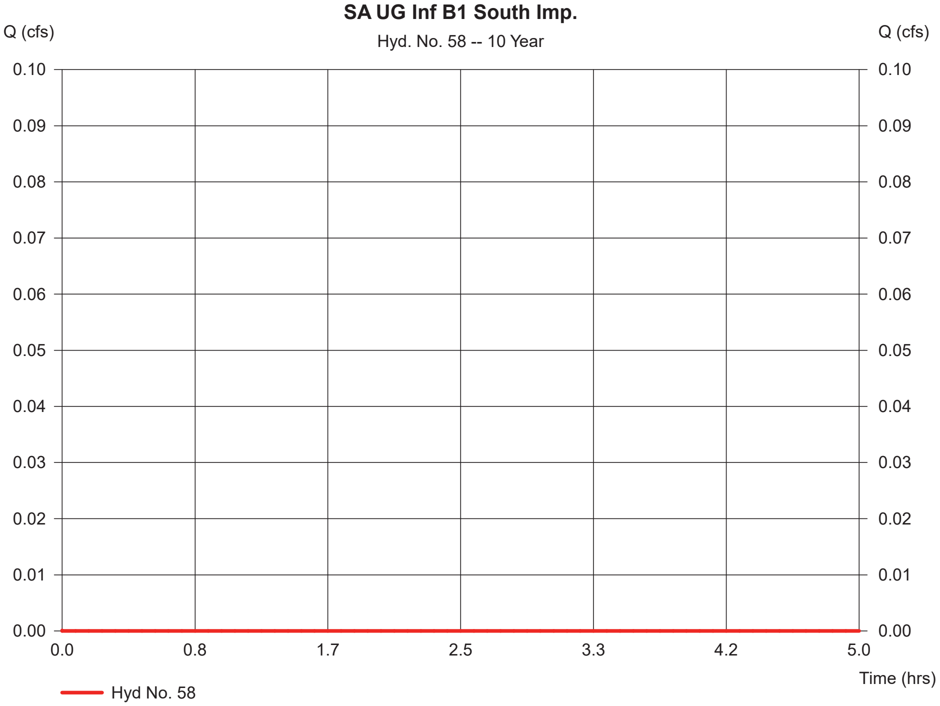


Hydrograph Report

Hyd. No. 58

SA UG Inf B1 South Imp.

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 0.420 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.65 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

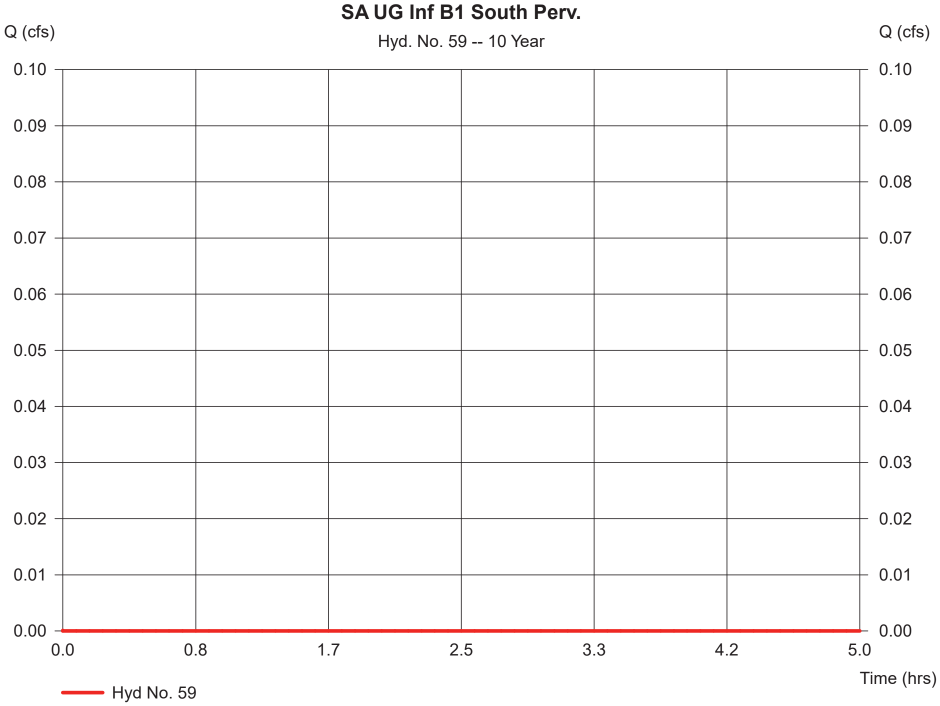


Hydrograph Report

Hyd. No. 59

SA UG Inf B1 South Perv.

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 0.490 ac	Curve number	= 49
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.65 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



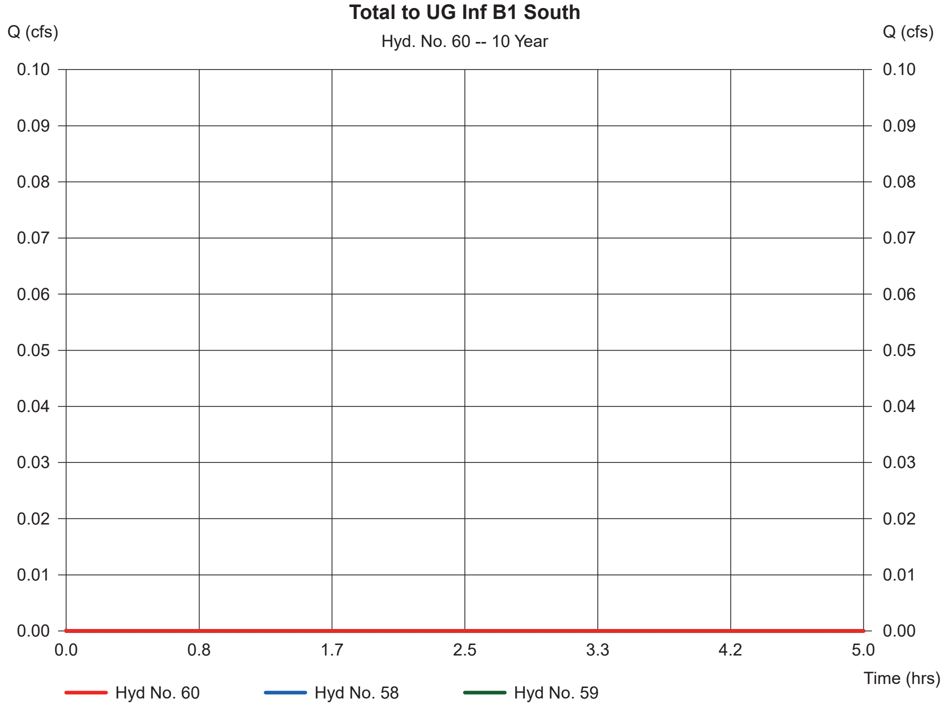
Hydrograph Report

Hyd. No. 60

Total to UG Inf B1 South

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyds. = 58, 59

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 0.910 ac



Total to UG Inf B1 South

Hyd. No. 60 -- 10 Year

Hydrograph Report

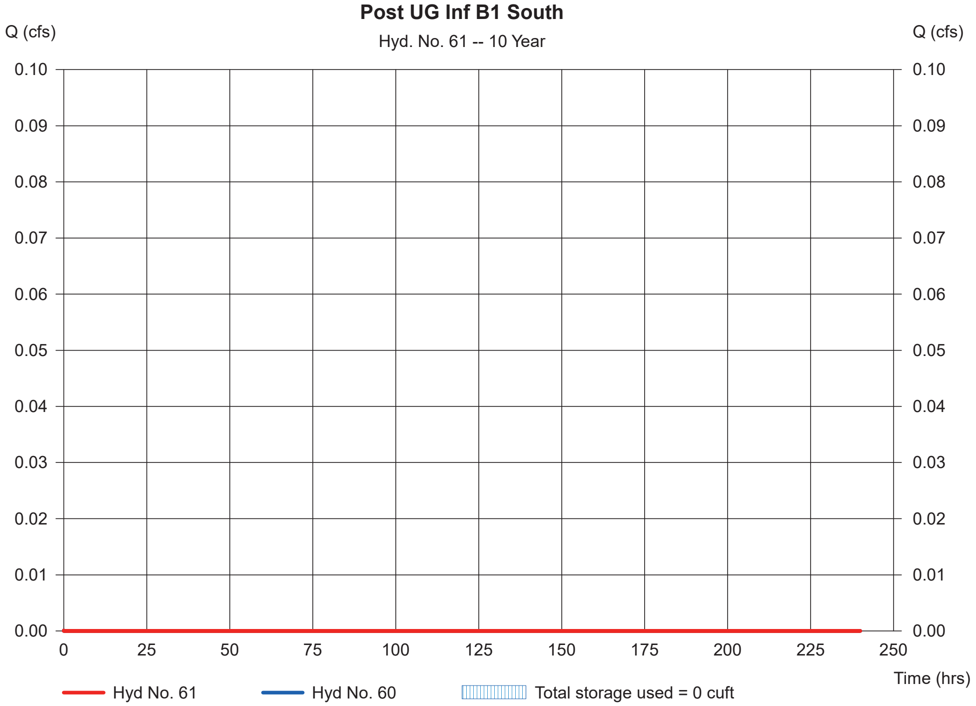
Hyd. No. 61

Post UG Inf B1 South

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyd. No. = 60 - Total to UG Inf B1 South
Reservoir name = UG Inf B1 South

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



Post UG Inf B1 South

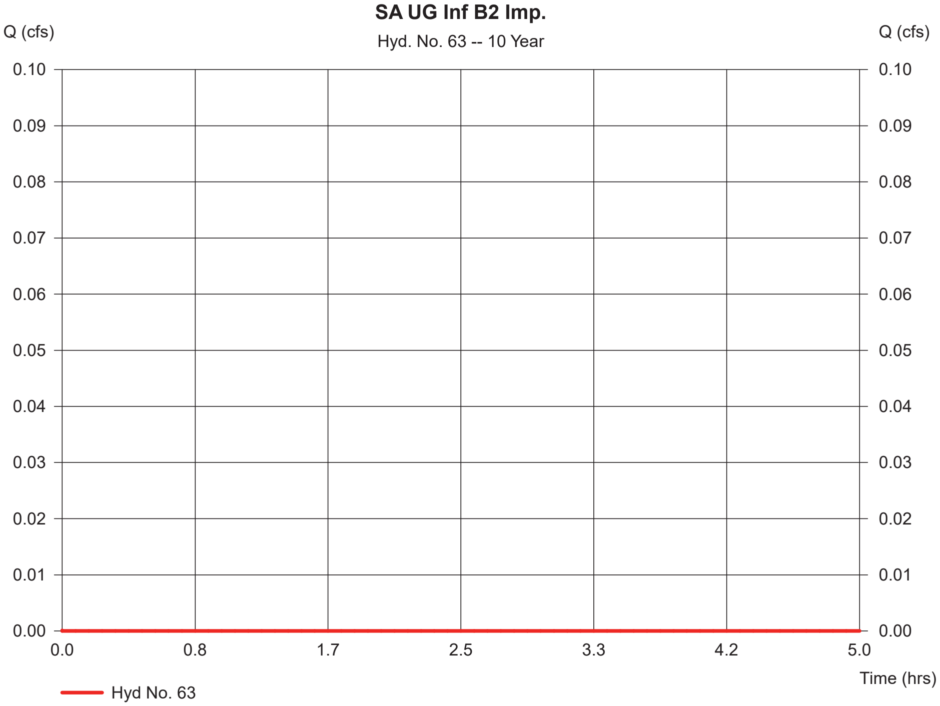
Hyd. No. 61 -- 10 Year

Hydrograph Report

Hyd. No. 63

SA UG Inf B2 Imp.

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 5.200 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.65 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

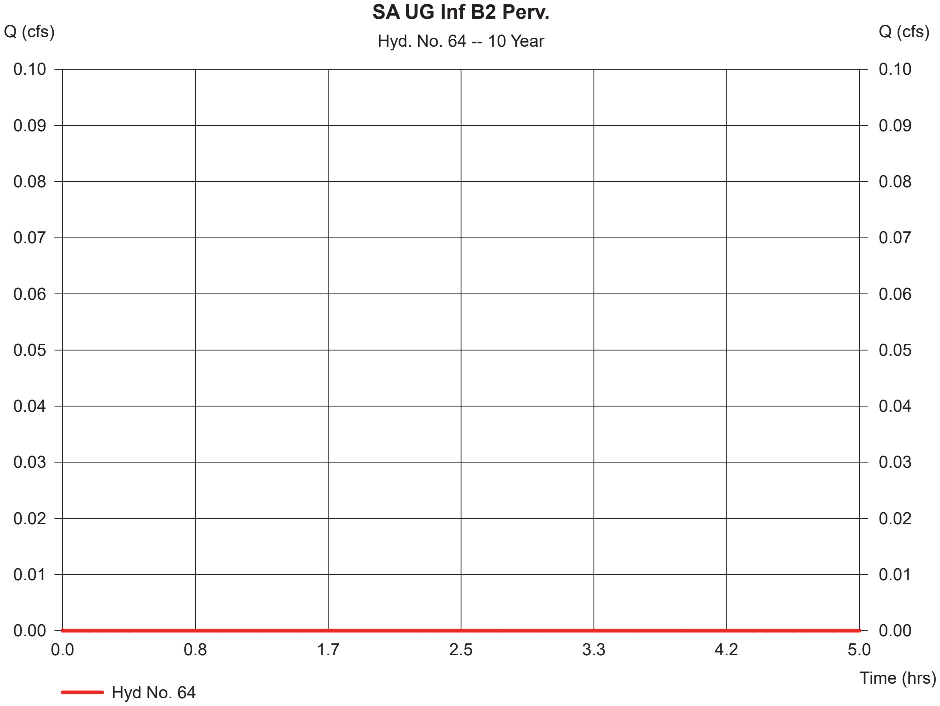


Hydrograph Report

Hyd. No. 64

SA UG Inf B2 Perv.

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 0.100 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.65 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



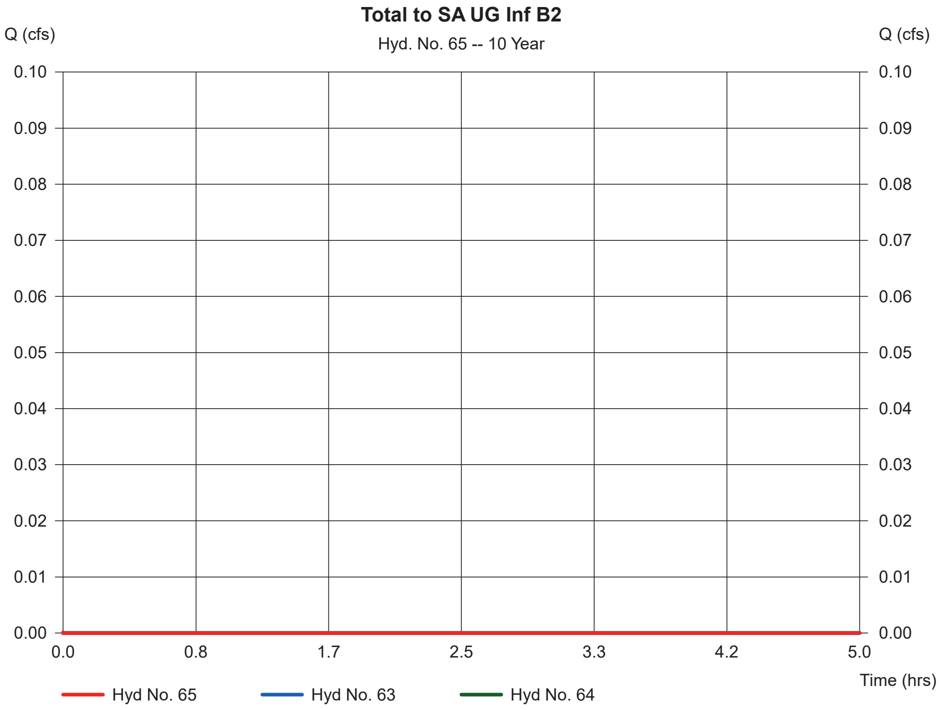
Hydrograph Report

Hyd. No. 65

Total to SA UG Inf B2

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyds. = 63, 64

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 5.300 ac



Hydrograph Report

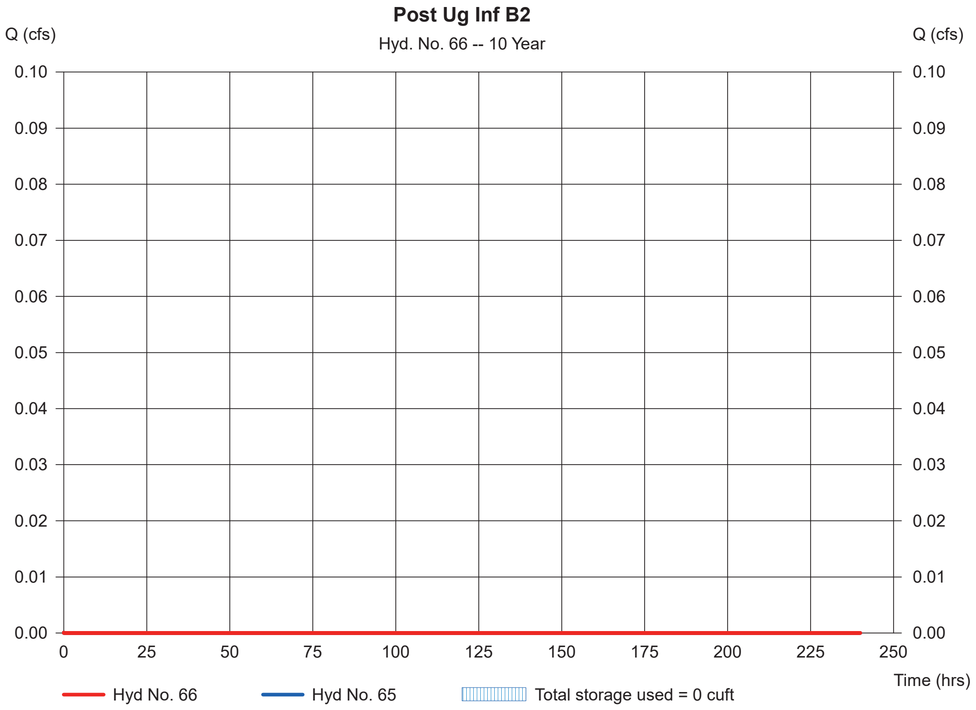
Hyd. No. 66

Post Ug Inf B2

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyd. No. = 65 - Total to SA UG Inf B2
Reservoir name = UG Inf B2

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



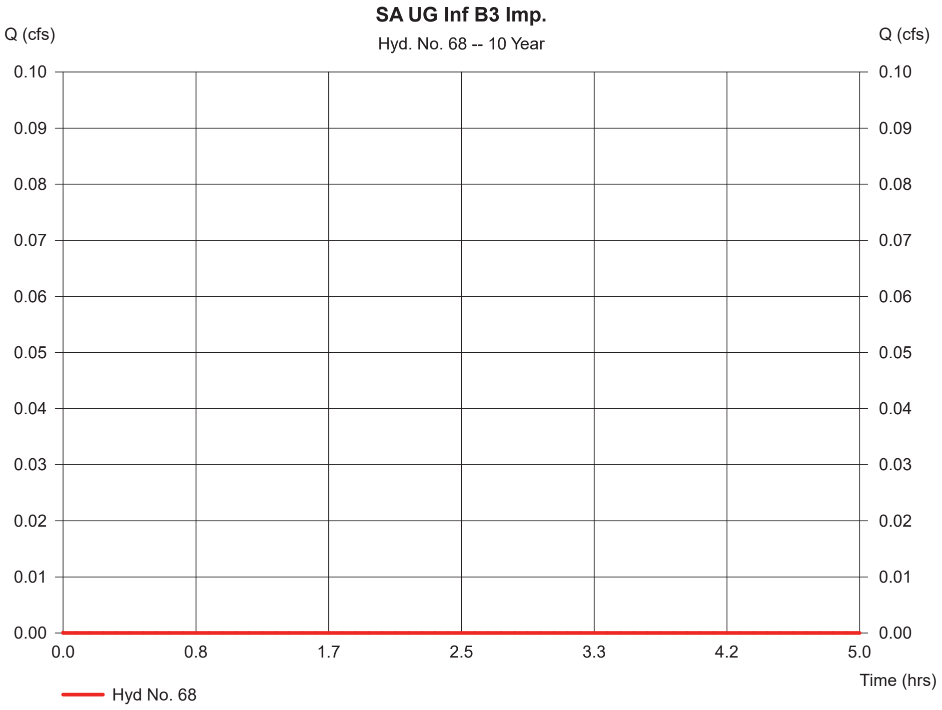
Hydrograph Report

Hyd. No. 68

SA UG Inf B3 Imp.

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 5 min
Drainage area = 2.020 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.65 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

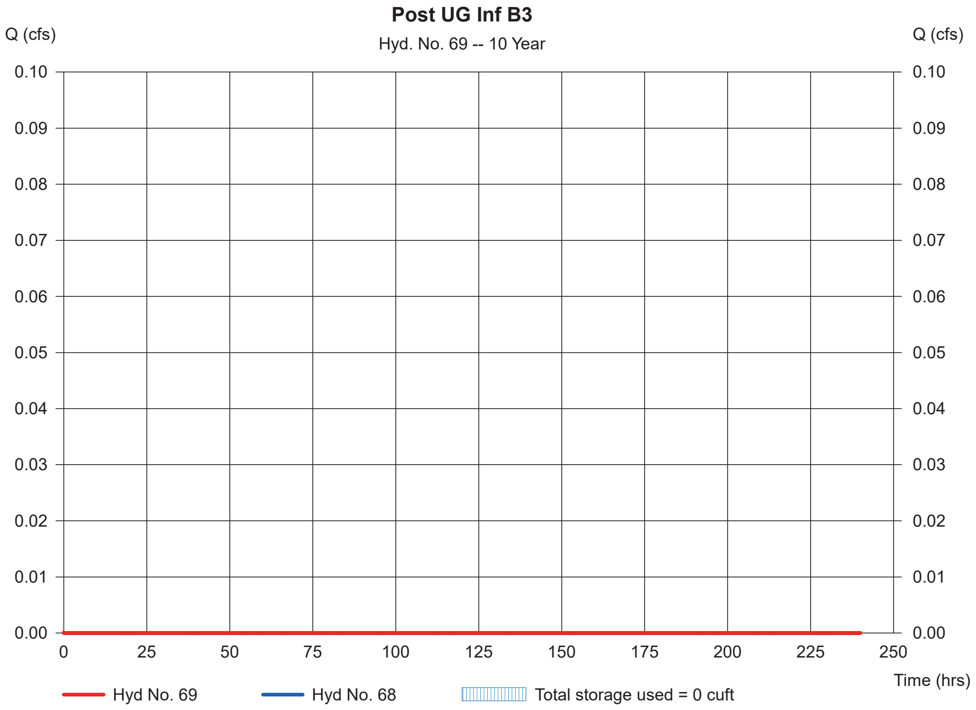
Hyd. No. 69

Post UG Inf B3

Hydrograph type = Reservoir
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyd. No. = 68 - SA UG Inf B3 Imp.
Reservoir name = UG Inf B3

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



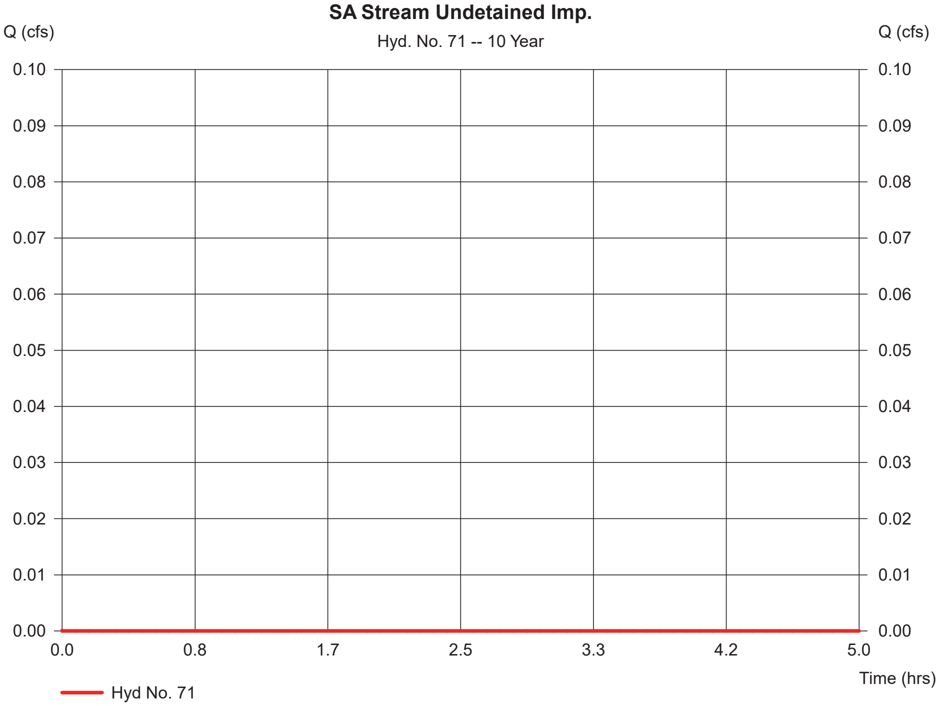
Hydrograph Report

Hyd. No. 71

SA Stream Undetained Imp.

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 5 min
Drainage area = 0.290 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.65 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



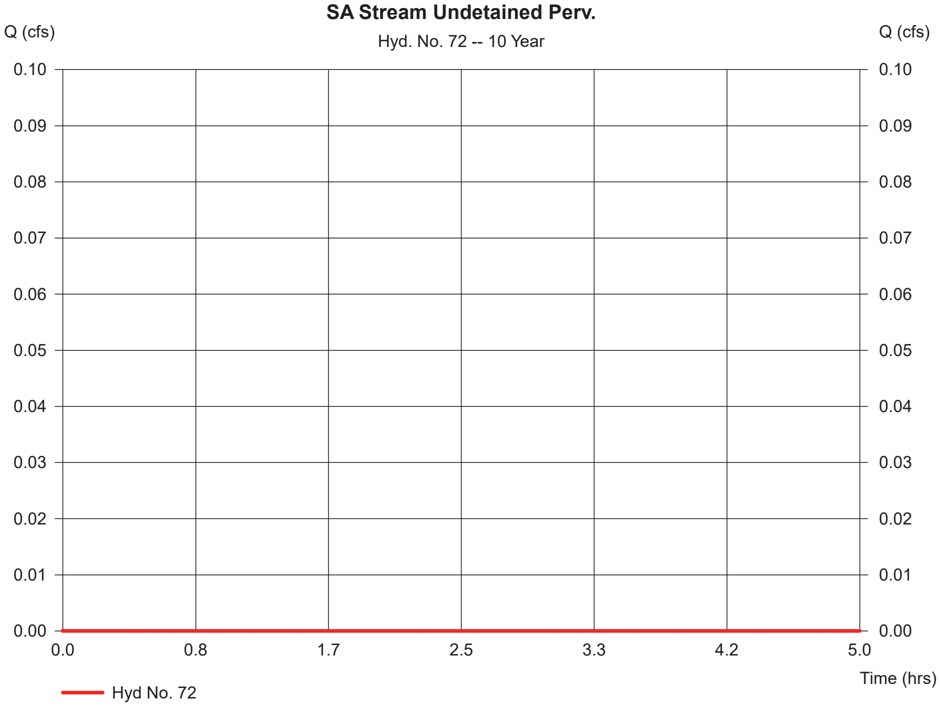
Hydrograph Report

Hyd. No. 72

SA Stream Undetained Perv.

Hydrograph type = SCS Runoff
Storm frequency = 10 yrs
Time interval = 5 min
Drainage area = 5.610 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.65 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 41
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



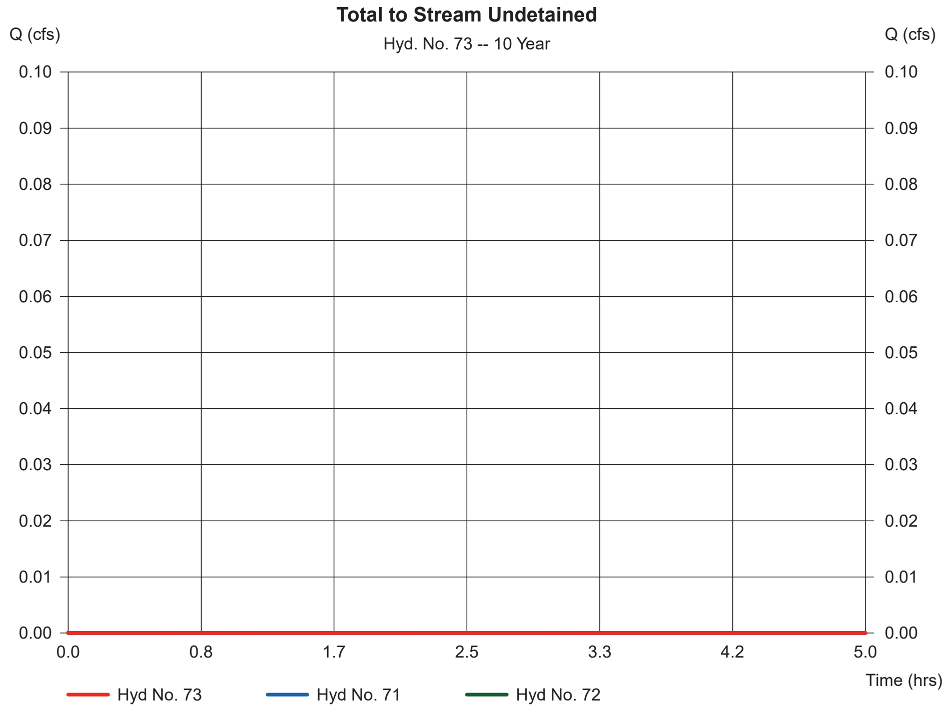
Hydrograph Report

Hyd. No. 73

Total to Stream Undetained

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyds. = 71, 72

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 5.900 ac



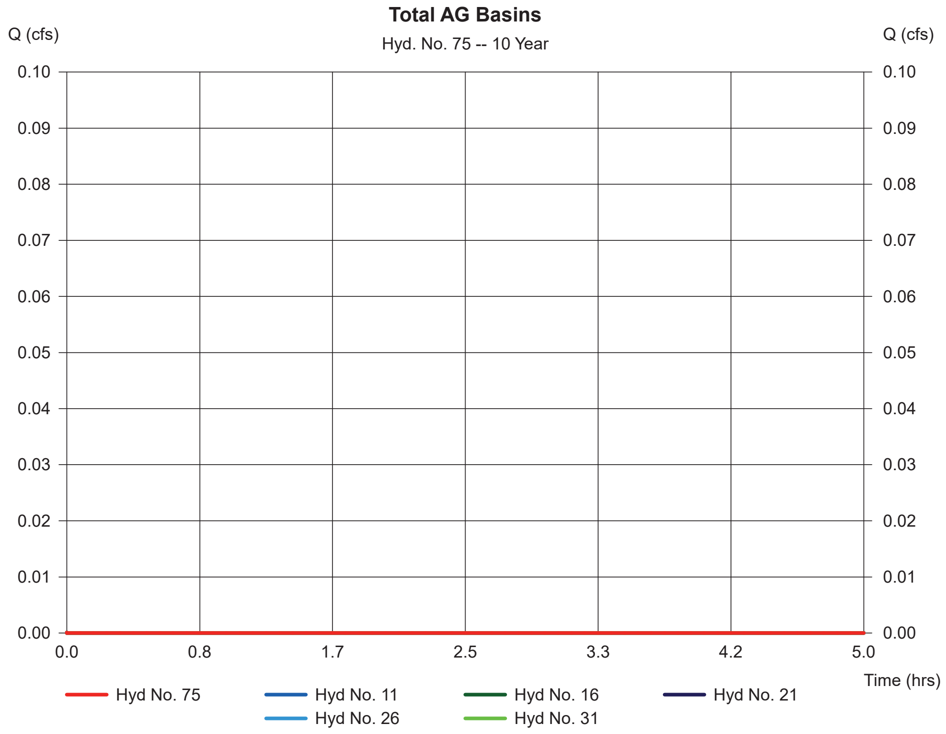
Hydrograph Report

Hyd. No. 75

Total AG Basins

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyds. = 11, 16, 21, 26, 31

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 0.000 ac

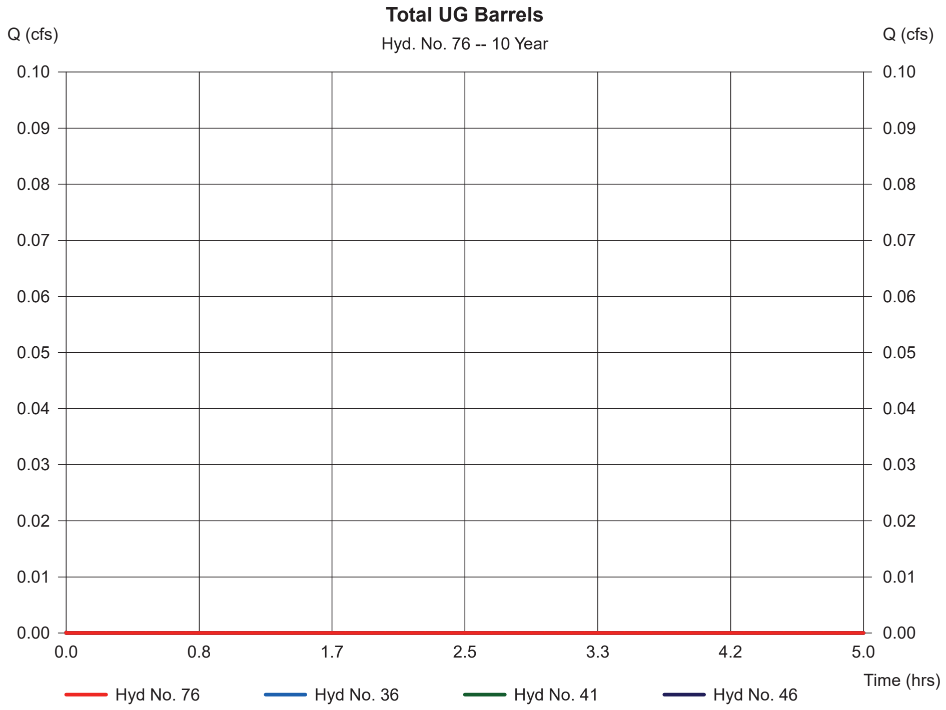


Hydrograph Report

Hyd. No. 76

Total UG Barrels

Hydrograph type	= Combine	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Inflow hyds.	= 36, 41, 46	Contrib. drain. area	= 0.000 ac

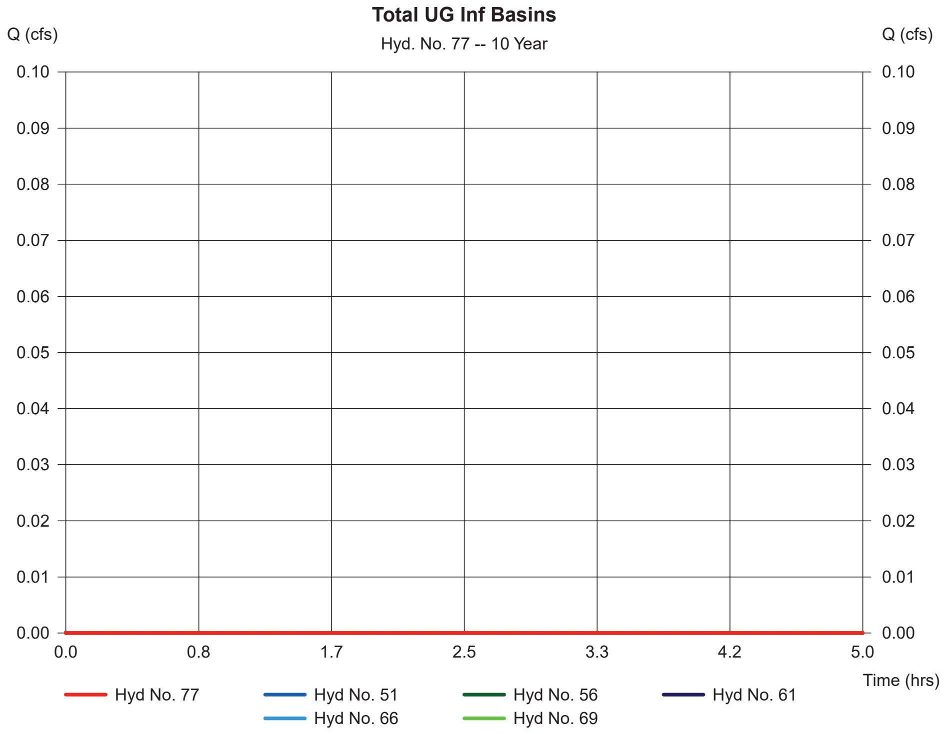


Hydrograph Report

Hyd. No. 77

Total UG Inf Basins

Hydrograph type	= Combine	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Inflow hyds.	= 51, 56, 61, 66, 69	Contrib. drain. area	= 0.000 ac



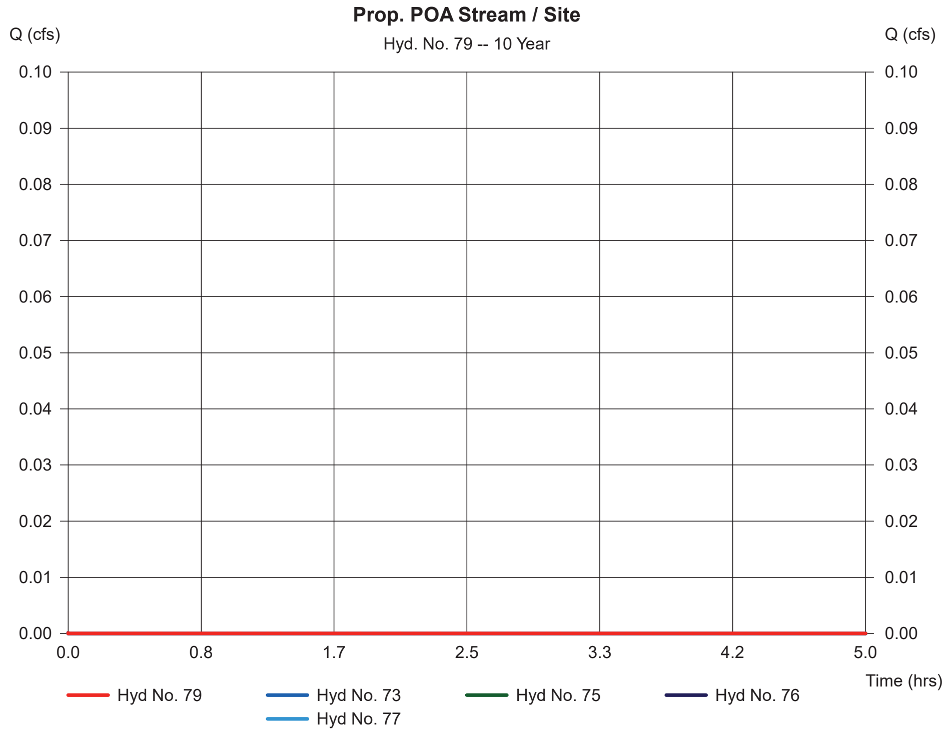
Hydrograph Report

Hyd. No. 79

Prop. POA Stream / Site

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 5 min
Inflow hyds. = 73, 75, 76, 77

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 0.000 ac



Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	0.000	5	n/a	0	----	------	------	Ex. SA Stream (Imp.)
2	SCS Runoff	0.000	5	n/a	0	----	------	------	Ex. SA Stream (Perv.)
4	SCS Runoff	0.000	5	n/a	0	----	------	------	Ex. SA Pond (Imp.)
5	SCS Runoff	0.000	5	n/a	0	----	------	------	Ex. SA Pond (Perv.)
7	Combine	0.000	5	n/a	0	1, 2, 4, 5,	------	------	Ex. Total
9	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B1 North Imp.
10	Combine	0.000	5	n/a	0	9	------	------	Total to AG Basin B1 North
11	Reservoir	0.000	5	n/a	0	10	0.00	0.000	Post AG Basin B1 North
13	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B1 NW Imp.
14	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B1 NW Perv.
15	Combine	0.000	5	n/a	0	13, 14	------	------	Total to AG Basin B1 NW
16	Reservoir	0.000	5	n/a	0	15	0.00	0.000	Post AG Basin B1 NW
18	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B1 SW Imp.
19	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B1 SW Perv.
20	Combine	0.000	5	n/a	0	18, 19	------	------	Total to AG Basin B1 SW
21	Reservoir	0.000	5	n/a	0	20	0.00	0.000	Post AG Basin B1 SW
23	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin South Imp.
24	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin South Perv.
25	Combine	0.000	5	n/a	0	23, 24	------	------	Total to AG Basin South
26	Reservoir	0.000	5	n/a	0	25	0.00	0.000	Post AG Basin South
28	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B2 Imp.
29	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B2 Perv.
30	Combine	0.000	5	n/a	0	28, 29	------	------	Total to AG Basin B2
31	Reservoir	0.000	5	n/a	0	30	0.00	0.000	Post AG Basin B2
33	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Barrels B1 NE Imp.
34	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Barrels B1 NE Perv.
35	Combine	0.000	5	n/a	0	33, 34	------	------	Total to UG Barrels B1 NE
36	Reservoir	0.000	5	n/a	0	35	0.00	0.000	Post UG Barrels B1 NE
38	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Barrels B1 SE Imp.
39	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Barrels B1 SE Perv.

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
40	Combine	0.000	5	n/a	0	38, 39	------	------	Total to UG Barrels B1 SE
41	Reservoir	0.000	5	n/a	0	40	0.00	0.000	Post UG Barrels B1 SE
43	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Barrels South Imp.
44	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Barrels South Perv.
45	Combine	0.000	5	n/a	0	43, 44	------	------	Total to UG Barrels South
46	Reservoir	0.000	5	n/a	0	45	0.00	0.000	Post UG Barrels South
48	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B1 NW Imp.
49	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B1 NW Perv.
50	Combine	0.000	5	n/a	0	48, 49	------	------	Total to UG Inf B1 NW
51	Reservoir	0.000	5	n/a	0	50	0.00	0.000	Post Ug Inf B1 NW
53	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B1 SW Imp.
54	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B1 SW Perv.
55	Combine	0.000	5	n/a	0	53, 54	------	------	Total to UG Inf B1 SW
56	Reservoir	0.000	5	n/a	0	55	0.00	0.000	Post Ug Inf B1 SW
58	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B1 South Imp.
59	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B1 South Perv.
60	Combine	0.000	5	n/a	0	58, 59	------	------	Total to UG Inf B1 South
61	Reservoir	0.000	5	n/a	0	60	0.00	0.000	Post UG Inf B1 South
63	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B2 Imp.
64	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B2 Perv.
65	Combine	0.000	5	n/a	0	63, 64	------	------	Total to SA UG Inf B2
66	Reservoir	0.000	5	n/a	0	65	0.00	0.000	Post Ug Inf B2
68	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B3 Imp.
69	Reservoir	0.000	5	n/a	0	68	0.00	0.000	Post UG Inf B3
71	SCS Runoff	0.000	5	n/a	0	----	------	------	SA Stream Undetained Imp.
72	SCS Runoff	0.000	5	n/a	0	----	------	------	SA Stream Undetained Perv.
73	Combine	0.000	5	n/a	0	71, 72	------	------	Total to Stream Undetained
75	Combine	0.000	5	n/a	0	11, 16, 21, 26, 31,	------	------	Total AG Basins
76	Combine	0.000	5	n/a	0	36, 41, 46,	------	------	Total UG Barrels
77	Combine	0.000	5	n/a	0	51, 56, 61, 66, 69,	------	------	Total UG Inf Basins

---

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
79	Combine	0.000	5	n/a	0	73, 75, 76, 77,	------	------	Prop. POA Stream / Site

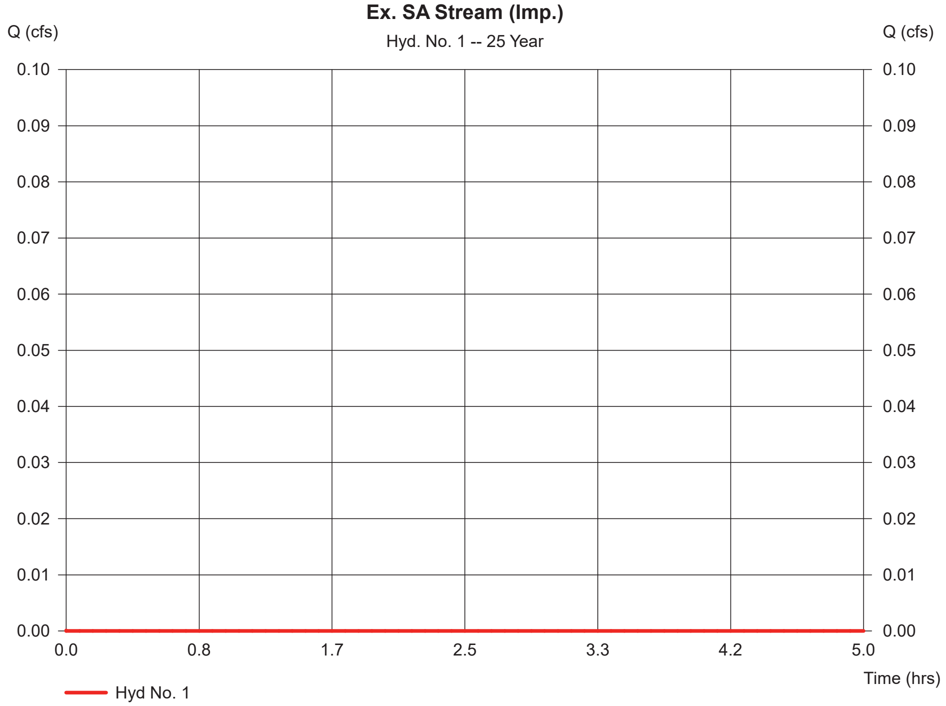
Hydrograph Report

Hyd. No. 1

Ex. SA Stream (Imp.)

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 5 min
Drainage area = 22.560 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.68 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 16.20 min
Distribution = Type III
Shape factor = 484



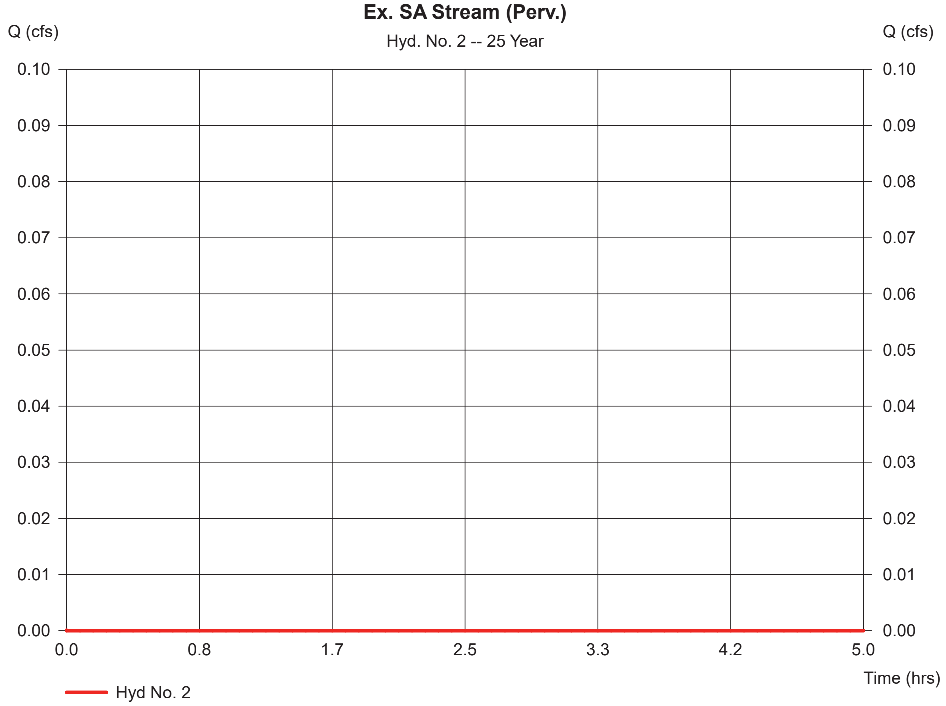
Hydrograph Report

Hyd. No. 2

Ex. SA Stream (Perv.)

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 5 min
Drainage area = 33.110 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.68 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 37
Hydraulic length = 0 ft
Time of conc. (Tc) = 16.20 min
Distribution = Type III
Shape factor = 484



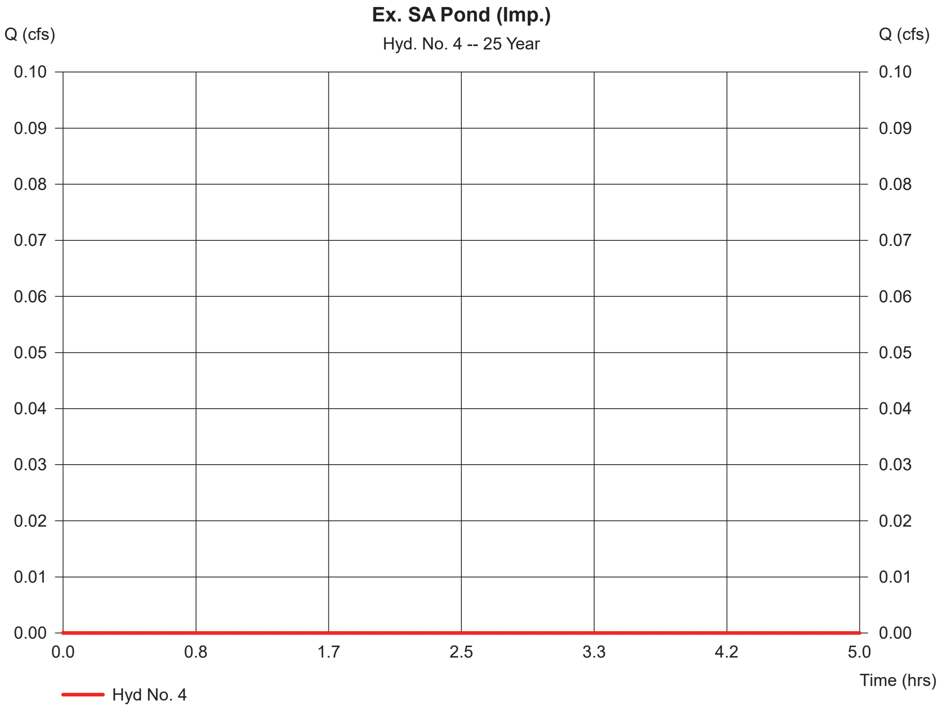
Hydrograph Report

Hyd. No. 4

Ex. SA Pond (Imp.)

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 5 min
Drainage area = 2.800 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.68 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



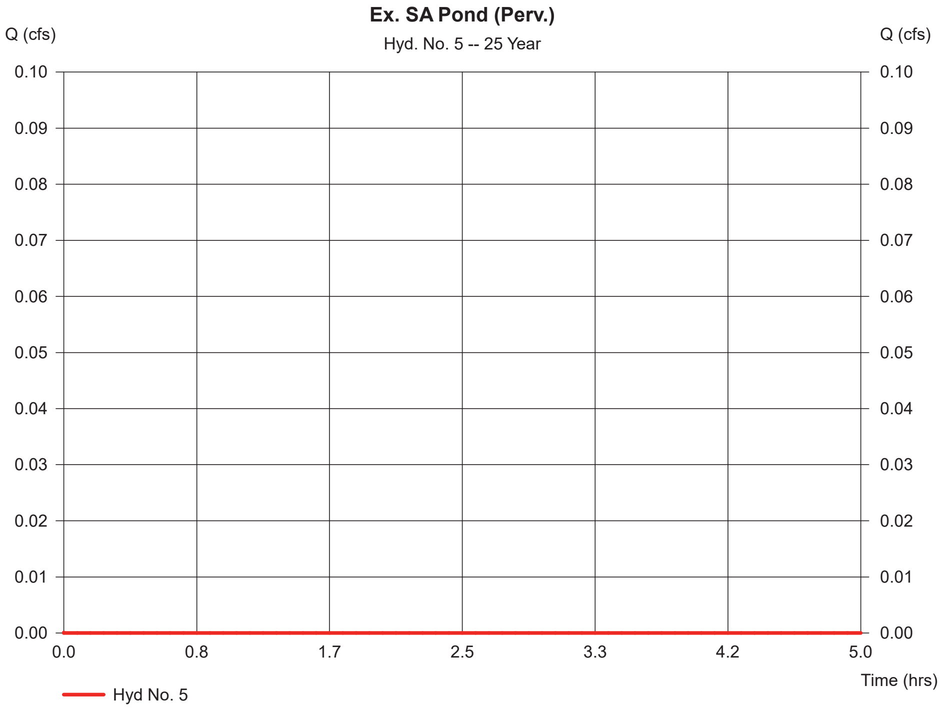
Hydrograph Report

Hyd. No. 5

Ex. SA Pond (Perv.)

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 5 min
Drainage area = 3.590 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.68 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 39
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484

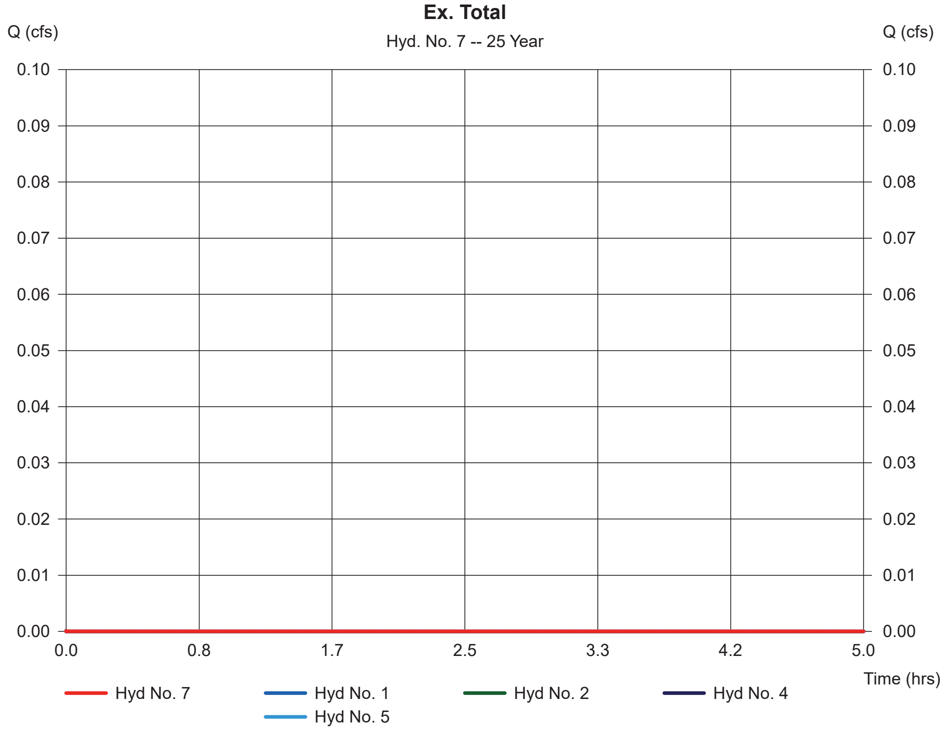


Hydrograph Report

Hyd. No. 7

Ex. Total

Hydrograph type	= Combine	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Inflow hyds.	= 1, 2, 4, 5	Contrib. drain. area	= 62.060 ac

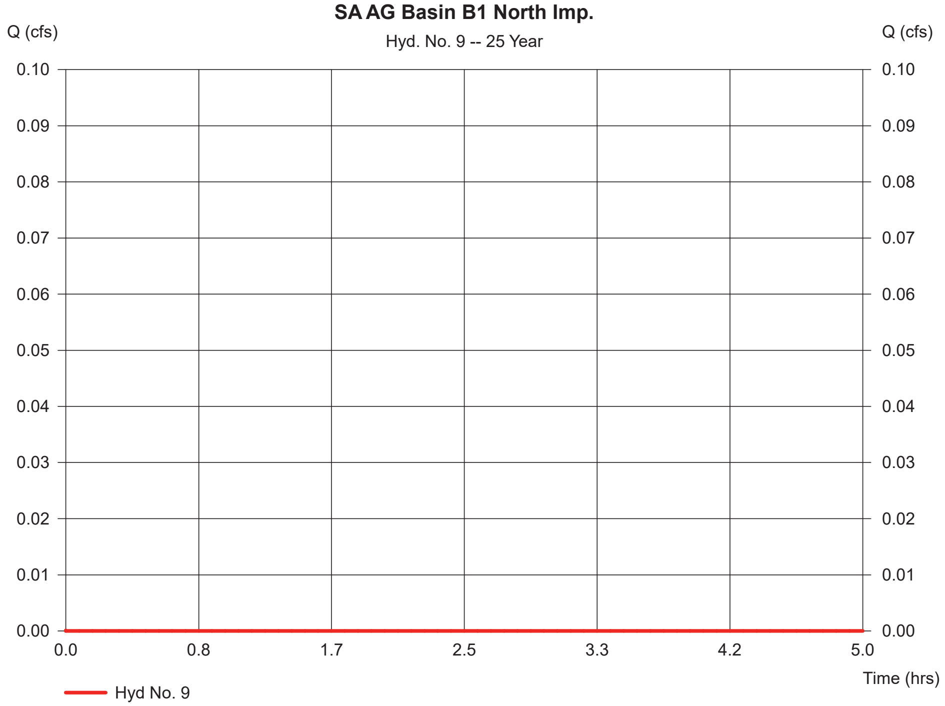


Hydrograph Report

Hyd. No. 9

SA AG Basin B1 North Imp.

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 2.100 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.68 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



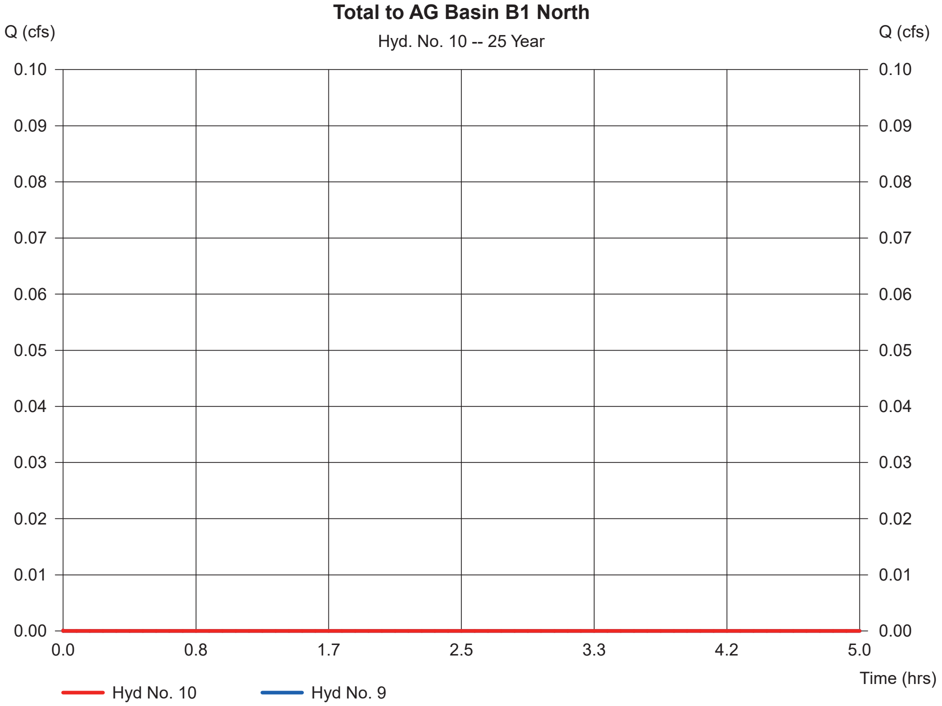
Hydrograph Report

Hyd. No. 10

Total to AG Basin B1 North

Hydrograph type = Combine
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyds. = 9

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 2.100 ac



Hydrograph Report

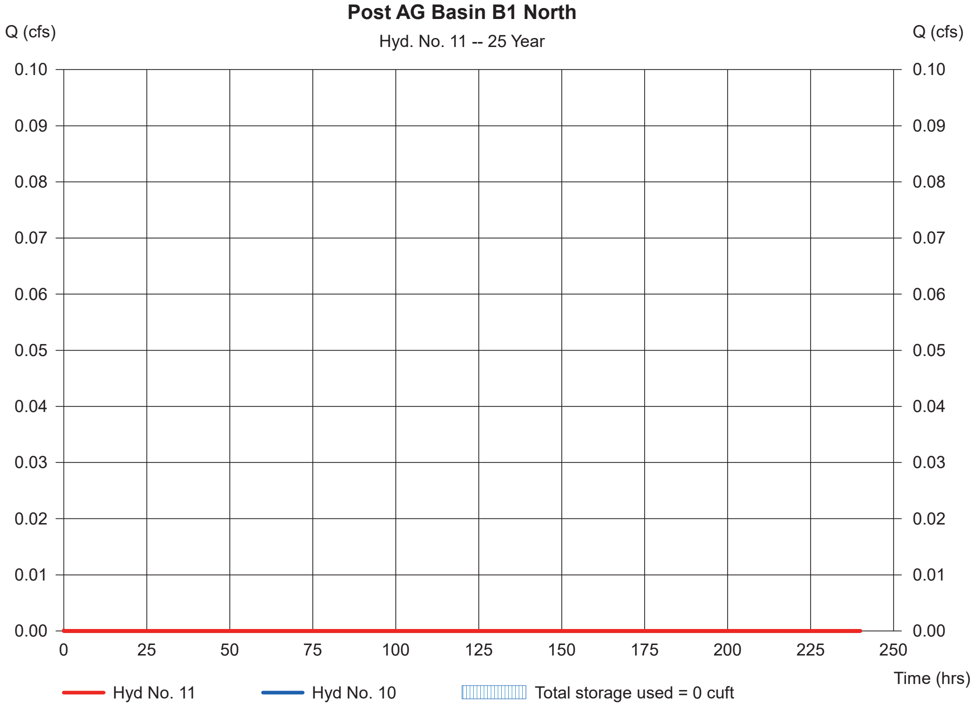
Hyd. No. 11

Post AG Basin B1 North

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyd. No. = 10 - Total to AG Basin B1 North
Reservoir name = AG Basin B1 North

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



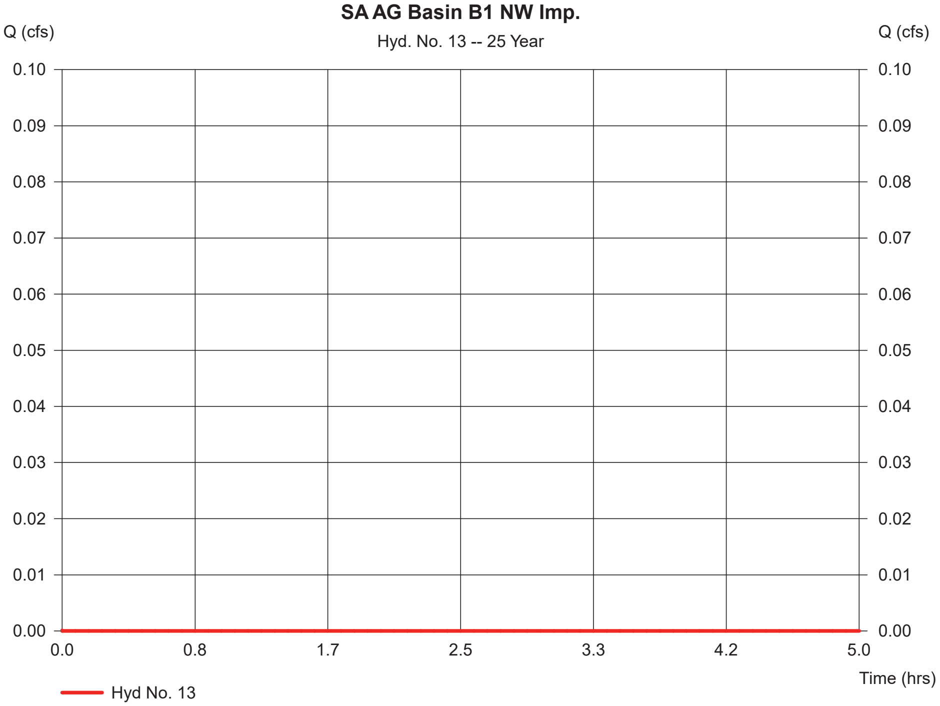
Hydrograph Report

Hyd. No. 13

SA AG Basin B1 NW Imp.

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 5 min
Drainage area = 1.010 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.68 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



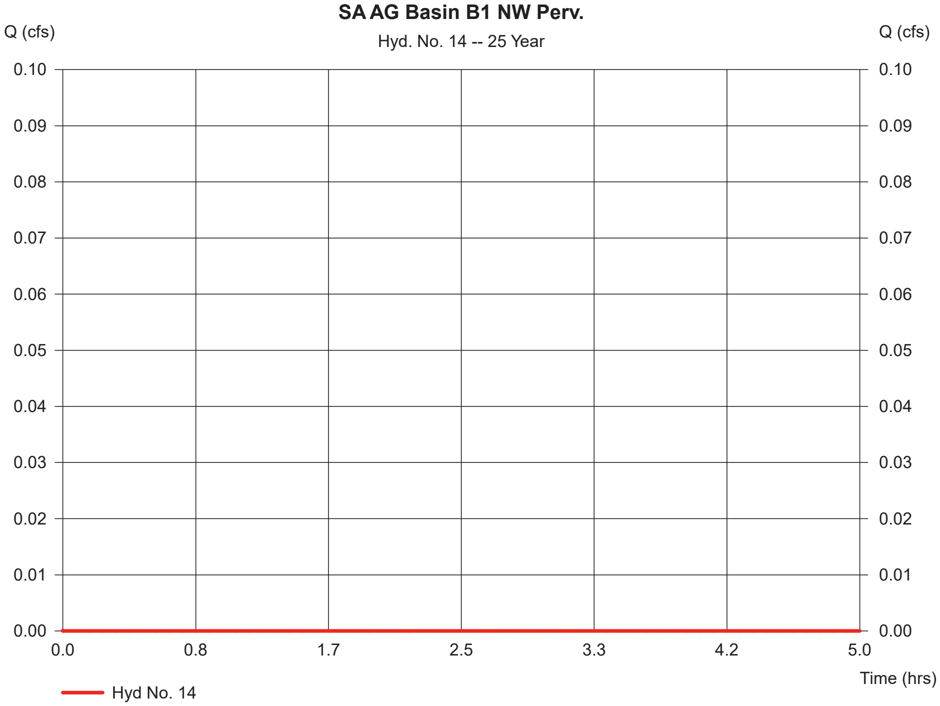
Hydrograph Report

Hyd. No. 14

SA AG Basin B1 NW Perv.

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 5 min
Drainage area = 0.520 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.68 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 62
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



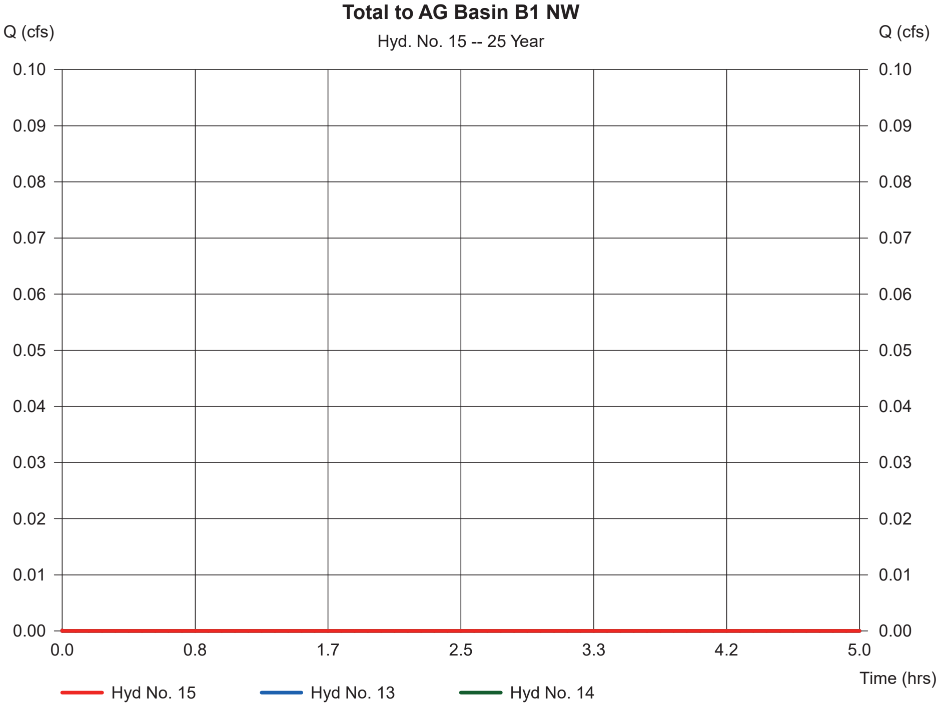
Hydrograph Report

Hyd. No. 15

Total to AG Basin B1 NW

Hydrograph type = Combine
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyds. = 13, 14

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 1.530 ac



Hydrograph Report

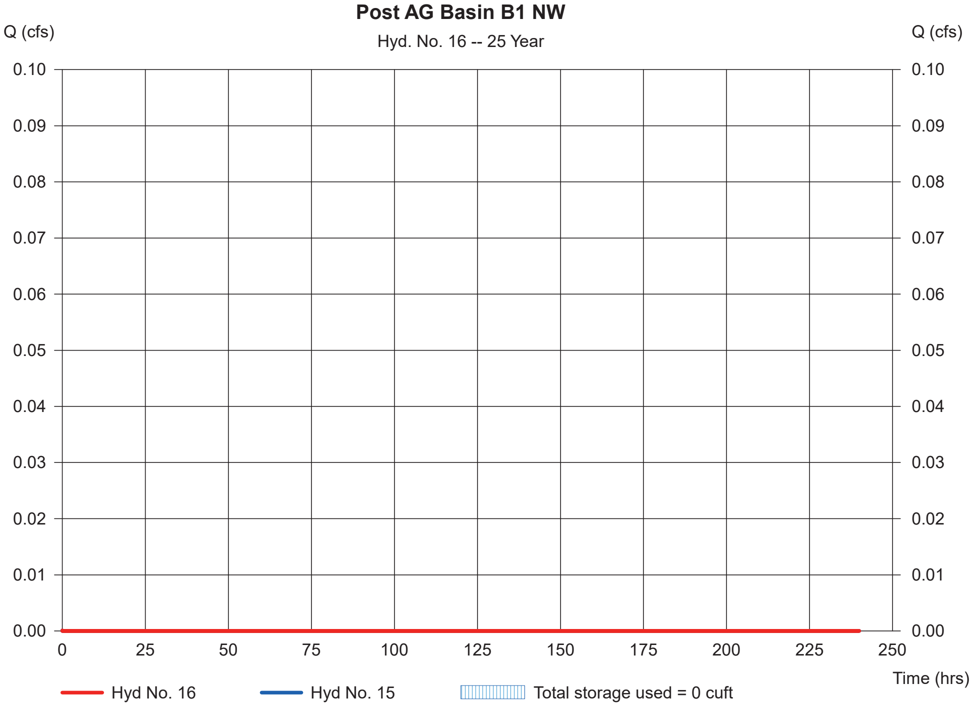
Hyd. No. 16

Post AG Basin B1 NW

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyd. No. = 15 - Total to AG Basin B1 NW
Reservoir name = AG Basin B1 Northwest

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



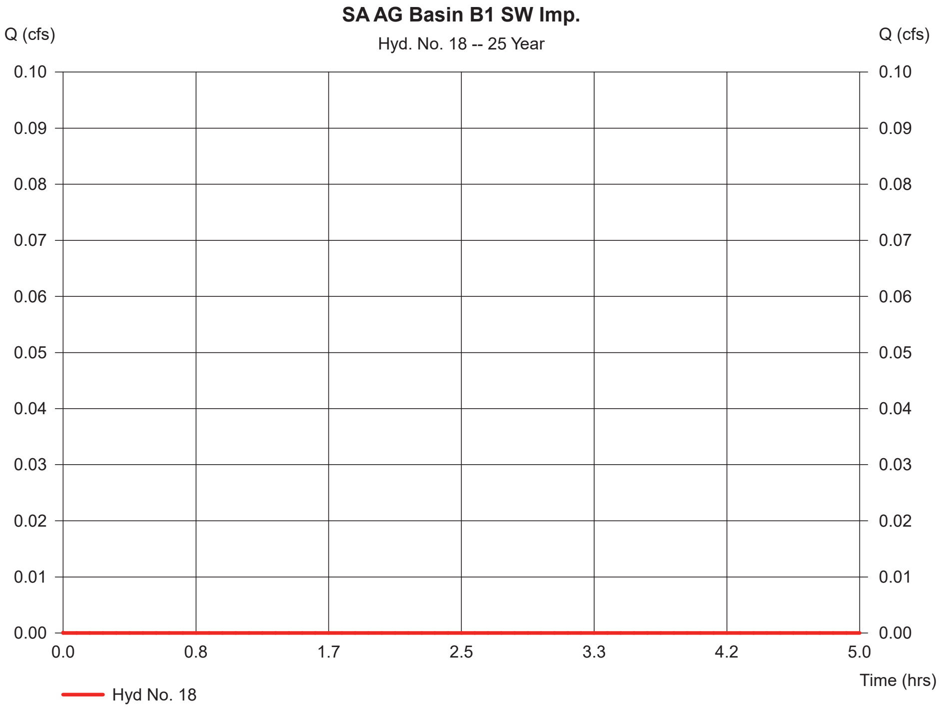
Hydrograph Report

Hyd. No. 18

SA AG Basin B1 SW Imp.

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 5 min
Drainage area = 0.420 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.68 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



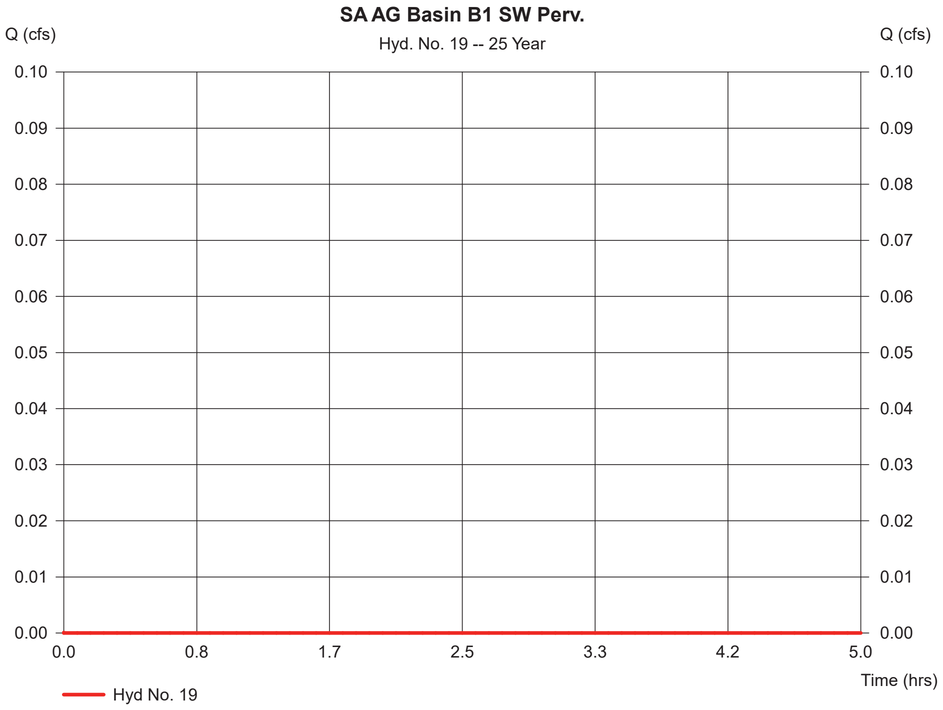
Hydrograph Report

Hyd. No. 19

SA AG Basin B1 SW Perv.

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 5 min
Drainage area = 0.310 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.68 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 39
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



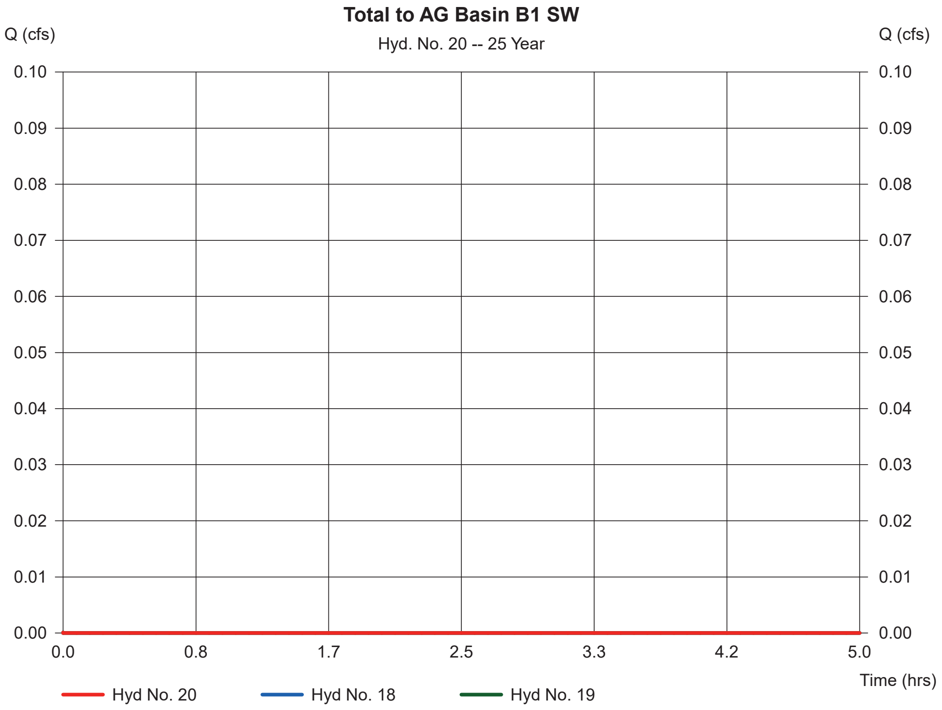
Hydrograph Report

Hyd. No. 20

Total to AG Basin B1 SW

Hydrograph type = Combine
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyds. = 18, 19

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 0.730 ac


Total to AG Basin B1 SW
Hyd. No. 20 -- 25 Year

Hydrograph Report

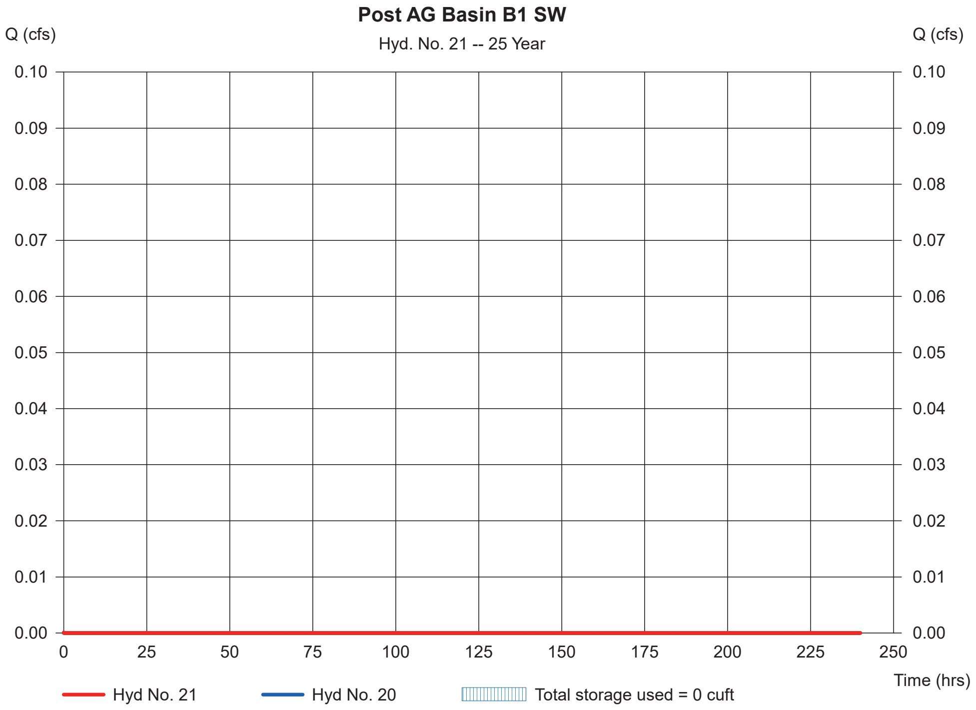
Hyd. No. 21

Post AG Basin B1 SW

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyd. No. = 20 - Total to AG Basin B1 SW
Reservoir name = AG Basin B1 Southwest

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.

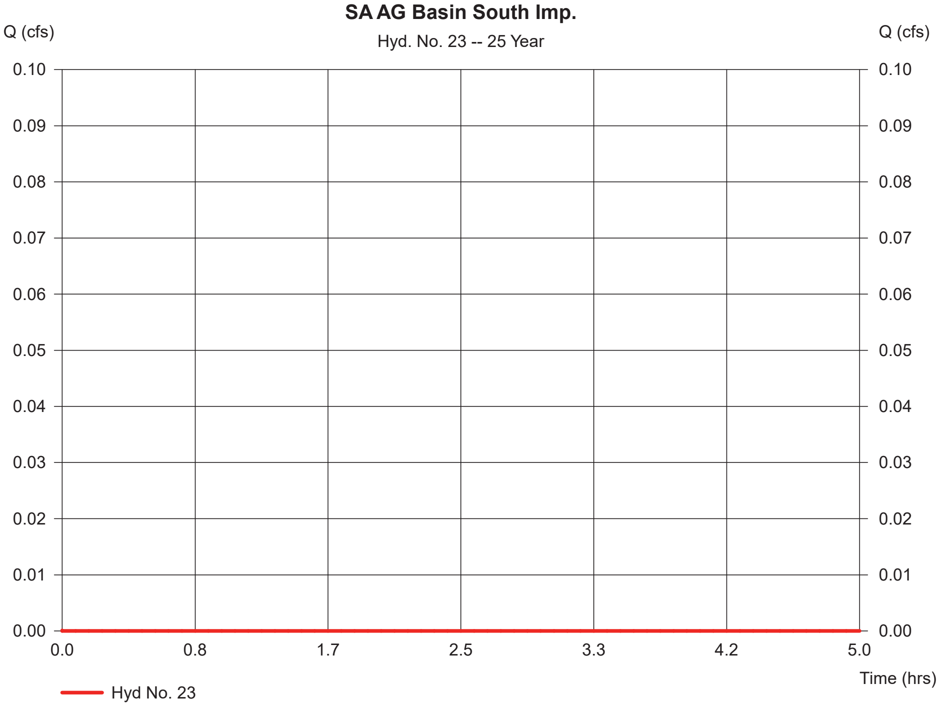

Post AG Basin B1 SW
Hyd. No. 21 -- 25 Year

Hydrograph Report

Hyd. No. 23

SA AG Basin South Imp.

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 2.060 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.68 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

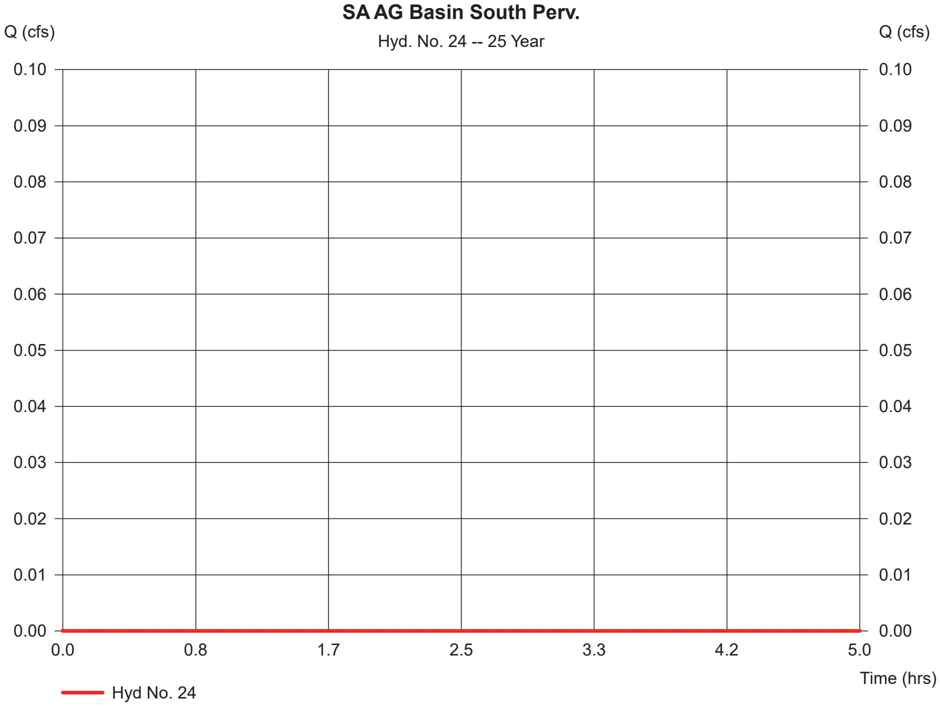


Hydrograph Report

Hyd. No. 24

SA AG Basin South Perv.

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 0.920 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.68 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

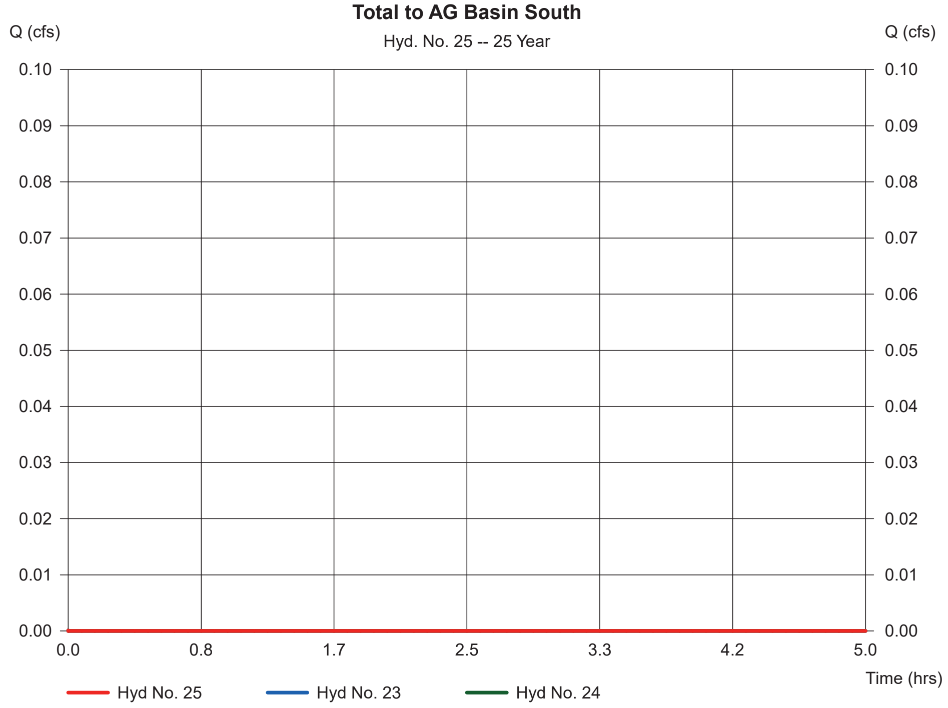
Hydraflow Hydrographs by Intelisolve v9.1
Friday, Jan 20, 2023

Hyd. No. 25

Total to AG Basin South

Hydrograph type = Combine
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyds. = 23, 24

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 2.980 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1
Friday, Jan 20, 2023

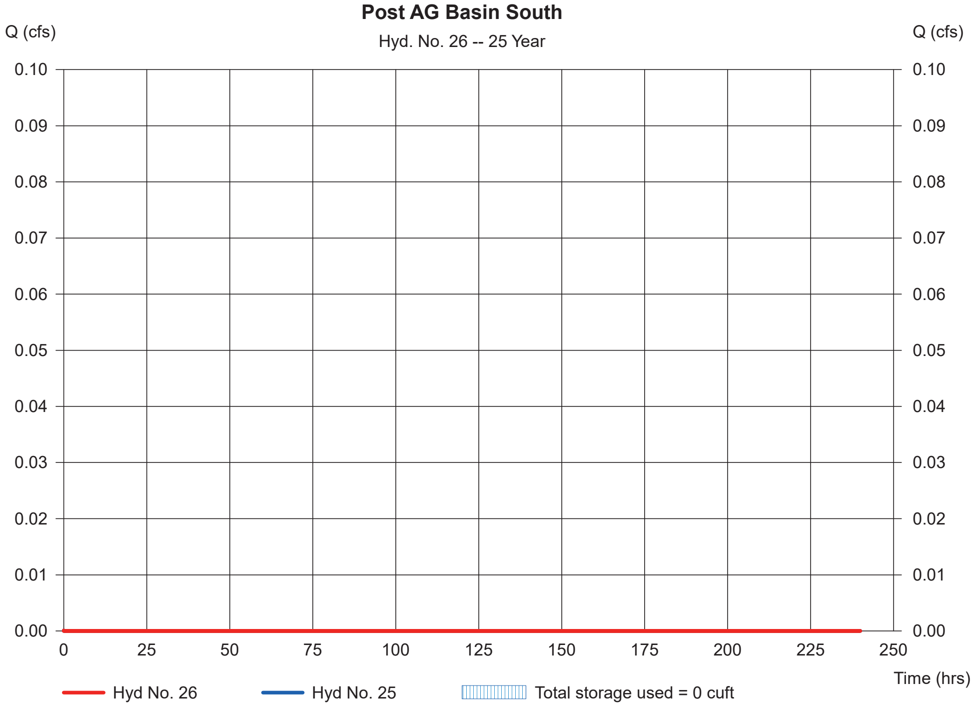
Hyd. No. 26

Post AG Basin South

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyd. No. = 25 - Total to AG Basin South
Reservoir name = AG Basin South

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



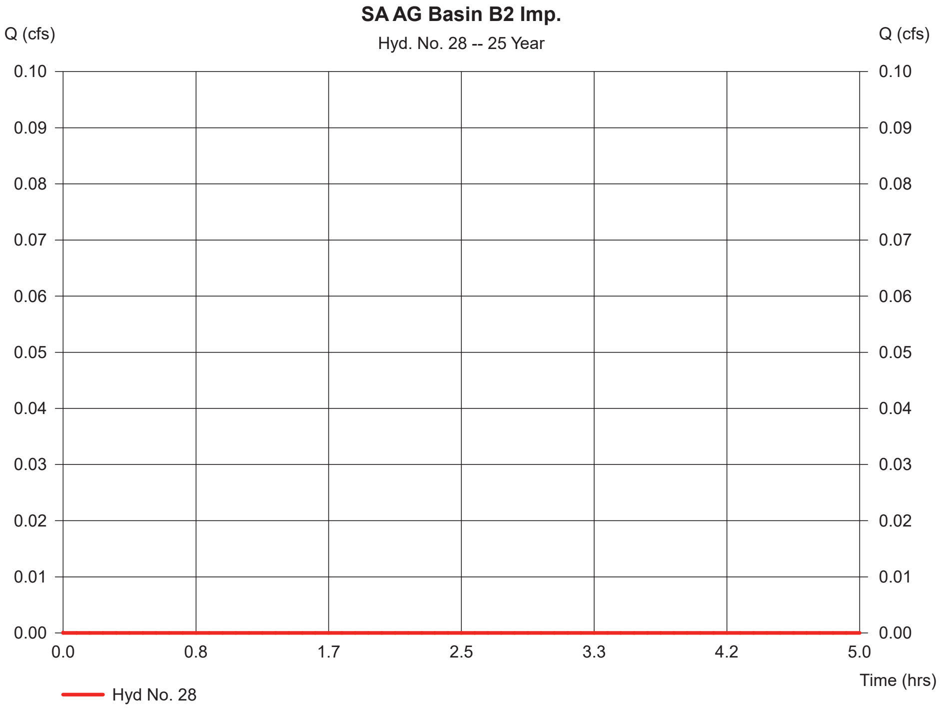
Hydrograph Report

Hyd. No. 28

SA AG Basin B2 Imp.

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 5 min
Drainage area = 2.150 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.68 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



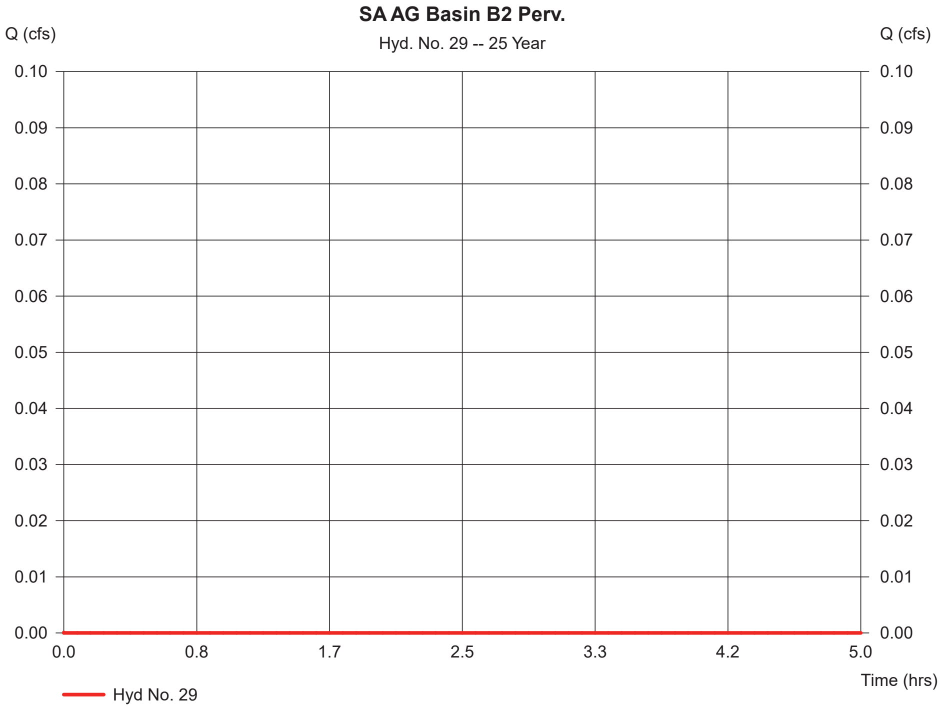
Hydrograph Report

Hyd. No. 29

SA AG Basin B2 Perv.

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 5 min
Drainage area = 0.620 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.68 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 43
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



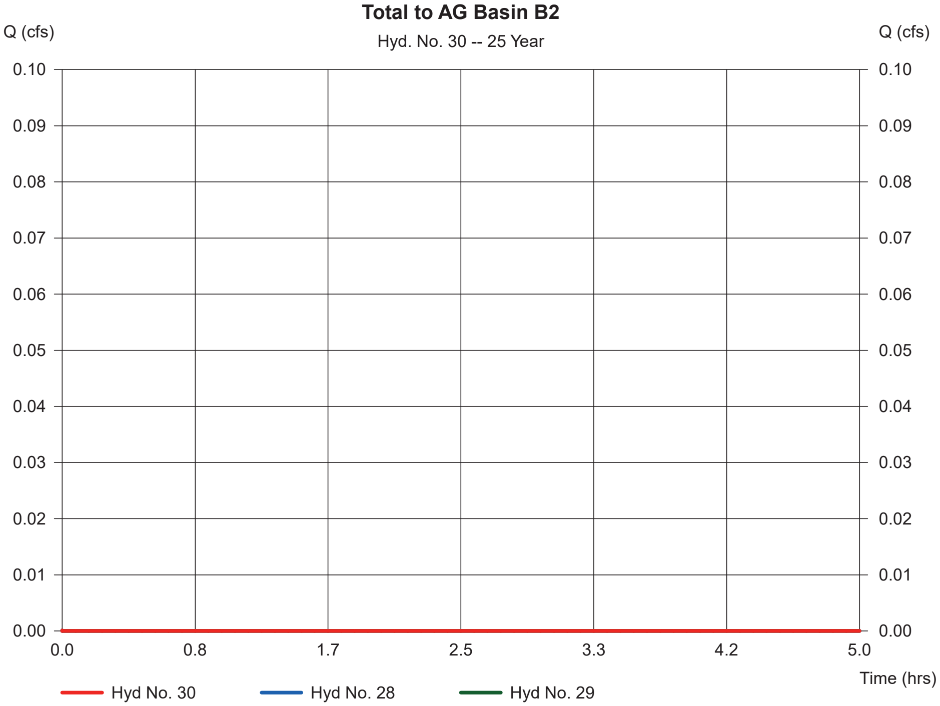
Hydrograph Report

Hyd. No. 30

Total to AG Basin B2

Hydrograph type = Combine
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyds. = 28, 29

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 2.770 ac



Hydrograph Report

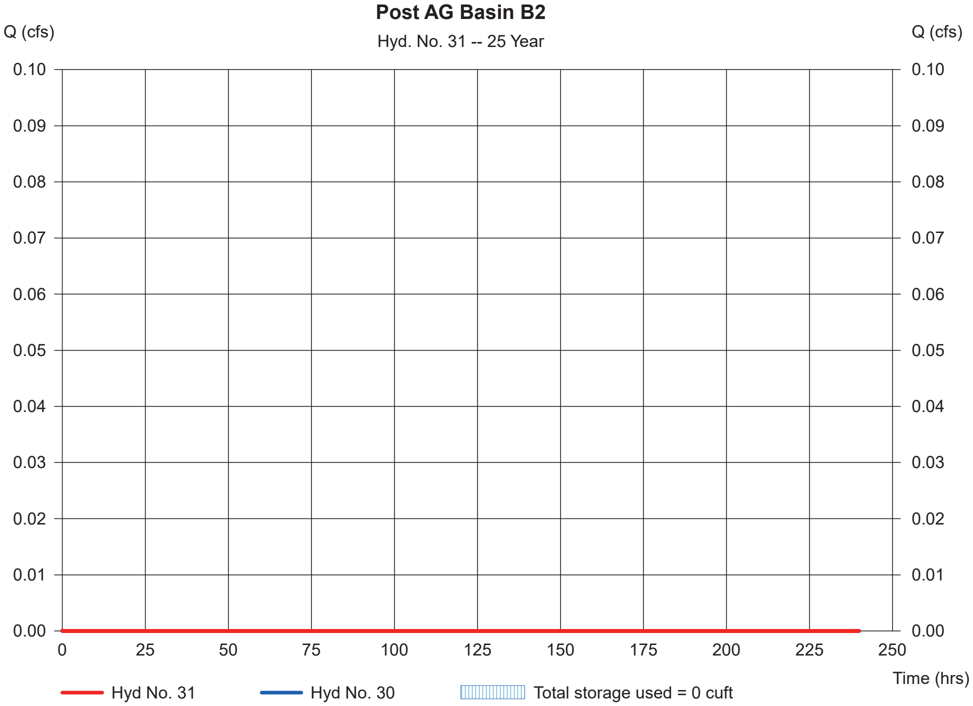
Hyd. No. 31

Post AG Basin B2

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyd. No. = 30 - Total to AG Basin B2
Reservoir name = AG Basin B2

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



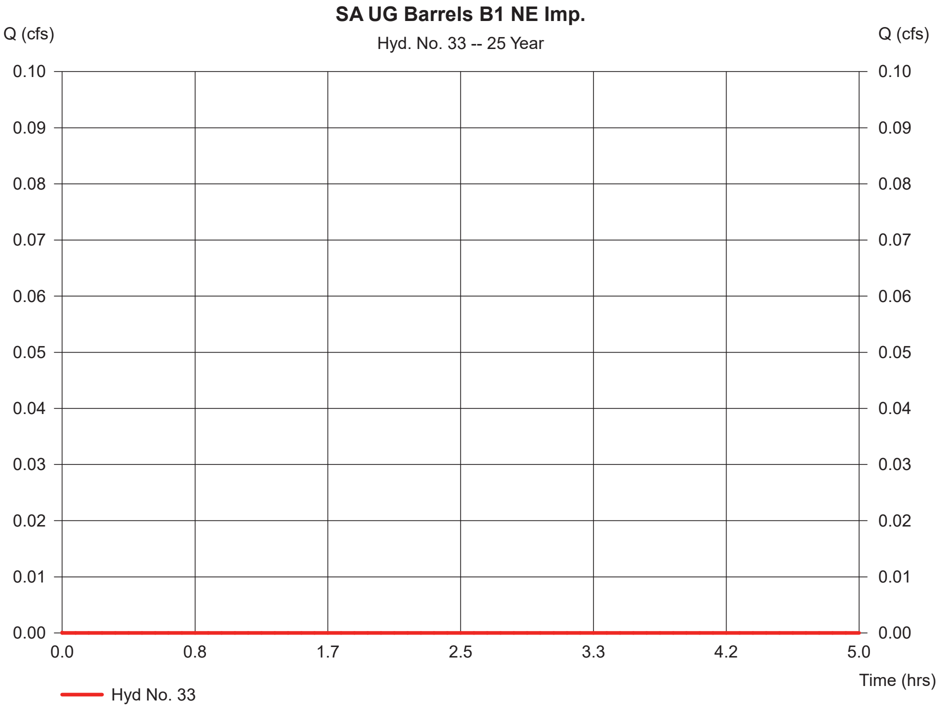
Hydrograph Report

Hyd. No. 33

SA UG Barrels B1 NE Imp.

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 5 min
Drainage area = 8.080 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.68 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



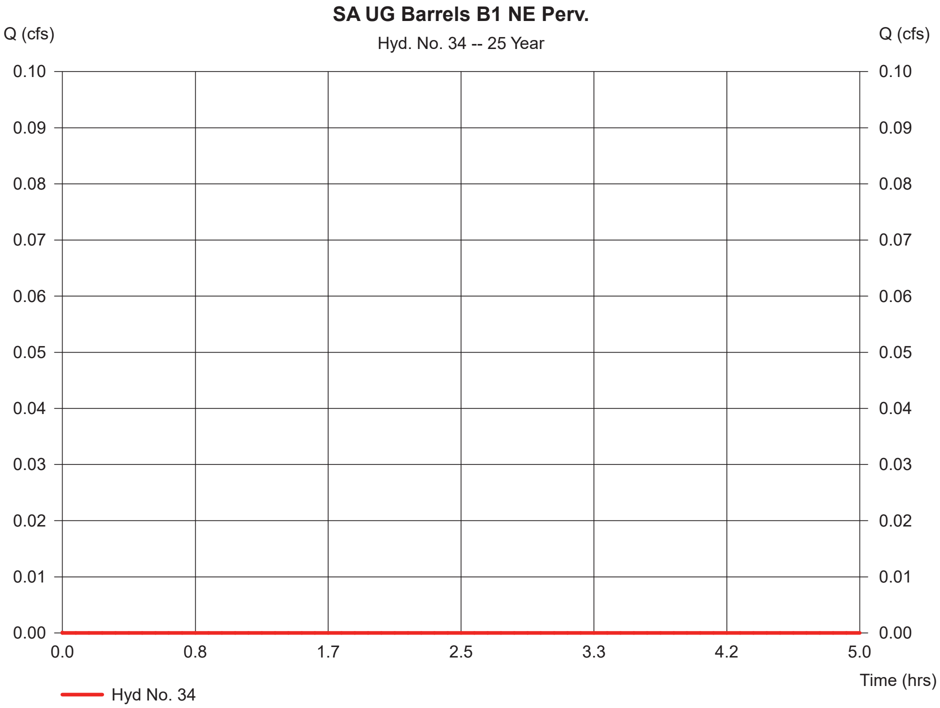
Hydrograph Report

Hyd. No. 34

SA UG Barrels B1 NE Perv.

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 5 min
Drainage area = 0.140 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.68 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 64
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



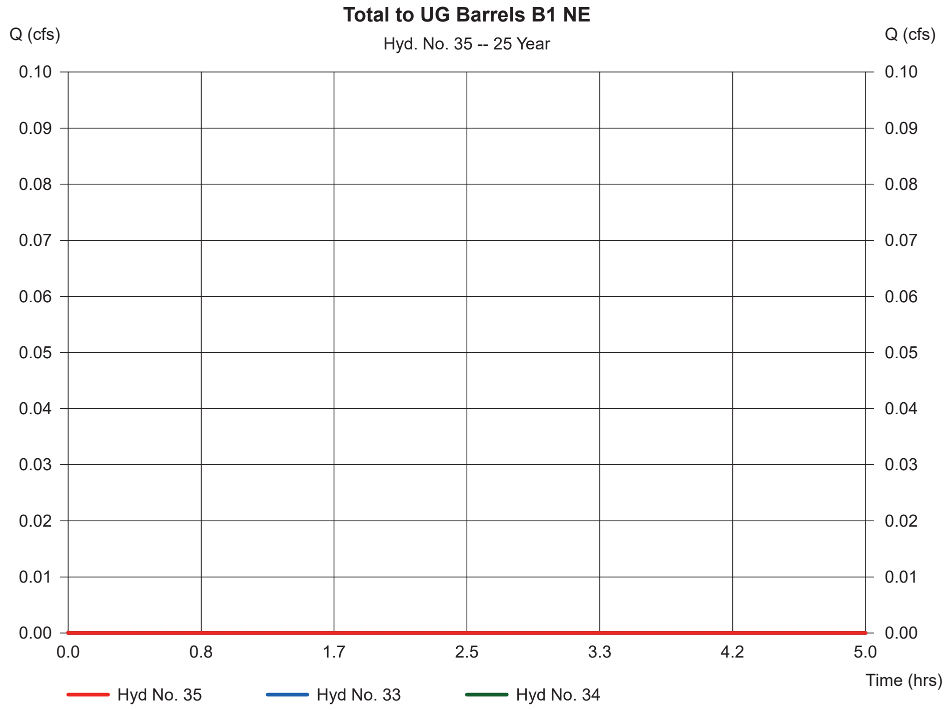
Hydrograph Report

Hyd. No. 35

Total to UG Barrels B1 NE

Hydrograph type = Combine
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyds. = 33, 34

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 8.220 ac



Hydrograph Report

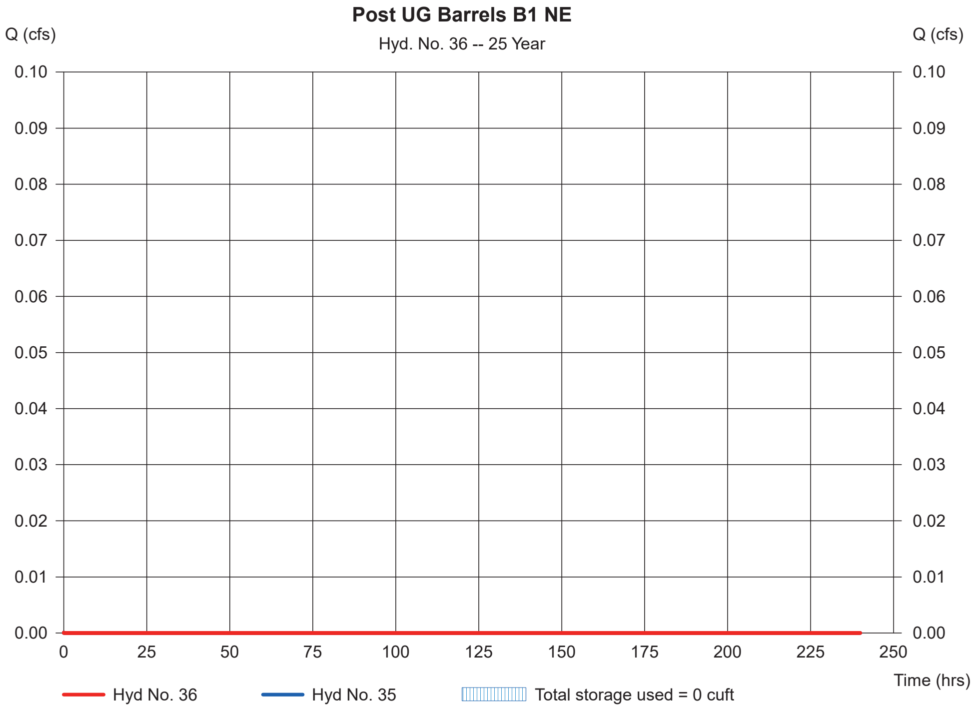
Hyd. No. 36

Post UG Barrels B1 NE

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyd. No. = 35 - Total to UG Barrels B1 NE
Reservoir name = UG BARRELS B1 Northeast

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



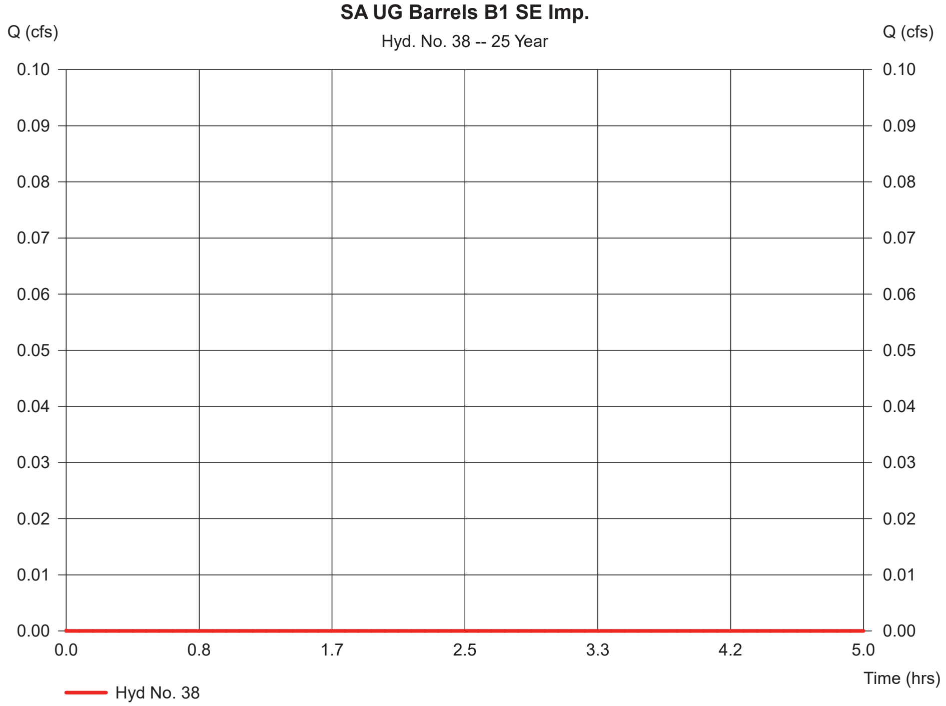
Hydrograph Report

Hyd. No. 38

SA UG Barrels B1 SE Imp.

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 5 min
Drainage area = 9.290 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.68 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



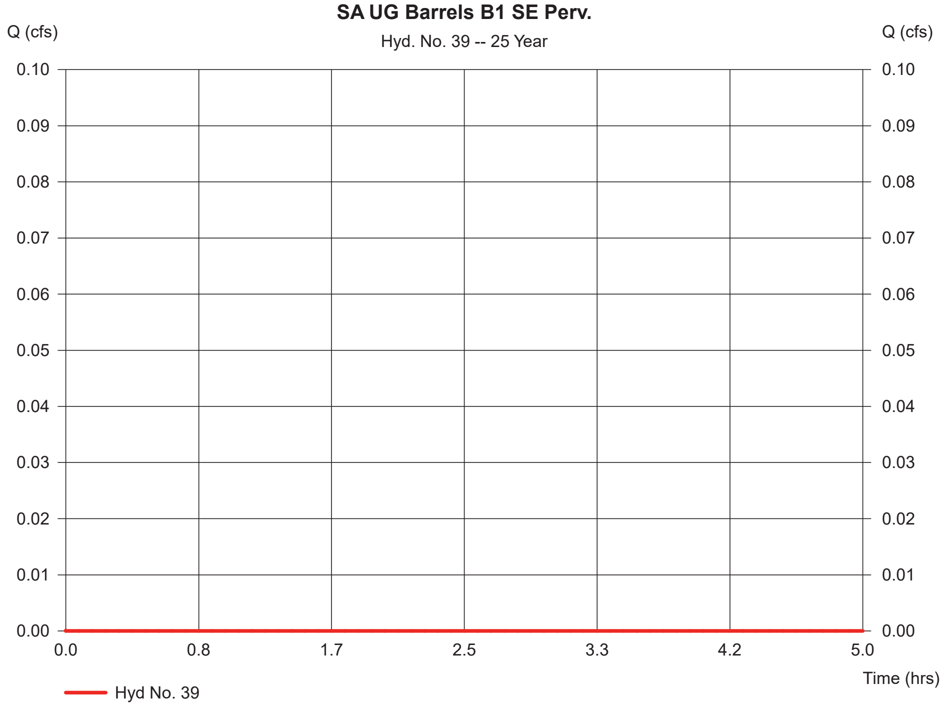
Hydrograph Report

Hyd. No. 39

SA UG Barrels B1 SE Perv.

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 5 min
Drainage area = 0.440 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.68 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 46
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



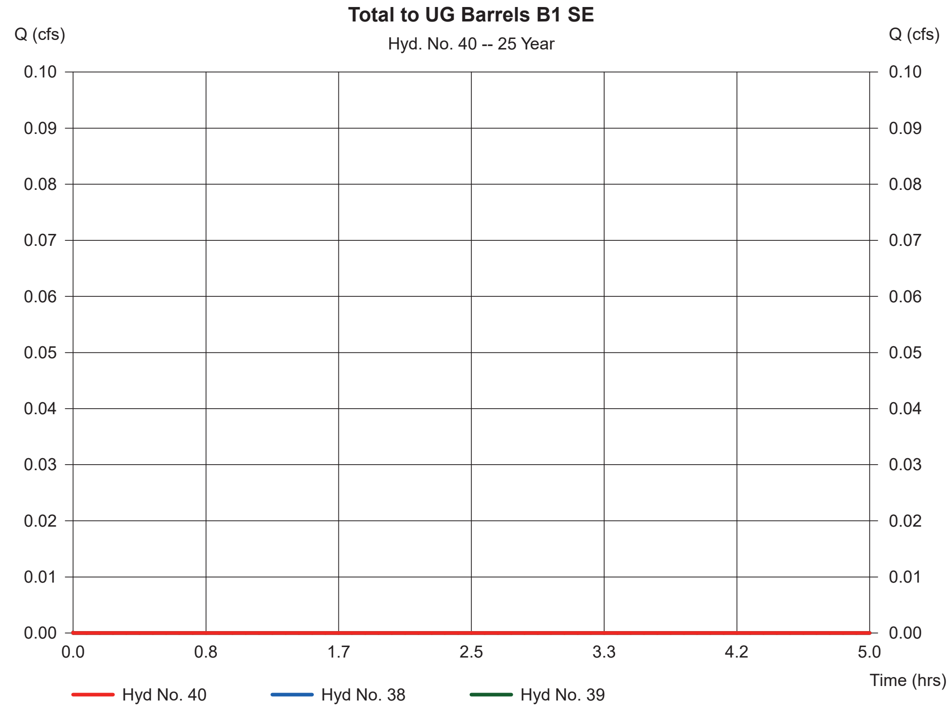
Hydrograph Report

Hyd. No. 40

Total to UG Barrels B1 SE

Hydrograph type = Combine
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyds. = 38, 39

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 9.730 ac



Hydrograph Report

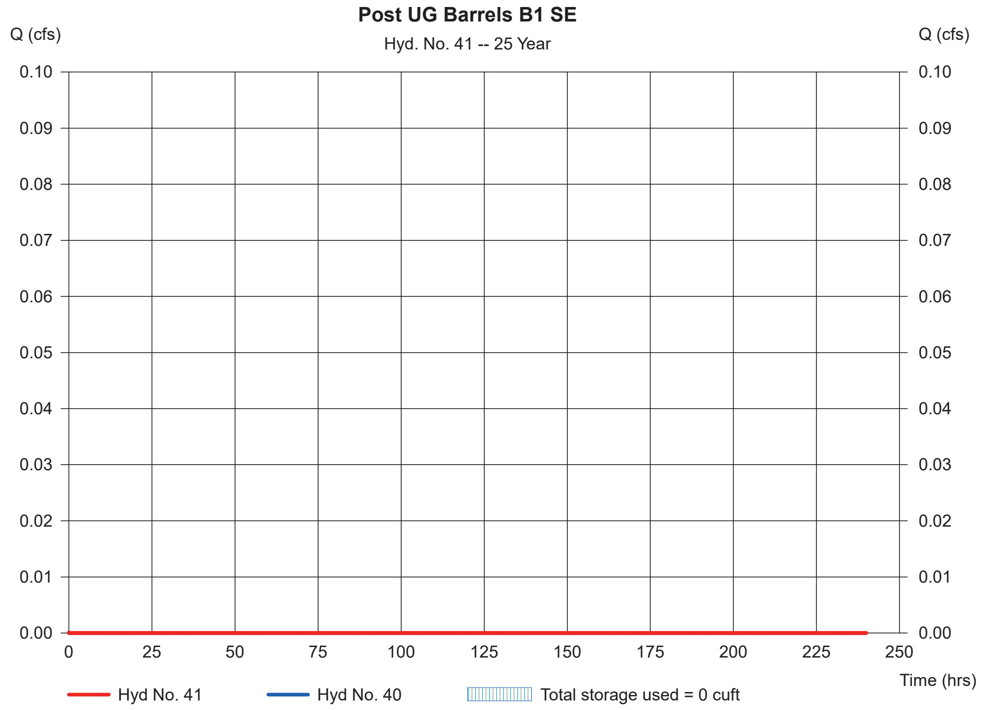
Hyd. No. 41

Post UG Barrels B1 SE

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyd. No. = 40 - Total to UG Barrels B1 SE
Reservoir name = UG BARRELS B1 Southeast

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



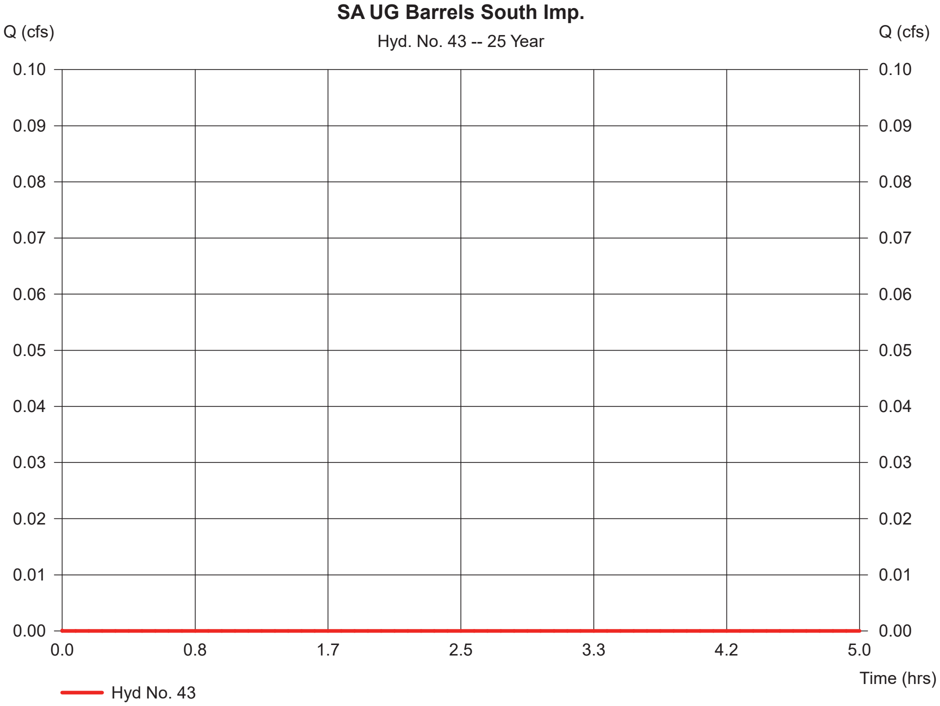
Hydrograph Report

Hyd. No. 43

SA UG Barrels South Imp.

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 5 min
Drainage area = 1.420 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.68 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



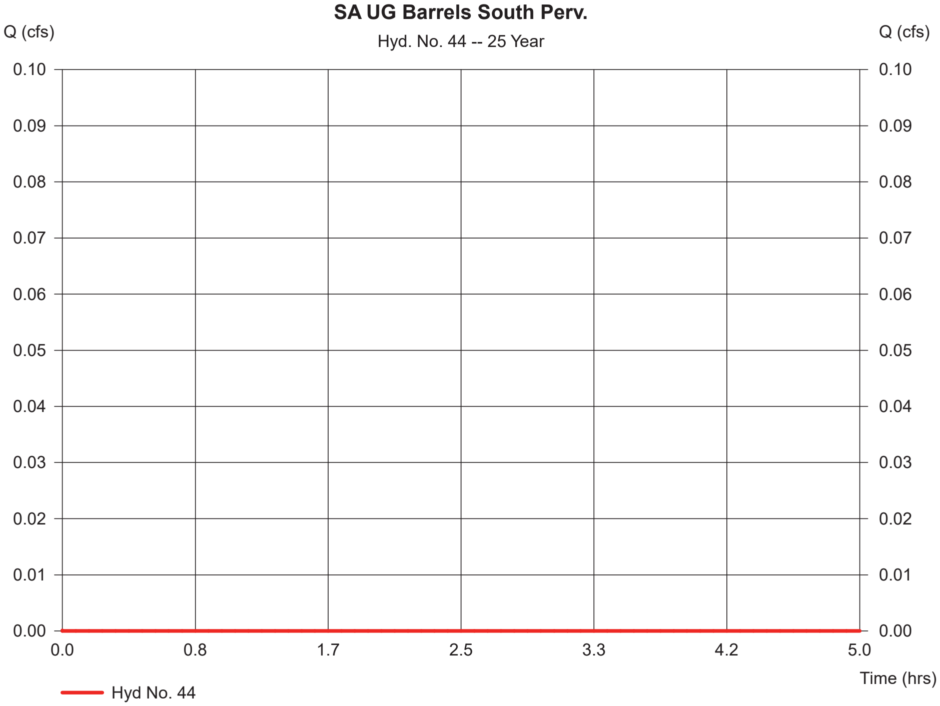
Hydrograph Report

Hyd. No. 44

SA UG Barrels South Perv.

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 5 min
Drainage area = 0.140 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.68 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 64
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



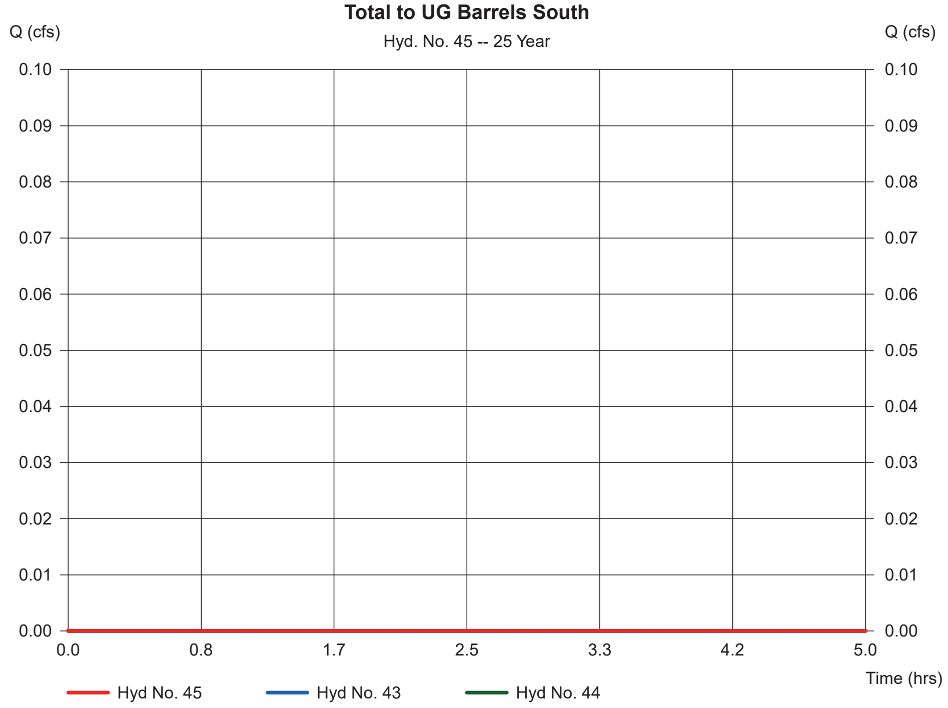
Hydrograph Report

Hyd. No. 45

Total to UG Barrels South

Hydrograph type = Combine
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyds. = 43, 44

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 1.560 ac



Hydrograph Report

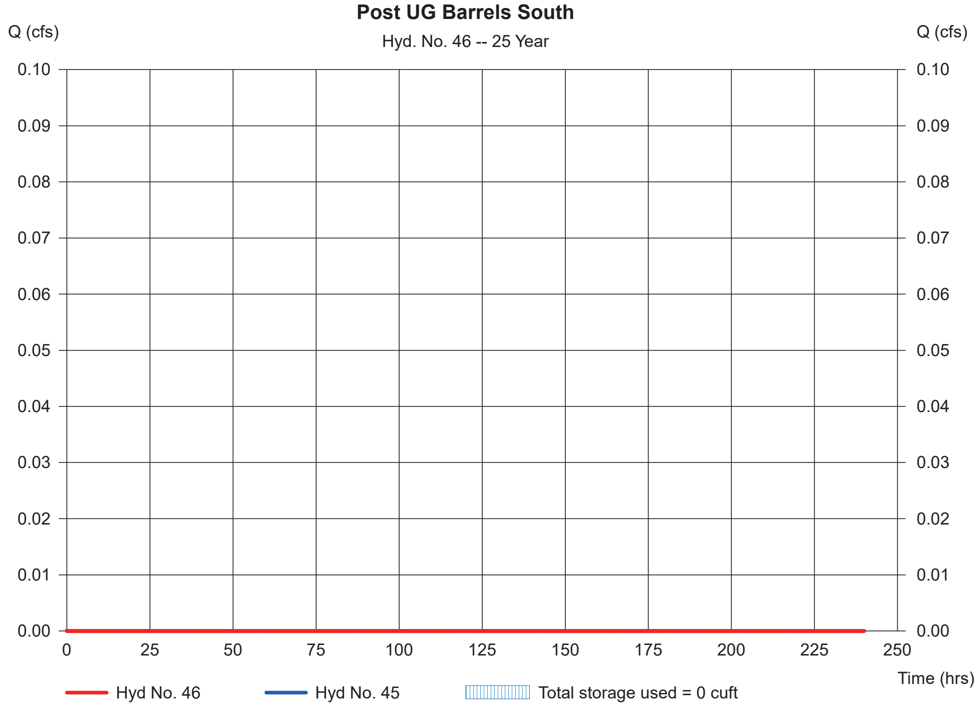
Hyd. No. 46

Post UG Barrels South

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyd. No. = 45 - Total to UG Barrels South
Reservoir name = UG BARRELS South Bldg

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



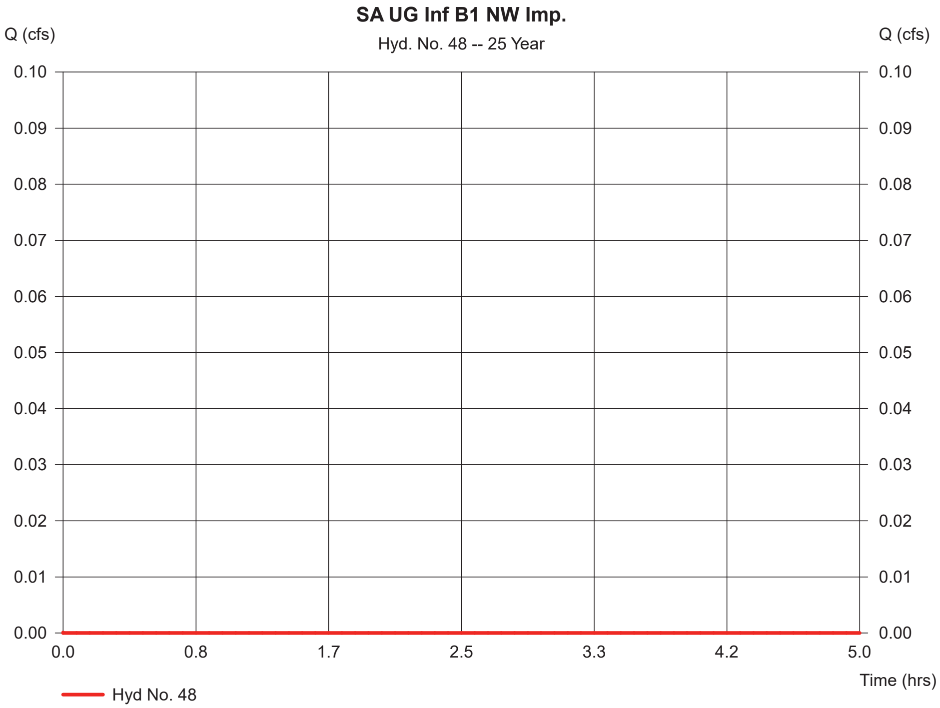
Hydrograph Report

Hyd. No. 48

SA UG Inf B1 NW Imp.

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 5 min
Drainage area = 9.310 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.68 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



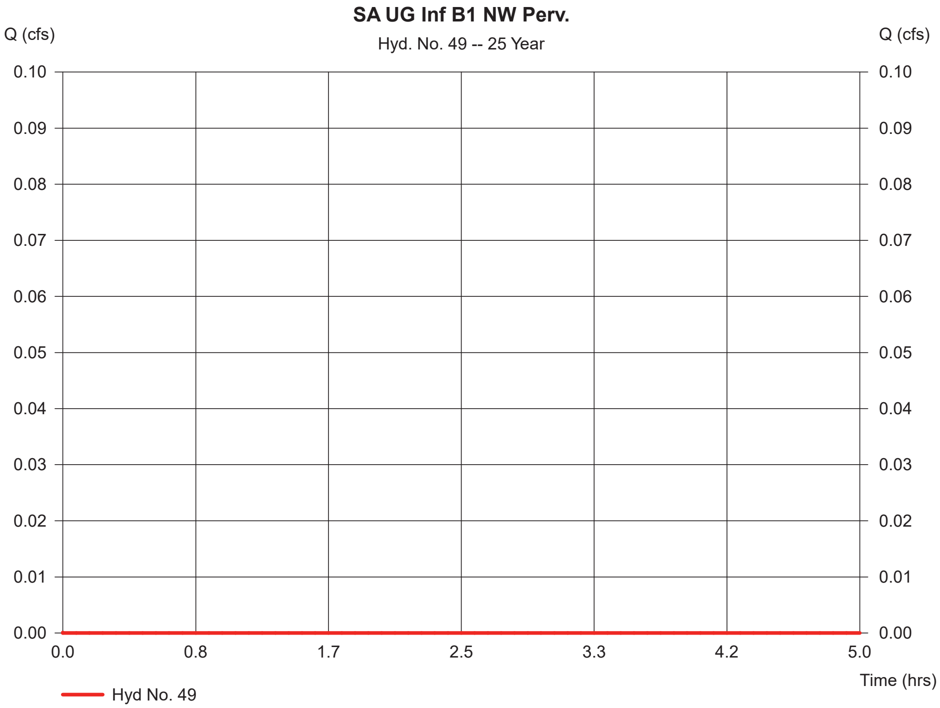
Hydrograph Report

Hyd. No. 49

SA UG Inf B1 NW Perv.

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 5 min
Drainage area = 0.260 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.68 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 39
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



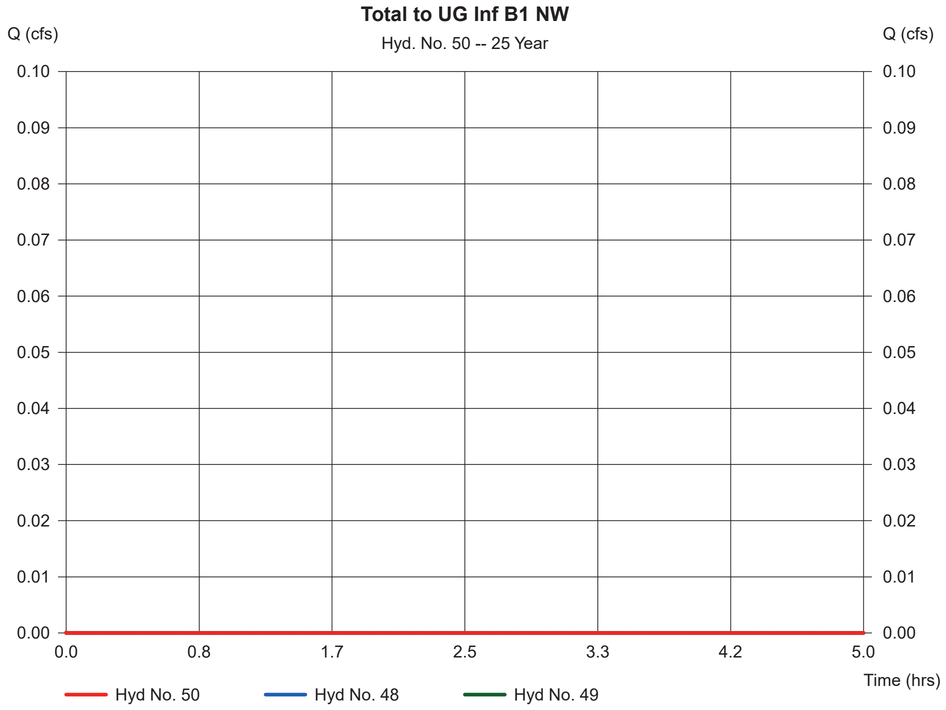
Hydrograph Report

Hyd. No. 50

Total to UG Inf B1 NW

Hydrograph type = Combine
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyds. = 48, 49

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 9.570 ac



Hydrograph Report

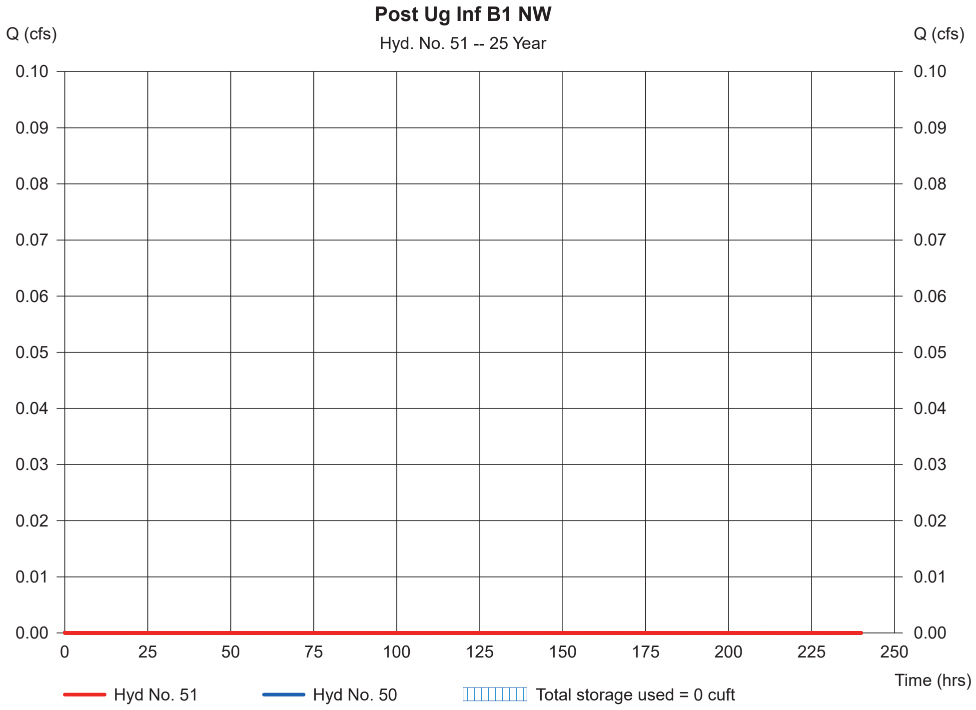
Hyd. No. 51

Post Ug Inf B1 NW

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyd. No. = 50 - Total to UG Inf B1 NW
Reservoir name = UG Inf B1 NW

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.

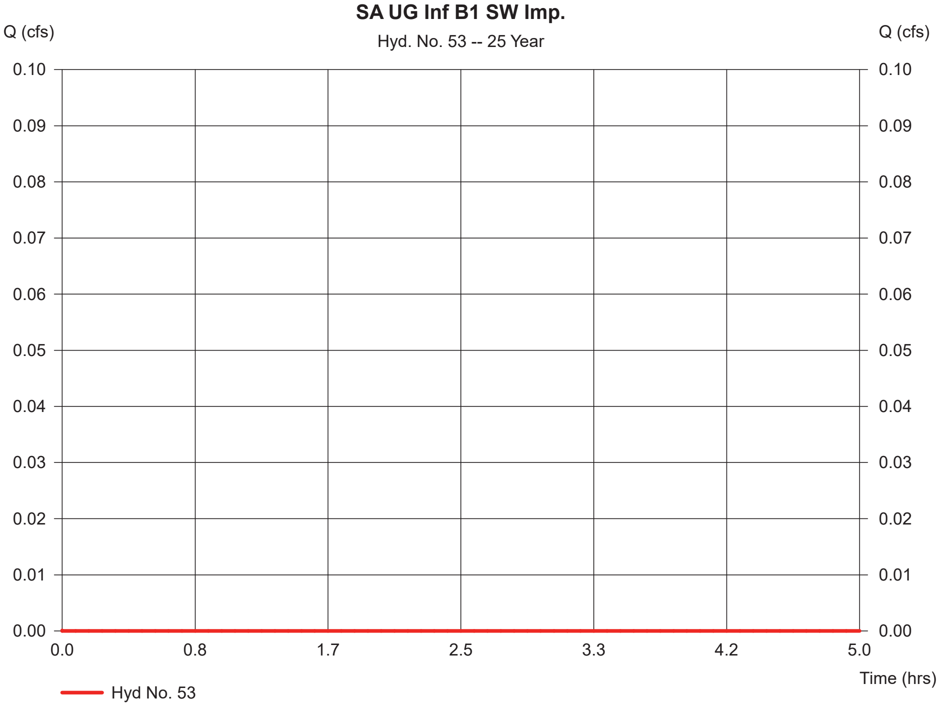


Hydrograph Report

Hyd. No. 53

SA UG Inf B1 SW Imp.

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 7.980 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.68 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

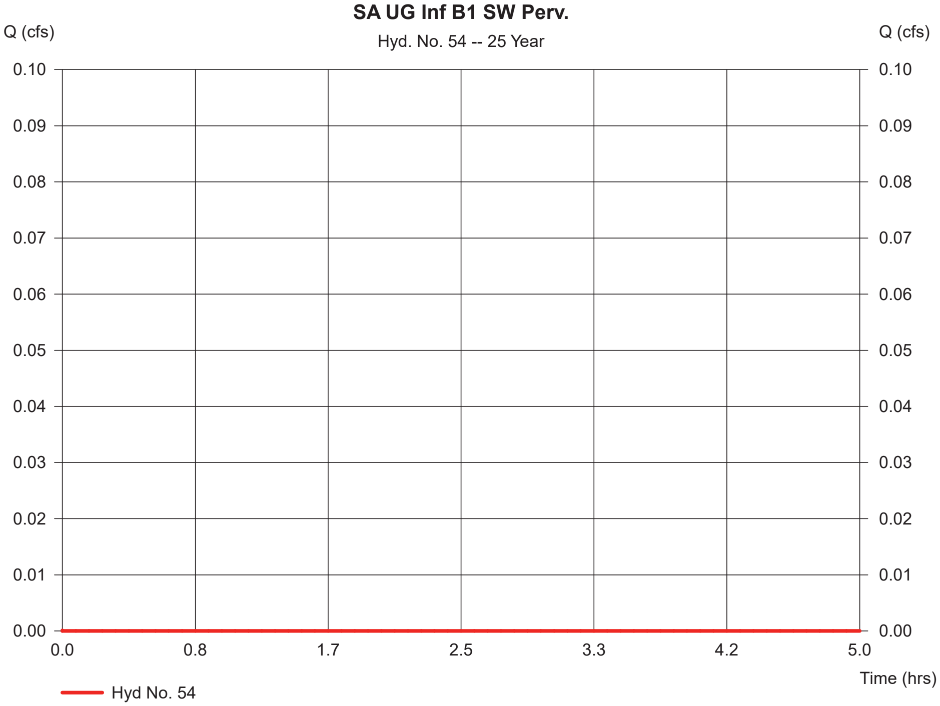


Hydrograph Report

Hyd. No. 54

SA UG Inf B1 SW Perv.

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 0.300 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.68 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



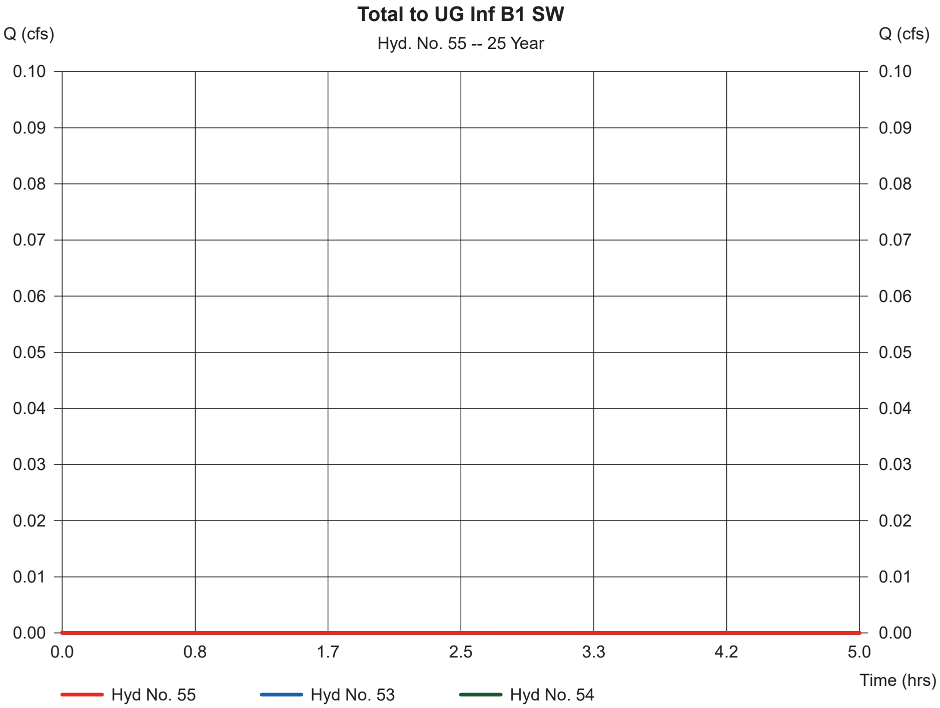
Hydrograph Report

Hyd. No. 55

Total to UG Inf B1 SW

Hydrograph type = Combine
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyds. = 53, 54

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 8.280 ac



Hydrograph Report

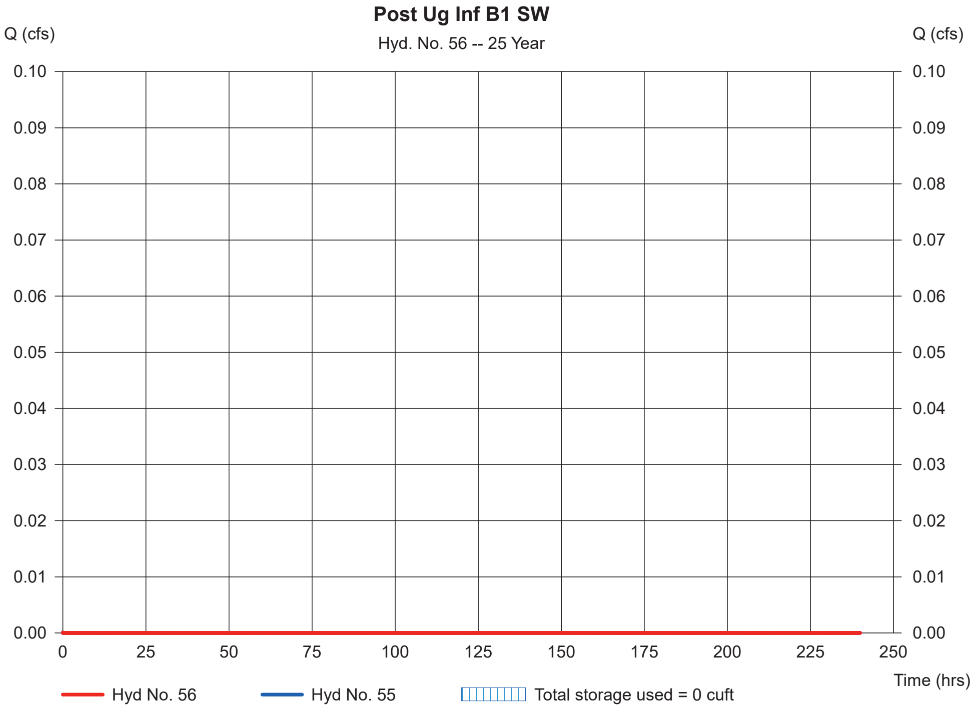
Hyd. No. 56

Post Ug Inf B1 SW

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyd. No. = 55 - Total to UG Inf B1 SW
Reservoir name = UG Inf B1 SW

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



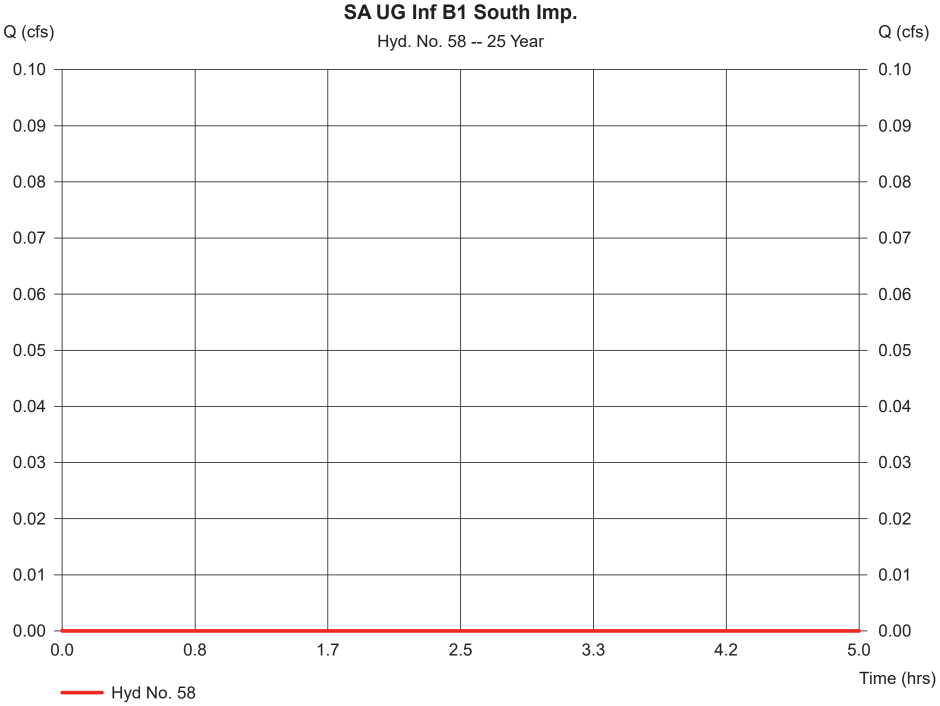
Hydrograph Report

Hyd. No. 58

SA UG Inf B1 South Imp.

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 5 min
Drainage area = 0.420 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.68 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



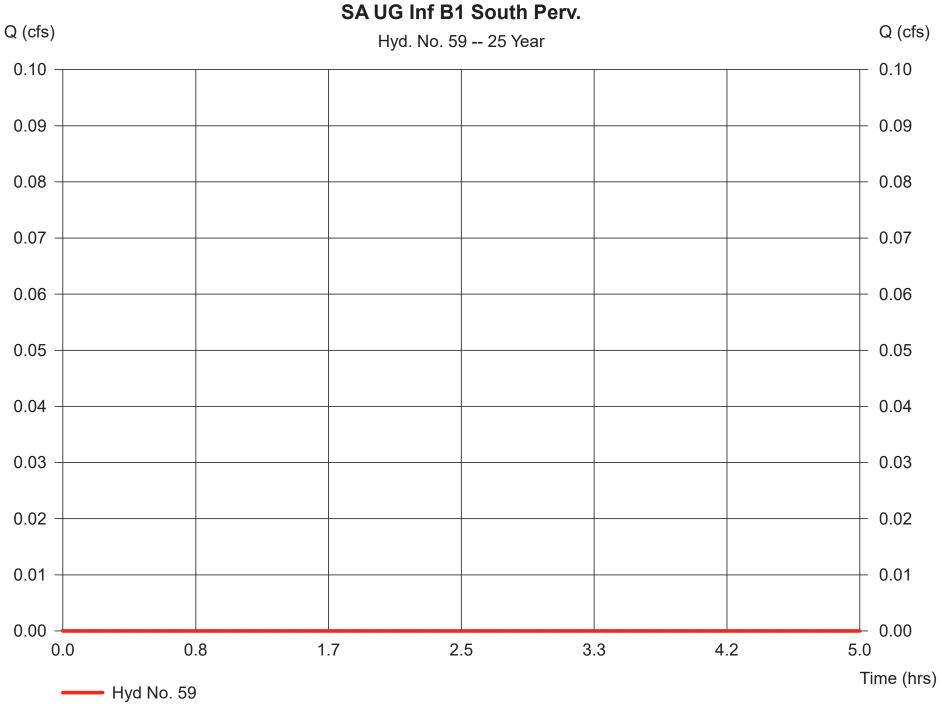
Hydrograph Report

Hyd. No. 59

SA UG Inf B1 South Perv.

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 5 min
Drainage area = 0.490 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.68 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 49
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

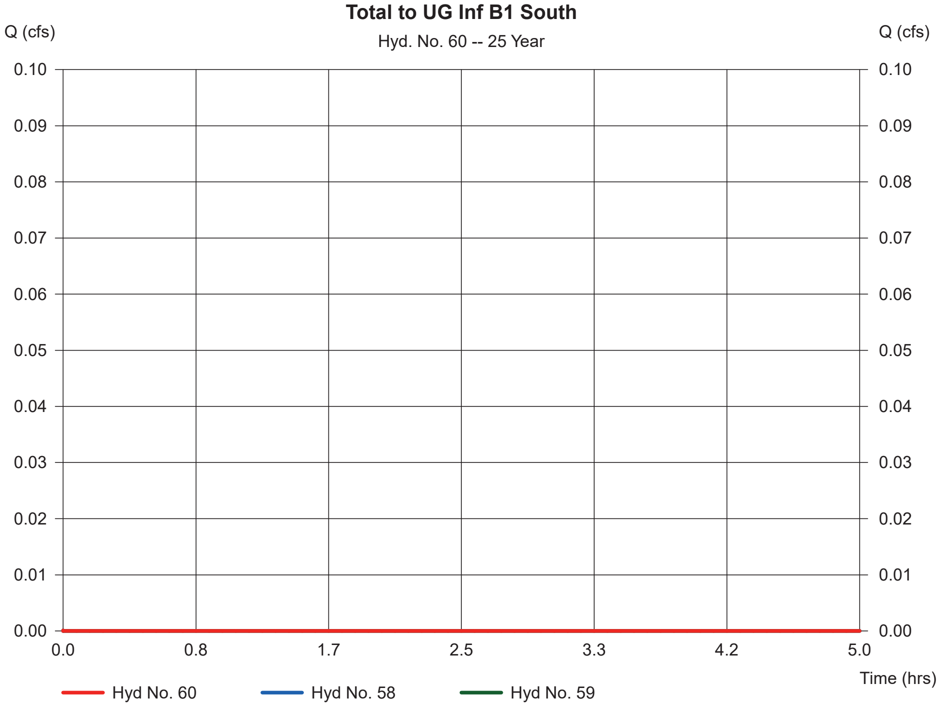
Hydraflow Hydrographs by Intelisolve v9.1 Friday, Jan 20, 2023

Hyd. No. 60

Total to UG Inf B1 South

Hydrograph type = Combine
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyds. = 58, 59

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 0.910 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1 Friday, Jan 20, 2023

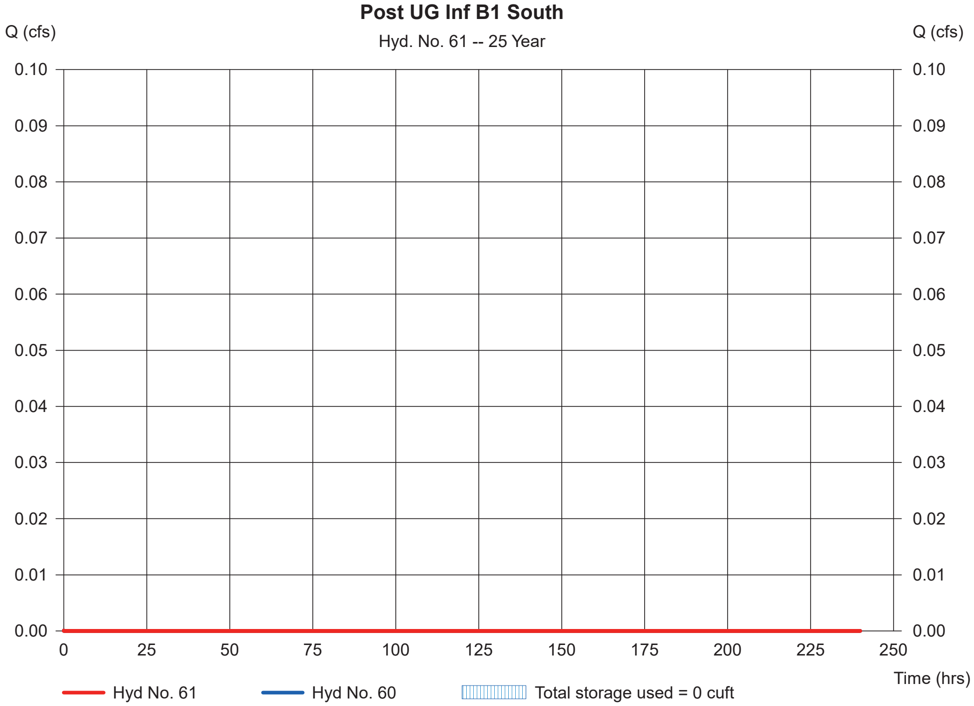
Hyd. No. 61

Post UG Inf B1 South

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyd. No. = 60 - Total to UG Inf B1 South
Reservoir name = UG Inf B1 South

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.

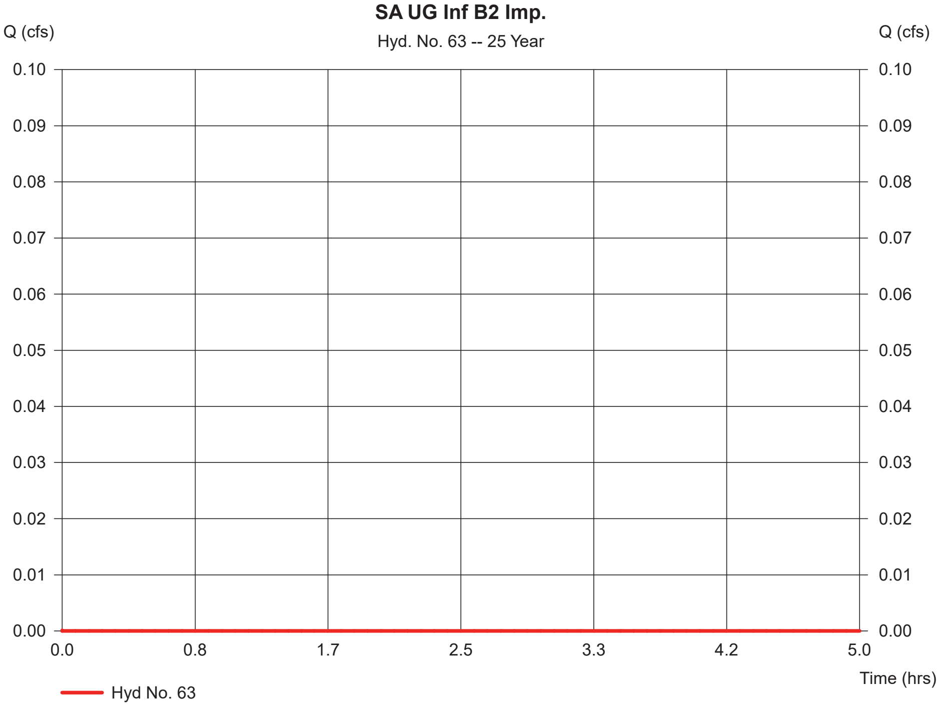


Hydrograph Report

Hyd. No. 63

SA UG Inf B2 Imp.

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 5.200 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.68 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

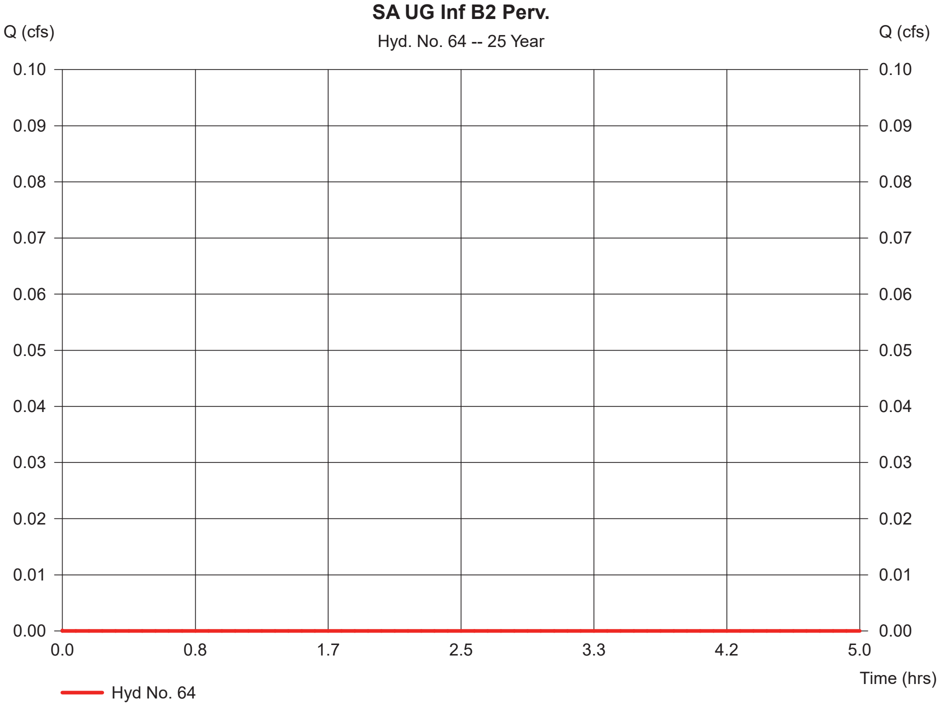


Hydrograph Report

Hyd. No. 64

SA UG Inf B2 Perv.

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 0.100 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 5.68 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

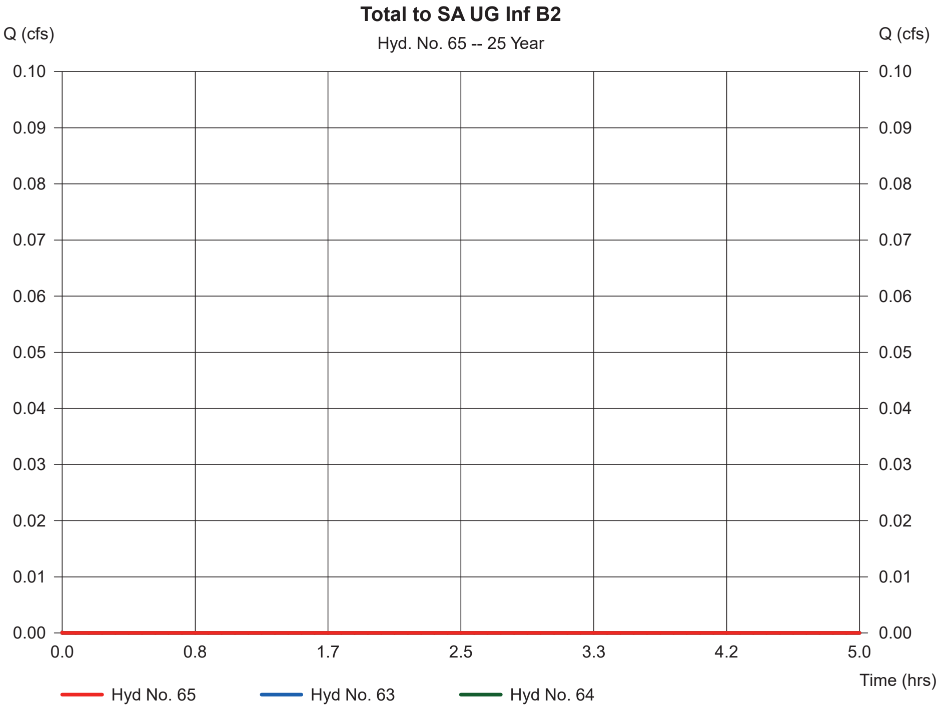
Friday, Jan 20, 2023

Hyd. No. 65

Total to SA UG Inf B2

Hydrograph type = Combine
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyds. = 63, 64

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 5.300 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

Friday, Jan 20, 2023

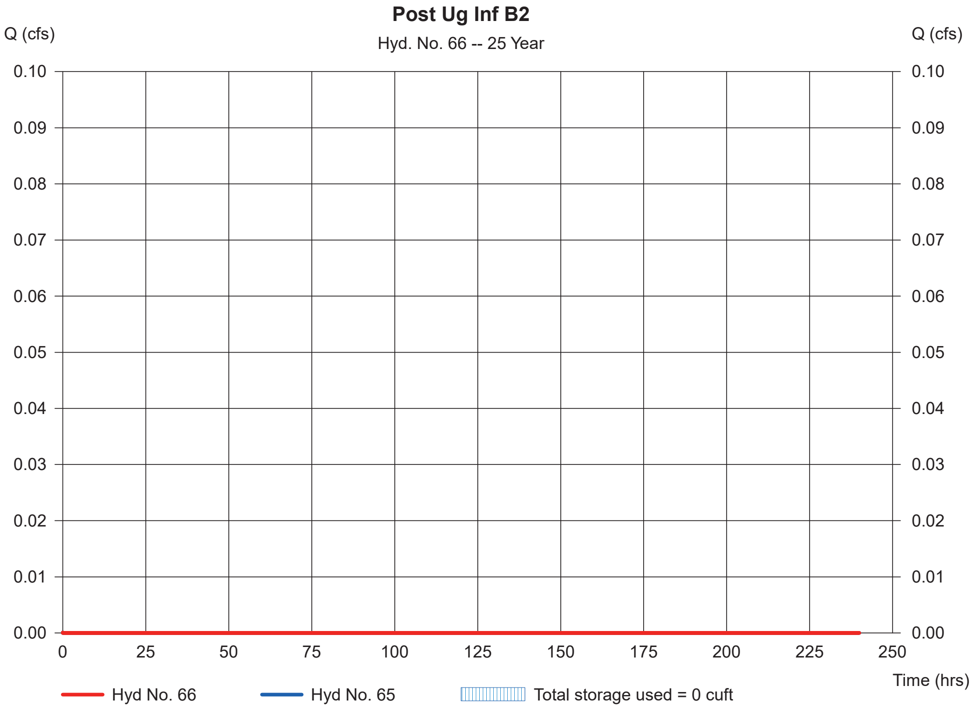
Hyd. No. 66

Post Ug Inf B2

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyd. No. = 65 - Total to SA UG Inf B2
Reservoir name = UG Inf B2

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



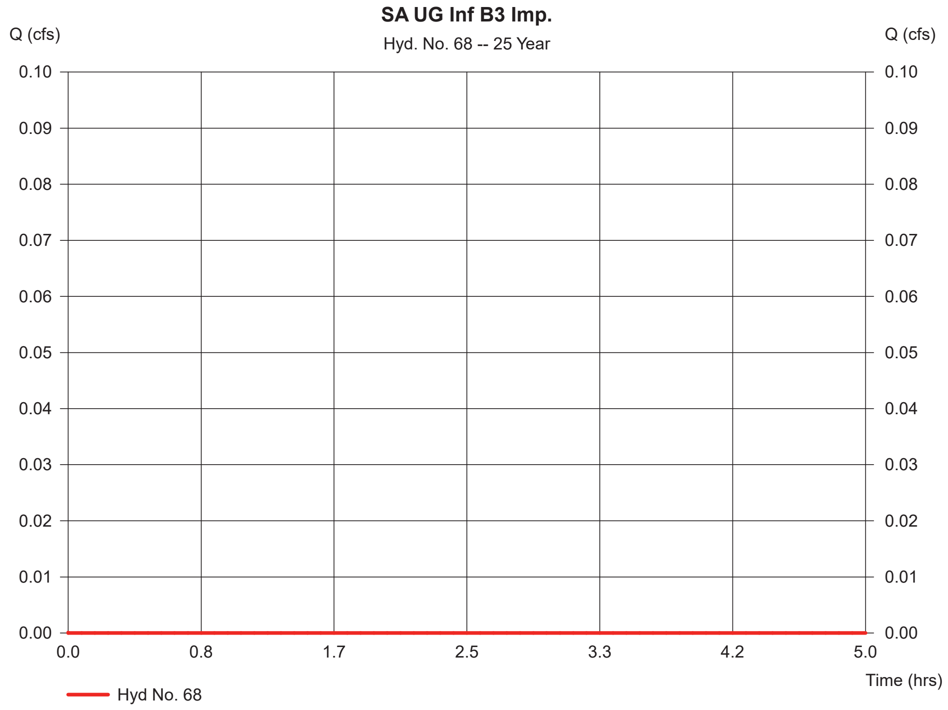
Hydrograph Report

Hyd. No. 68

SA UG Inf B3 Imp.

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 5 min
Drainage area = 2.020 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.68 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

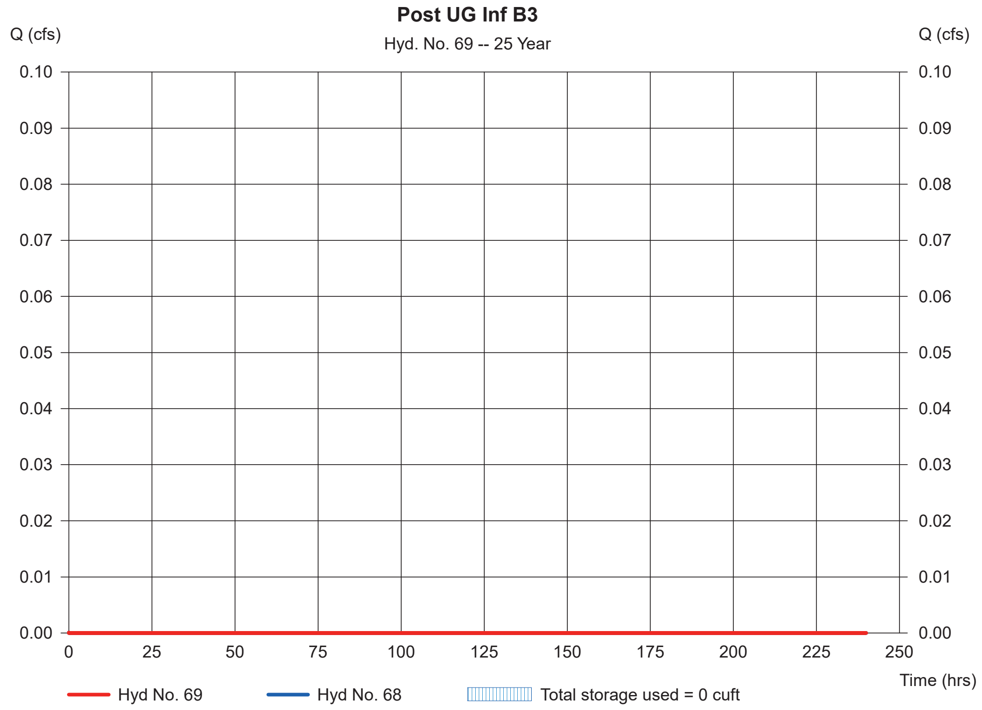
Hyd. No. 69

Post UG Inf B3

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyd. No. = 68 - SA UG Inf B3 Imp.
Reservoir name = UG Inf B3

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



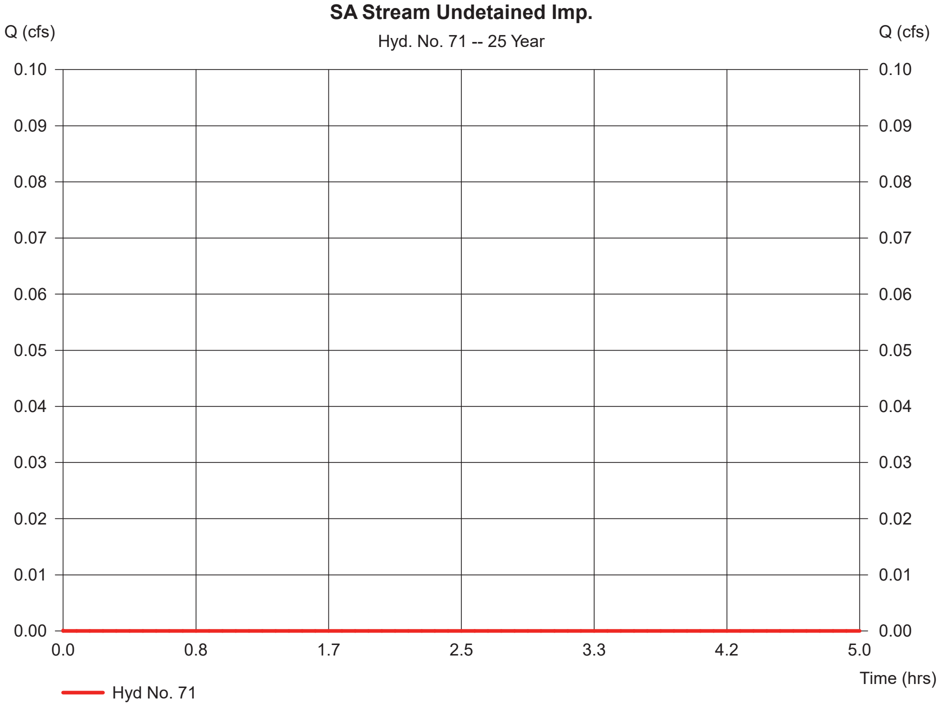
Hydrograph Report

Hyd. No. 71

SA Stream Undetained Imp.

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 5 min
Drainage area = 0.290 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.68 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484


SA Stream Undetained Imp.

Hyd. No. 71 -- 25 Year

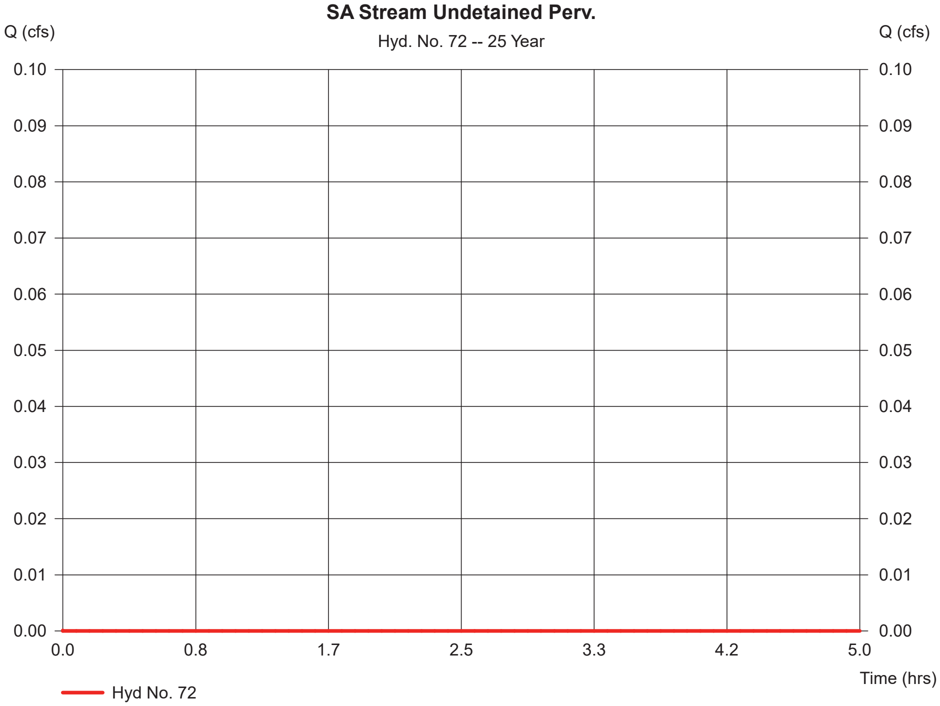
Hydrograph Report

Hyd. No. 72

SA Stream Undetained Perv.

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 5 min
Drainage area = 5.610 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 5.68 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 41
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484


SA Stream Undetained Perv.

Hyd. No. 72 -- 25 Year

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

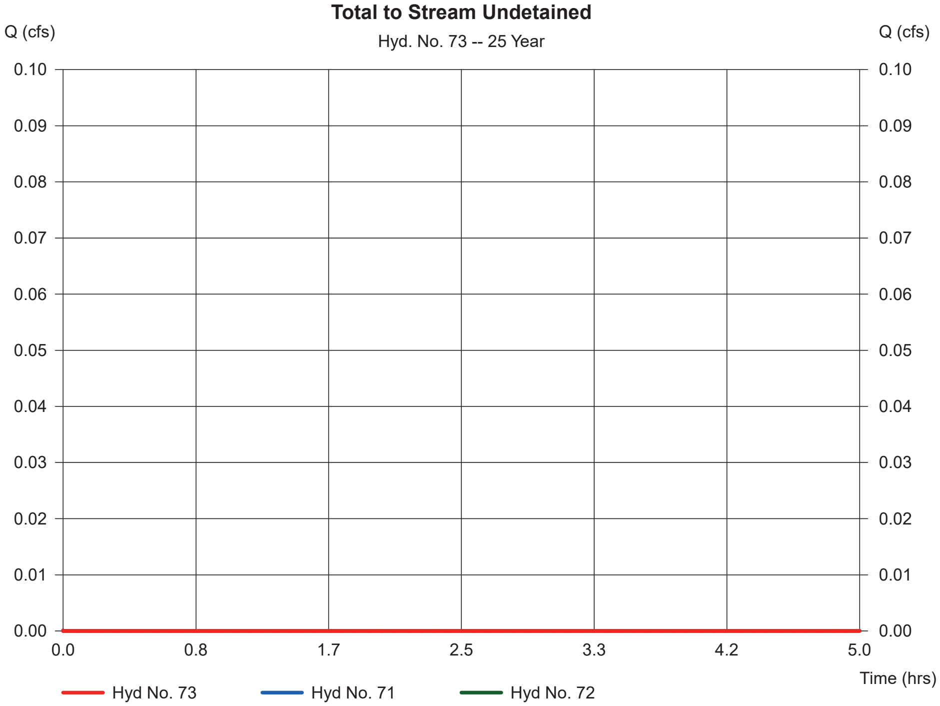
Friday, Jan 20, 2023

Hyd. No. 73

Total to Stream Undetained

Hydrograph type = Combine
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyds. = 71, 72

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 5.900 ac



Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1

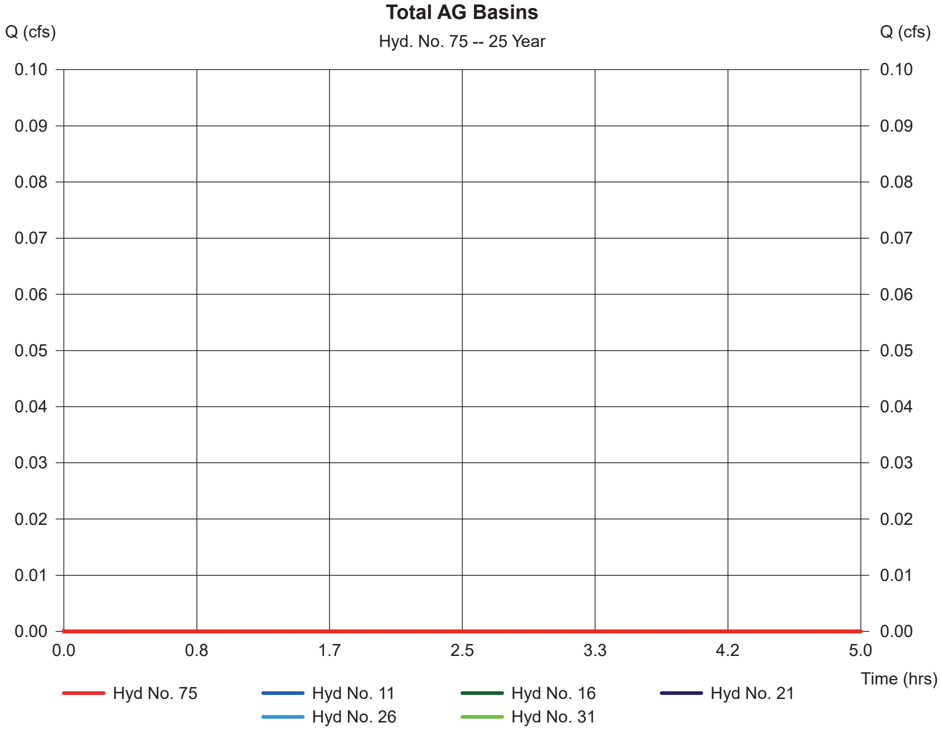
Friday, Jan 20, 2023

Hyd. No. 75

Total AG Basins

Hydrograph type = Combine
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyds. = 11, 16, 21, 26, 31

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 0.000 ac



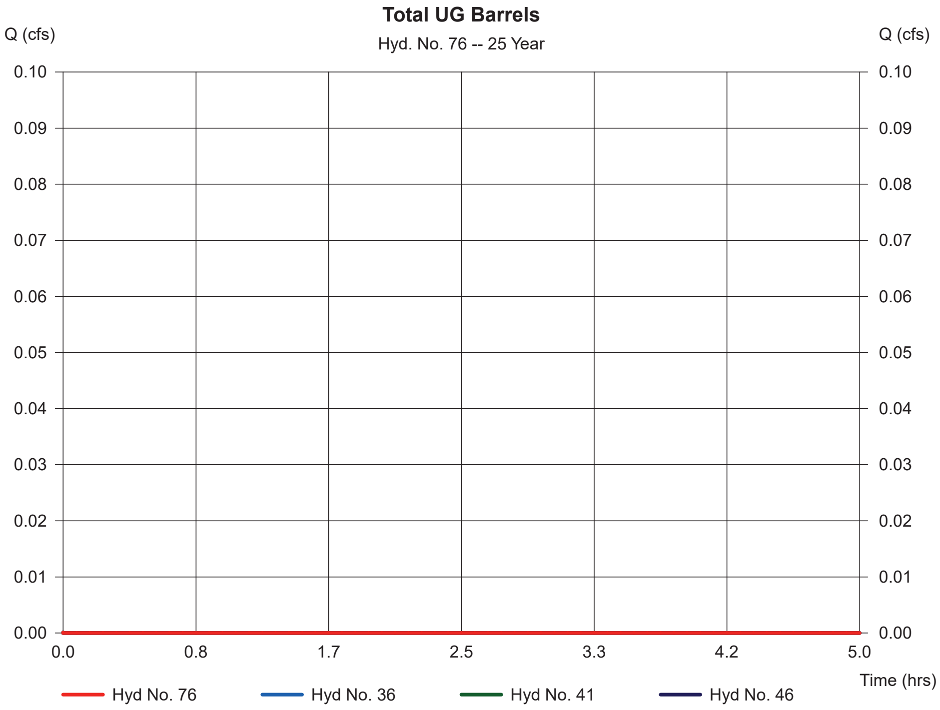
Hydrograph Report

Hyd. No. 76

Total UG Barrels

Hydrograph type = Combine
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyds. = 36, 41, 46

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 0.000 ac



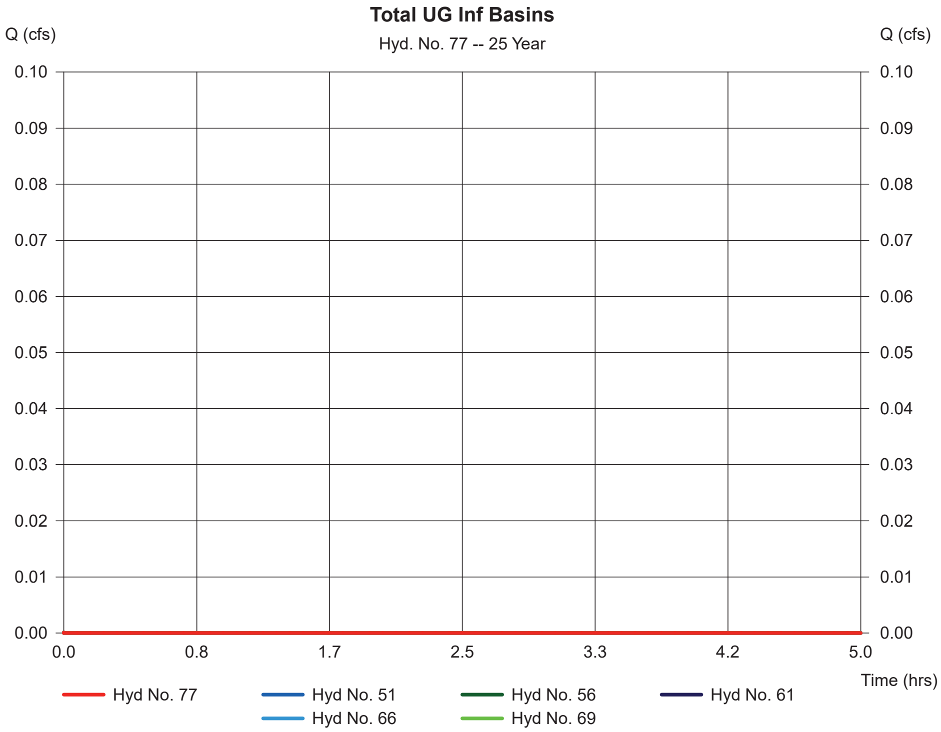
Hydrograph Report

Hyd. No. 77

Total UG Inf Basins

Hydrograph type = Combine
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyds. = 51, 56, 61, 66, 69

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 0.000 ac



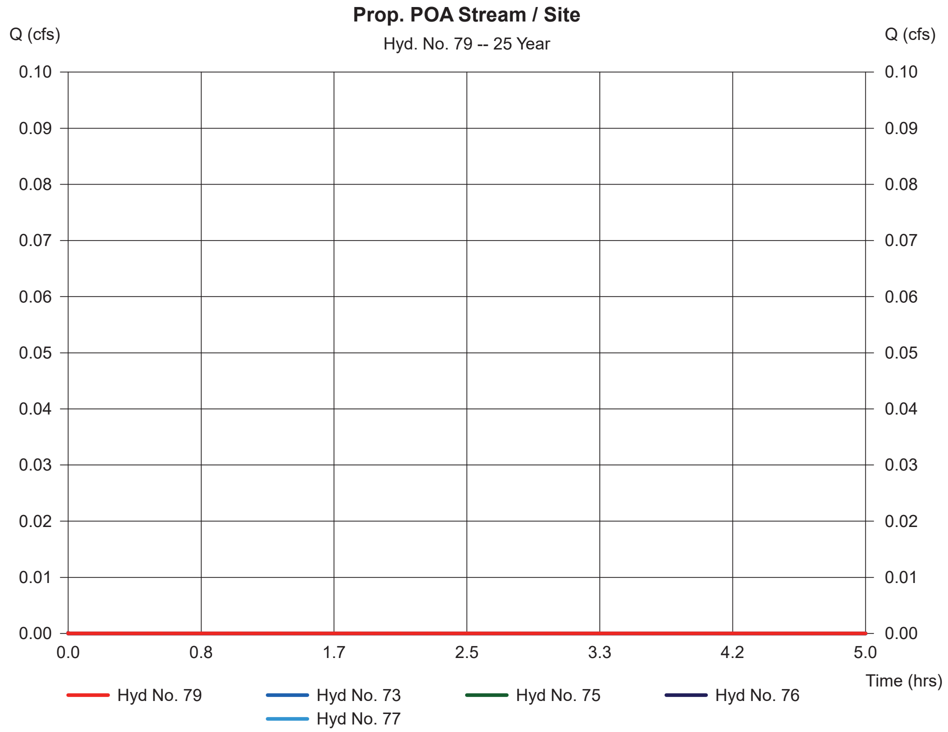
Hydrograph Report

Hyd. No. 79

Prop. POA Stream / Site

Hydrograph type = Combine
Storm frequency = 25 yrs
Time interval = 5 min
Inflow hyds. = 73, 75, 76, 77

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 0.000 ac



Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
1	SCS Runoff	0.000	5	n/a	0	----	------	------	Ex. SA Stream (Imp.)
2	SCS Runoff	0.000	5	n/a	0	----	------	------	Ex. SA Stream (Perv.)
4	SCS Runoff	0.000	5	n/a	0	----	------	------	Ex. SA Pond (Imp.)
5	SCS Runoff	0.000	5	n/a	0	----	------	------	Ex. SA Pond (Perv.)
7	Combine	0.000	5	n/a	0	1, 2, 4, 5,	------	------	Ex. Total
9	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B1 North Imp.
10	Combine	0.000	5	n/a	0	9	------	------	Total to AG Basin B1 North
11	Reservoir	0.000	5	n/a	0	10	0.00	0.000	Post AG Basin B1 North
13	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B1 NW Imp.
14	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B1 NW Perv.
15	Combine	0.000	5	n/a	0	13, 14	------	------	Total to AG Basin B1 NW
16	Reservoir	0.000	5	n/a	0	15	0.00	0.000	Post AG Basin B1 NW
18	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B1 SW Imp.
19	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B1 SW Perv.
20	Combine	0.000	5	n/a	0	18, 19	------	------	Total to AG Basin B1 SW
21	Reservoir	0.000	5	n/a	0	20	0.00	0.000	Post AG Basin B1 SW
23	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin South Imp.
24	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin South Perv.
25	Combine	0.000	5	n/a	0	23, 24	------	------	Total to AG Basin South
26	Reservoir	0.000	5	n/a	0	25	0.00	0.000	Post AG Basin South
28	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B2 Imp.
29	SCS Runoff	0.000	5	n/a	0	----	------	------	SA AG Basin B2 Perv.
30	Combine	0.000	5	n/a	0	28, 29	------	------	Total to AG Basin B2
31	Reservoir	0.000	5	n/a	0	30	0.00	0.000	Post AG Basin B2
33	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Barrels B1 NE Imp.
34	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Barrels B1 NE Perv.
35	Combine	0.000	5	n/a	0	33, 34	------	------	Total to UG Barrels B1 NE
36	Reservoir	0.000	5	n/a	0	35	0.00	0.000	Post UG Barrels B1 NE
38	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Barrels B1 SE Imp.
39	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Barrels B1 SE Perv.

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
40	Combine	0.000	5	n/a	0	38, 39	------	------	Total to UG Barrels B1 SE
41	Reservoir	0.000	5	n/a	0	40	0.00	0.000	Post UG Barrels B1 SE
43	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Barrels South Imp.
44	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Barrels South Perv.
45	Combine	0.000	5	n/a	0	43, 44	------	------	Total to UG Barrels South
46	Reservoir	0.000	5	n/a	0	45	0.00	0.000	Post UG Barrels South
48	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B1 NW Imp.
49	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B1 NW Perv.
50	Combine	0.000	5	n/a	0	48, 49	------	------	Total to UG Inf B1 NW
51	Reservoir	0.000	5	n/a	0	50	0.00	0.000	Post Ug Inf B1 NW
53	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B1 SW Imp.
54	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B1 SW Perv.
55	Combine	0.000	5	n/a	0	53, 54	------	------	Total to UG Inf B1 SW
56	Reservoir	0.000	5	n/a	0	55	0.00	0.000	Post Ug Inf B1 SW
58	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B1 South Imp.
59	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B1 South Perv.
60	Combine	0.000	5	n/a	0	58, 59	------	------	Total to UG Inf B1 South
61	Reservoir	0.000	5	n/a	0	60	0.00	0.000	Post UG Inf B1 South
63	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B2 Imp.
64	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B2 Perv.
65	Combine	0.000	5	n/a	0	63, 64	------	------	Total to SA UG Inf B2
66	Reservoir	0.000	5	n/a	0	65	0.00	0.000	Post Ug Inf B2
68	SCS Runoff	0.000	5	n/a	0	----	------	------	SA UG Inf B3 Imp.
69	Reservoir	0.000	5	n/a	0	68	0.00	0.000	Post UG Inf B3
71	SCS Runoff	0.000	5	n/a	0	----	------	------	SA Stream Undetained Imp.
72	SCS Runoff	0.000	5	n/a	0	----	------	------	SA Stream Undetained Perv.
73	Combine	0.000	5	n/a	0	71, 72	------	------	Total to Stream Undetained
75	Combine	0.000	5	n/a	0	11, 16, 21, 26, 31,	------	------	Total AG Basins
76	Combine	0.000	5	n/a	0	36, 41, 46,	------	------	Total UG Barrels
77	Combine	0.000	5	n/a	0	51, 56, 61, 66, 69,	------	------	Total UG Inf Basins

---

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph description
79	Combine	0.000	5	n/a	0	73, 75, 76, 77,	------	------	Prop. POA Stream / Site

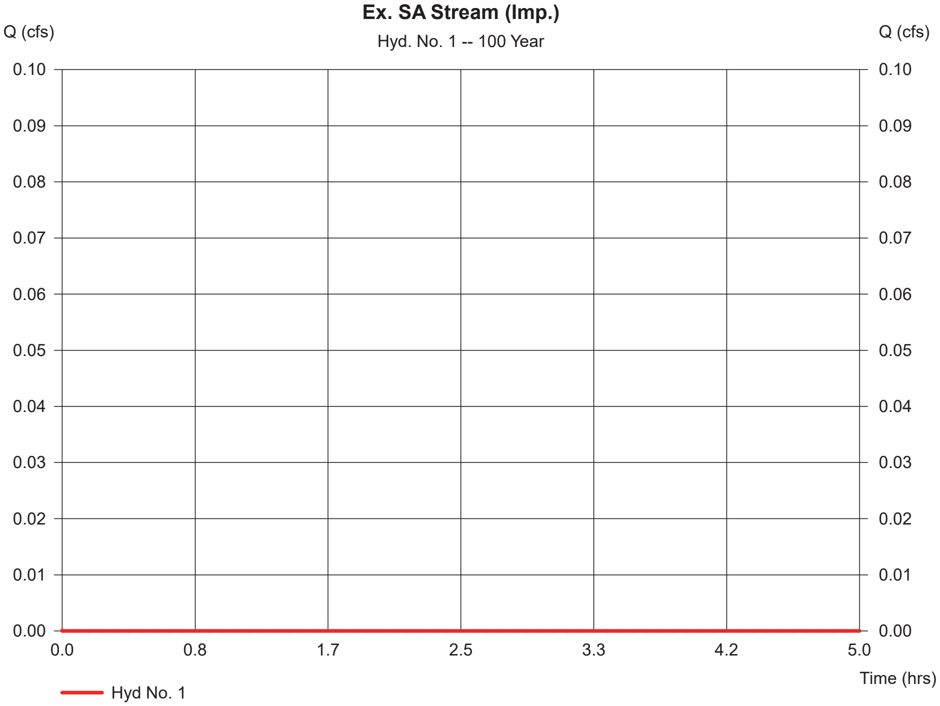
Hydrograph Report

Hyd. No. 1

Ex. SA Stream (Imp.)

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 22.560 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 16.20 min
Distribution = Type III
Shape factor = 484



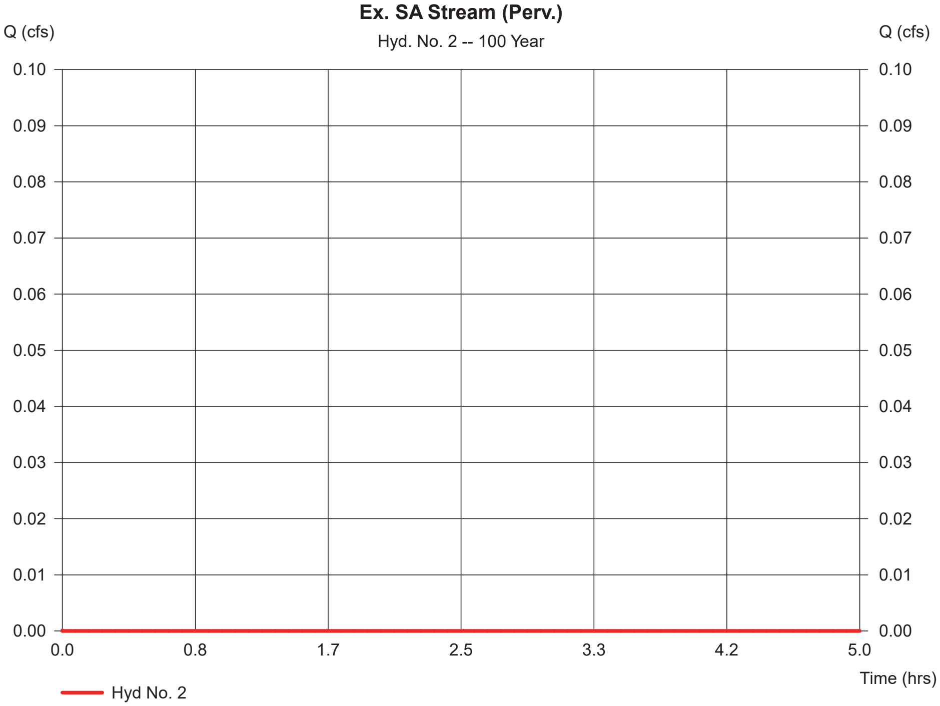
Hydrograph Report

Hyd. No. 2

Ex. SA Stream (Perv.)

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 33.110 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 37
Hydraulic length = 0 ft
Time of conc. (Tc) = 16.20 min
Distribution = Type III
Shape factor = 484

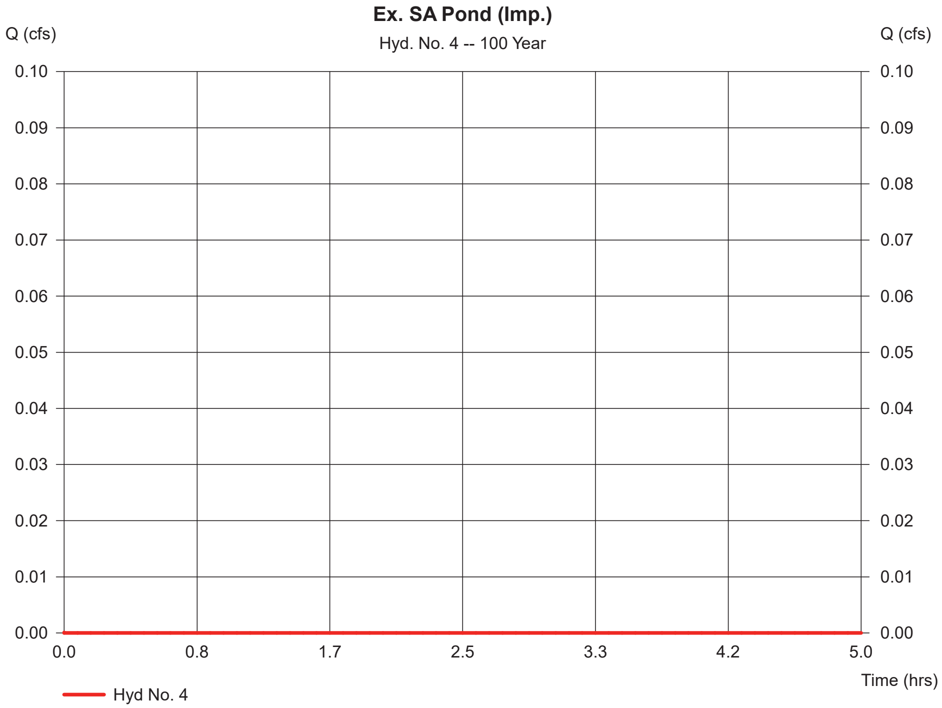


Hydrograph Report

Hyd. No. 4

Ex. SA Pond (Imp.)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 2.800 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 8.91 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

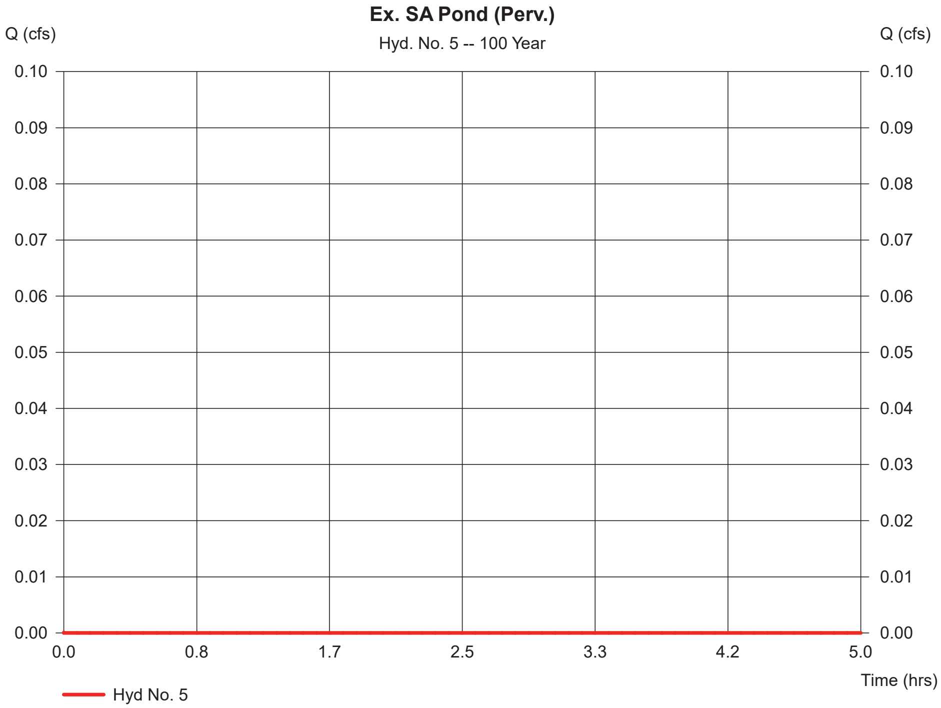


Hydrograph Report

Hyd. No. 5

Ex. SA Pond (Perv.)

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 3.590 ac	Curve number	= 39
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 8.91 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

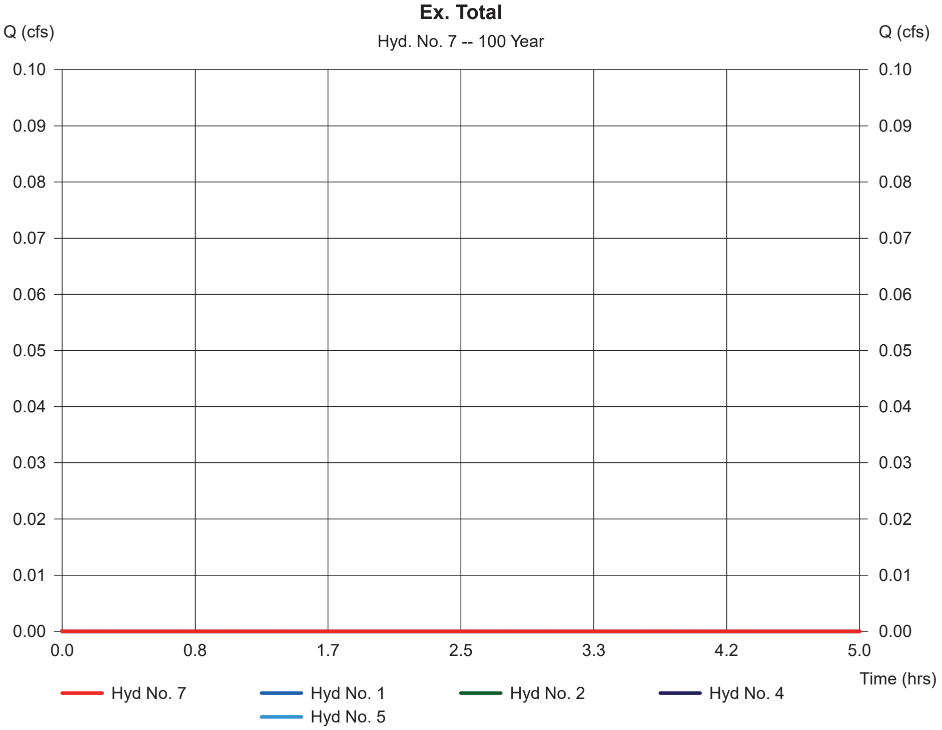


Hydrograph Report

Hyd. No. 7

Ex. Total

Hydrograph type	= Combine	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Inflow hyds.	= 1, 2, 4, 5	Contrib. drain. area	= 62.060 ac

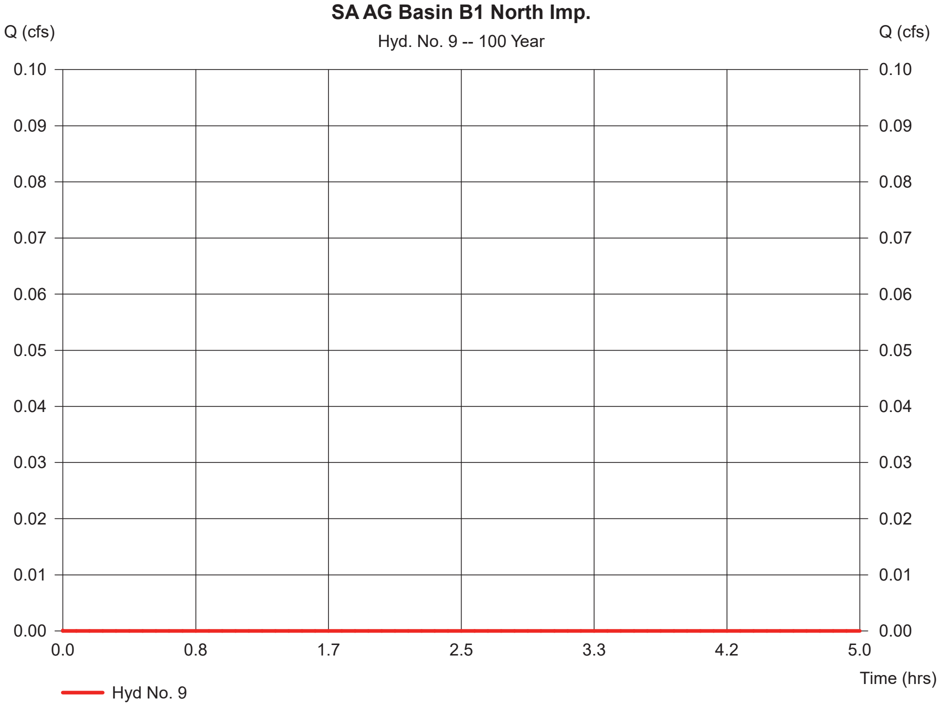


Hydrograph Report

Hyd. No. 9

SA AG Basin B1 North Imp.

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 2.100 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 8.91 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



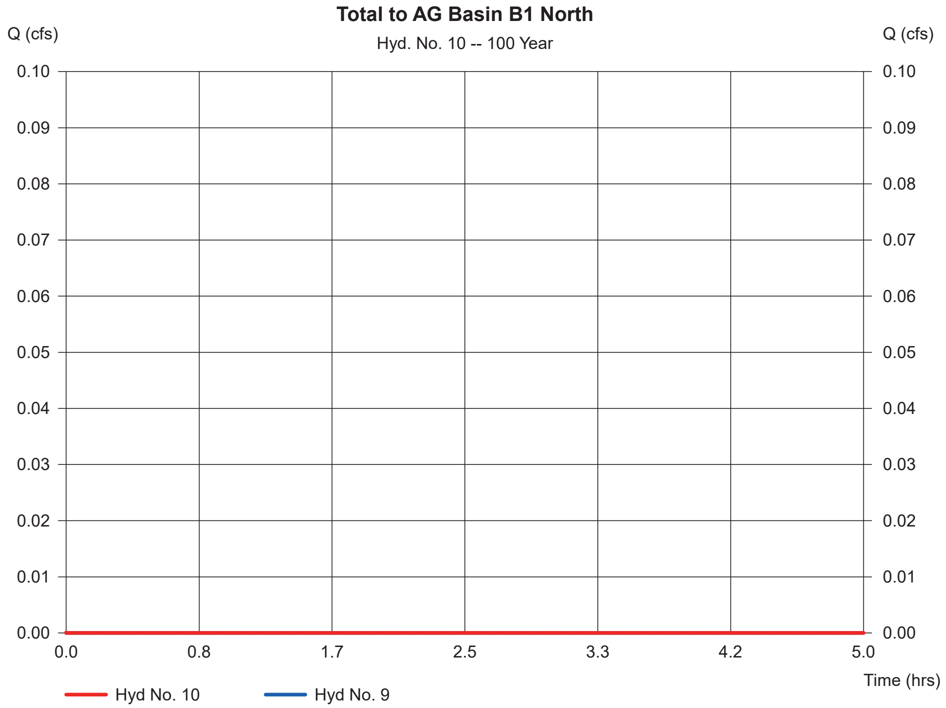
Hydrograph Report

Hyd. No. 10

Total to AG Basin B1 North

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyds. = 9

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 2.100 ac



Hydrograph Report

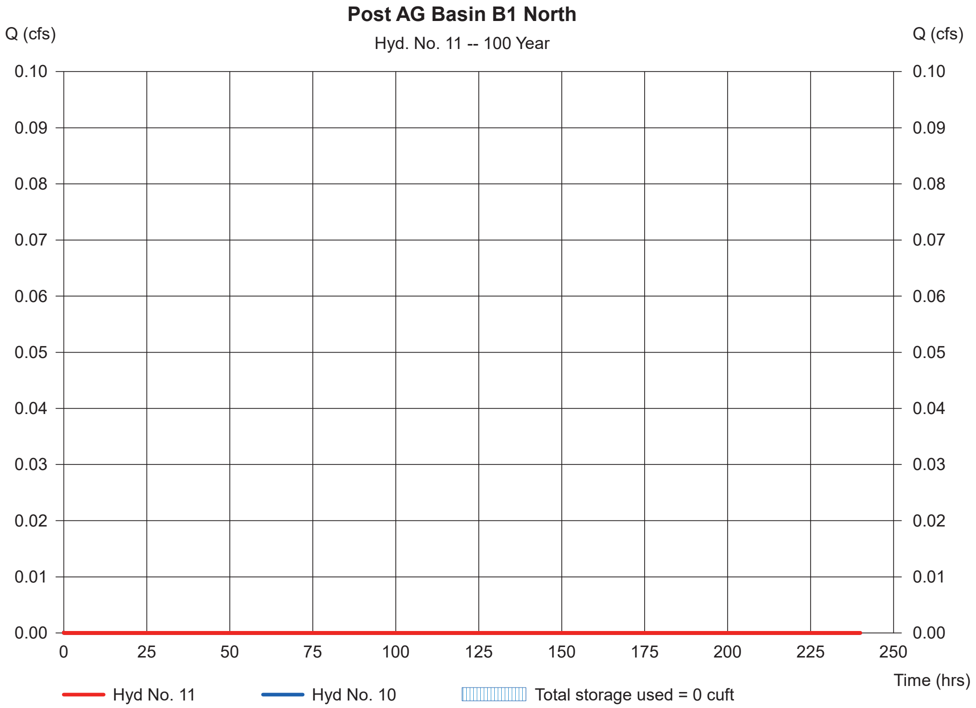
Hyd. No. 11

Post AG Basin B1 North

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyd. No. = 10 - Total to AG Basin B1 North
Reservoir name = AG Basin B1 North

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



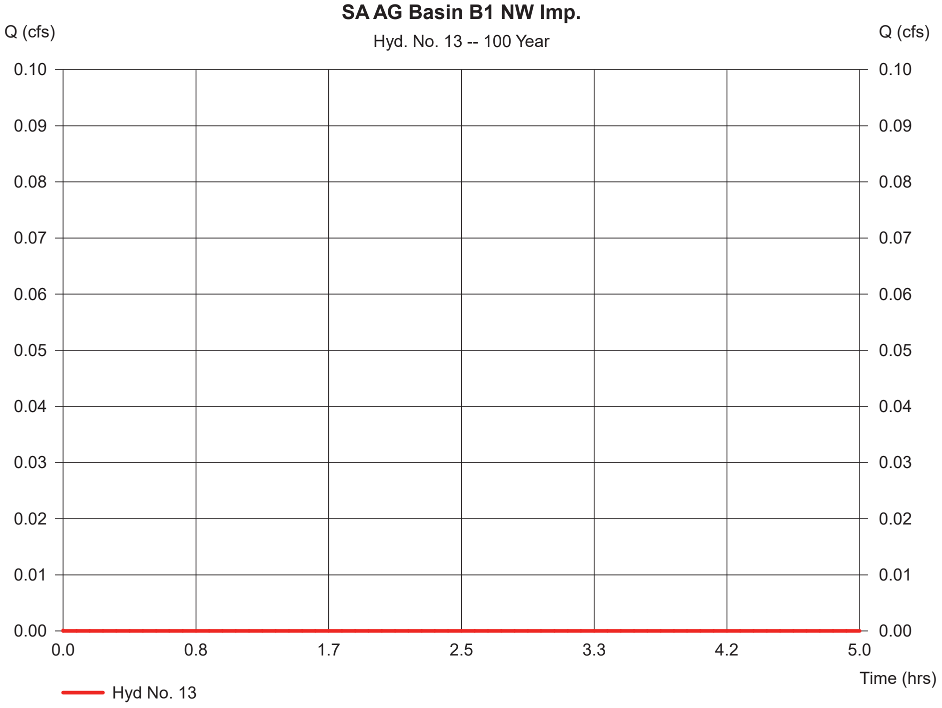
Hydrograph Report

Hyd. No. 13

SA AG Basin B1 NW Imp.

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 1.010 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484


SA AG Basin B1 NW Imp.

Hyd. No. 13 -- 100 Year

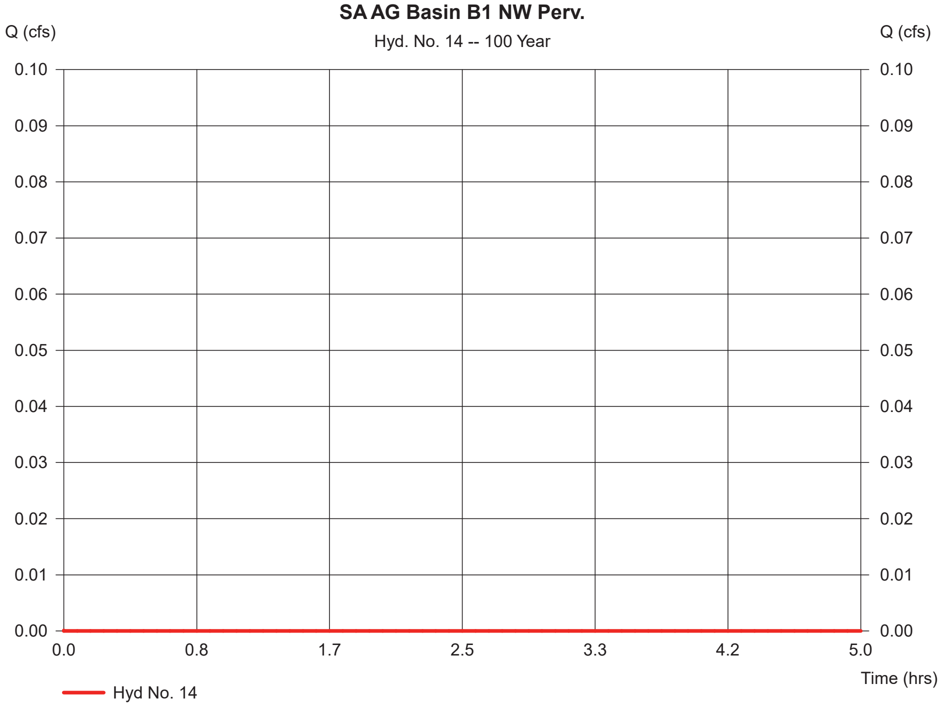
Hydrograph Report

Hyd. No. 14

SA AG Basin B1 NW Perv.

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 0.520 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 62
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484


SA AG Basin B1 NW Perv.

Hyd. No. 14 -- 100 Year

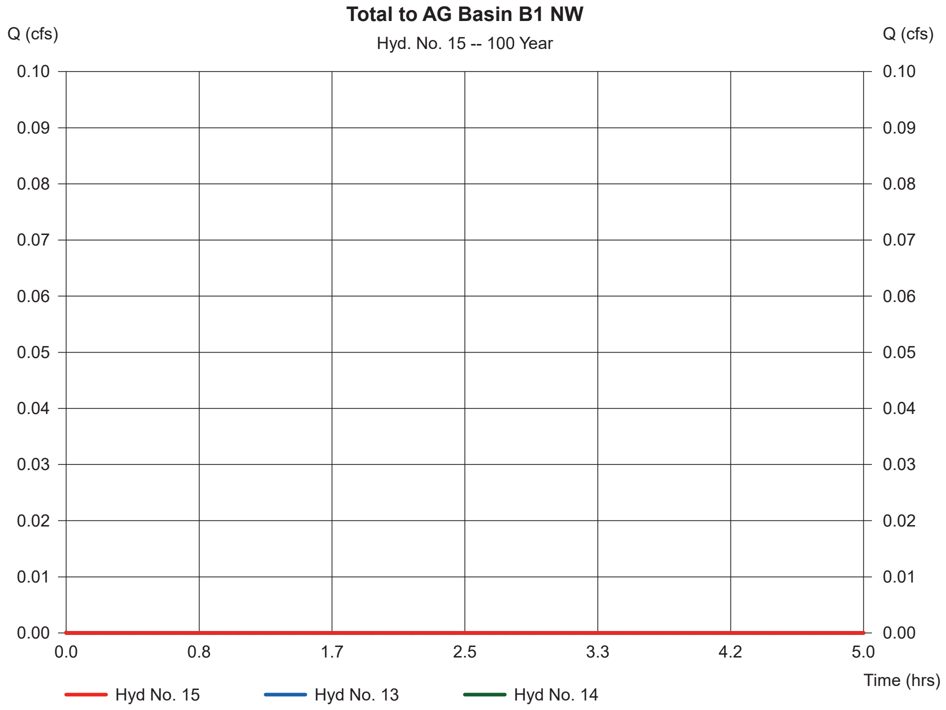
Hydrograph Report

Hyd. No. 15

Total to AG Basin B1 NW

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyds. = 13, 14

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 1.530 ac



Hydrograph Report

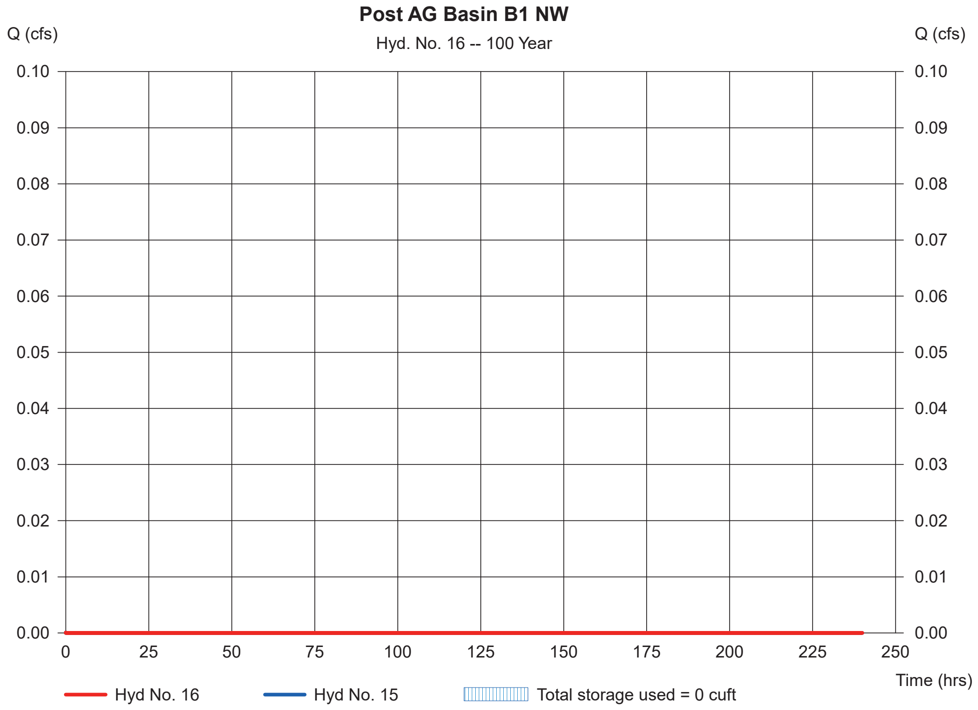
Hyd. No. 16

Post AG Basin B1 NW

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyd. No. = 15 - Total to AG Basin B1 NW
Reservoir name = AG Basin B1 Northwest

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



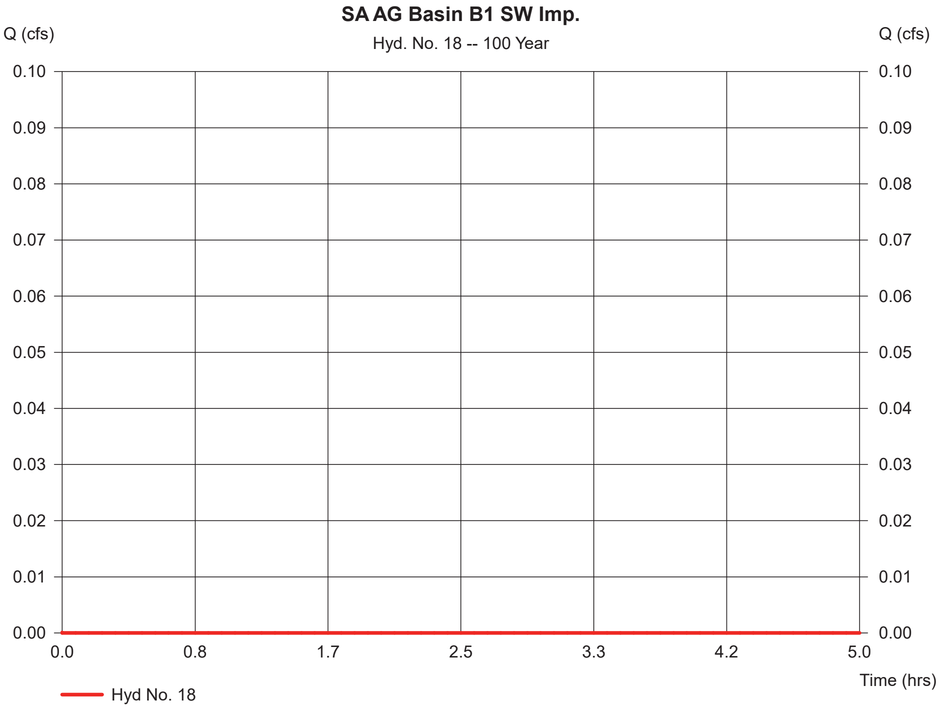
Hydrograph Report

Hyd. No. 18

SA AG Basin B1 SW Imp.

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 0.420 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



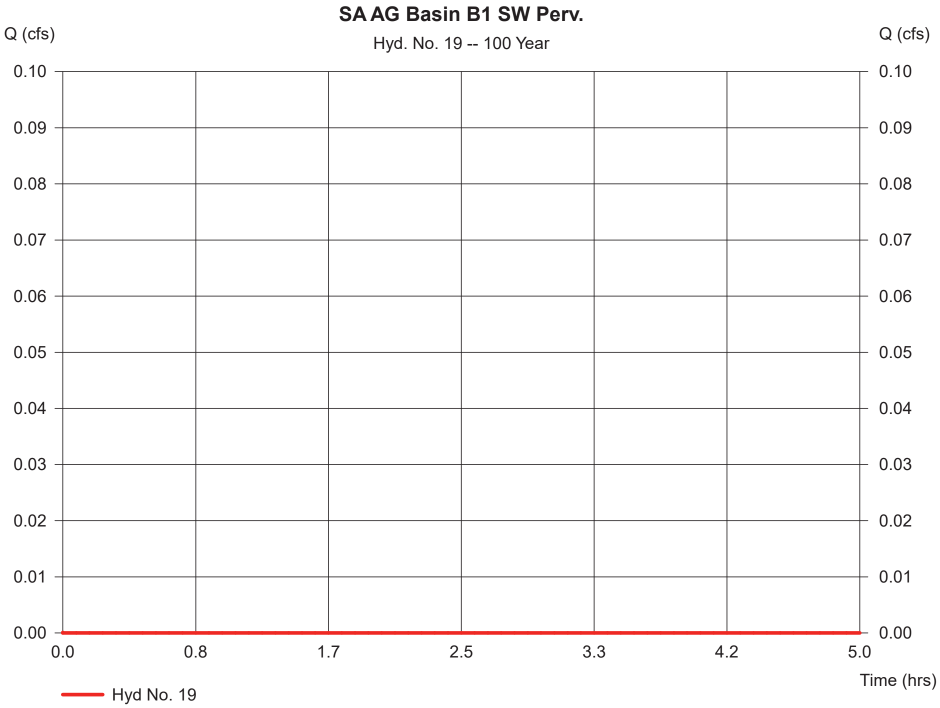
Hydrograph Report

Hyd. No. 19

SA AG Basin B1 SW Perv.

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 0.310 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 39
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



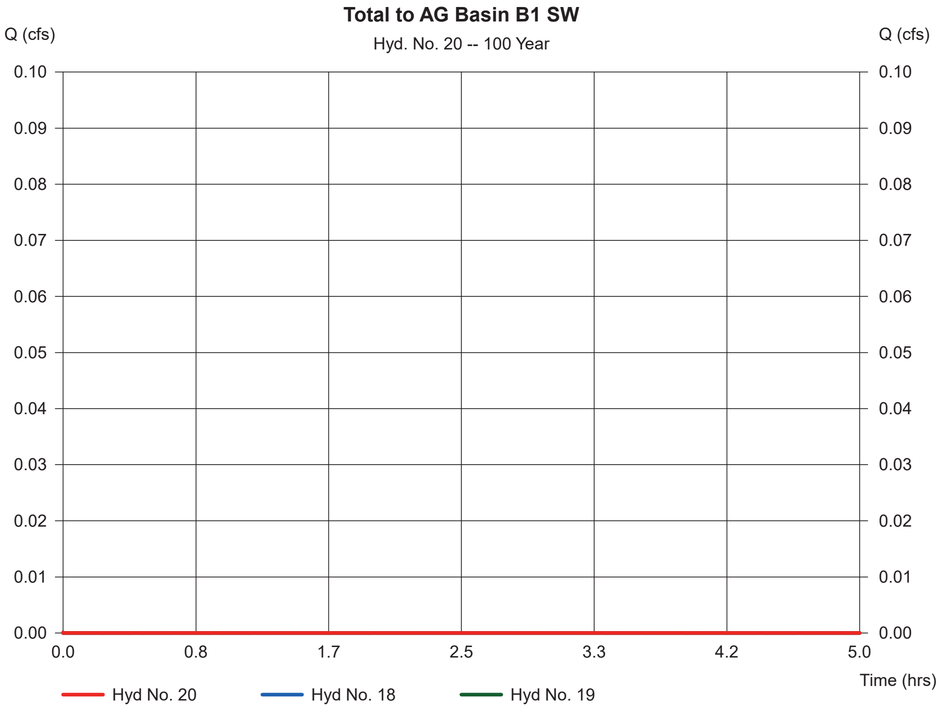
Hydrograph Report

Hyd. No. 20

Total to AG Basin B1 SW

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyds. = 18, 19

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 0.730 ac



Hydrograph Report

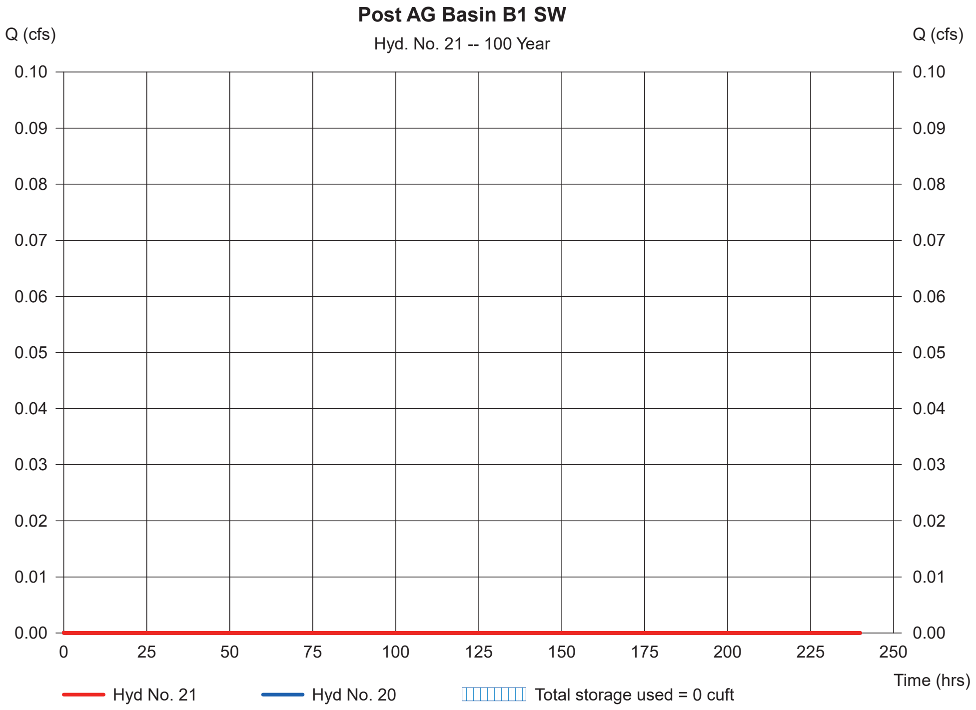
Hyd. No. 21

Post AG Basin B1 SW

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyd. No. = 20 - Total to AG Basin B1 SW
Reservoir name = AG Basin B1 Southwest

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.

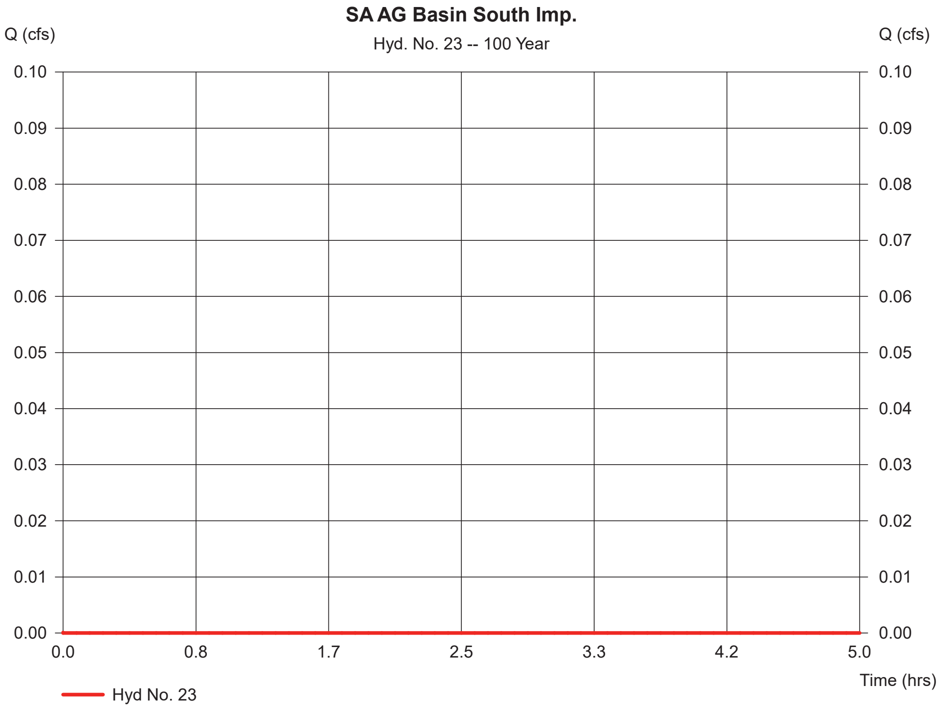


Hyd. No. 23

SA AG Basin South Imp.

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 2.060 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484

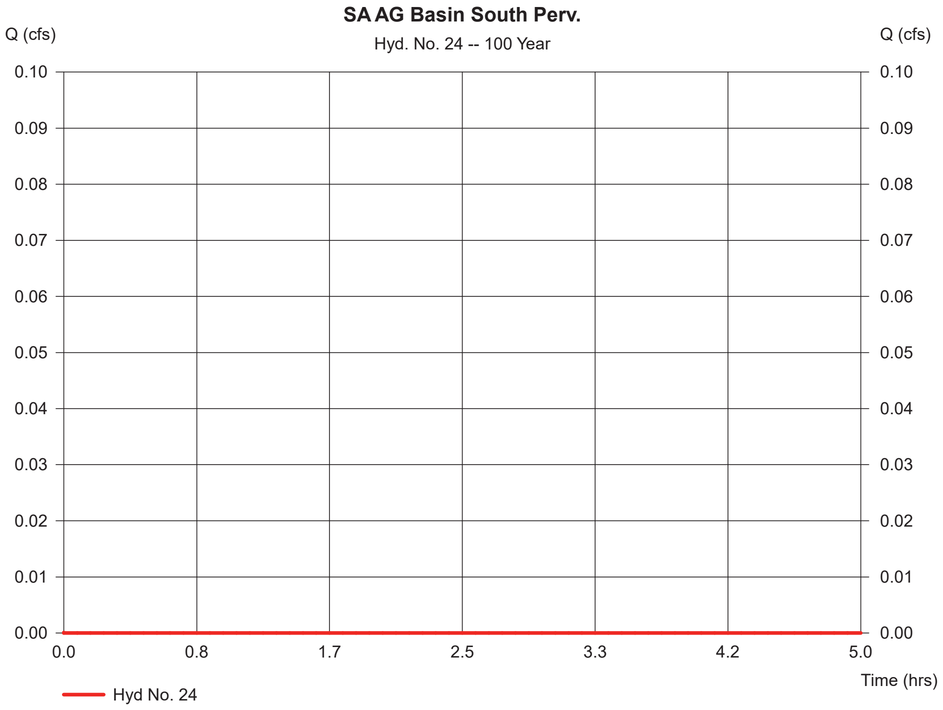


Hyd. No. 24

SA AG Basin South Perv.

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 0.920 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 39
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



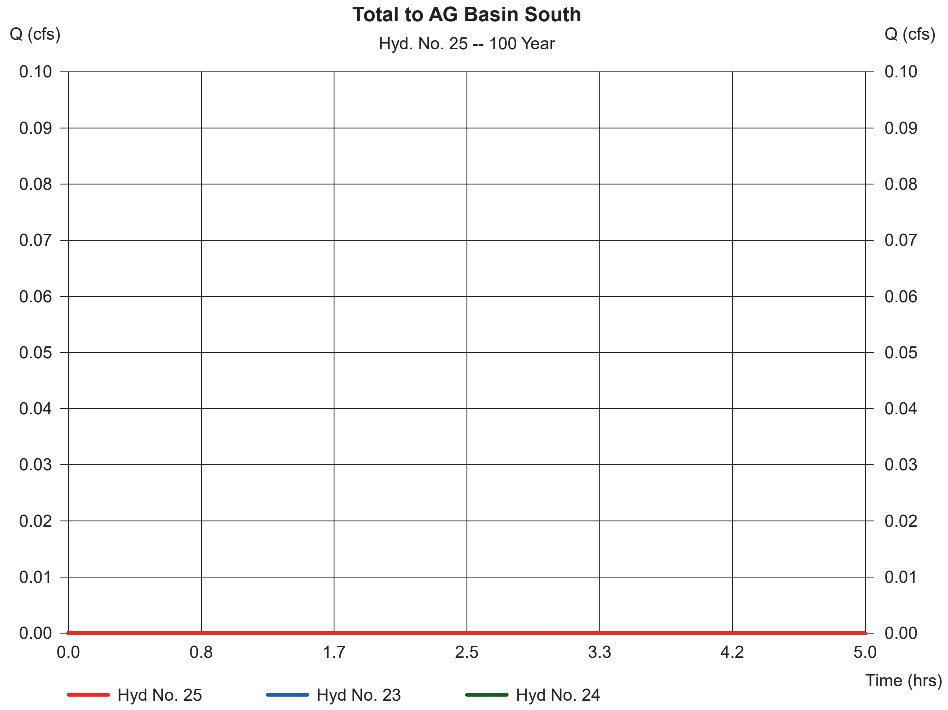
Hydrograph Report

Hyd. No. 25

Total to AG Basin South

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyds. = 23, 24

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 2.980 ac



Hydrograph Report

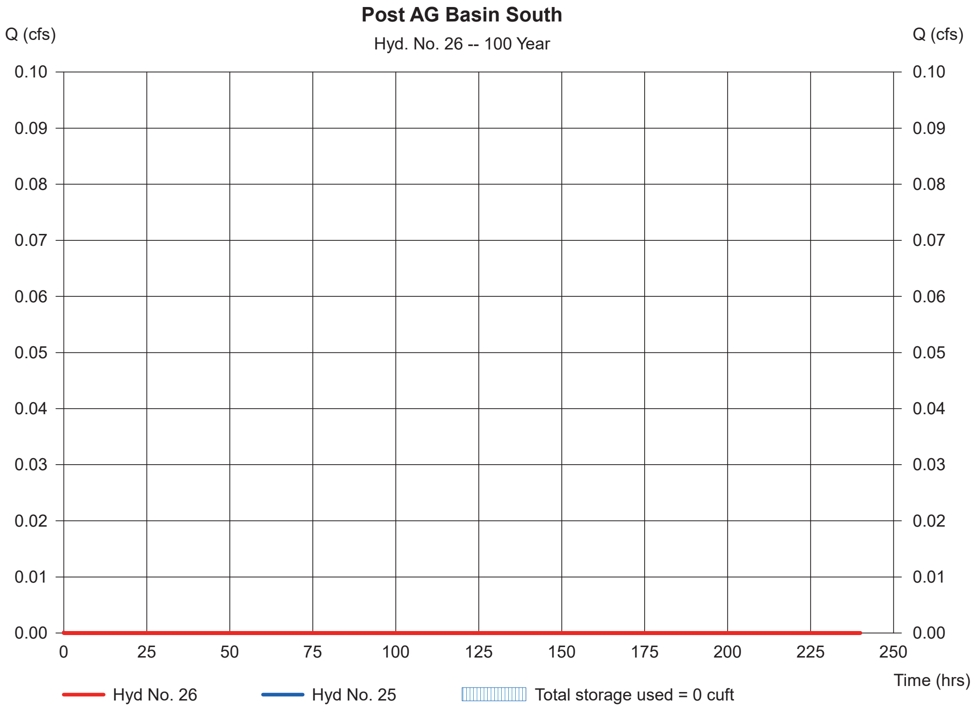
Hyd. No. 26

Post AG Basin South

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyd. No. = 25 - Total to AG Basin South
Reservoir name = AG Basin South

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.

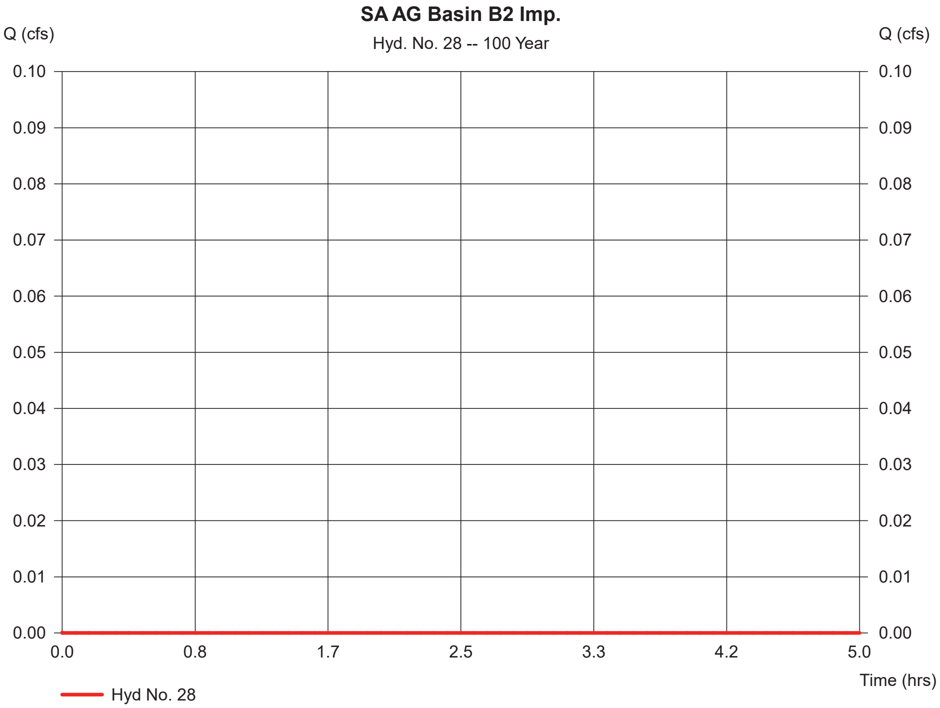


Hydrograph Report

Hyd. No. 28

SA AG Basin B2 Imp.

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 2.150 ac	Curve number	= 98
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 8.91 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484

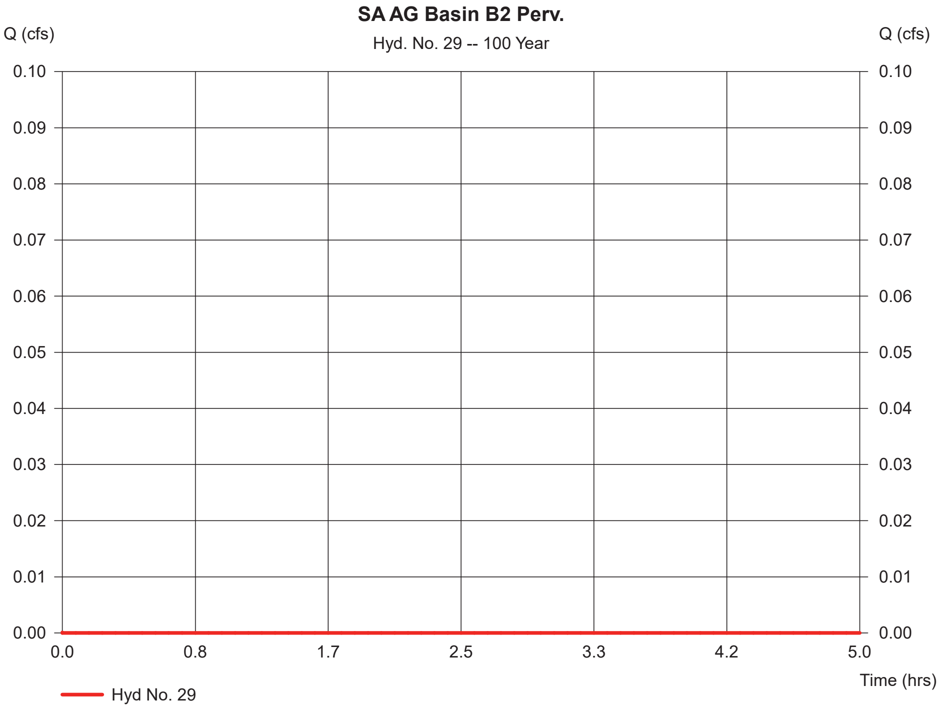


Hydrograph Report

Hyd. No. 29

SA AG Basin B2 Perv.

Hydrograph type	= SCS Runoff	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Drainage area	= 0.620 ac	Curve number	= 43
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 10.00 min
Total precip.	= 8.91 in	Distribution	= Type III
Storm duration	= 24 hrs	Shape factor	= 484



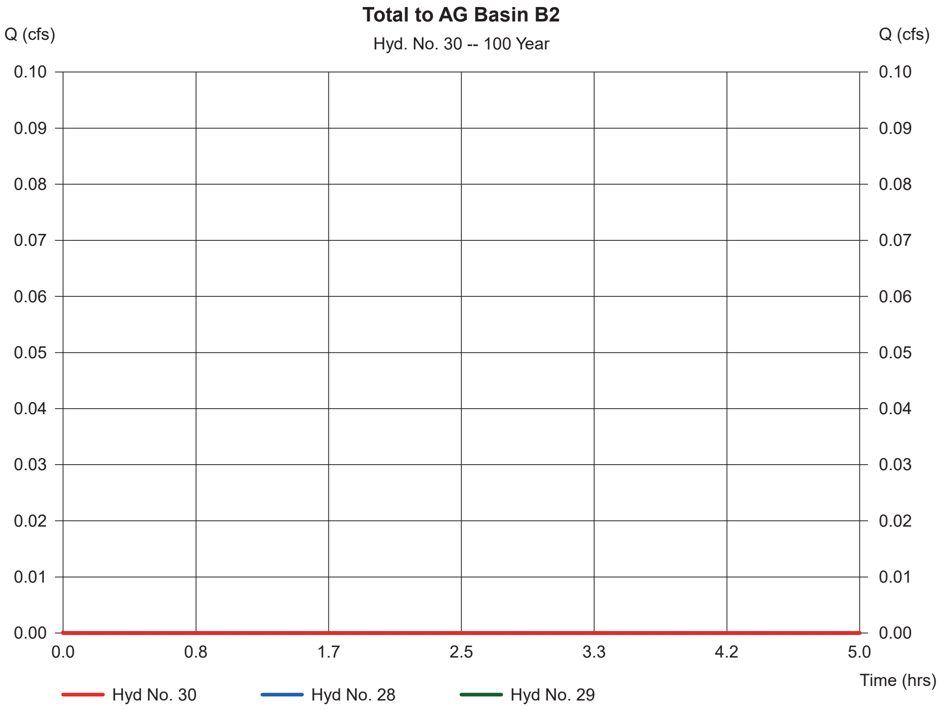
Hydrograph Report

Hyd. No. 30

Total to AG Basin B2

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyds. = 28, 29

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 2.770 ac



Hydrograph Report

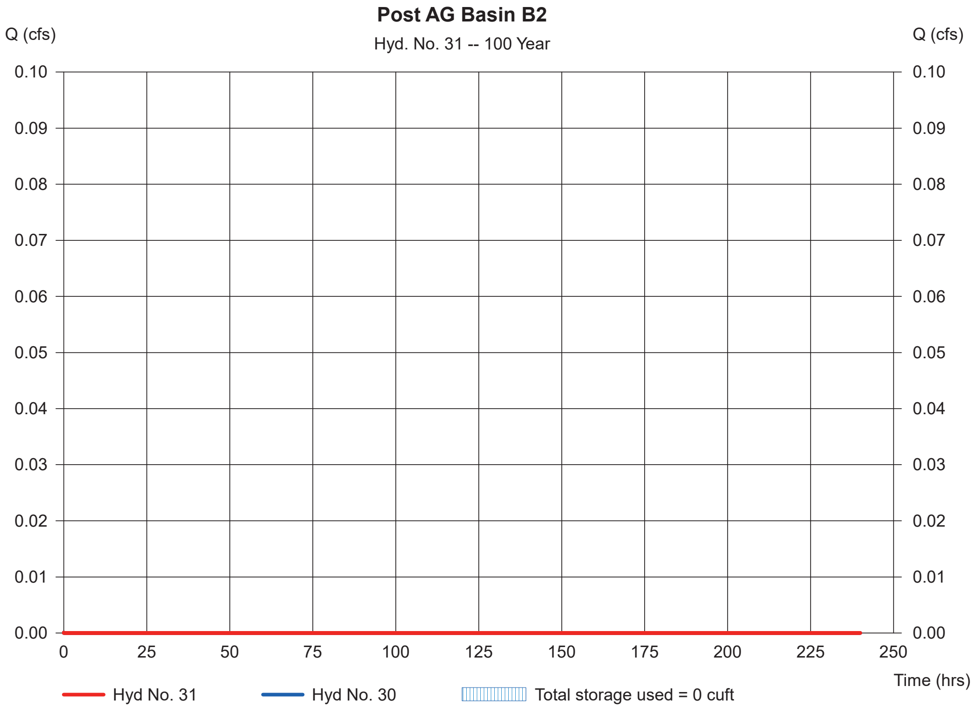
Hyd. No. 31

Post AG Basin B2

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyd. No. = 30 - Total to AG Basin B2
Reservoir name = AG Basin B2

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



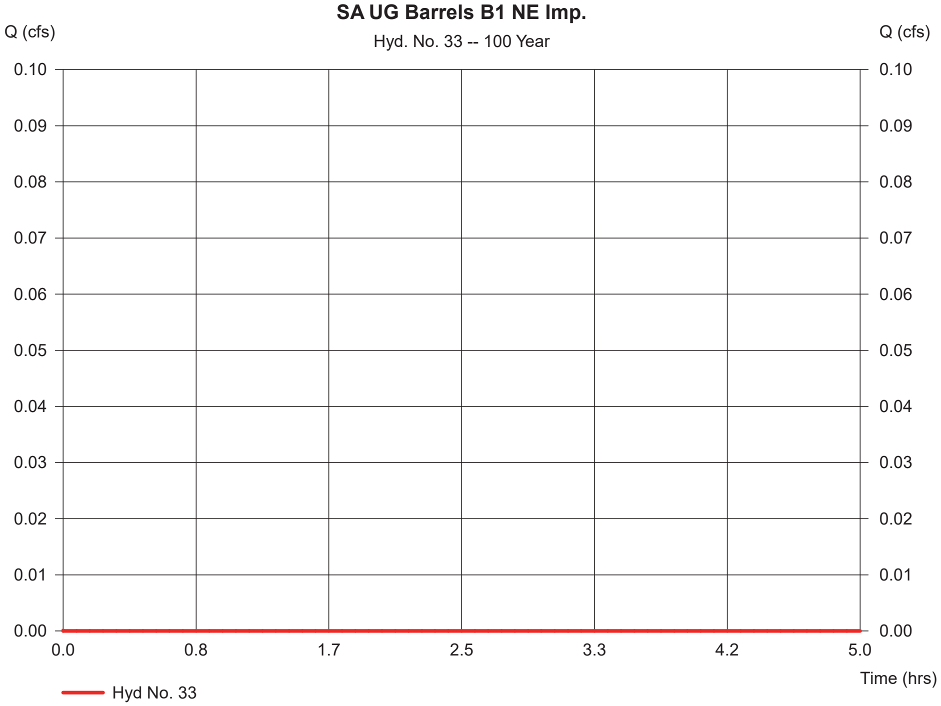
Hydrograph Report

Hyd. No. 33

SA UG Barrels B1 NE Imp.

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 8.080 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



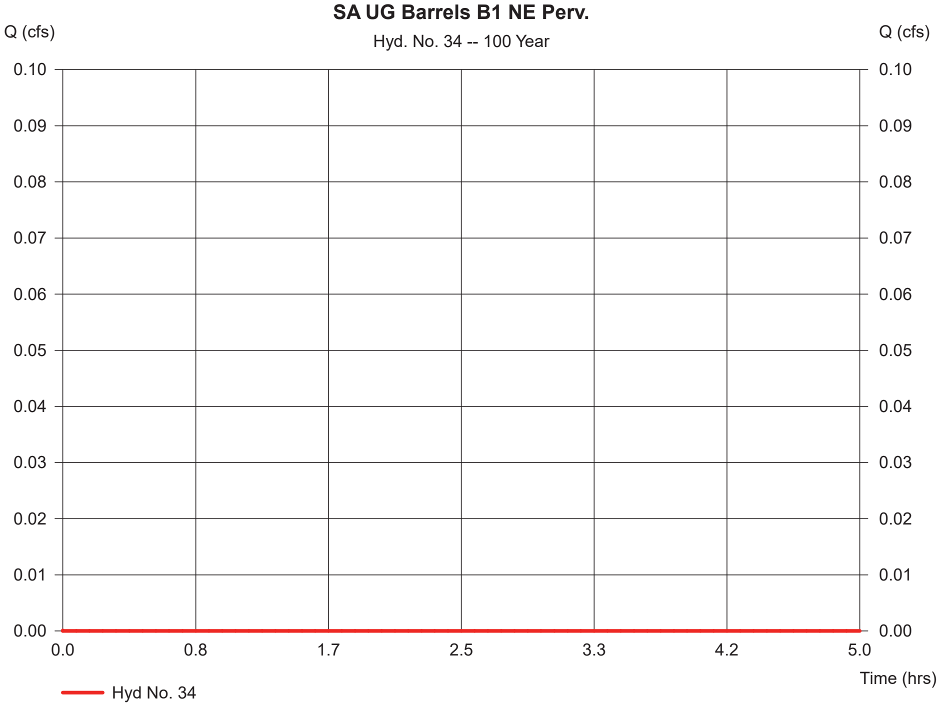
Hydrograph Report

Hyd. No. 34

SA UG Barrels B1 NE Perv.

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 0.140 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 64
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



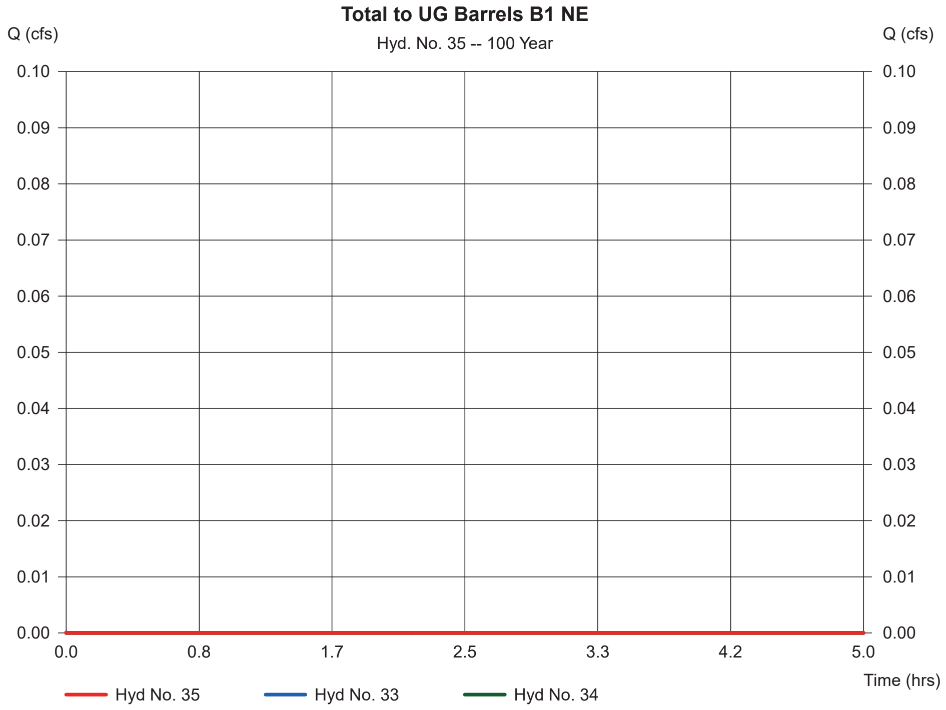
Hydrograph Report

Hyd. No. 35

Total to UG Barrels B1 NE

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyds. = 33, 34

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 8.220 ac



Hydrograph Report

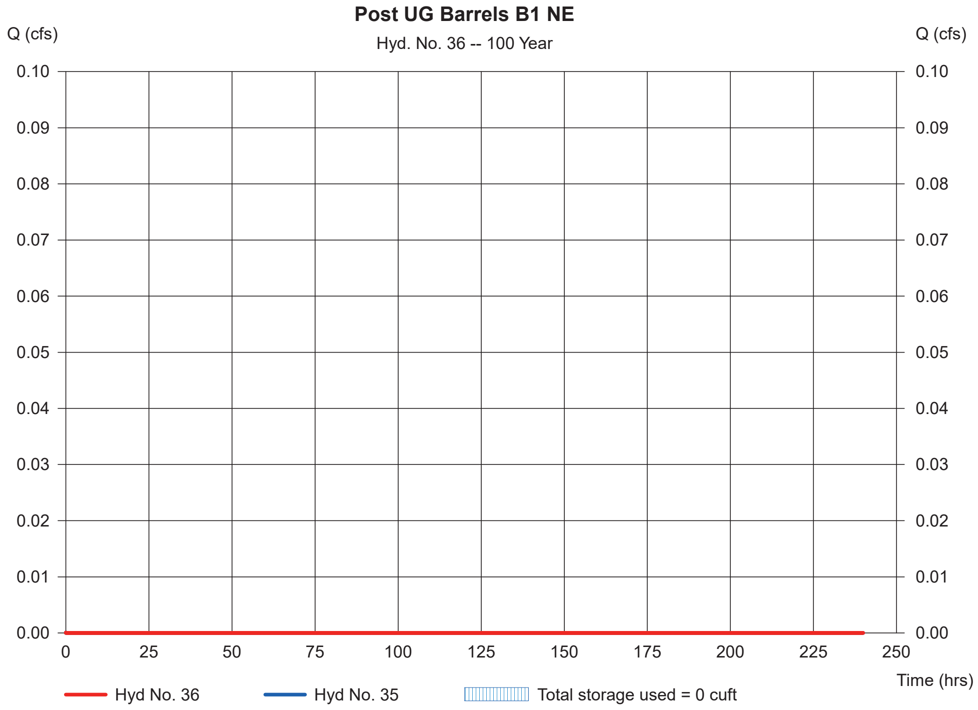
Hyd. No. 36

Post UG Barrels B1 NE

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyd. No. = 35 - Total to UG Barrels B1 NE
Reservoir name = UG BARRELS B1 Northeast

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



Hydrograph Report

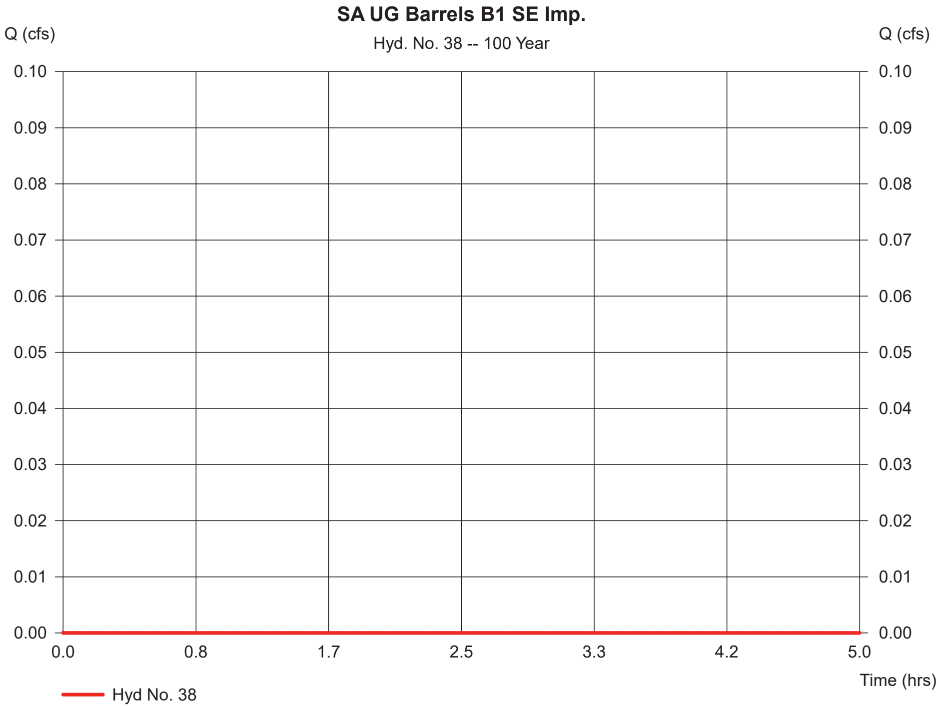
Hydraflow Hydrographs by Intelisolve v9.1 Friday, Jan 20, 2023

Hyd. No. 38

SA UG Barrels B1 SE Imp.

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 9.290 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

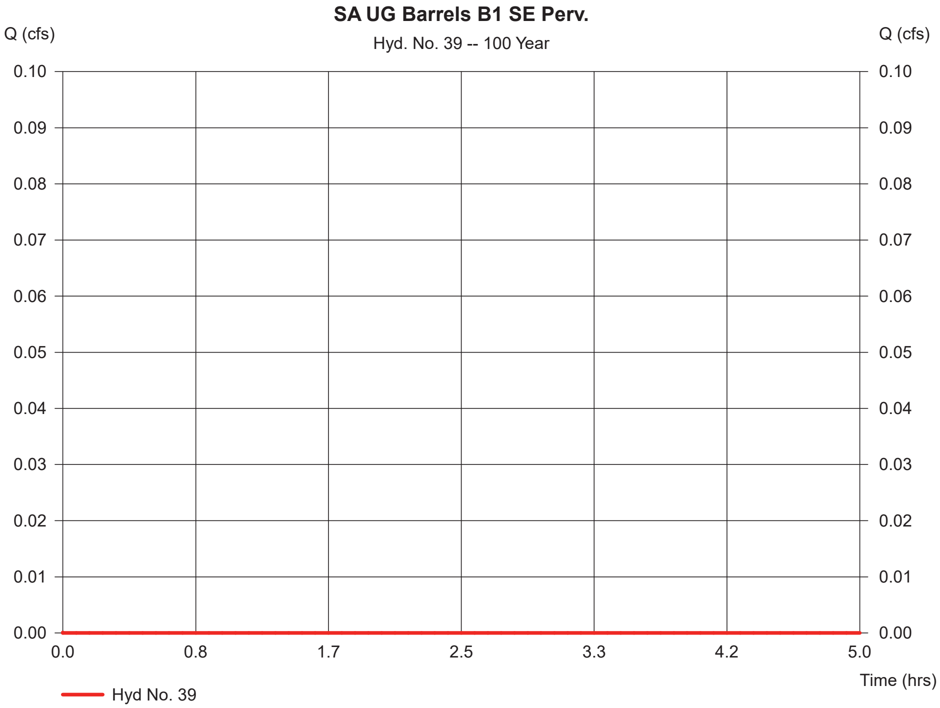
Hydraflow Hydrographs by Intelisolve v9.1 Friday, Jan 20, 2023

Hyd. No. 39

SA UG Barrels B1 SE Perv.

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 0.440 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 46
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



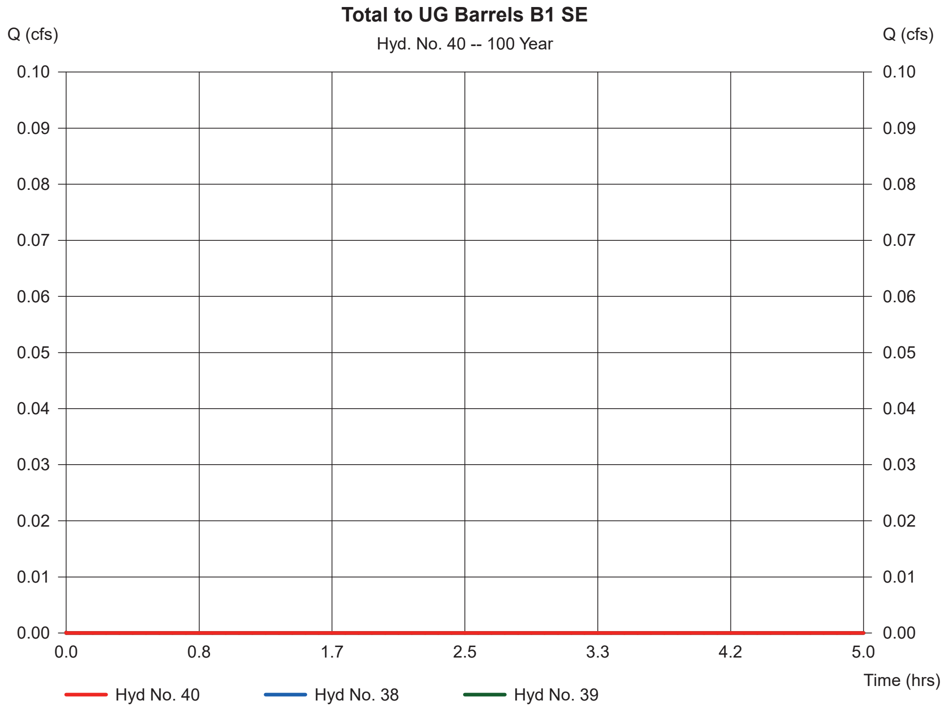
Hydrograph Report

Hyd. No. 40

Total to UG Barrels B1 SE

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyds. = 38, 39

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 9.730 ac



Hydrograph Report

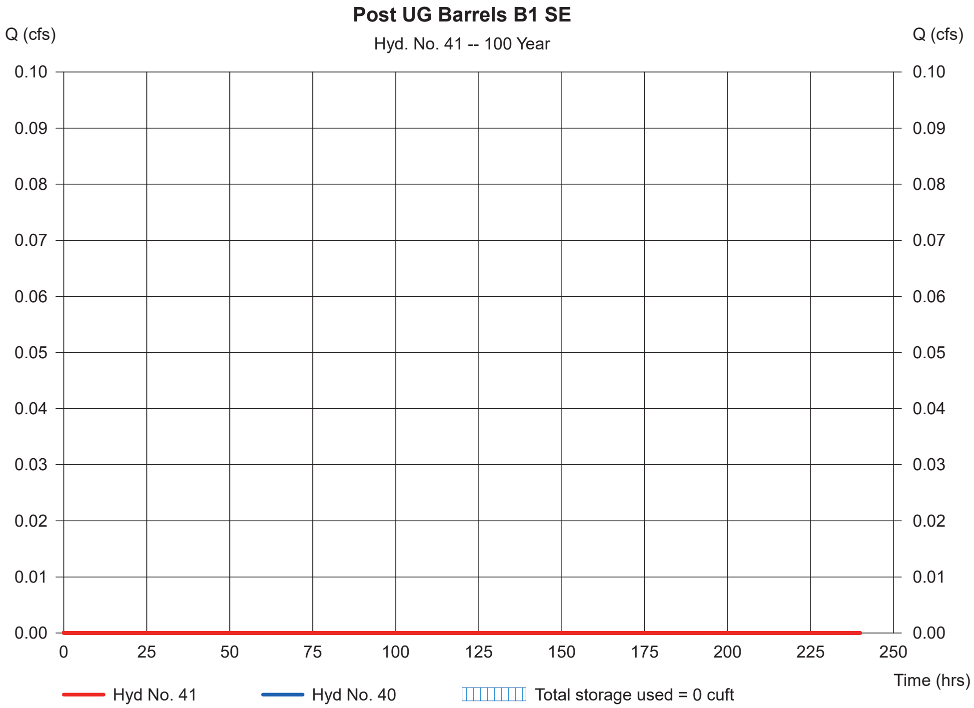
Hyd. No. 41

Post UG Barrels B1 SE

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyd. No. = 40 - Total to UG Barrels B1 SE
Reservoir name = UG BARRELS B1 Southeast

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



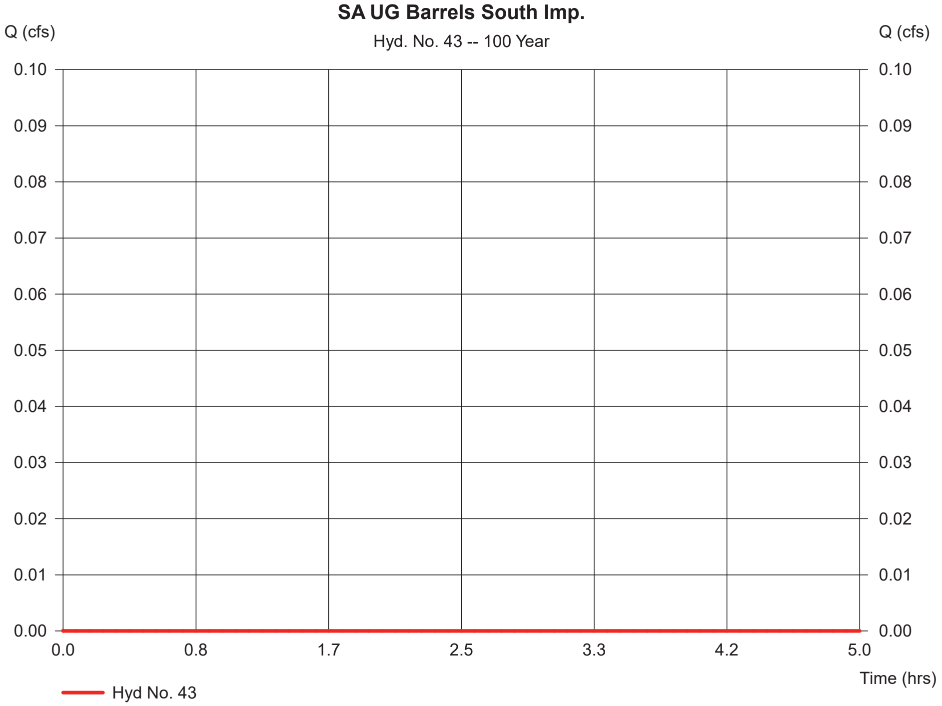
Hydrograph Report

Hyd. No. 43

SA UG Barrels South Imp.

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 1.420 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



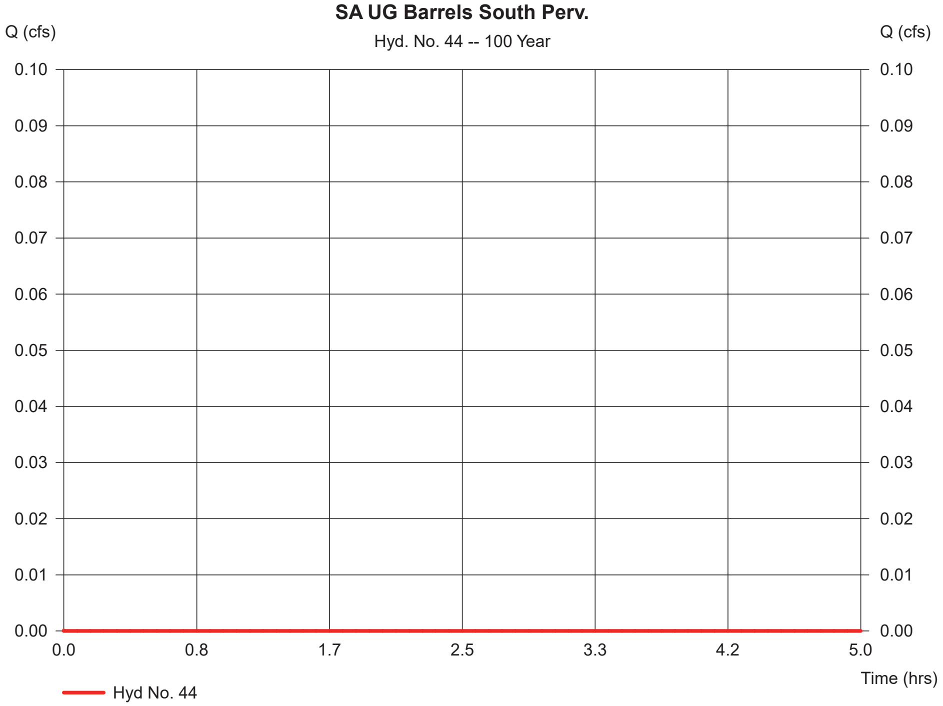
Hydrograph Report

Hyd. No. 44

SA UG Barrels South Perv.

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 0.140 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 64
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



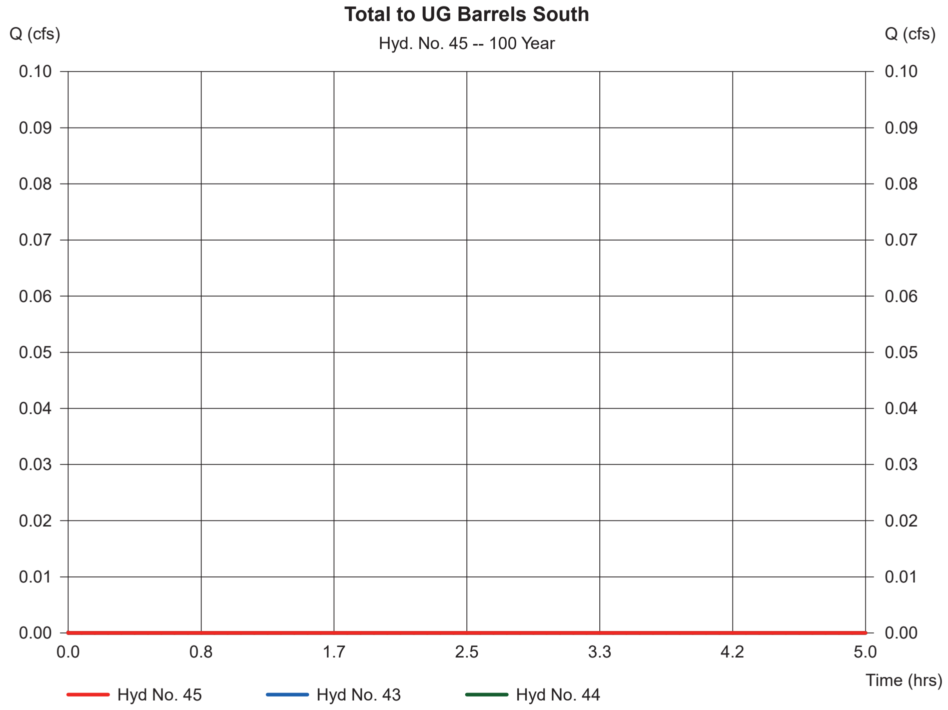
Hydrograph Report

Hyd. No. 45

Total to UG Barrels South

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyds. = 43, 44

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 1.560 ac



Hydrograph Report

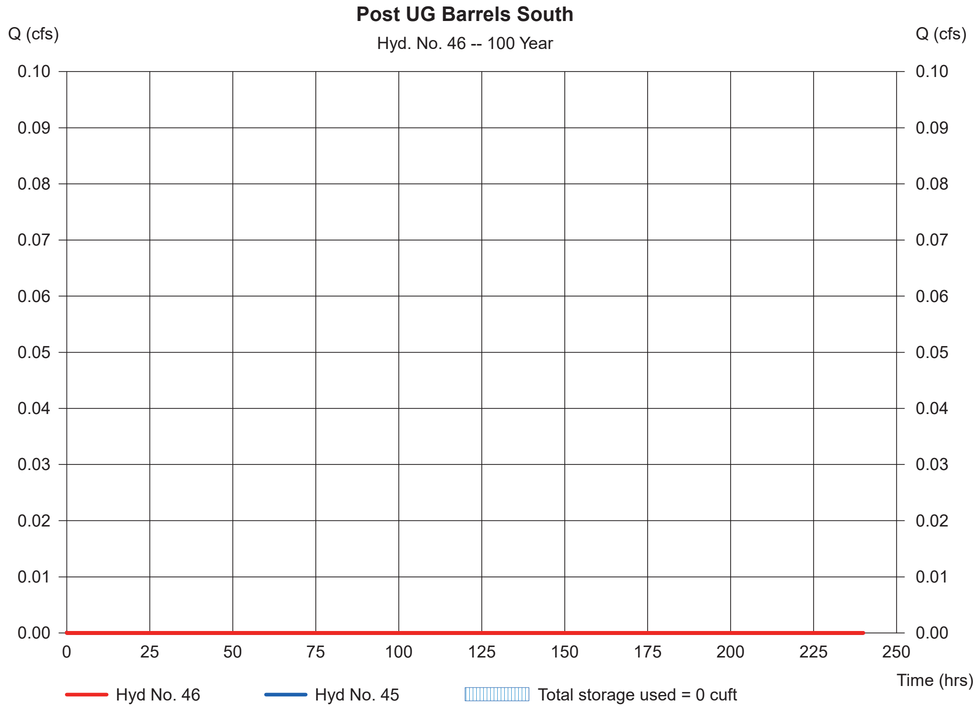
Hyd. No. 46

Post UG Barrels South

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyd. No. = 45 - Total to UG Barrels South
Reservoir name = UG BARRELS South Bldg

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



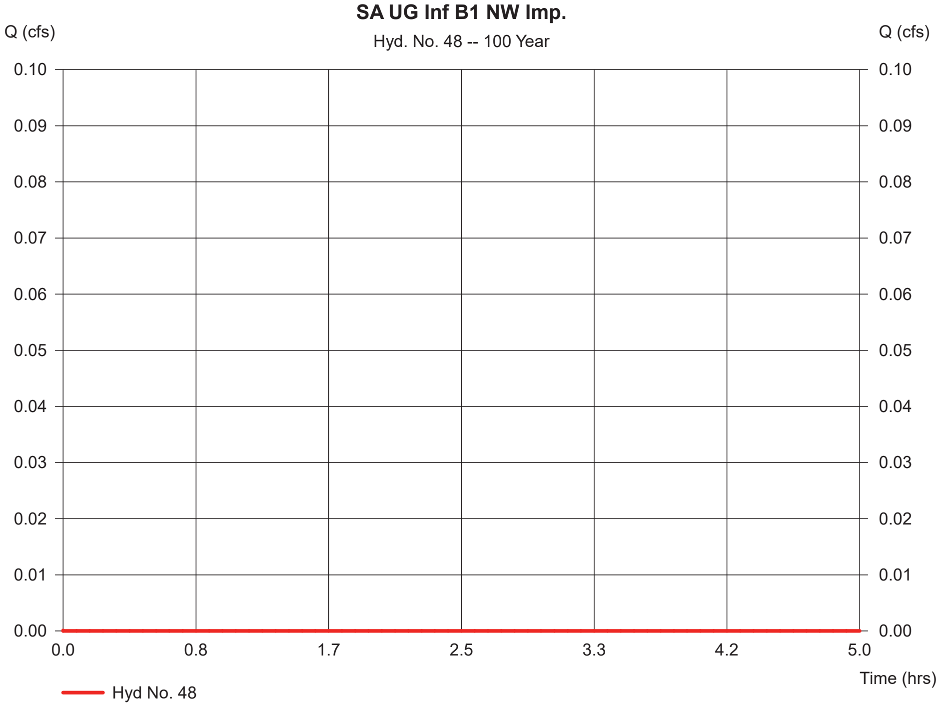
Hydrograph Report

Hyd. No. 48

SA UG Inf B1 NW Imp.

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 9.310 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



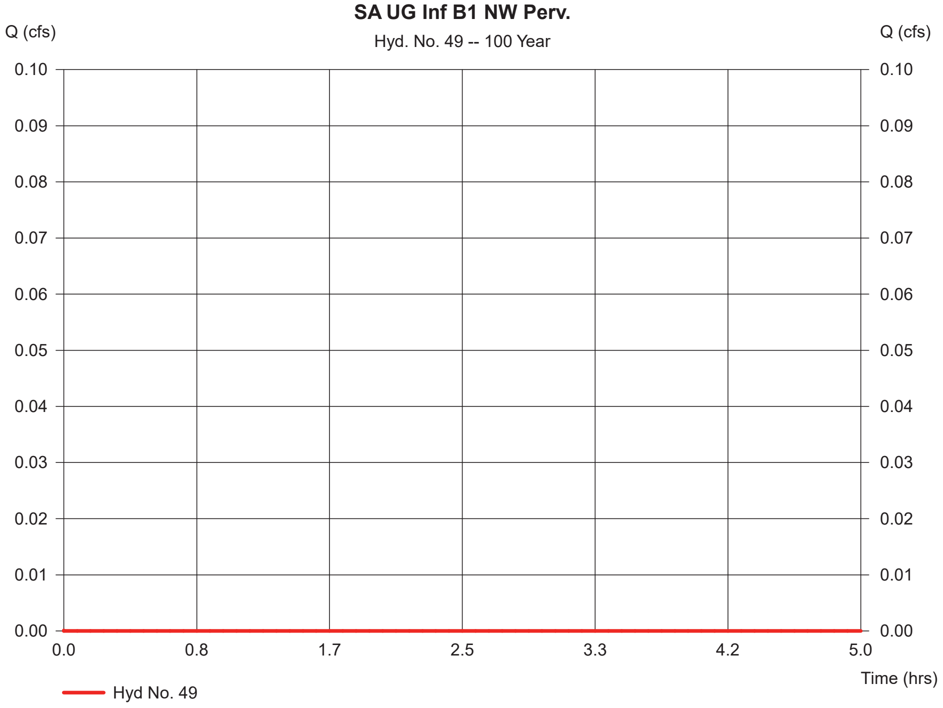
Hydrograph Report

Hyd. No. 49

SA UG Inf B1 NW Perv.

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 0.260 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 39
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



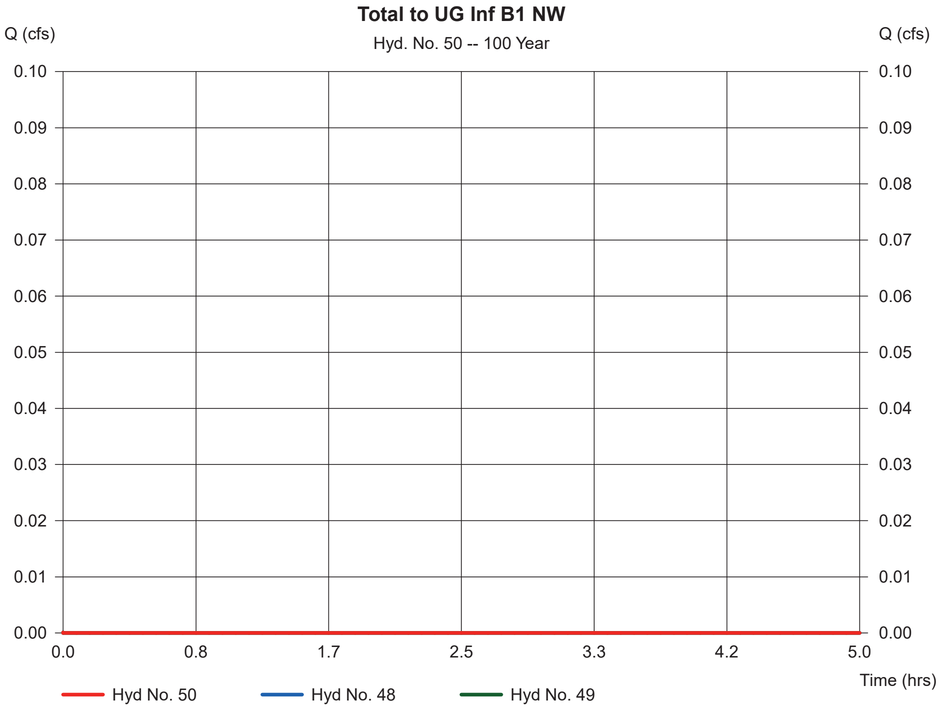
Hydrograph Report

Hyd. No. 50

Total to UG Inf B1 NW

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyds. = 48, 49

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 9.570 ac



Hydrograph Report

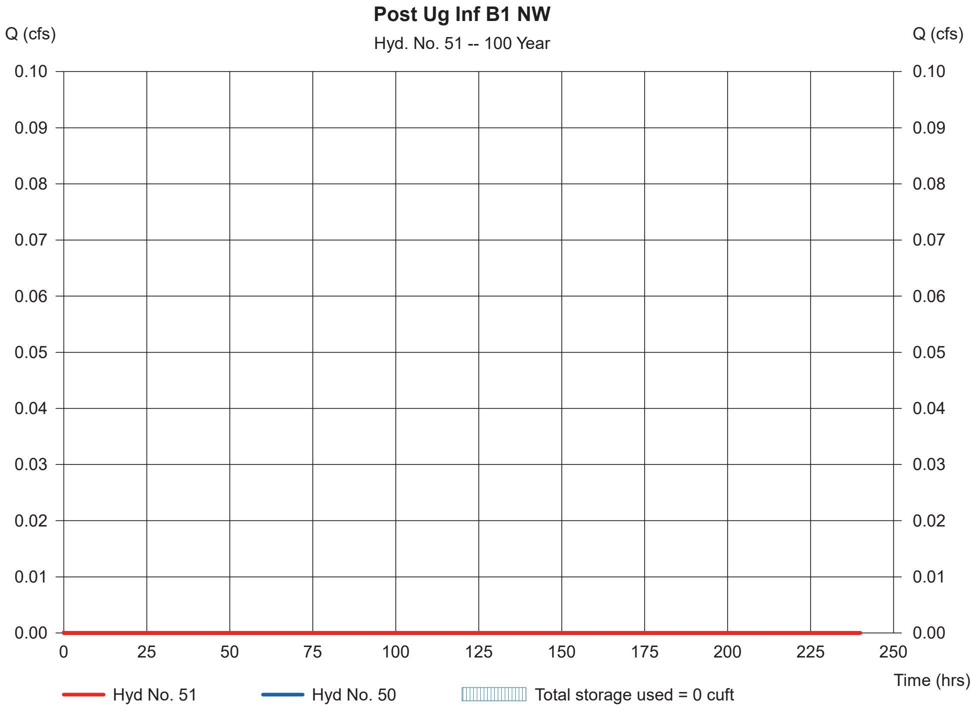
Hyd. No. 51

Post Ug Inf B1 NW

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyd. No. = 50 - Total to UG Inf B1 NW
Reservoir name = UG Inf B1 NW

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



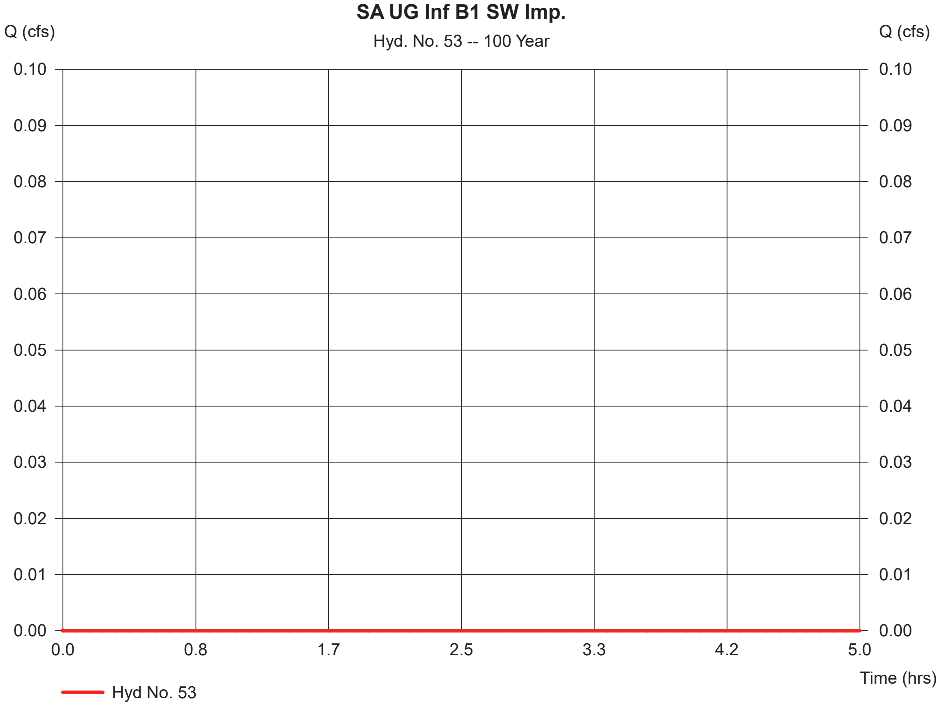
Hydrograph Report

Hyd. No. 53

SA UG Inf B1 SW Imp.

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 7.980 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



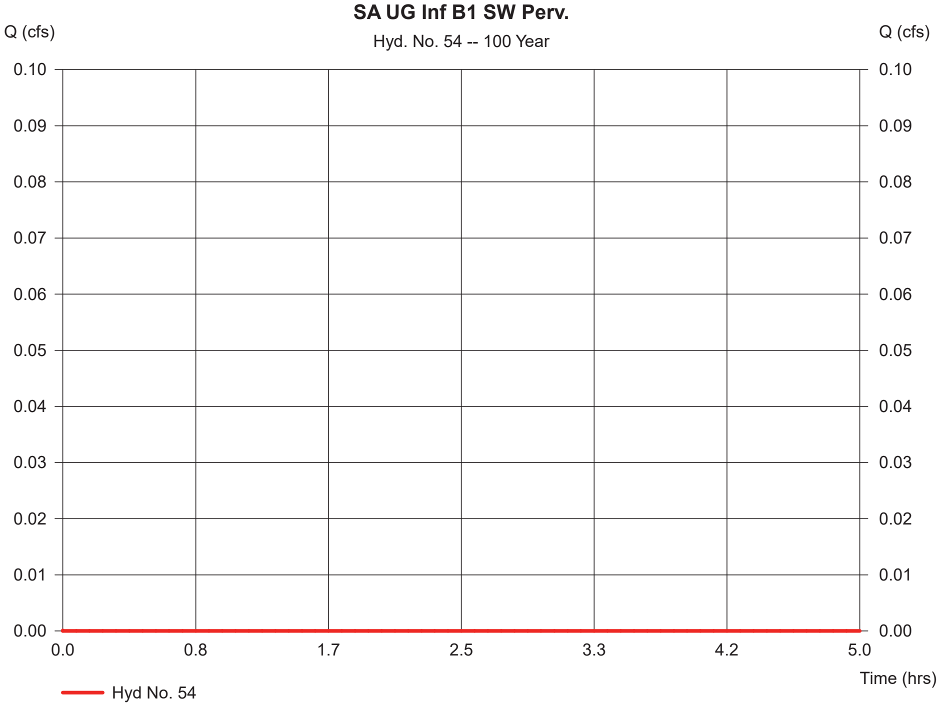
Hydrograph Report

Hyd. No. 54

SA UG Inf B1 SW Perv.

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 0.300 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 39
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

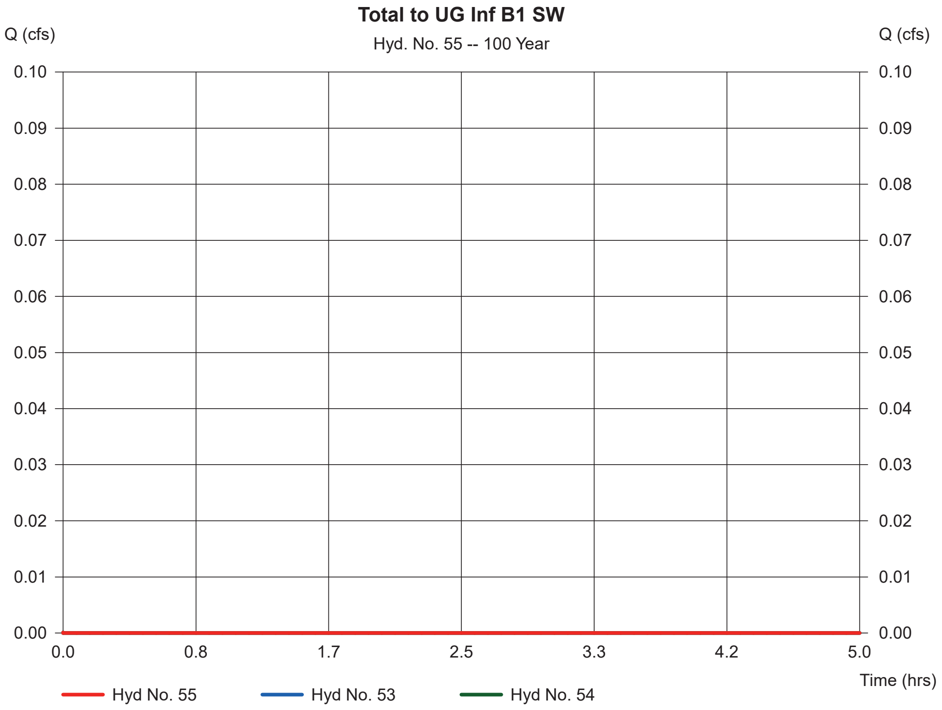
Hydraflow Hydrographs by Intelisolve v9.1 Friday, Jan 20, 2023

Hyd. No. 55

Total to UG Inf B1 SW

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyds. = 53, 54

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 8.280 ac


Total to UG Inf B1 SW

Hyd. No. 55 -- 100 Year

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.1 Friday, Jan 20, 2023

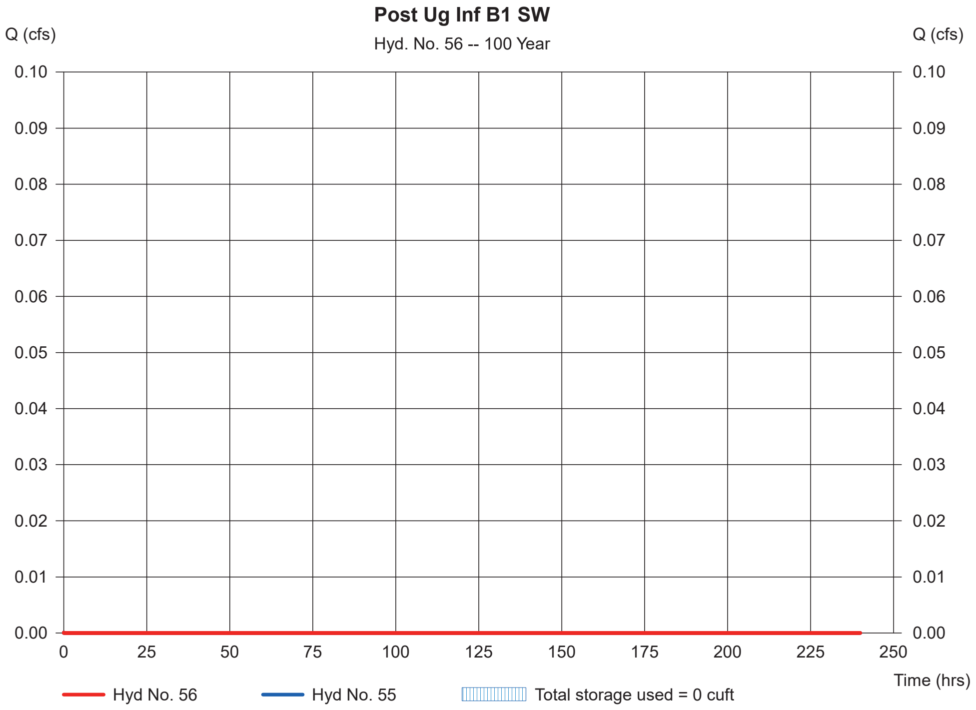
Hyd. No. 56

Post Ug Inf B1 SW

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyd. No. = 55 - Total to UG Inf B1 SW
Reservoir name = UG Inf B1 SW

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.


Post Ug Inf B1 SW

Hyd. No. 56 -- 100 Year

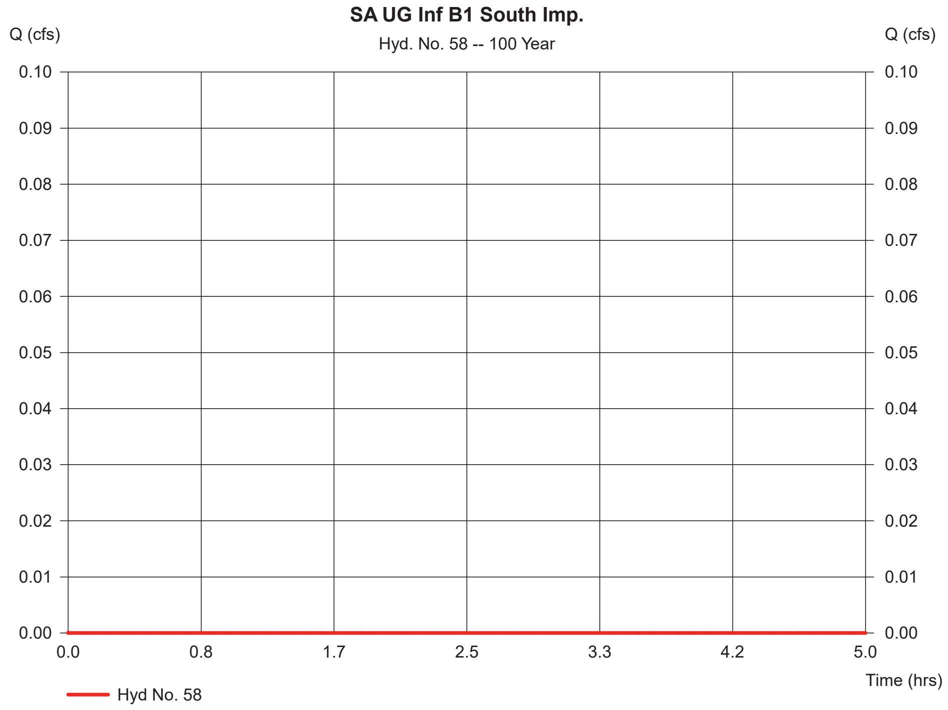
Hydrograph Report

Hyd. No. 58

SA UG Inf B1 South Imp.

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 0.420 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



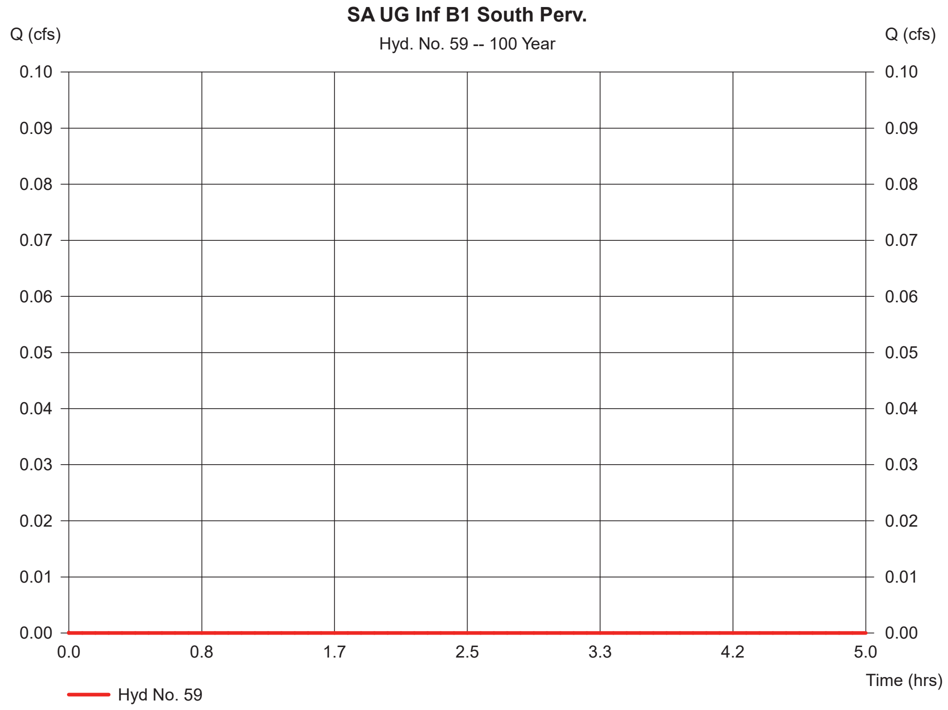
Hydrograph Report

Hyd. No. 59

SA UG Inf B1 South Perv.

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 0.490 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 49
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



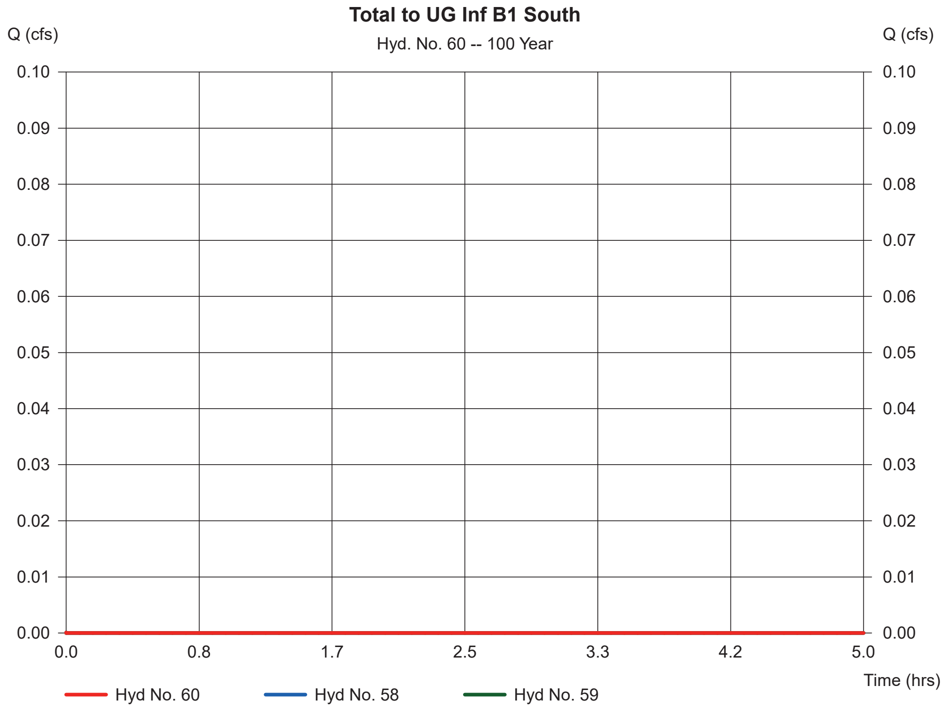
Hydrograph Report

Hyd. No. 60

Total to UG Inf B1 South

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyds. = 58, 59

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 0.910 ac



Hydrograph Report

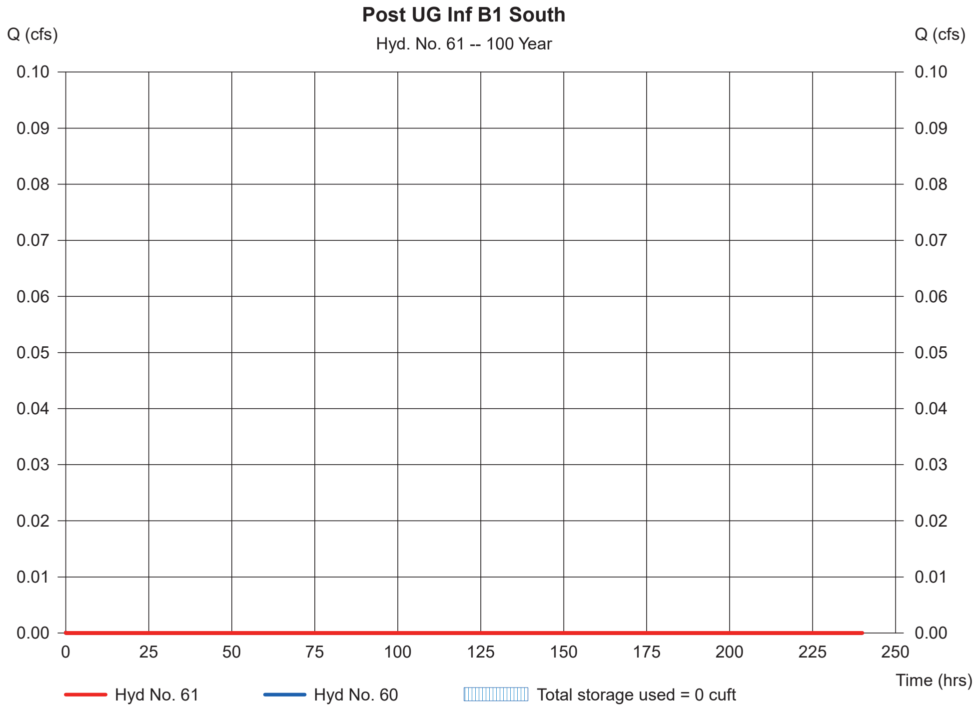
Hyd. No. 61

Post UG Inf B1 South

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyd. No. = 60 - Total to UG Inf B1 South
Reservoir name = UG Inf B1 South

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



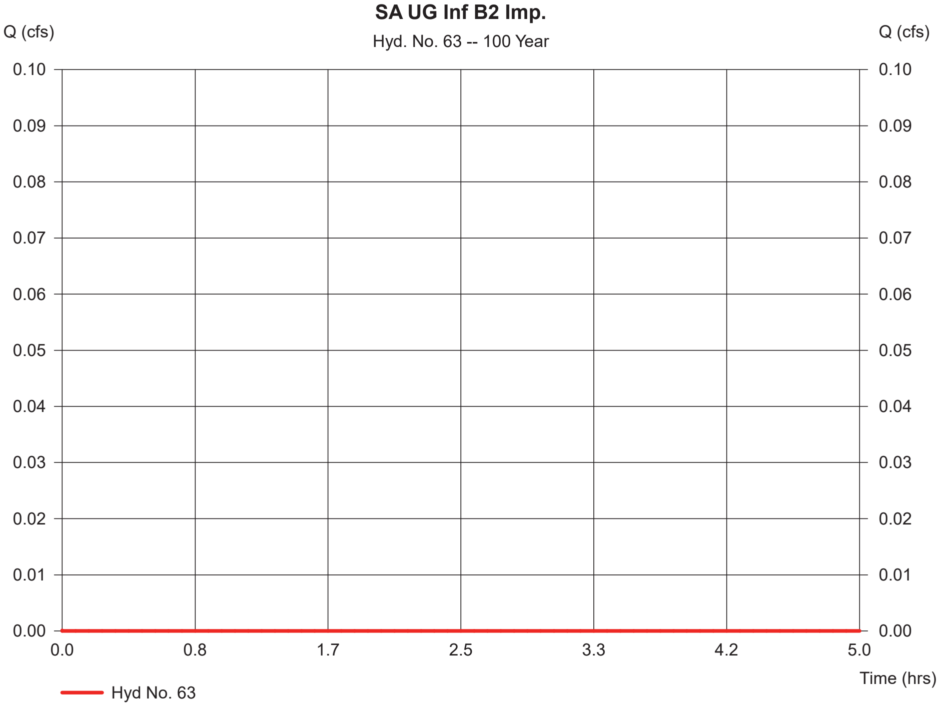
Hydrograph Report

Hyd. No. 63

SA UG Inf B2 Imp.

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 5.200 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



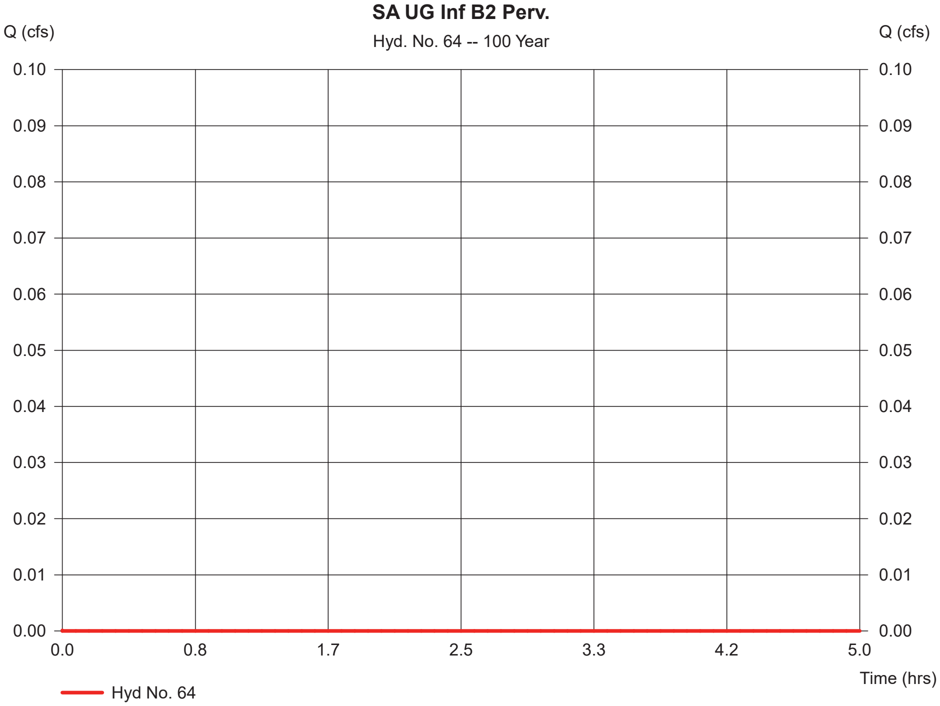
Hydrograph Report

Hyd. No. 64

SA UG Inf B2 Perv.

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 0.100 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 39
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



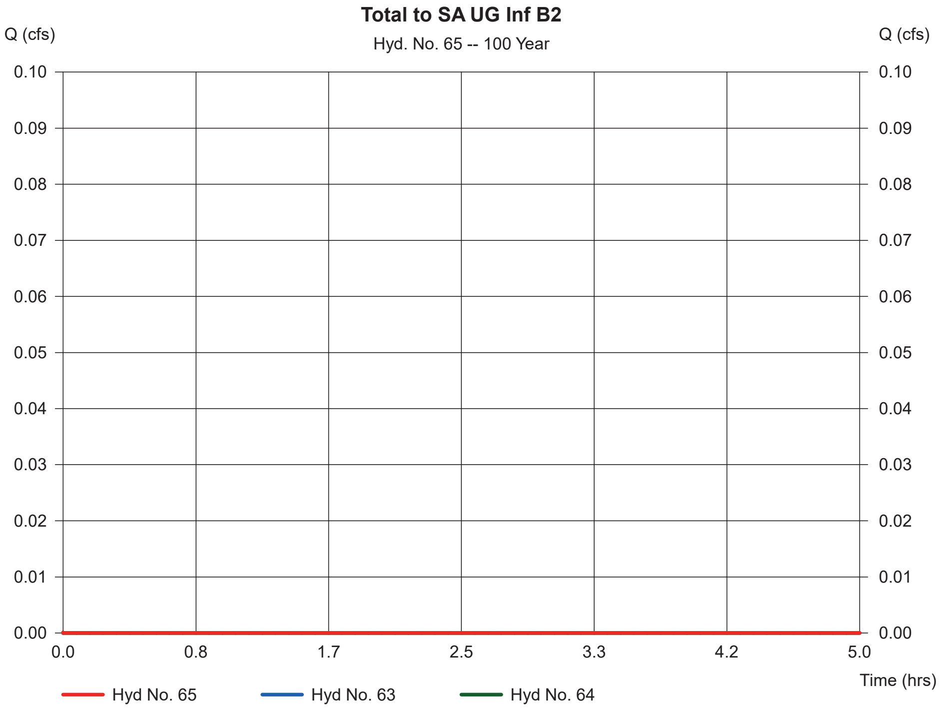
Hydrograph Report

Hyd. No. 65

Total to SA UG Inf B2

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyds. = 63, 64

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 5.300 ac



Hydrograph Report

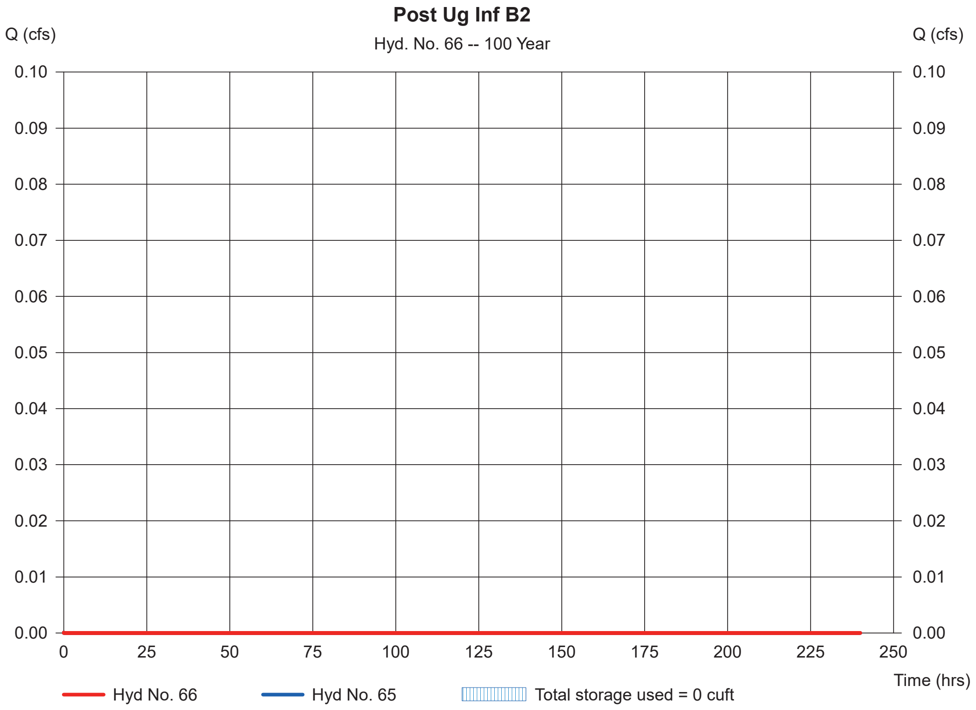
Hyd. No. 66

Post Ug Inf B2

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyd. No. = 65 - Total to SA UG Inf B2
Reservoir name = UG Inf B2

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



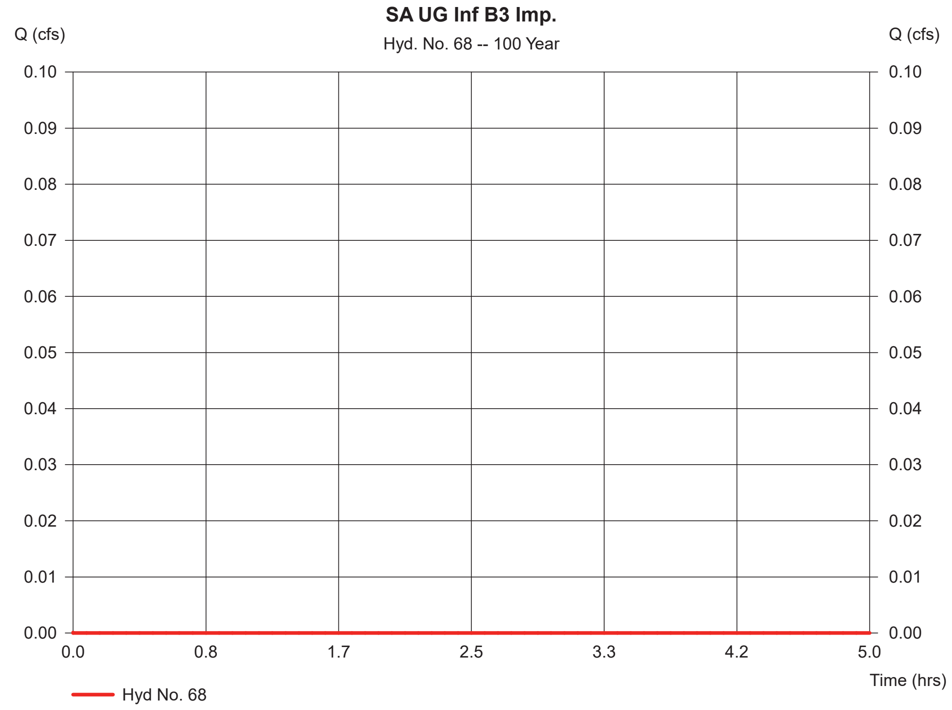
Hydrograph Report

Hyd. No. 68

SA UG Inf B3 Imp.

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 2.020 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



Hydrograph Report

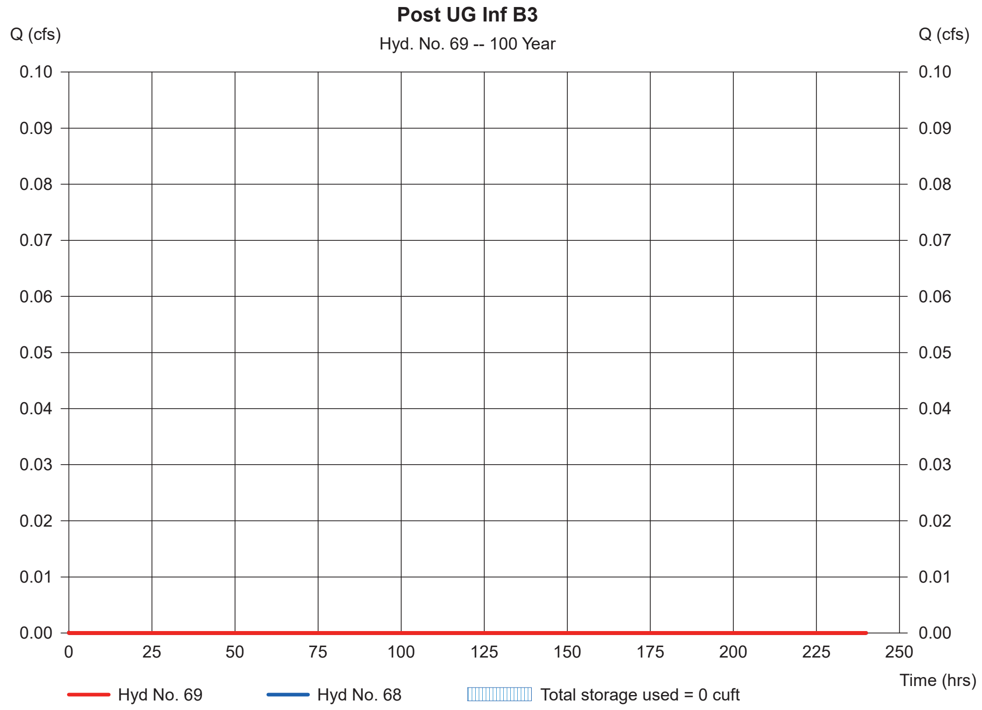
Hyd. No. 69

Post UG Inf B3

Hydrograph type = Reservoir
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyd. No. = 68 - SA UG Inf B3 Imp.
Reservoir name = UG Inf B3

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Max. Elevation = 0.00 ft
Max. Storage = 0 cuft

Storage Indication method used.



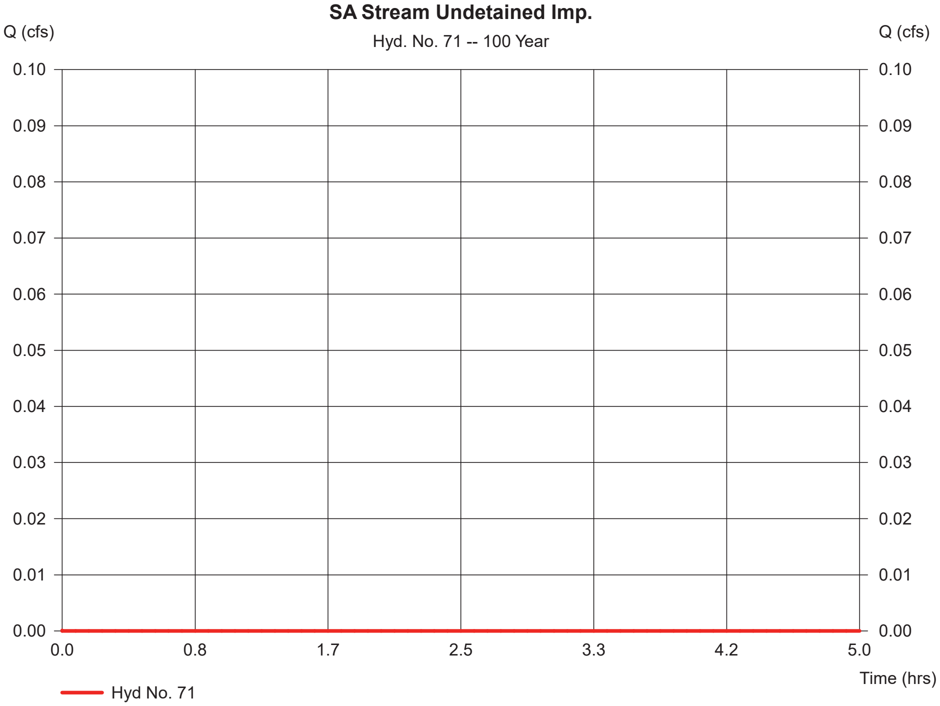
Hydrograph Report

Hyd. No. 71

SA Stream Undetained Imp.

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 0.290 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 98
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



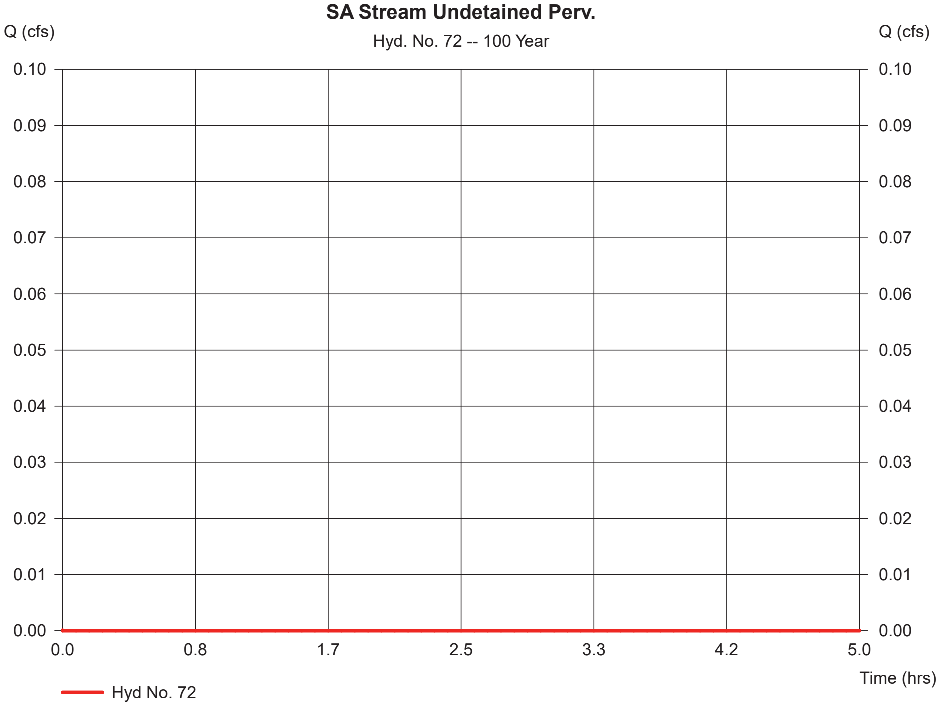
Hydrograph Report

Hyd. No. 72

SA Stream Undetained Perv.

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 5 min
Drainage area = 5.610 ac
Basin Slope = 0.0 %
Tc method = USER
Total precip. = 8.91 in
Storm duration = 24 hrs

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Curve number = 41
Hydraulic length = 0 ft
Time of conc. (Tc) = 10.00 min
Distribution = Type III
Shape factor = 484



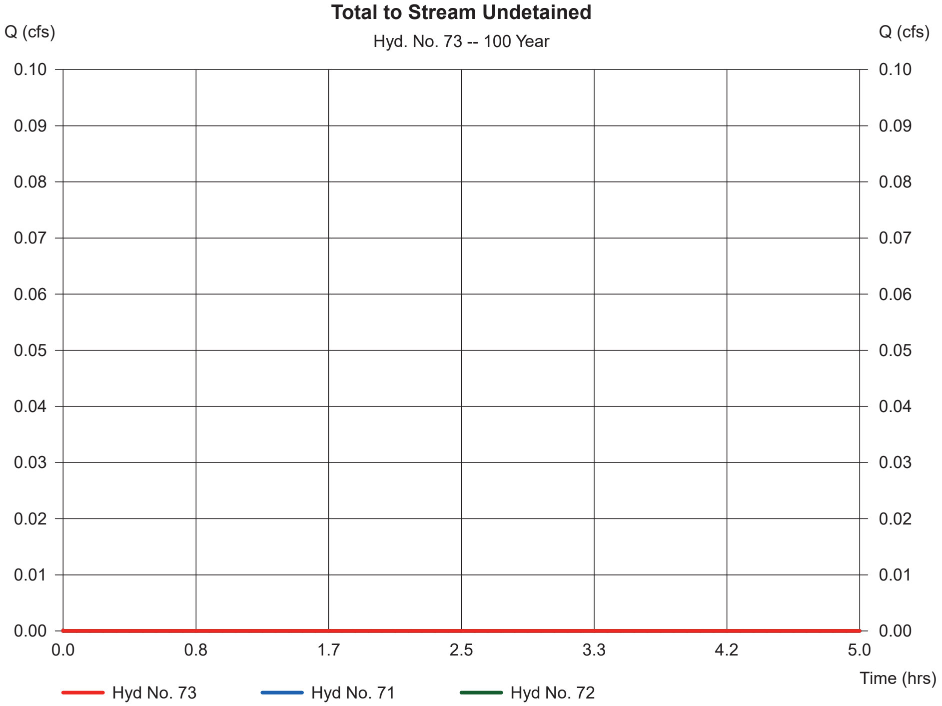
Hydrograph Report

Hyd. No. 73

Total to Stream Undetained

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyds. = 71, 72

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 5.900 ac



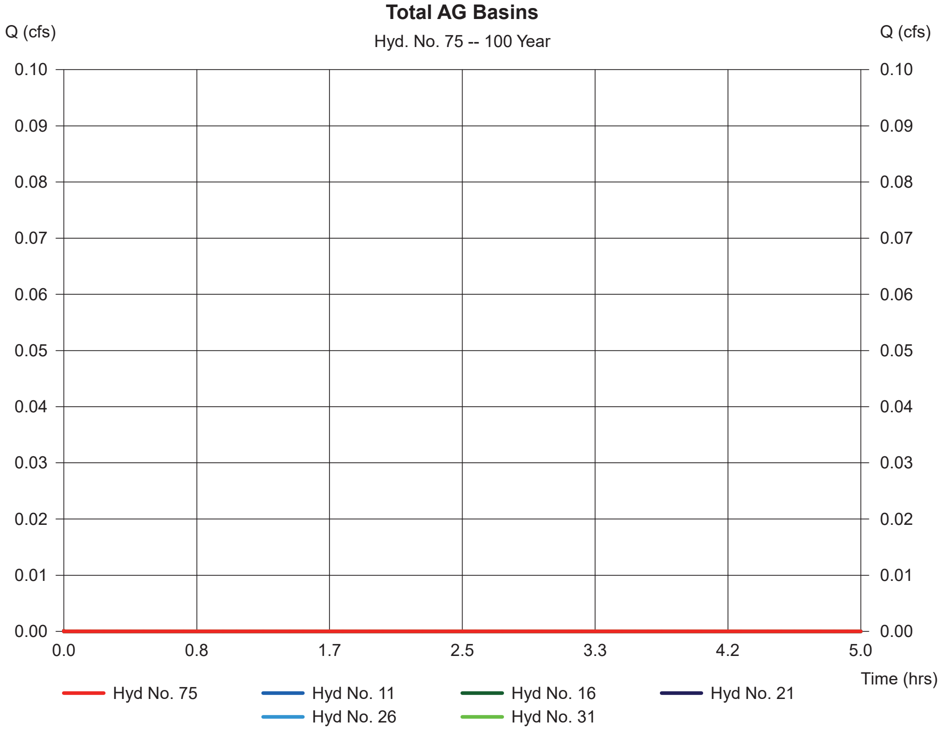
Hydrograph Report

Hyd. No. 75

Total AG Basins

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 5 min
Inflow hyds. = 11, 16, 21, 26, 31

Peak discharge = 0.000 cfs
Time to peak = n/a
Hyd. volume = 0 cuft
Contrib. drain. area = 0.000 ac

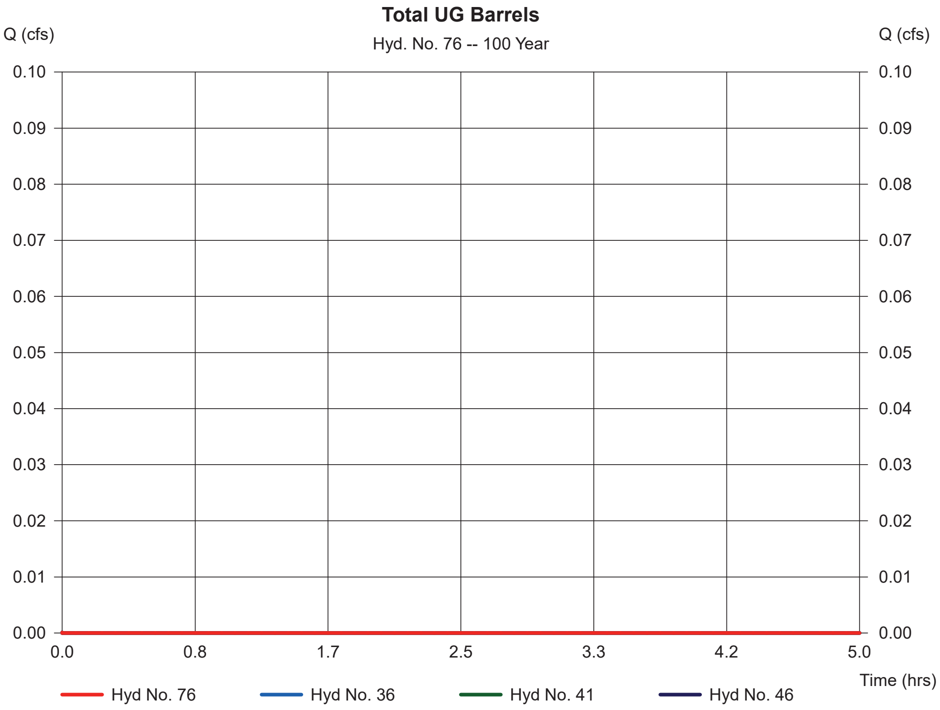


Hydrograph Report

Hyd. No. 76

Total UG Barrels

Hydrograph type	= Combine	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Inflow hyds.	= 36, 41, 46	Contrib. drain. area	= 0.000 ac

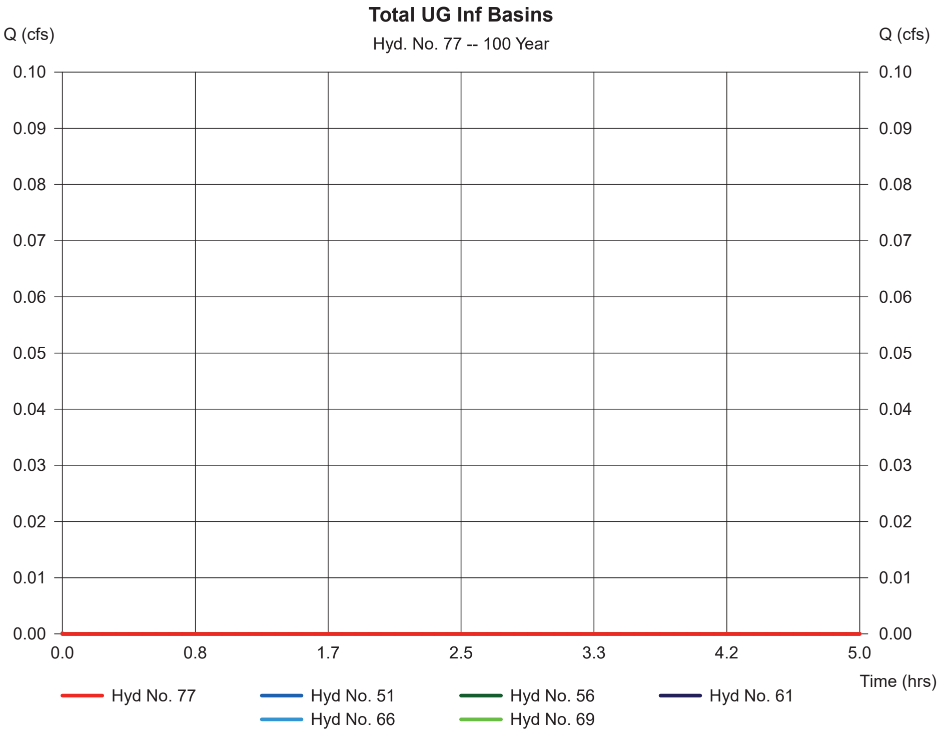


Hydrograph Report

Hyd. No. 77

Total UG Inf Basins

Hydrograph type	= Combine	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Inflow hyds.	= 51, 56, 61, 66, 69	Contrib. drain. area	= 0.000 ac

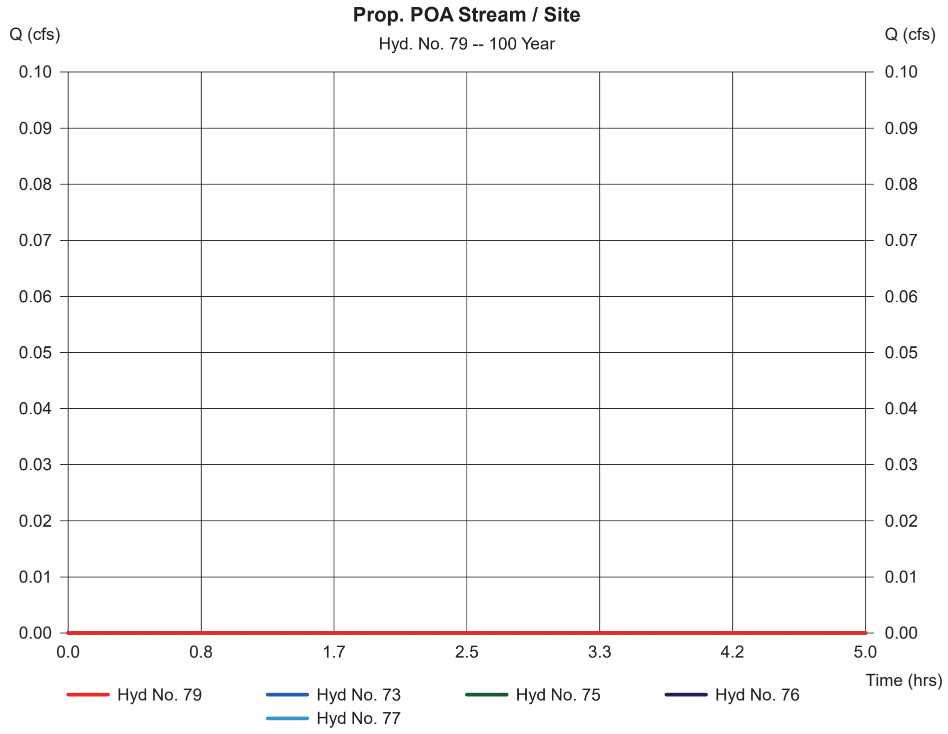


Hydrograph Report

Hyd. No. 79

Prop. POA Stream / Site

Hydrograph type	= Combine	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= n/a
Time interval	= 5 min	Hyd. volume	= 0 cuft
Inflow hyds.	= 73, 75, 76, 77	Contrib. drain. area	= 0.000 ac



Hydraflow Rainfall Report

Return Period	Intensity-Duration-Frequency Equation Coefficients (FHA)			
(Yrs)	B	D	E	(N/A)
1	0.0000	0.0000	0.0000	--------
2	69.8703	13.1000	0.8658	--------
3	0.0000	0.0000	0.0000	--------
5	79.2597	14.6000	0.8369	--------
10	88.2351	15.5000	0.8279	--------
25	102.6072	16.5000	0.8217	--------
50	114.8193	17.2000	0.8199	--------
100	127.1596	17.8000	0.8186	--------

File name: SampleFHA.idf

Intensity = B / (Tc + D)^E

Return Period	Intensity Values (in/hr)											
(Yrs)	5 min	10	15	20	25	30	35	40	45	50	55	60
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	5.69	4.61	3.89	3.38	2.99	2.69	2.44	2.24	2.07	1.93	1.81	1.70
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	6.57	5.43	4.65	4.08	3.65	3.30	3.02	2.79	2.59	2.42	2.27	2.15
10	7.24	6.04	5.21	4.59	4.12	3.74	3.43	3.17	2.95	2.77	2.60	2.46
25	8.25	6.95	6.03	5.34	4.80	4.38	4.02	3.73	3.48	3.26	3.07	2.91
50	9.04	7.65	6.66	5.92	5.34	4.87	4.49	4.16	3.88	3.65	3.44	3.25
100	9.83	8.36	7.30	6.50	5.87	5.36	4.94	4.59	4.29	4.03	3.80	3.60

Tc = time in minutes. Values may exceed 60.

Precip. file name: Rockland County.pcp

Storm Distribution	Rainfall Precipitation Table (in)							
	1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr
SCS 24-hour	2.90	3.01	0.00	0.00	5.65	5.68	0.00	8.91
SCS 6-Hr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-1st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-2nd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-3rd	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-4th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Huff-Indy	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Custom	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Hydraflow Table of Contents

25 - Year

100 - Year

OUTLET PROTECTION (SCOUR HOLE) CALCULATIONS

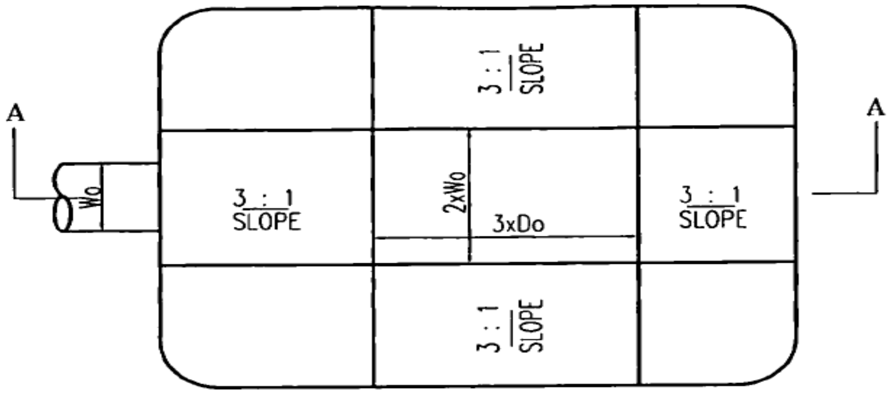
DYNAMIC ENGINEERING

SCOUR HOLE DESIGN

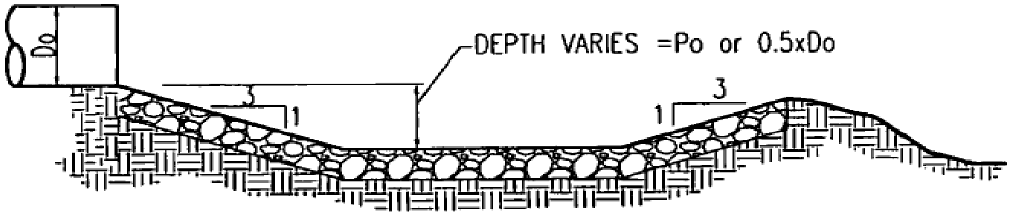
Project:	Prop. Industrial Park at 25 Old Mill Road
Job #:	3709-99-004
Location:	Suffern
Design Storm:	25 Yr
Computed By:	TJB
Checked By:	RDM
Date:	6/20/2022

Discharge in Basin, Therefore Tailwater is greater than 0.5 x Do

Discharge Point	Headwall #4
Q (25-yr storm cfs)	**14.62**
Inside Height of Outlet Culvert, Do (in)	**24**
Inside Height of Outlet Culvert, Do (ft)	2.0
Tailwater (ft), Tw	**0.720**
Length of Apron, L (ft)	**6.00**
Width of Culvert, Wo(in)	**24**
Width of Culvert, Wo(ft)	**2.0**
Width of Apron, W(ft)	**4.00**
Where Y = 1/2 Do, Y(ft)	**1.000**
Median Stone Diameter, D50 (ft)	**0.24**
Where Y = Do, Y(ft)	**2.000**
Median Stone Diameter, D50 (ft)	**0.16**



PLAN



SECTION A-A

Note: Use D50 of 6 inches minimum

Equations used:

L=3*Do
W=2*Wo
Where Y=1/2 Do
D50=(0.0125/Tw)*(q^1.33)
Where Y=Do
D50=(0.0082/Tw)*(q^1.33)

Peak Water Surface Elevation for 2 Yr. Storm is 307.92 FES Invert: 307.20 therefore Tailwater: 0.72

Notes:

1. The use of scour holes shall comply with county or local ordinances which would restrict the use of such devices due to the possible problems with mosquito breeding.
2. No bends or curves at the intersection of the conduit and apron or scour hole will be permitted.
3. There shall be no over fall from the end of the apron to the receiving material.
4. The thickness of the riprap lining, filter, and quality shall meet the requirements in the New York State Standards and Specifications for Erosion and Sediment Control.

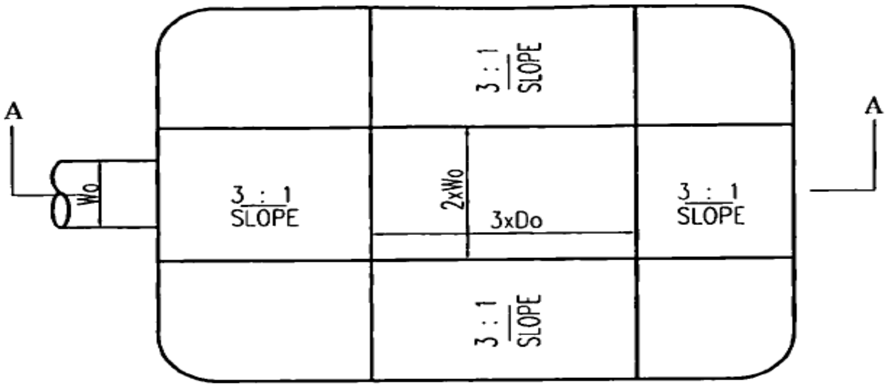
DYNAMIC ENGINEERING

SCOUR HOLE DESIGN

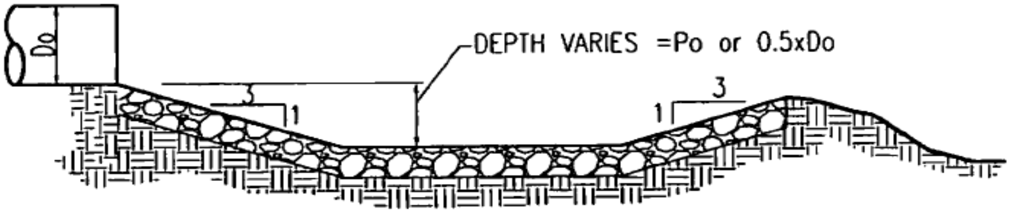
Project:	Prop. Industrial Park at 25 Old Mill Road
Job #:	3709-99-004
Location:	Suffern
Design Storm:	25 Yr
Computed By:	TJB
Checked By:	RDM
Date:	6/20/2022

Discharge in Basin, Therefore Tailwater is greater than 0.5 x Do

Discharge Point	Headwall AG B1 NW
Q (25-yr storm cfs)	**4.66**
Inside Height of Outlet Culvert, Do (in)	**18**
Inside Height of Outlet Culvert, Do (ft)	1.5
Tailwater (ft), Tw	**1.130**
Length of Apron, L (ft)	**4.50**
Width of Culvert, Wo(in)	**18**
Width of Culvert, Wo(ft)	**1.5**
Width of Apron, W(ft)	**3.00**
Where Y = 1/2 Do, Y(ft)	**0.750**
Median Stone Diameter, D50 (ft)	**0.05**
Where Y = Do, Y(ft)	**1.500**
Median Stone Diameter, D50 (ft)	**0.03**



PLAN



SECTION A–A

Note: Use D50 of 6 inches minimum

Equations used:

L=3*Do
W=2*Wo
Where Y=1/2 Do
D50=(0.0125/Tw)*(q^1.33)
Where Y=Do
D50=(0.0082/Tw)*(q^1.33)

Peak Water Surface Elevation for 2 Yr. Storm is 305.13 FES Invert: 304.00 therefore Tailwater: 1.13

Notes:
1. The use of scour holes shall comply with county or local ordinances which would restrict the use of such devices due to the possible problems with mosquito breeding.
2. No bends or curves at the intersection of the conduit and apron or scour hole will be permitted.
3. There shall be no over fall from the end of the apron to the receiving material.
4. The thickness of the riprap lining, filter, and quality shall meet the requirements in the New York State Standards and Specifications for Erosion and Sediment Control.

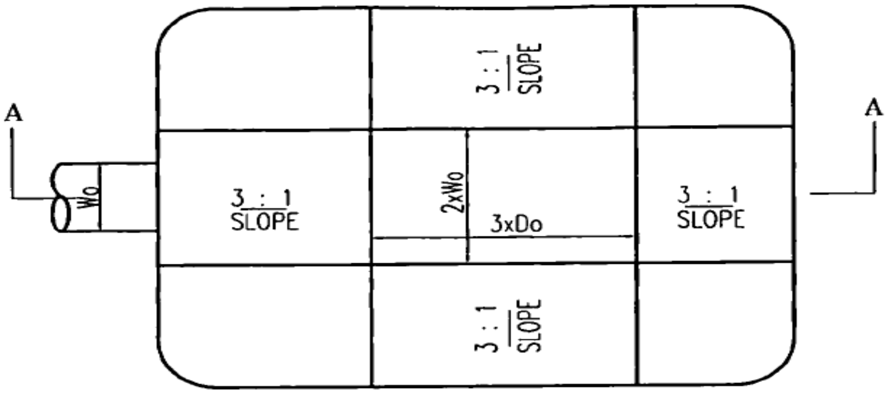
DYNAMIC ENGINEERING

SCOUR HOLE DESIGN

Project:	Prop. Industrial Park at 25 Old Mill Road
Job #:	3709-99-004
Location:	Suffern
Design Storm:	25 Yr
Computed By:	TJB
Checked By:	RDM
Date:	6/20/2022

Discharge in Basin, Therefore Tailwater is greater than 0.5 x Do

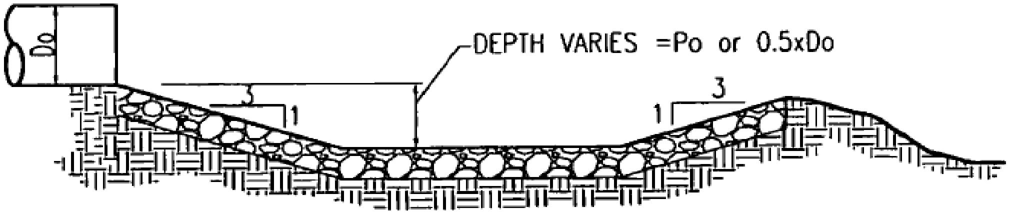
Discharge Point	Headwall # 149
Q (25-yr storm cfs)	**1.84**
Inside Height of Outlet Culvert, Do (in)	**15**
Inside Height of Outlet Culvert, Do (ft)	1.3
Tailwater (ft), Tw	**1.100**
Length of Apron, L (ft)	**3.75**
Width of Culvert, Wo(in)	**15**
Width of Culvert, Wo(ft)	**1.3**
Width of Apron, W(ft)	**2.50**
Where Y = 1/2 Do, Y(ft)	**0.625**
Median Stone Diameter, D50 (ft)	**0.02**
Where Y = Do, Y(ft)	**1.250**
Median Stone Diameter, D50 (ft)	**0.01**



PLAN

Note: Use D50 of 6 inches minimum

Equations used:
L=3*Do
W=2*Wo
Where Y=1/2 Do
D50=(0.0125/Tw)*(q^1.33)
Where Y=Do
D50=(0.0082/Tw)*(q^1.33)



SECTION A-A

Peak Water Surface Elevation for 2 Yr. Storm is 309.7 FES Invert: 308.60 therefore Tailwater: 1.10

Notes:

1. The use of scour holes shall comply with county or local ordinances which would restrict the use of such devices due to the possible problems with mosquito breeding.
2. No bends or curves at the intersection of the conduit and apron or scour hole will be permitted.
3. There shall be no over fall from the end of the apron to the receiving material.
4. The thickness of the riprap lining, filter, and quality shall meet the requirements in the New York State Standards and Specifications for Erosion and Sediment Control.

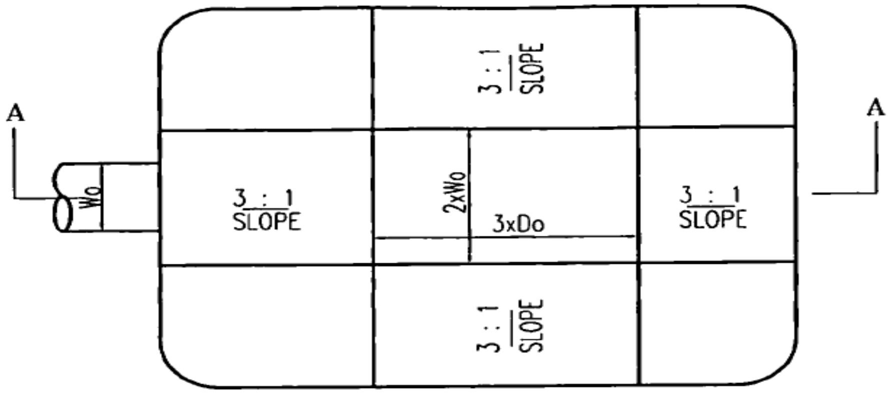
DYNAMIC ENGINEERING

SCOUR HOLE DESIGN

Project:	Prop. Industrial Park at 25 Old Mill Road
Job #:	3709-99-004
Location:	Suffern
Design Storm:	25 Yr
Computed By:	TJB
Checked By:	RDM
Date:	6/20/2022

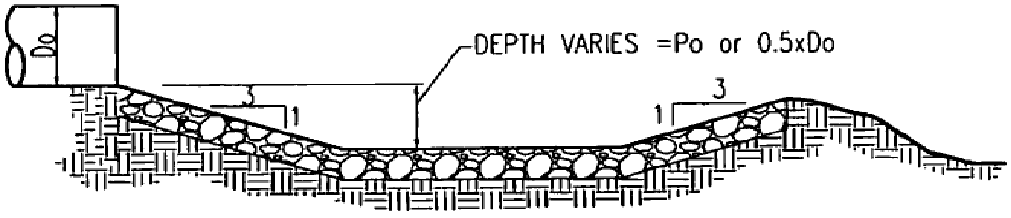
Discharge in Basin, Therefore Tailwater is greater than 0.5 x Do

Discharge Point	Headwall # 76
Q (25-yr storm cfs)	**3.37**
Inside Height of Outlet Culvert, Do (in)	**15**
Inside Height of Outlet Culvert, Do (ft)	1.3
Tailwater (ft), Tw	**1.060**
Length of Apron, L (ft)	**3.75**
Width of Culvert, Wo(in)	**15**
Width of Culvert, Wo(ft)	**1.3**
Width of Apron, W(ft)	**2.50**
Where Y = 1/2 Do, Y(ft)	**0.625**
Median Stone Diameter, D50 (ft)	**0.04**
Where Y = Do, Y(ft)	**1.250**
Median Stone Diameter, D50 (ft)	**0.03**



PLAN

Note: Use D50 of 6 inches minimum



SECTION A-A

Equations used:

L=3*Do
W=2*Wo
Where Y=1/2 Do
D50=(0.0125/Tw)*(q^1.33)
Where Y=Do
D50=(0.0082/Tw)*(q^1.33)

Peak Water Surface Elevation for 2 Yr. Storm is 311.56 FES Invert: 310.50 therefore Tailwater: 1.06

Notes:
1. The use of scour holes shall comply with county or local ordinances which would restrict the use of such devices due to the possible problems with mosquito breeding.
2. No bends or curves at the intersection of the conduit and apron or scour hole will be permitted.
3. There shall be no over fall from the end of the apron to the receiving material.
4. The thickness of the riprap lining, filter, and quality shall meet the requirements in the New York State Standards and Specifications for Erosion and Sediment Control.

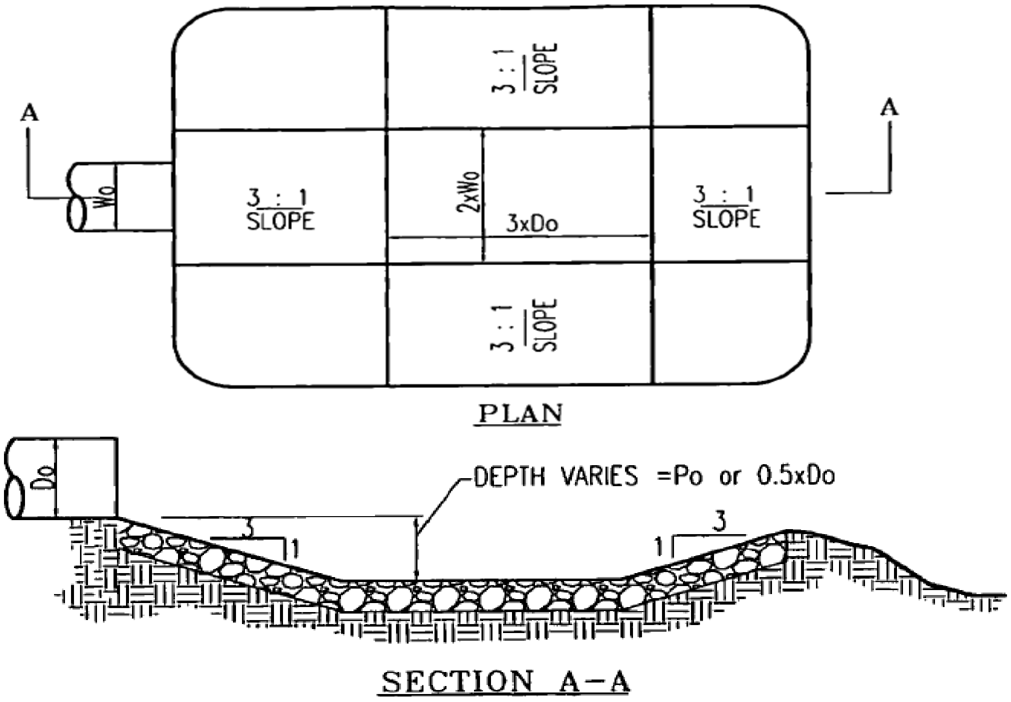
DYNAMIC ENGINEERING

SCOUR HOLE DESIGN

Project:	Prop. Industrial Park at 25 Old Mill Road
Job #:	3709-99-004
Location:	Suffern
Design Storm:	25 Yr
Computed By:	TJB
Checked By:	RDM
Date:	6/20/2022

Discharge in Basin, Therefore Tailwater is greater than 0.5 x Do

Discharge Point	Headwall # 71
Q (25-yr storm cfs)	**4.13**
Inside Height of Outlet Culvert, Do (in)	**15**
Inside Height of Outlet Culvert, Do (ft)	1.3
Tailwater (ft), Tw	**1.060**
Length of Apron, L (ft)	**3.75**
Width of Culvert, Wo(in)	**15**
Width of Culvert, Wo(ft)	**1.3**
Width of Apron, W(ft)	**2.50**
Where Y = 1/2 Do, Y(ft)	**0.625**
Median Stone Diameter, D50 (ft)	**0.06**
Where Y = Do, Y(ft)	**1.250**
Median Stone Diameter, D50 (ft)	**0.04**



Note: Use D50 of 6 inches minimum

Equations used:
L=3*Do
W=2*Wo
Where Y=1/2 Do
D50=(0.0125/Tw)*(q^1.33)
Where Y=Do
D50=(0.0082/Tw)*(q^1.33)

Peak Water Surface Elevation for 2 Yr. Storm is 311.56 FES Invert: 310.50 therefore Tailwater: 1.06

Notes:
1. The use of scour holes shall comply with county or local ordinances which would restrict the use of such devices due to the possible problems with mosquito breeding.
2. No bends or curves at the intersection of the conduit and apron or scour hole will be permitted.
3. There shall be no over fall from the end of the apron to the receiving material.
4. The thickness of the riprap lining, filter, and quality shall meet the requirements in the New York State Standards and Specifications for Erosion and Sediment Control.

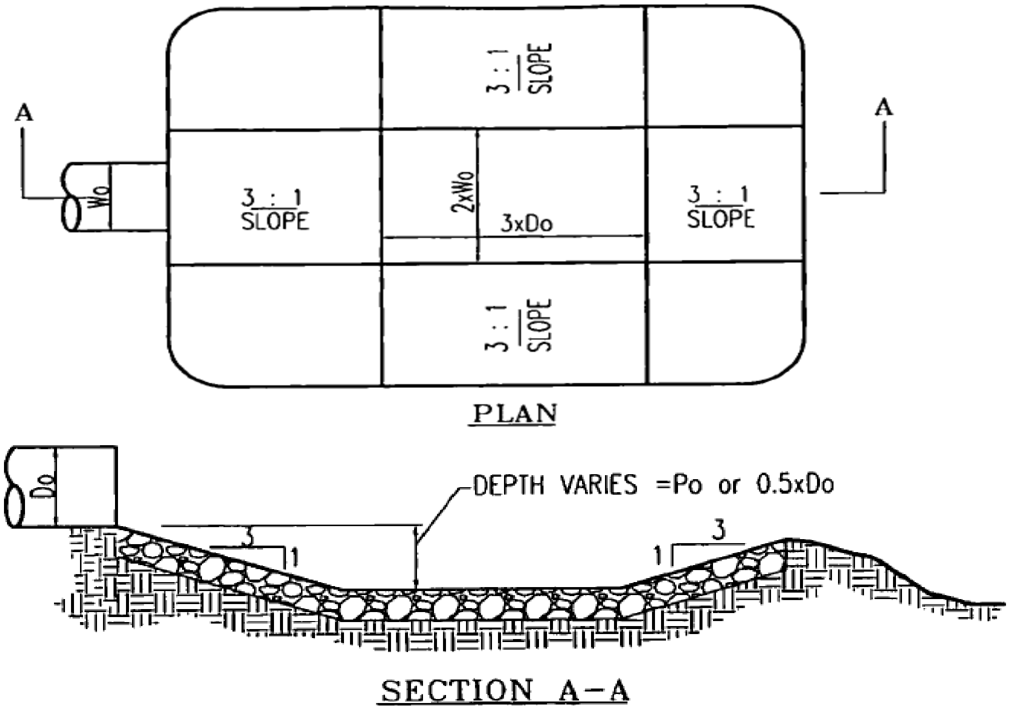
DYNAMIC ENGINEERING

SCOUR HOLE DESIGN

Project:	Prop. Industrial Park at 25 Old Mill Road
Job #:	3709-99-004
Location:	Suffern
Design Storm:	25 Yr
Computed By:	TJB
Checked By:	RDM
Date:	6/20/2022

Discharge in Basin, Therefore Tailwater is greater than 0.5 x Do

Discharge Point	Headwall # 90
Q (25-yr storm cfs)	**4.13**
Inside Height of Outlet Culvert, Do (in)	**15**
Inside Height of Outlet Culvert, Do (ft)	1.3
Tailwater (ft), Tw	**1.060**
Length of Apron, L (ft)	**3.75**
Width of Culvert, Wo(in)	**15**
Width of Culvert, Wo(ft)	**1.3**
Width of Apron, W(ft)	**2.50**
Where Y = 1/2 Do, Y(ft)	**0.625**
Median Stone Diameter, D50 (ft)	**0.06**
Where Y = Do, Y(ft)	**1.250**
Median Stone Diameter, D50 (ft)	**0.04**



PLAN

SECTION A-A

Note: Use D50 of 6 inches minimum

Equations used:
L=3*Do
W=2*Wo
Where Y=1/2 Do
D50=(0.0125/Tw)*(q^1.33)
Where Y=Do
D50=(0.0082/Tw)*(q^1.33)

Peak Water Surface Elevation for 2 Yr. Storm is 311.56 FES Invert: 310.50 therefore Tailwater: 1.06

Notes:
1. The use of scour holes shall comply with county or local ordinances which would restrict the use of such devices due to the possible problems with mosquito breeding.
2. No bends or curves at the intersection of the conduit and apron or scour hole will be permitted.
3. There shall be no over fall from the end of the apron to the receiving material.
4. The thickness of the riprap lining, filter, and quality shall meet the requirements in the New York State Standards and Specifications for Erosion and Sediment Control.

DYNAMIC ENGINEERING

SCOUR HOLE DESIGN

Project:	Prop. Industrial Park at 25 Old Mill Road
Job #:	3709-99-004
Location:	Suffern
Design Storm:	25 Yr
Computed By:	TJB
Checked By:	RDM
Date:	6/20/2022

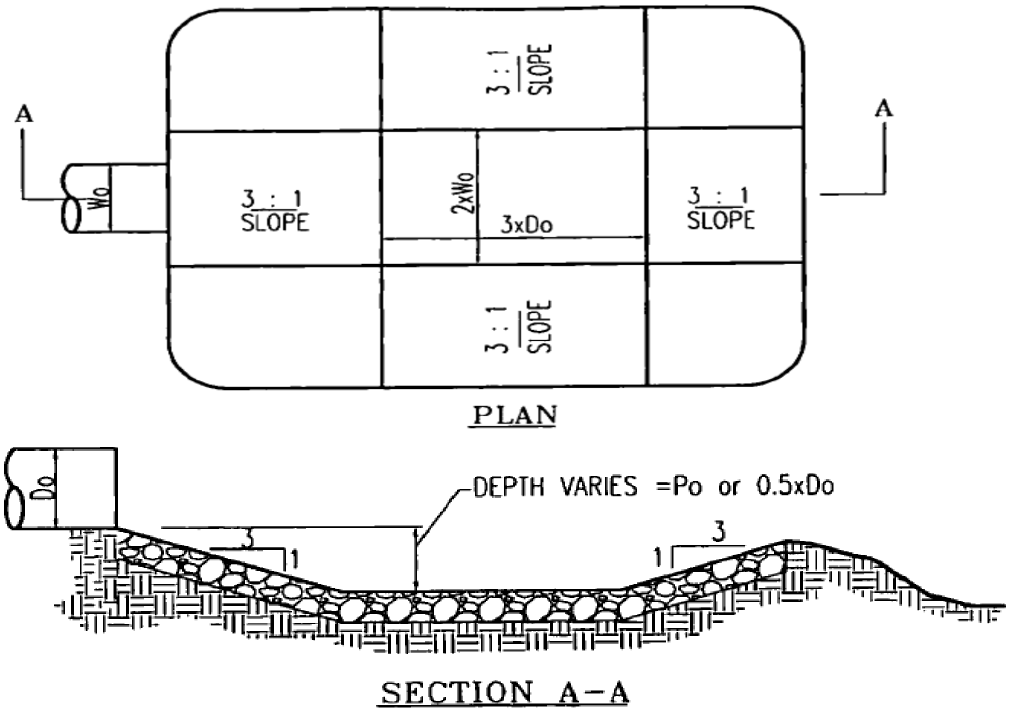
Discharge in Basin, Therefore Tailwater is greater than 0.5 x Do

Discharge Point	Headwall # 88
Q (25-yr storm cfs)	**8.34**
Inside Height of Outlet Culvert, Do (in)	**24**
Inside Height of Outlet Culvert, Do (ft)	2.0
Tailwater (ft), Tw	**3.520**
Length of Apron, L (ft)	**6.00**
Width of Culvert, Wo(in)	**24**
Width of Culvert, Wo(ft)	**2.0**
Width of Apron, W(ft)	**4.00**
Where Y = 1/2 Do, Y(ft)	**1.000**
Median Stone Diameter, D50 (ft)	**0.02**
Where Y = Do, Y(ft)	**2.000**
Median Stone Diameter, D50 (ft)	**0.02**

Note: Use D50 of 6 inches minimum

Equations used:

L=3*Do
W=2*Wo
Where Y=1/2 Do
D50=(0.0125/Tw)*(q^1.33)
Where Y=Do
D50=(0.0082/Tw)*(q^1.33)



Peak Water Surface Elevation for 2 Yr. Storm is 306.92 FES Invert: 303.40 therefore Tailwater: 3.52

Notes:

1. The use of scour holes shall comply with county or local ordinances which would restrict the use of such devices due to the possible problems with mosquito breeding.
2. No bends or curves at the intersection of the conduit and apron or scour hole will be permitted.
3. There shall be no over fall from the end of the apron to the receiving material.
4. The thickness of the riprap lining, filter, and quality shall meet the requirements in the New York State Standards and Specifications for Erosion and Sediment Control.

MANUFACTURED TREATMENT DEVICE CERTIFICATIONS

State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Nonpoint Pollution Control
Division of Water Quality
401-02B
Post Office Box 420
Trenton, New Jersey 08625-0420
609-633-7021 Fax: 609-777-0432
http://www.state.nj.us/dep/dwq/bnpc_home.htm

PHILIP D. MURPHY
Governor

SHEILA Y. OLIVER
Lt. Governor

CATHERINE R. MCCABE
Commissioner

May 18, 2020

Derek M. Berg
Director – Stormwater Regulatory Management - East
Contech Engineered Solutions LLC
71 US Route 1, Suite F
Scarborough, ME 04074

Re: MTD Lab Certification
Cascade Separator™
On-line Installation

TSS Removal Rate 50%

Dear Mr. Berg:

This revised certification letter supersedes the Department's prior certification dated October 1, 2019. This revision was completed to reflect Contech's enhanced fabrication capability to manufacture a smaller-size unit of its the Cascade Separator™ Manufactured Treatment Device (MTD), while still meeting the scaling methodology as agreed upon by the manufacturers' working group on September 19, 2016. Based on this modification, Table A-1 of the New Jersey Corporation for Advanced Technology (NJCAT) Verification report located at http://www.njcat.org/uploads/newDocs/NJCATTechnologyVerificationFinal.pdf has been revised to specify this smaller unit and associated maximum treatment flow rate. Table 1 below has been revised to reflect this same updated model size and flow rate.

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7(c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Contech Engineered Solutions, LLC (Contech) has requested an MTD Laboratory Certification for the Cascade Separator™ stormwater treatment system.

The project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advance Technology" dated January 25,

2013. The applicable protocol is the "New Jersey Laboratory Testing Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the aforementioned protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report with the Verification Appendix (dated September 2019) for this device is published online at http://www.njcat.org/verification-process/technology-verification-database.html.

The NJDEP certifies the use of the Cascade Separator™ stormwater treatment system at a TSS removal rate of 50% when designed, operated, and maintained in accordance with the information provided in the Verification Appendix and the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5.

2. The Cascade Separator™ shall be installed using the same configuration reviewed by NJCAT and shall be sized in accordance with the criteria specified in item 6 below.

3. This Cascade Separator™ cannot be used in series with another MTD or a media filter (such as a sand filter) to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.

4. Additional design criteria for MTDs can be found in Chapter 9.6 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual, which can be found online at www.njstormwater.org.

5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the Cascade Separator™. A copy of the maintenance plan is attached to this certification. However, it is recommended to review the maintenance website at https://www.conteches.com/Portals/0/Documents/Maintenance%20Guides/Cascade-Maintenance%20Guide.pdf?ver=2018-11-05-093254-300. for any changes to the maintenance requirements.

6. Sizing Requirement:

   The example below demonstrates the sizing procedure for the Cascade Separator™:

   Example: A 0.25-acre impervious site is to be treated to 50% TSS removal using a Cascade Separator™. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs.

   Maximum Treatment Flow Rate (MTFR) Evaluation:

   The site runoff (Q) was based on the following:

time of concentration = 10 minutes
i = 3.2 in/hr (page 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual)
c = 0.99 (runoff coefficient for impervious)
Q = ciA = 0.99 x 3.2 x 0.25 = 0.79 cfs

Given the site runoff is 0.79 cfs and based on Table A-1 below, the Cascade Separator™ Model CS-3 with an MTFR of 1.02 cfs would be the smallest model approved that could be used for this site to remove 50% of the TSS from the impervious area without exceeding the MTFR.

The sizing table corresponding to the available system models is noted below. Additional specifications regarding each model can be found in the Verification Appendix under Table A-1.

Table A-1 Cascade Separator™ Models and Associated MTFRs

Model	Manhole Diameter (ft)	MTFR (cfs)	50% Maximum Sediment Storage Area Volume (ft^3)
CS-3	3	1.02	5.3
CS-4	4	1.80	9.4
CS-5	5	2.81	14.7
CS-6	6	4.05	21.2
CS-8	8	7.20	37.7
CS-10	10	11.3	58.9
CS-12	12	16.2	84.8

A detailed maintenance plan is mandatory for any project with a stormwater BMP subject to the Stormwater Management rules under N.J.A.C. 7:8. The plan must include all of the items identified in the Maintenance requirements section of the Stormwater Management rules under N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of inspection and maintenance equipment and tools, specific corrective and preventative maintenance tasks, indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact Brian Salvo of my office at (609) 633-7021.

Sincerely,

Gabriel Mahon

Gabriel Mahon, Chief
Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan

cc: Chron File
Richard Magee, NJCAT
Jim Murphy, NJDEP-BNPC
Vince Mazzei, NJDEP-DLUR
Brian Salvo, NJDEP-BNPC

CONTECH®
ENGINEERED SOLUTIONS

Cascade Separator™ Inspection and Maintenance Guide

CASCADE
separator™

Maintenance

The Cascade Separator™ system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects sediment and debris will depend upon on-site activities and site pollutant characteristics. For example, unstable soils or heavy winter sanding will cause the sediment storage sump to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (i.e. spring and fall). However, more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment wash-down areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

A visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet chamber, flumes or outlet channel. The inspection should also quantify the accumulation of hydrocarbons, trash and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided in this Inspection and Maintenance Guide.

Access to the Cascade Separator unit is typically achieved through one manhole access cover. The opening allows for inspection and cleanout of the center chamber (cylinder) and sediment storage sump, as well as inspection of the inlet chamber and slanted skirt. For large units, multiple manhole covers allow access to the chambers and sump.

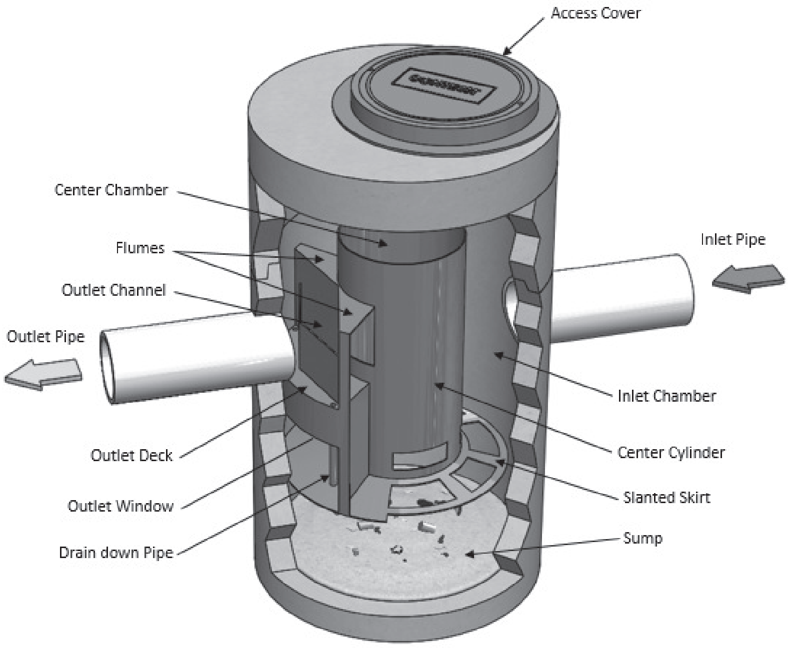
The Cascade Separator system should be cleaned before the level of sediment in the sump reaches the maximum sediment depth and/or when an appreciable level of hydrocarbons and trash has accumulated. If sorbent material is used, it must be replaced when significant discoloration has occurred. Performance may be impacted when maximum sediment storage capacity is exceeded. Contech recommends maintaining the system when sediment level reaches the 50% storage volume. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Finer, silty particles at the top of the pile typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine if the height of the sediment pile off the bottom of the sump floor exceeds 50% of the total height of sediment storage sump.

Cleaning

Cleaning of a Cascade Separator system should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole cover and insert the vacuum hose down through the center chamber and into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The areas outside the center chamber and the slanted skirt should also be washed off if pollutant build-up exists in these areas.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. Then the system should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and to ensure proper safety precautions. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the Cascade Separator system must be done is accordance with local regulations. In many locations, disposal of evacuated sediments may be handled in the same manner as disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal. If any components are damaged, replacement parts can be ordered from the manufacturer.



Cascade Separator Inspection & Maintenance Log

Cascade Model:

Location:

Date	Water Depth to Sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The depth to sediment is determined by taking a measurement from the manhole opening to the top of the sediment pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine if the height of the sediment pile off the bottom of the sump floor exceeds 50% of the total height of sediment storage sump. Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.
2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

A Cascade Separator unit can be easily cleaned in less than 30 minutes.

A vacuum truck excavates pollutants from the systems.

SUPPORT

- Drawings and specifications are available at www.ContechES.com.
- Site-specific design support is available from our engineers.

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, and earth stabilization products. For information, visit www.ContechES.com or call 800.338.1122

CONTECH®
ENGINEERED SOLUTIONS
800.925.5240
www.ContechES.com

NJCAT TECHNOLOGY VERIFICATION

JELLYFISH® FILTER

Imbrium Systems Corporation

January 2012

TABLE OF CONTENTS

List of Tables

List of Figures

1. Introduction

1.1 New Jersey Corporation for Advance Technology (NJCAT) Program

NJCAT is a not-for-profit corporation to promote in New Jersey the retention and growth of technology-based businesses in emerging fields such as environmental and energy technologies. NJCAT provides innovators with the regulatory, commercial, technological and financial assistance required to bring their ideas to market successfully. Specifically, NJCAT functions to:

- Advance policy strategies and regulatory mechanisms to promote technology commercialization;
- Identify, evaluate, and recommend specific technologies for which the regulatory and commercialization process should be facilitated;
- Facilitate funding and commercial relationships/alliances to bring new technologies to market and new business to the state; and
- Assist in the identification of markets and applications for commercialized technologies.

The technology verification program specifically encourages collaboration between vendors and users of technology. Through this program, teams of academic and business professionals are formed to implement a comprehensive evaluation of vendor specific performance claims. Thus, suppliers have the competitive edge of an independent third party confirmation of claims.

Pursuant to N.J.S.A. 13:1D-134 et seq. (Energy and Environmental Technology Verification Program) the New Jersey Department of Environmental Protection (NJDEP) and NJCAT have established a Performance Partnership Agreement (PPA) whereby NJCAT performs the technology verification review and NJDEP certifies that the technology meets the regulatory intent and that there is a net beneficial environmental effect of the technology. In addition, NJDEP/NJCAT work in conjunction to develop expedited or more efficient timeframes for review and decision-making of permits or approvals associated with the verified/certified technology.

The PPA also requires that:

- The NJDEP shall enter into reciprocal environmental technology agreements concerning the evaluation and verification protocols with the United States Environmental Protection Agency, other local required or national environmental agencies, entities or groups in other states and New Jersey for the purpose of encouraging and permitting the reciprocal acceptance of technology data and information concerning the evaluation and verification of energy and environmental technologies; and

- The NJDEP shall work closely with the State Treasurer to include in State bid specifications, as deemed appropriate by the State Treasurer, any technology verified under the Energy and Environment Technology Verification Program.

1.2 Interim Certification

Imbrium Systems Corporation (Imbrium) is a leading provider of innovative stormwater treatment solutions, offering a variety of products, maintenance, laboratory, and engineering support to meet stormwater treatment needs. Imbrium's patented product, the Jellyfish® Filter, is a Best Management Practice (BMP) designed to meet federal, state, and local requirements for treating stormwater runoff in compliance with the 1972 Clean Water Act and NPDES Stormwater Amendments, and phosphorus TMDLs in critical or impaired watersheds. The Jellyfish® Filter is typically comprised of a manhole or vault configuration that houses a cartridge deck and multiple high surface area membrane filtration cartridges. The Jellyfish® Filter improves the quality of stormwater runoff before it enters receiving waterways through a combination of hydrodynamic separation pre-treatment followed by filtration to provide enhanced solids removal. (See Section 2 for an additional description of the technology.)

Imbrium received New Jersey Corporation for Advanced Technology (NJCAT) verification of claims for the Jellyfish® Filter in June 2008 and a Conditional Interim Certification was issued by NJDEP in February of 2009. A major condition of this Conditional Interim Certification was the execution of a field evaluation in accordance with the TARP Tier II Protocol (TARP, 2003) and New Jersey Tier II Stormwater Test Requirements—Amendments to TARP Tier II Protocol (NJDEP, 2006). Conditional Interim Certification was extended in September of 2011. A Quality Assurance Project Plan for the Field Evaluation was completed in May of 2010, resulting in the commencement of monitoring activities. The TARP Tier II Protocol is designed to evaluate Total Suspended Solids (TSS) removal on an annual basis. While other pollutant removal efficiencies may be measured during TARP Tier II testing they are not part of the protocol.

1.3 Applicant Profile

Imbrium Systems Corporation, 7564 Standish Place, Suite 112, Rockville, MD 20855, has been actively engaged in the stormwater treatment industry since the introduction of its Stormceptor® product in 1992. Originally established as the Stormceptor Group of Companies, in 2006 the company changed its name to Imbrium Systems. This name change was implemented as the company expanded research and development to deliver new technologies to the stormwater treatment industry.

Imbrium Systems is a global company with U.S. headquarters (Imbrium Systems Corporation) located in Rockville, Maryland and Canadian and International headquarters (Imbrium Systems Incorporated and Imbrium International Limited) located in Toronto, Ontario, Canada, with satellite offices located across North America.

Imbrium Systems is a wholly-owned business of Monteco Ltd. Monteco is a privately-held company headquartered in Toronto, Ontario which focuses on developing innovative clean-tech solutions for application in the air, water and energy industry sectors. Monteco supports its businesses with centralized corporate services including research & development, public relations, government affairs, marketing and communication, human resources and finance.

1.4 Key Contacts

Richard S. Magee, Sc.D., P.E., BCEE
Technical Director
NJ Corporation for Advanced Technology
Center for Environmental Systems
Stevens Institute of Technology
Castle Point on Hudson
Hoboken, NJ 07030
201-216-8081
973-879-3056 mobile
rsmagee@rcn.com

Scott Perry
Managing Director
Imbrium Systems Corporation
7564 Standish Place, Suite 112
Rockville, Maryland 20855
1-888-279-8826
1-800-565-4801
301-461-3515 mobile
sperry@imbriumsystems.com

Joel Garbon
Product Manager
Imbrium Systems Corporation
3811 S.W. Corbett Ave.
Portland, Oregon 97239
503-706-6193
jgarbon@imbriumsystems.com

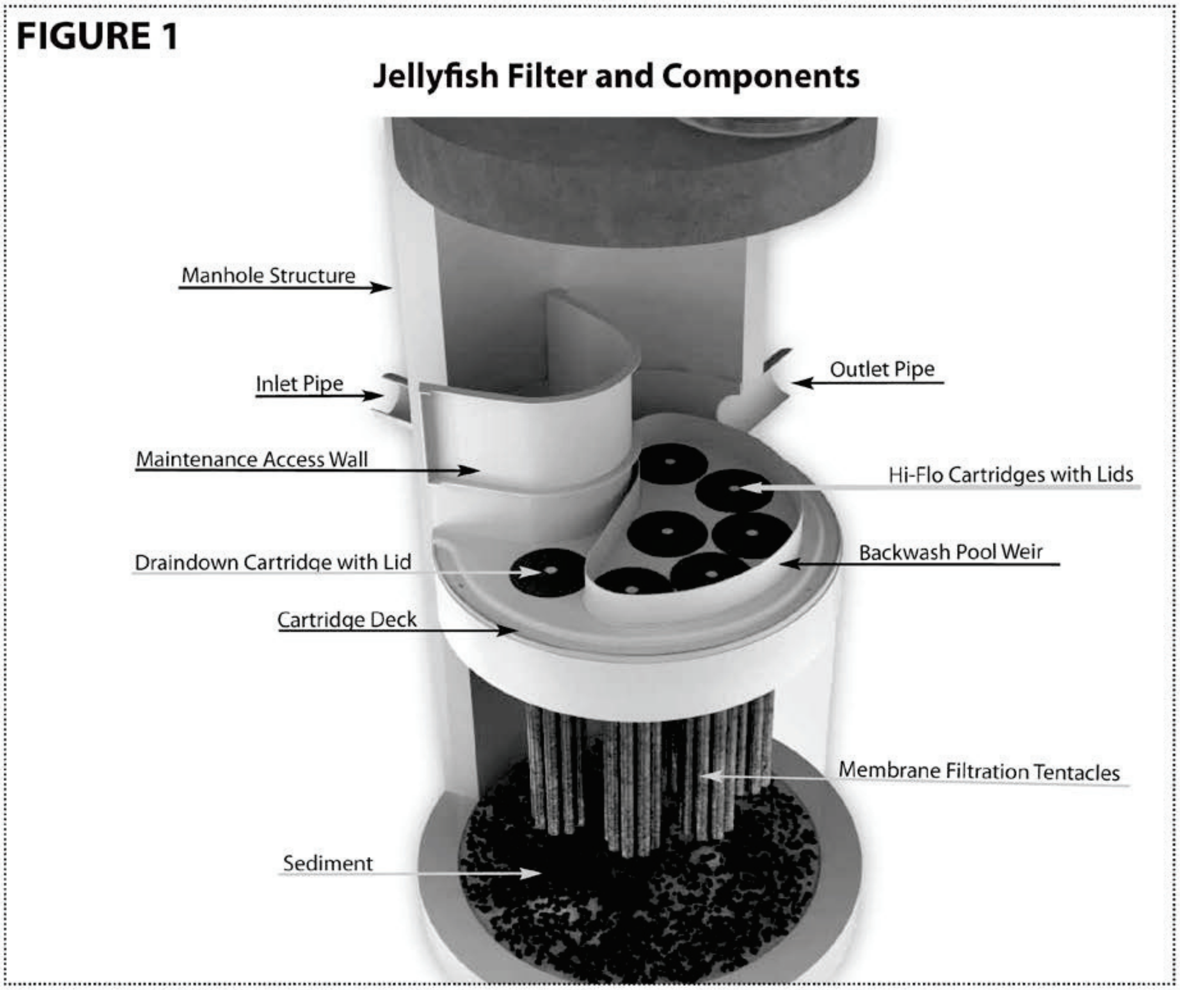
2. The Jellyfish® Filter

The Jellyfish® Filter is an engineered stormwater quality treatment technology that utilizes multiple lightweight membrane filtration cartridges in a compact stand-alone treatment system that removes a high level and wide variety of stormwater pollutants. The Jellyfish® Filter integrates pre-treatment and filtration with passive self-cleaning mechanisms. The system utilizes membrane filtration cartridges with very high filtration surface area and flow capacity, which provide the advantages of high sediment capacity and low filtration flux rate (flow per unit surface area) at relatively low driving head compared to conventional filter systems. Figure 1 shows the Jellyfish® Filter and its major components.

The cartridge deck contains a receptacle for each filter cartridge. The cartridge is lowered down into the receptacle such that the cartridge head plate and rim gasket rest on the lip of the receptacle. A cartridge lid is fastened onto the receptacle to anchor the cartridge. Each cartridge lid contains a flow control orifice. The orifice in the hi-flo cartridge lid is larger than the orifice in the draindown cartridge lid.

Jellyfish® Filter cartridges are designated as either hi-flo cartridges or draindown cartridges, depending on their placement position within the cartridge deck. Cartridges placed within the 6-inch (150 mm) high backwash pool weir that extends above the deck are automatically passively backwashed after each storm event and are designated as the hi-flo cartridges. Cartridges placed outside the backwash pool weir are not passively backwashed but facilitate the draindown of the backwash pool, and these are designated as the draindown cartridges. The design flow rate of a draindown cartridge is controlled by a cartridge lid orifice to one-half the design flow rate of a hi-flo cartridge of similar length. The lower design flow rate of the draindown cartridge reduces the likelihood of occlusion prior to scheduled maintenance.

Figure 1 Jellyfish® Filter and Components

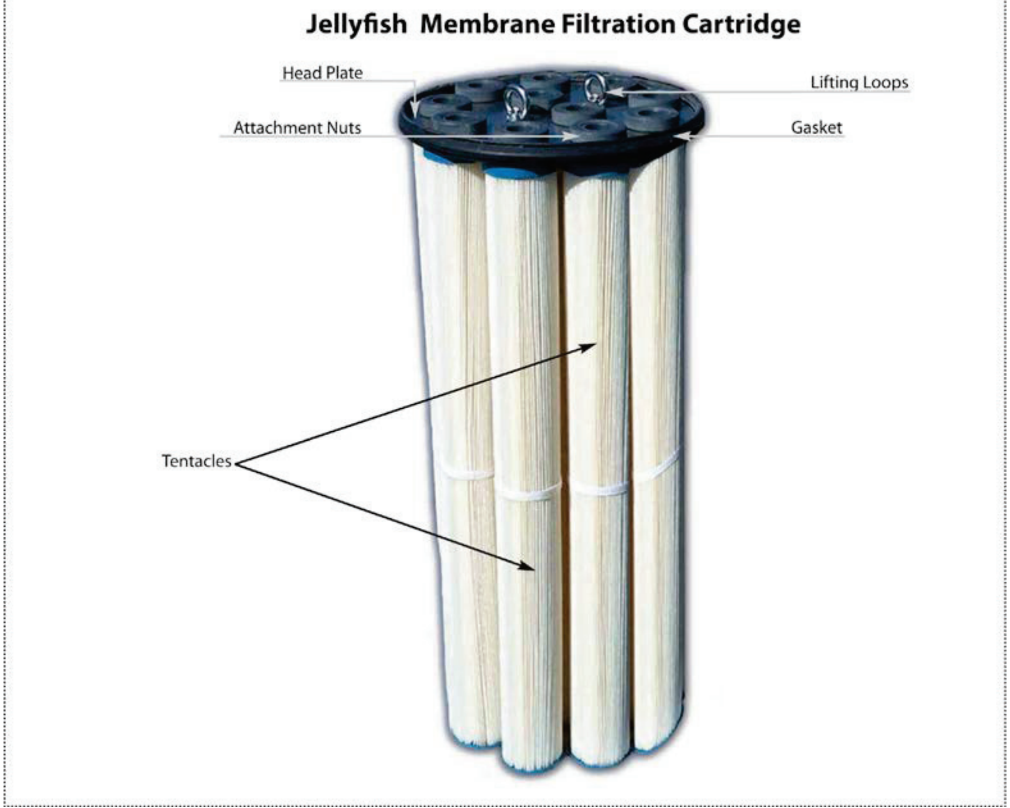


Note: Separator Skirt Not Shown

Each cartridge consists of multiple removable filter elements ("filtration tentacles") attached to a cartridge head plate. Each filtration tentacle consists of a central perforated tube surrounded by a specialized membrane. The cylindrical filtration tentacle has a threaded pipe nipple at the top and is sealed at the bottom with an end cap. A cluster of tentacles is attached to a stainless steel head plate by inserting the top pipe nipples through the head plate holes and securing with removable nuts. A removable oil-resistant polymeric rim gasket is attached to the head plate to impart a watertight seal when the cartridge is secured into the cartridge receptacle with the cartridge lid. The cartridge length is typically either 27 inches (686 mm) or 54 inches (1372 mm), with options for custom lengths if required. A Jellyfish membrane filtration cartridge is depicted in Figure 2.

Figure 2 Jellyfish® Membrane Filtration Cartridge

FIGURE 2

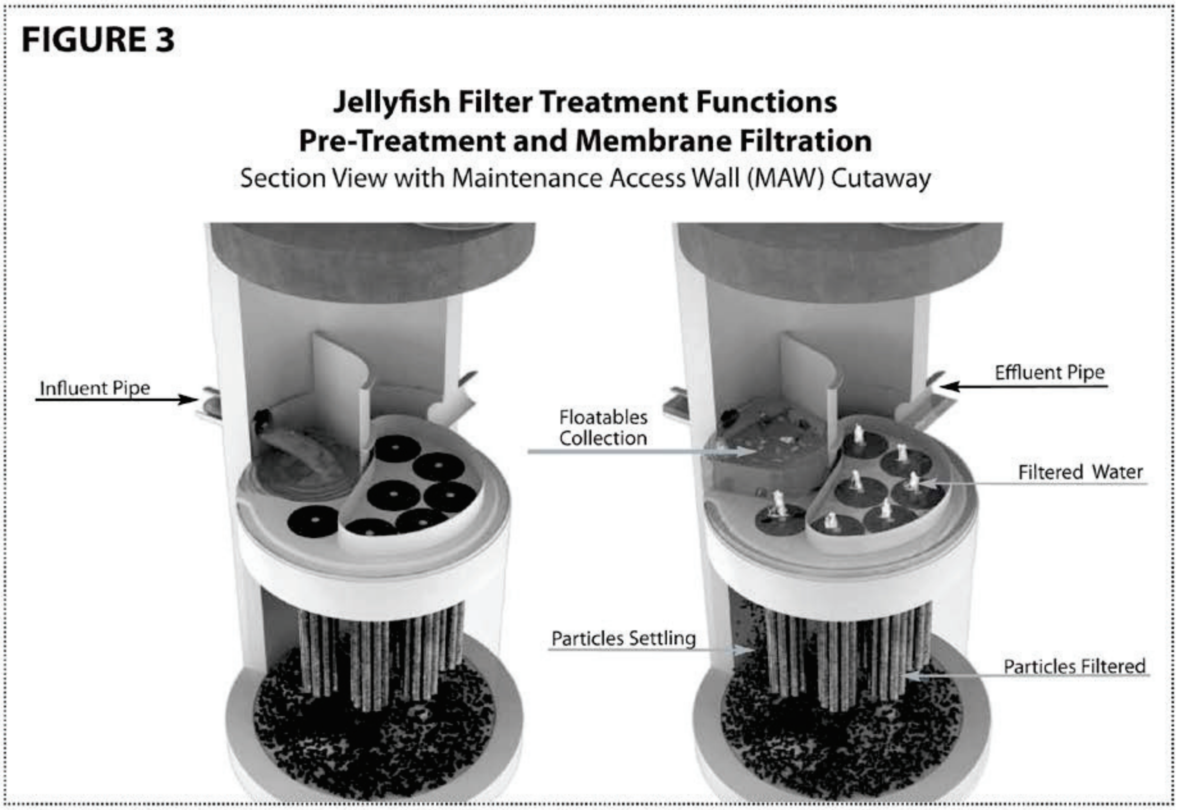


The filtration tentacle membranes provide an extremely large amount of surface area, resulting in outstanding flow capacity and suspended sediment removal capacity. A typical Jellyfish cartridge with eleven 54-inch (1372 mm) long filtration tentacles has 381 ft2 (35.4 m2) of membrane surface area. Hydraulic testing on a clean 54-inch (1372 mm) filter cartridge is discussed in **Appendix B**. In addition, the filtration tentacle membrane has anti-microbial characteristics to inhibit the growth of bio-film that might otherwise prematurely occlude the pores of the membrane and restrict hydraulic conductivity.

Inflow events with driving head ranging from less than 1 inch (25 mm) up to the maximum design driving head will cause continuous forward flow and filtration treatment through the draindown cartridges. Inflow events with driving head that exceeds the 6-inch (150 mm) height of the backwash pool weir will cause continuous forward flow and filtration treatment through the hi-flo cartridges. Typically, a minimum 18 inches (457 mm) of driving head is designed into the system but may vary from 12 to 24 inches (305 to 610 mm) depending on specific site requirements.

The Jellyfish® Filter provides both pre-treatment and membrane filtration treatment to remove pollutants from stormwater runoff. These functions are depicted in Figure 3 below.

Figure 3 Jellyfish® Filter Treatment Functions



Pre-treatment removes coarse sediment (particles generally > 50 microns), particulate-bound pollutants attached to coarse sediment (nutrients, toxic metals, hydrocarbons), free oil and floatable trash and debris. These pollutants are removed by gravity separation. Large, heavy particles fall to the sump (sedimentation) and low density pollutants rise to the surface (floatation) within the pre-treatment channel.

Membrane filtration treatment removes suspended particulates (generally < 50 microns) and particulate-bound pollutants (nutrients, toxic metals, hydrocarbons, and bacteria). Laboratory and field performance testing of the Jellyfish® Filter have demonstrated capture of particulates as small as 2 microns. As a layer of sediment builds up on the external membrane surface, membrane pores are partially occluded which serves to reduce the effective pore size. This process, referred to as “filter ripening”, significantly improves the removal efficiency of pollutants relative to a brand new or clean membrane. Filter ripening accounts for the ability of the Jellyfish® Filter to remove particles finer than the nominal pore size rating of the membranes.

The Jellyfish® Filter utilizes several self-cleaning processes to remove accumulated sediment from the external surfaces of the filtration membranes, including automatic passive backwash of the hi-flo cartridges, vibrational pulses, and gravity. Combined, these processes extend the cartridge service life and maintenance interval and reduce life-cycle costs.

Automatic passive backwash is performed on the hi-flo cartridge at the end of each runoff event and can also occur multiple times during a single storm event as intensity and driving head varies. During inflow, filtered water exiting the hi-flo cartridges forms a pool above the cartridge deck inside the backwash pool weir. The depth and volume of the back wash pool will vary with the available driving head, ranging from some minimal quantity up to a quantity sufficient to fill and overflow the backwash pool (typical weir height is 6 inches / 150 mm). As the inflow event subsides and forward driving head decreases, water in the backwash pool reverses flow direction and automatically passively backwashes the hi-flo cartridges, removing sediment from the membrane surfaces. Water in the lower chamber (below deck) is displaced through the draindown cartridges.

Vibrational pulses occur as a result of complex and variable pressure and flow direction conditions that arise in the space between the top surface of the cartridge head plate and the underside of the cartridge lid. During forward flow a stream of filtered water exits the top of each filtration tentacle into this space and encounters resistance from the cartridge lid and turbulent pool of water within the space. Water is forced through the cartridge lid flow control orifice with a pulsating fountain effect. The variable localized pressure causes pulses to transmit vibrations to the membranes, thereby dislodging accumulated sediment. The effect appears more pronounced at higher flow rates, and applies to both hi-flo and draindown cartridges.

Gravity continuously applies a force to accumulated sediment on the membranes, both during inflow events and inter-event dry periods. As fine particles agglomerate into larger masses on the membrane surface, adhesion to the membrane surface can lessen, and a peeling effect ensues which ultimately results in agglomerates falling away from the membrane. Complex chemical and biological effects may also play a role in this process.

Standard Models

The Jellyfish® Filter standard model numbers provide information about the manhole inside diameter (expressed in U.S. customary units) and cartridge counts for hi-flo and draindown cartridges. For example, Jellyfish Filter model number JF6-4-1 is a 6-ft diameter manhole with four hi-flo cartridges and one draindown cartridge. Standard model numbers assume the use of 54-inch (1372 mm) long cartridges. Specific designations for non-standard structures or cartridge lengths are noted in the Jellyfish Filter Owner's Manual published by Imbrium Systems and provided to system owners. For the field test that is the subject of this report a Jellyfish Filter JF4-2-1 was used, which is a 4-ft diameter manhole with two 54-inch long hi-flo cartridges and one 54-inch long draindown cartridge.

Design flow capacities and pollutant capacities for standard Jellyfish Filter manhole configurations are shown in Tables 1 and 2.

Table 1 Design Flow Capacities - Standard Jellyfish® Filter Configurations

Manhole Diameter (ft / m) [1]	Model No.	Hi-Flo Cartridges [2] 54 in / 1372 mm	Draindown Cartridges [2] 54 in / 1372 mm	Treatment Flow Rate (gpm / cfs)	Treatment Flow Rate (L/s)
Catch Basin		varies	varies	varies	varies
4 / 1.2	JF4-2-1	2	1	200 / 0.45	12.6
6 / 1.8	JF6-3-1	3	1	280 / 0.62	17.7
	JF6-4-1	4	1	360 / 0.80	22.7
	JF6-5-1	5	1	440 / 0.98	27.8
	JF6-6-1	6	1	520 / 1.16	32.8
8 / 2.4	JF8-6-2	6	2	560 / 1.25	35.3
	JF8-7-2	7	2	640 / 1.43	40.4
	JF8-8-2	8	2	720 / 1.60	45.4
	JF8-9-2	9	2	800 / 1.78	50.5
	JF8-10-2	10	2	880 / 1.96	55.5
10 / 3.0	JF10-11-3	11	3	1000 / 2.23	63.1
	JF10-12-3	12	3	1080 / 2.41	68.1
	JF10-12-4	12	4	1120 / 2.50	70.7
	JF10-13-4	13	4	1200 / 2.67	75.7
	JF10-14-4	14	4	1280 / 2.85	80.8
	JF10-15-4	15	4	1360 / 3.03	85.8
	JF10-16-4	16	4	1440 / 3.21	90.8
	JF10-17-4	17	4	1520 / 3.39	95.9
	JF10-18-4	18	4	1600 / 3.56	100.9
	JF10-19-4	19	4	1720 / 3.83	108.5
12 / 3.6	JF12-20-5	20	5	1800 / 4.01	113.6
	JF12-21-5	21	5	1880 / 4.19	118.6
	JF12-22-5	22	5	1960 / 4.37	123.7
	JF12-23-5	23	5	2040 / 4.54	128.7
	JF12-24-5	24	5	2120 / 4.72	133.8
	JF12-25-5	25	5	2200 / 4.90	138.8
	JF12-26-5	26	5	2280 / 5.08	143.8
	JF12-27-5	27	5	2360 / 5.26	148.9
Vault		varies	varies	varies	varies

[1] Smaller and larger systems may be custom designed

[2] Shorter length cartridge configurations are available

Table 2 Design Pollutant Capacities - Standard Jellyfish® Filter Configurations

Model Diameter (ft / m)	**Wet Volume Below Deck (ft^3 / L)**	**Sediment Capacity [1] (ft^3 / L)**	**Oil Capacity [2] (gal / L)**
Catch Basin	varies	varies	varies
JF4 4 / 1.2	82 / 2313	12 / 0.34	100 / 379
JF6 6 / 1.8	184 / 5205	28 / 0.79	224 / 848
JF8 8 / 2.4	327 / 9252	50 / 1.42	388 / 1469
JF10 10 / 3.0	511 / 14,456	78 / 2.21	608 / 2302
JF12 12 / 3.6	735 / 20,820	113 / 3.20	732 / 2771
Vault	varies	varies	varies

[1] Assumes 12 inches (305 mm) of sediment depth in sump.
Systems may be designed with increased sediment capacity.
[2] Assumes 24 inches (610 mm) of pre-treatment channel depth for oil storage

3. Technology System Evaluation: Project Plan

3.1 Introduction

The TARP field test of Imbrium Systems' Jellyfish® Filter that is the primary subject of this report (Sansalone 2011) was conducted by the University of Florida Engineering School of Sustainable Infrastructure and Environment (UF-ESSIE) in Gainesville, Florida. Prior to initiating the field test at the University of Florida, the source area rainfall and pollutant characteristics and University analytical processes were reviewed with NJCAT and NJDEP and confirmed as acceptable for performing a TARP field study.

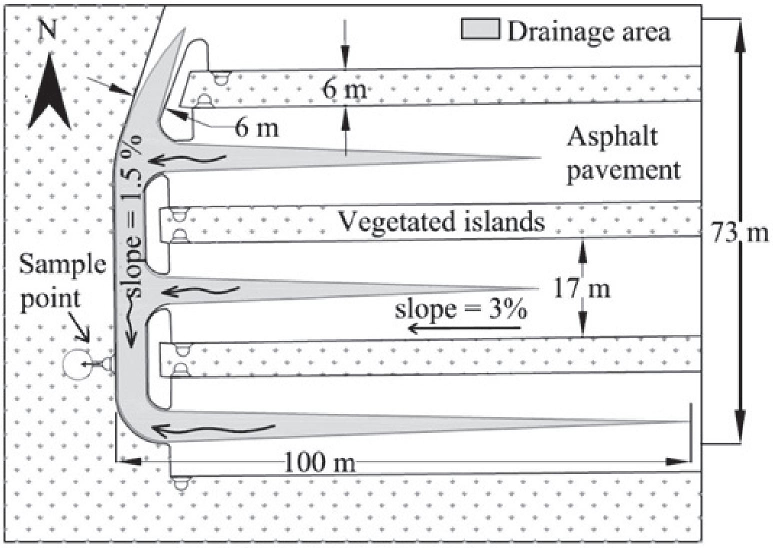
UF-ESSIE prepared a Quality Assurance Project Plan (QAPP) for the proposed field study. The QAPP was submitted to NJCAT for review and was subsequently approved. The QAPP adheres to guidelines established in EPA Requirements for Quality Assurance Project Plans (EPA QA/R-

5), the TARP Protocol for Stormwater Best Management Practice Demonstrations, and the Virginia Technology Assessment Protocol (VTAP) Guidance for Evaluating Stormwater Manufactured Treatment Devices.

3.2 Site and System Description

The Reitz Union parking lot at the University of Florida – Gainesville was the field study site. It is an asphalt-paved source area that functions as a primary parking facility for the University of Florida. The parking lot was built in the 1990s and is designed to provide adequate conveyance of runoff during wet weather events with storm runoff considered with respect to adequate surface drainage. Raised vegetated islands separate parking aisles and drain to the impervious asphalt-paved surface which drains by gravitationally-driven sheet flow to the curb and gutter leading to regularly-spaced catch-basins. The total area of the island is 24.39 % of the entire parking lot and the percentage of pavement is 75.61 %. The islands are mainly planted with magnolia trees, an occasional sycamore tree and grass. These catch-basins concentrate and collect gutter flow and provide entry of runoff into a storm sewer pipe system on the University of Florida campus. All the collected runoff discharges to Lake Alice about 2000 ft away from the parking lot. The combination of impervious asphalt pavement and raised vegetated islands, a very common design for surface parking across North America (Berretta and Sansalone 2011), provides substantial loads of nitrogen, phosphorus, metals, and particulate matter (PM) to runoff from the site.

Figure 4(a) illustrates the drainage for the contributing area and (b) provides an aerial view of the watershed.



4(b) Aerial photo of the Reitz Union surface parking facility at the University of Florida in Gainesville, illustrating the contributing drainage area and influent appurtenance (Inlet A) serving as the feed to the JF4-2-1. North is towards the top of the page. The NW intersection is Museum Road at Center Drive.

Depending on the storm event intensity and wind direction the drainage area can vary from 5,400 to 8,600 ft^2 (0.12 to 0.20 acres) of pavement. The catchment drains to inlet A as shown in Figure 4(b) and 4(a). Runoff captured by inlet A is the source of influent to the downstream Jellyfish Filter.

Data from a 2009 monitoring study (Berretta and Sansalone, 2011) at this identical test site was useful in the selection of a properly sized Jellyfish Filter for the site. The study included runoff flow rate data from 15 storm events. Two of those storms generated peak runoff flow rates that exceeded 200 gpm. Based on this actual historical data, the Jellyfish Filter model JF4-2-1 with 54-inch long filtration cartridges was installed for field testing. The JF4-2-1 is a 4-ft diameter manhole configuration with two hi-flo cartridges, each rated at 80 gpm, and a single draindown cartridge rated at 40 gpm, for a total Maximum Treatment Flow Rate (MTFR) of 200 gpm at 18 inches of driving head. The historical runoff data suggested that over the course of a minimum 20-storm monitoring campaign, several storms would generate peak flow rates that meet or exceed the treatment unit's MTFR. This was indeed the case; two storms generated peak flow rates exceeding 200 gpm during the Jellyfish® Filter monitoring period.

Since the University required a temporary installation of the treatment unit, a fiberglass JF4-2-1 was provided and installed above-ground on a hillside just below the catchment area. The above-ground installation facilitated much easier site construction and minimal site disturbance, and provided advantages for the monitoring personnel in terms of access to sampling points and instrumentation, and direct observation of flow dynamics within the treatment unit. A profile view schematic of the site set-up is shown in Figure 5 and a corresponding photo in Figure 6. The unit was equipped with a side man-way to facilitate manual removal of accumulated PM as well as system inspection at the conclusion of the study.

The JF4-2-1 was configured with a below-deck inlet pipe and deflector plate, which are standard options for the Jellyfish Filter. The test unit contained a circular maintenance access pipe, a feature that has been replaced in later designs by a horseshoe-shaped maintenance access wall. The test unit also contained a pressure relief pipe that could potentially function as an internal bypass, however this feature was rendered nonfunctional by the installation of an external bypass. External bypass piping was configured around the unit such that influent flows attaining a water elevation exceeding 18 inches above deck elevation would be externally bypassed to the downstream drop box where effluent samples were taken. The invert of the horizontal run of bypass piping was set at 18 inches above deck elevation to insure that the design driving head of 18 inches was provided to the Jellyfish Filter. Top view photos of the JF4-2-1 cartridge deck are shown in Figures 7 and 8.

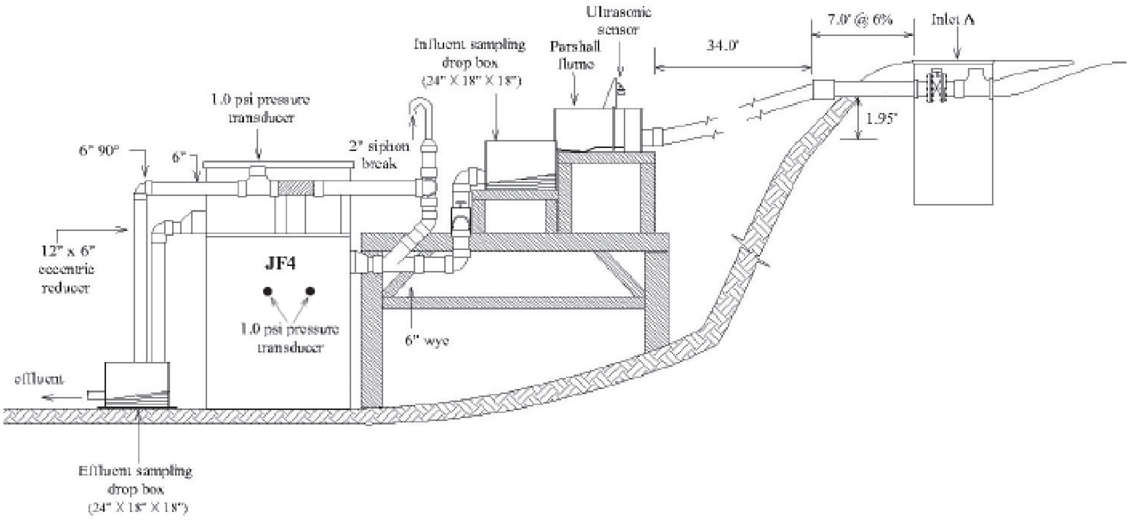


Figure 5 Profile view schematic of the field set-up for the Jellyfish® Filter JF4-2-1

Figure 6 Photo of field test set-up for the Jellyfish® Filter JF4-2-1. Below-deck inlet pipe enters the right side of the vessel and outlet pipe (invert at deck level) exits the left side of the vessel. External bypass piping has invert of horizontal section 18 inches above deck level.

Figure 7 Top view photos of the Jellyfish® Filter JF4-2-1 deck with two hi-flo cartridges and one draindown cartridge installed with cartridge lids off (upper left image) and cartridge lids on (upper right image). The backwash pool weir encloses the hi-flo cartridge. Also shown are the maintenance access pipe (large), pressure relief pipe (small), and the outlet opening (lower right in each image).

Figure 8 Top view photo of the Jellyfish® Filter JF4-2-1 during operation. Filtered water exits the cartridge lid orifice as a pulsating fountain.

3.3 Test Methods, Procedures and Equipment

Field monitoring system design for the Jellyfish® Filter JF4-2-1 included the following:

Monitoring and collection of rainfall-runoff were performed for 25 storm events. Runoff samples were collected manually on a time basis with physical, hydrologic and radar observations. Manual sampling with flow weighting was used. Samples of the whole influent and effluent flows were collected manually at 2-10 minute intervals, depending on storm duration. Manual sampling of the whole flow has a distinct advantage over auto-sampling of a small portion of the cross-section of flow, since sampling of the whole flow provides a more accurate representation of the actual pollutant load transported in the runoff. The flow rate at the time of sampling, and throughout the storm duration, was recorded automatically by the flowmeter, and therefore the flow volume is known for each time interval during the storm. Once the storm event ended, the samples taken at timed intervals across the hydrograph were transported to the laboratory and composited. Compositing was flow volume-weighted based on the volume of runoff corresponding to each respective time interval on the hydrograph. After compositing, analysis was performed.

During events, runoff was conveyed from the catchment to the treatment system after collection by catch basin inlet A. The distance from inlet A to the treatment system was 34 feet. Influent samples were collected at the influent drop box upstream of the treatment unit and effluent samples were collected at the effluent drop box downstream of the unit. The influent sample location was 4 feet upstream, and the effluent sample location was 2 feet downstream, of the unit.

Flow rate measurement utilized a 1 inch (25 mm) Parshall flume equipped with an ultrasonic sensor (model Shuttle Level Transmitter) connected to a data logger (model EasyLog EL-USB). Flow from the flume discharged into the influent drop box, creating a free well-defined discharge for representative manual sampling. The Parshall flume calibration curve is shown in Figure 9.

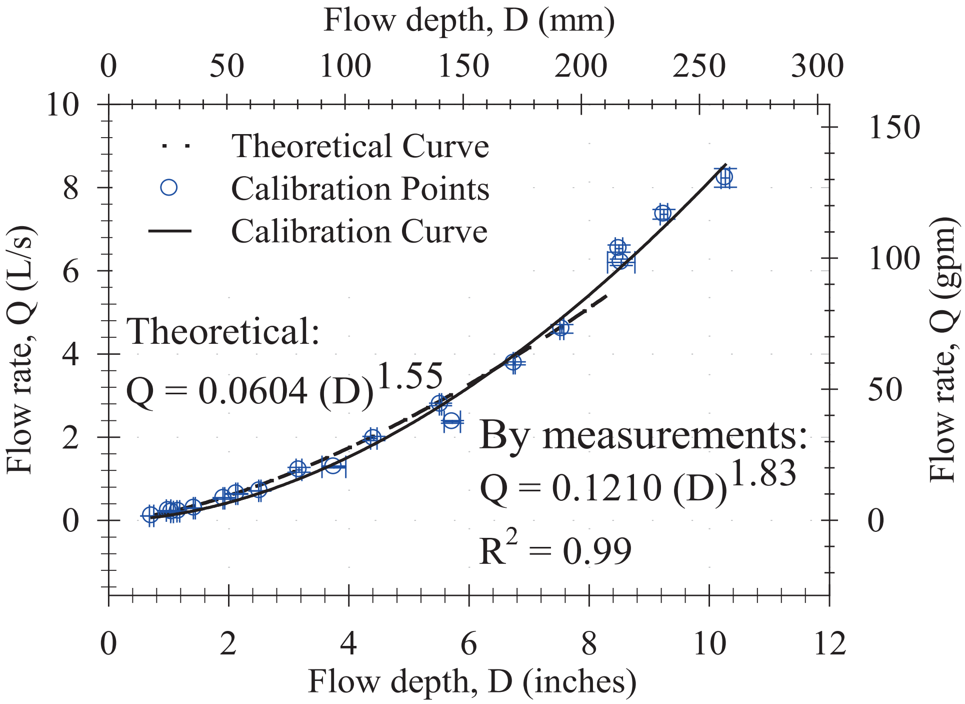


Figure 9 Parshall flume calibration curve

Rainfall measurement utilized a tipping bucket rain gauge manufactured by ISCO Inc. (0.01-inch bucket capacity) equipped with a data logger installed on the roof of the Unit Operations building located 150 meters south of the monitored site. Rainfall data were recorded every five minutes by the data logger.

Head loss measurements utilized monitoring of water pressure/elevation in the inlet and outlet pipes of the treatment unit with two 1-psi pressure transducers (model PDCR 1830 1 psig, manufactured by DRUCK Inc.) connected to a data logger (model CR1000, manufactured by Campbell Scientific Inc.).

pH, conductivity, and temperature measurement utilized a YSI 600XLM-M Multi-Parameter Water Quality Logger installed in the treatment unit's inlet for continuous automatic monitoring.

Sample analyses were performed in the University of Florida analytical labs, which is a NJDEP certified environmental laboratory. Samples were transported to the labs immediately after each storm and all time-sensitive analyses were performed within sample holding times. All samples were handled in accordance with chain-of-custody procedures and analyzed in accordance with Standard Method protocols. A summary of the analytical tests performed is given in Table 3.

Table 3 Summary of Analytical Tests

	Analysis	Test Methods
Water Chemistry Analysis	pH	S.M[1].4500-H^+ B
	Conductivity/TDS/Salinity	S.M.2510
	Oxidation-Reduction Potential	S.M.2580
	Temperature	S.M.2550
	Alkalinity	S.M.2320
Particulate Matter (PM) Analysis	Sediment PM	Sansalone and Kim., (2008)[2]
	Settleable PM	S.M.2540-F
	Suspended PM (as TSS)	S.M.2540-D
	Volatile Suspended PM (VSS)	S.M.2540-E
	Total PM (as SSC)	ASTM D-3977-97
	Turbidity	S.M.2130
	PSD	S.M.2560-D
Phosphorus Analysis	Total Phosphorus (TP)	S.M.4500-P-B Acid Hydrolysis
Nitrogen Analysis	Total Nitrogen (TN)	Persulfate Digestion Method
Metals Analysis	Total Metals (Cu, Cr, Pb, Zn)	S.M.3030 B
Oil and Grease	Total O&G	S.M. 5520
COD	Total COD	Reactor Digestion Method
	Dissolved COD	Reactor Digestion Method

[1] S.M.: Standard Method

[2] J. Sansalone and J-Y Kim, "Transport of Particulate Matter Fractions in Urban Source Area Pavement Surface Runoff", ***J. Environmental Quality***, 37:1883–1893 2008.
[2] J-Y Kim and J. Sansalone, "Event-Based Size Distributions of Particulate Matter Transported During Urban Rainfall-Runoff Events", ***Water Research***, 42(10-11), 2756-2768, May 2008.

3.4 Hydraulic Testing of the Jellyfish® Filter JF4-2-1

Extensive hydraulic testing was conducted at the University of Florida on a new clean 54-inch long Jellyfish® filtration cartridge with various orifice sizes in the cartridge lid. Hydraulic testing was also conducted on the Jellyfish® Filter JF4-2-1 with the standard 70 mm lid orifice on each of the two hi-flo cartridges and the standard 35 mm lid orifice on the single draindown cartridge, and was performed on the system with clean cartridges prior to commissioning as well as with dirty cartridges at the conclusion of the monitoring period (25 monitored storm events and 15 inches of cumulative rainfall).

3.5 Stormwater Data Collection Requirements

Of the 25 qualifying storm events sampled between May of 2010 and June of 2011: 1) the total rainfall was equal to or greater than 0.1 inch for all storm events sampled, 2) the minimum inter-event period was greater than 10 hours for all storm events sampled, 3) flow-weighted composite samples covered 100% of total storm flow for all storm events sampled, 4) the minimum influent/effluent samples collected in the storm events was 8 and the average number of influent samples collected per storm event was 11.1 and the average number of effluent samples per storm event was 10.5, 5) the total sampled rainfall was 15.01 inches, 6) three events exceeded 75% of the design treatment capacity, while two of these events exceeded the design treatment capacity (>100%), and 7) TSS-SM and SSC data were collected for all storm events sampled. All of the events qualified to strict interpretation of the stormwater data collection requirements as per New Jersey Tier II Stormwater Test Requirements—Amendments to TARP Tier II Protocol (NJDEP, 2006) and the NJDEP interpretation of TARP (2003). (**Tables 4** and **5)**

4. Technology System Performance

4.1 Data Quality Assessment

Data were analyzed using statistical methods in accordance with guidelines in the **TARP Protocol for Stormwater Best Management Practice Demonstrations** and the **VTAP Guidance for Evaluating Stormwater Manufactured Treatment Devices**. Data were examined by statistical and regression analysis, ANOVA statistics, non-parametric analysis, correlations, probability distributions of data, normality testing, standards, and physical data replication.

Data integrity in the laboratory was addressed in a multi-level review process for all analyses conducted. The initial step in this review process was conducted by each lab analyst as tests were conducted. Calibration values and procedures were checked against previous tests to alert the analyst in case of malfunction in equipment or test errors.

The second level of review was conducted by the lab director who collected results and entered these values into the tabular spreadsheets for each test. Each of the results was checked for accuracy of input as well as to appropriateness for the samples which were analyzed. All results were overseen or conducted personally by the lab manager. All preliminary calculations were reviewed. The final level of review was conducted by the project manager who reviewed all results generated within the laboratory.

4.2 Test Results

Hydrology

Event-based hydrologic indices including previous dry hours (PDH), event duration, peak flow rate, median flow rate, mean flow rate, total runoff volume, rainfall depth, initial pavement residence time (IPRT), and runoff coefficient were monitored for a total of 25 TARP and VTAP qualifying storm events occurring over the 13-month period spanning May 28, 2010 to June 27, 2011. Cumulative rainfall depth was 15.01 inches. Data are shown in **Tables 4** and **5**. Individual storm event summaries with hydrographs and hyetographs are detailed in **Appendix A**.

Monitored storm events across the field test program varied in duration from 26 to 691 minutes. Previous dry hours range from 10 to 910 hours. Rainfall ranged from 0.10 to 1.98 inches. IPRT ranged from 1 to 34 minutes. Runoff volume ranged from 54 to 3495 gpm. Maximum rainfall intensity ranged from 0.2 to 5.4 in/hr. Maximum runoff flow rate ranged from 7 to 226 gpm, median flow rate ranged from 0.7 to 87gpm. Two storms (July 15 and August 1) generated peak flow rates that exceeded the Maximum Treatment Flow Rate of 200 gpm for the Jellyfish Filter JF4-2-1.

Table 4 Monitored rainfall-runoff event hydrologic data

Event Date	t_{rain} (min)	d_{rain} (in)	$i_{rain\text{-}max}$ (inch/hr)	IPRT (min)	V_{inf} (gal)	V_{eff} (gal)	Runoff Reduction %	Q_p (gpm)	Q_{med} (gpm)	n_{inf}	n_{eff}	TARP& VTAP Qualified
28 May 2010	112	0.81	3.0	10	1972	974	51%	68	15.5	19	8	Yes
16 June	61	0.63	2.4	18	1323	1234	7%	85	10.3	11	10	Yes
21 June	43	0.92	4.8	6	2297	2238	3%	118	86.7	10	10	Yes
30 June	50	0.52	3.0	8	1442	1410	2%	145	52.3	11	11	Yes
15 July	28	0.38	3.6	8	953	872	8%	210	22.9	10	10	Yes
1 August	36	1.18	5.0	5	3163	3089	3%	226	75.1	10	10	Yes
6 August	104	0.14	2.0	5	368	271	27%	108	0.2	10	8	Yes
7 August	48	0.34	2.4	7	693	672	3%	131	6.8	10	10	Yes
23 August	42	0.11	0.6	20	82	51	38%	20	0.2	10	10	Yes
12 September	52	0.27	2.0	18	434	399	8%	61	1.6	10	10	Yes
26 September	78	0.14	0.2	1	298	221	26%	7	4.1	10	10	Yes
27 September	388	0.60	3.6	20	1015	996	2%	173	0.7	10	10	Yes
4 November	43	0.19	1.8	5	263	135	49%	56	1.8	10	10	Yes
16 November	34	0.13	1.0	8	81	44	46%	28	0.3	11	11	Yes
5 January 2011	125	0.84	4.2	3	1532	1309	15%	117	2.6	10	10	Yes
10 January	26	0.20	3.6	4	298	277	7%	53	0.2	8	8	Yes
25 January	389	1.74	0.7	5	3273	3268	0%	65	6.2	10	10	Yes
7 February	306	1.29	1.2	8	3495	3420	2%	35	12.1	11	11	Yes
9 March	691	1.15	0.6	10	2656	2594	2%	50	1.6	12	12	Yes
28 March	66	0.10	1.3	7	138	112	19%	16	0.9	12	10	Yes
30 March	179	0.60	3.0	34	979	973	2%	89	1.6	12	12	Yes
20 April	61	0.14	0.6	9	54	30	44%	52	0.1	12	12	Yes
14 May	295	1.98	5.4	5	2974	2830	2%	119	0.4	19	19	Yes
6 June	69	0.16	0.9	4	254	194	24%	25	0.1	10	10	Yes
27 June	50	0.45	1.7	2	894	840	6%	53	2.0	10	10	Yes
Sum		15.0			30,830	28,453						

Difference between influent and effluent volume: 30,830 – 28,453 = 2,407 gal.

PDH: Previous dry hours
t_{rain}: Event duration
d_{rain}: Rainfall depth
$i_{rain\text{-}max}$: Maximum rainfall intensity
IPRT: Initial pavement residence time
V_{runoff}: Runoff volume

Q_p: Maximum flow rate
Q_{med}: Median flow rate
n_{inf}: Number of influent samples
n_{eff}: Number of effluent samples
CRD: Cumulative rainfall depth

Table 5 Rainfall-runoff data collection requirements

Event Date	Sampling Coverage (nearest 10%)	Number of Composited samples	d_{rain} (in)	PDH (hr)	V_{runoff} (gal)	Q_p (gpm)	% of Treatment Design at Q_p	TARP& VTAP Qualified
28 May 2010	100	27(19i) (8e)	0.81	96	1972	68	34	Yes
16 June	100	21(11i) (10e)	0.63	288	1323	85	43	Yes
21 June	100	20(10i) (10e)	0.92	96	2297	118	59	Yes
30 June	100	22(11i) (11e)	0.52	288	1442	145	72	Yes
15 July	100	20(10i) (10e)	0.38	96	953	210	105	Yes
1 August	100	20(10i) (10e)	1.18	24	3163	226	113	Yes
6 August	100	18(10i) (8e)	0.14	120	368	108	54	Yes
7 August	100	20(10i) (10e)	0.34	24	693	131	65	Yes
23 August	100	20(10i) (10e)	0.11	48	82	20	10	Yes
12 September	100	20(10i) (10e)	0.27	172	434	61	30	Yes
26 September	100	20(10i) (10e)	0.14	40	298	7	4	Yes
27 September	100	20(10i) (10e)	0.60	10	1015	173	87	Yes
4 November	100	22(11i) (11e)	0.19	910	263	56	28	Yes
16 November	100	22(11i) (11e)	0.13	286	81	28	14	Yes
5 January 2011	100	20(10i) (10e)	0.84	72	1532	117	58	Yes
10 January	100	16(8i) (8e)	0.20	106	298	53	26	Yes
25 January	100	20(10i) (10e)	1.74	365	3273	65	32	Yes
7 February	100	22(11i) (11e)	1.29	12	3495	35	18	Yes
9 March	100	24(12i) (12e)	1.15	79	2656	50	25	Yes
28 March	100	22(11i) (11e)	0.10	438	138	16	8	Yes
30 March	100	24(12i) (12e)	0.60	48	979	89	44	Yes
20 April	100	24(12i) (12e)	0.14	196	54	52	26	Yes
14 May	100	38(19i) (19e)	1.98	188	2974	119	60	Yes
6 June	100	20(10i) (10e)	0.16	541	254	25	12	Yes
27 June	100	20(10i) (10e)	0.45	88	894	53	27	Yes
Sum			15.01		30,830			

("i" stands for influent, "e" stands for effluent)

Particle Size Distributions

Particle size distribution was analyzed for all 25 storm events using laser diffraction and M1e scattering theory (Dickenson and Sansalone 2009, Garofalo and Sansalone 2011). The % finer by mass, d_{10}, d_{50}, and d_{90}, are shown in **Table 6**. The d_{50} represents the particle diameter for which 50 percent of the particles by mass are smaller than or the same size as that diameter. Similarly, the d_{10} and the d_{90} represent the particle diameters for which 10 and 90 percent of the particles by mass are smaller than or the same size as those diameters. For the 25 events monitored in this study, influent runoff d_{10} ranges from 2 to 54 µm with a median of 9 µm. Effluent runoff d_{10} ranges from <1 to 2 µm with a median of 1 µm. Influent runoff d_{50} ranges from 22 to 263 µm with a median of 82 µm. Effluent runoff d_{50} ranges from 1 to 11 µm with a median of 3 µm. Influent runoff d_{90} ranges from 173 to 1016 µm with a median of 401 µm. Effluent runoff d_{90} ranges from 2 to 52 µm with a median of 12 µm.

Recognizing that intensity is only one parameter (others are deposition, volume, previous dry hours) impacting the complexity of transport, it was generally observed that larger particles were mobilized during the more intense rain events of 14 May 2011, 21 June and 1 August 2010, with peak rainfall intensities of 5.4, 4.8 and 5.0 in/hr (137.2, 121.9, and 127.0 mm/hr) and median flows of 0.4, 87 and 75 gpm (0.02, 5.4 and 4.7 L/s), respectively;. The 21 June event had the largest influent d_{10} and d_{50} values of 54 and 263 µm, respectively. The least intense events were 23 August, 26 September, 2010, 9 March and 20 April, 2011 with peak rain intensities of 0.6, 0.2, 0.6 and 0.6 in/hr (15.0, 5.1, 15.0 and 15.0 mm/hr) and median flow rates of 0.2, 4.1,1.6 and 0.1 gpm (0.01, 0.26, 0.1 and 0.006 L/s), respectively. The 20 April 2011 event had the smallest influent d_{10} and d_{50} values of 0.3 and 1 µm, respectively.

Particulate Matter Fractions and Removal Efficiency

Removal efficiencies for event-based particulate matter (PM) fractions including Turbidity, PM < 25µm, TSS, PM < 500 µm, PM < 1000 µm, PM < 2000 µm, and SSC were measured for the 25 storm events as shown in **Table 7** and **Table 8**. Detailed procedures of the physical granulometric separation are in Sansalone and Kim (2008), Kim and Sansalone (2008) and Sansalone et. al.(2009).

For the 25 qualifying storms, TSS removal efficiency ranged 71-98% with a median of 89%, and SSC removal efficiency ranged 89-100% with a median of 99%. Turbidity removal efficiency ranged 34-98% with a median of 85%. Influent runoff turbidity ranged from 5 to 171 NTU with a median of 33 NTU. Effluent runoff turbidity ranged from 1 to 14 NTU with a median of 5 NTU.

Total Phosphorus and Total Nitrogen

The event-based concentrations of Total Phosphorus (TP) and Total Nitrogen (TN) for the 25 events are presented in **Table 9**. For the 25 qualifying storms, TP removal efficiency ranged from 11-92% with a median of 59%. TN removal efficiency ranged from (-11) to 88% with a median of 51%.

Total Metals

The event-based influent and effluent concentrations and removal efficiencies of Total Chromium, Total Copper, Total Lead, and Total Zinc for the 25 events are presented in **Table 10**. For the 25 qualifying storms, Total Chromium removal efficiency ranged from (-24) to 98%

with a median of 36%. Total Copper removal efficiency ranged from 55 to 100% with a median of 90%. Total Lead removal efficiency ranged from (-27) to 100% with a median of 81%. Total Zinc removal efficiency ranged from 4 to 99% with a median of 70%.

Negative Percent Removal Rates

For treatment devices that are not designed to remove the dissolved fraction of constituents such as nutrients and metals, it is not unusual to observe a negative percent removal for such pollutants for some of the treated storms during a monitoring campaign. The JF4 is designed to remove PM and the associated particulate-bound fraction of such constituents. Within a storm flow, and within a treatment unit such as the JF4, there is a complex and dynamic combination of chemical, biological, and physical (advection and dispersion) as well as kinetics phenomena that affect the partitioning of constituents between the particulate-bound and dissolved phases. In most urban areas the source materials for nutrients are anthropogenic or biogenic PM that partition into solution as a function of time

There is a hetero-disperse distribution of PM sizes in the influent. Each of these PM size fractions has an initial concentration [mg/g] of particulate-bound nitrogen, phosphorus, or metal associated with it. This concentration varies by PM size fraction due to the varying surface area per unit mass of different PM size fractions. The kinetics of partitioning is such that there is a mass transfer of nitrogen, phosphorus, or metal from the particulate-bound phase to the dissolved phase when the flow enters a treatment unit. The process of partitioning occurs in the opposite direction as well, back to the particulate-bound phase that favors a higher concentration of constituent on the smaller PM fractions that have higher surface area per unit mass. In this way the finer suspended and colloidal PM fractions become preferentially enriched. These enriched fine PM size fractions are more readily flushed from any treatment unit by subsequent intra-event flows and subsequent storms (inter-event re-distribution keeps occurring).

Additionally, all treatment units sustain varying microbial populations, and microbial cells are both enriched with nitrogen and of a small size; by comparison in the fine suspended-size range and of a specific gravity not much greater than 1.0. High microbe concentration eluted in the effluent, relative to the influent, would therefore tend to decrease the percent removal of nitrogen and in part depend on the hydrology, inter-event microbial competition and water chemistry within the treatment unit. In comparison, phosphorus has much more rapid kinetics than TN and partitions back to PM, typically of a larger size range and of much more inorganic nature and therefore with a specific gravity in the range of 2 to 2.7. As a consequence the JF4 demonstrates a significantly higher removal for TP across the entire monitoring campaign and does not exhibit any event-based negatives. While there is phosphorus uptake by the microbial population, once phosphorus re-partitions back to the PM size distribution, TP is far more stable, less leachable, less reactive through microbial mediation, and less mobile as compared to TN in such a complex and temporally-varying environment of a treatment unit.

Table 6 Event-based particle size distributions (PSD)

Event Date	Influent PSD (µm)			Effluent PSD (µm)		
	d_{10}	d_{50}	d_{90}	d_{10}	d_{50}	d_{90}
28 May 2010	7	69	915	2	11	34
16 June	28	242	1016	1	6	16
21 June	54	263	769	1	6	34
30 June	8	75	271	1	5	17
15 July	40	225	628	2	6	17
1 August	26	213	693	2	6	17
6 August	16	231	984	1	3	18
7 August	19	186	737	1	4	12
23 August	14	190	714	2	4	40
12 September	9	89	328	1	2	8
26 September	4	35	173	1	3	52
27 September	15	136	723	1	3	11
4 November	3	68	401	1	2	9
16 November	5	51	610	1	2	12
5 January 2011	15	110	794	1	3	12
10 January	8	117	227	1	2	6
25 January	7	63	308	0	1	2
7 February	7	68	369	1	3	18
9 March	6	57	278	1	3	7
28 March	4	32	200	1	3	8
30 March	6	44	176	1	3	7
20 April	2	22	310	0	1	8
14 May	10	80	705	1	3	8
6 June	10	99	345	1	2	7
27 June	10	82	310	1	6	14
Mean	13	114	519	1	4	16
Median	9	82	401	1	3	12
Std. dev.	12	74	270	0	2	12

Table 7 Removal efficiencies for particulate matter (PM) fractions

Event Date	PM < 25 µm			TSS			%Volatile		Particulate Matter, PM Fractions							SSC		
									< 500 µm			< 1000 µm		< 2000 µm				
	EMC$_i$ [mg/L]	EMC$_e$ [mg/L]	PR (%)	EMC$_i$ [mg/L]	EMC$_e$ [mg/L]	PR (%)	EMV$_i$ (%)	EMV$_e$ (%)	EMC$_i$ [mg/L]	EMC$_e$ [mg/L]	PR (%)	EMC$_i$ [mg/L]	EMC$_e$ [mg/L]	EMC$_i$ [mg/L]	EMC$_e$ [mg/L]	EMC$_i$ [mg/L]	EMC$_e$ [mg/L]	PR (%)
28 May 2010	43.7	11.9	87	89.3	18.7	90	49.0	59.8	261.0	11.3	96	383.4	13.3	525.0	15.4	532.3	15.4	99
16 June	40.2	19.7	53	79.3	21.7	74	34.9	73.6	240.4	13.9	94	534.9	16.0	868.2	18.1	1401.7	18.1	99
21 June	18.4	9.9	48	105.5	15.2	86	21.3	72.6	209.2	5.5	97	374.6	6.5	556.2	7.4	1162.9	7.4	99
30 June	12.2	5.8	53	25.2	7.4	71	15.9	66.9	233.8	4.0	98	289.5	4.7	345.8	5.4	444.5	5.4	99
15 July	23.7	6.9	73	91.8	8.3	92	25.3	34.1	276.6	6.4	98	451.2	7.4	640.7	8.4	812.2	8.4	99
1 August	18.5	6.9	64	130.2	15.4	89	70.5	52.7	83.9	5.5	93	120.6	6.6	161.0	7.7	245.1	7.7	97
6 August	48.0	12.1	82	77.5	15.0	86	51.3	0.3	95.3	5.4	94	145.1	6.4	203.3	7.3	308.4	7.3	98
7 August	13.1	7.0	49	45.3	12.2	74	42.3	30.8	25.0	10.8	57	37.2	12.4	50.6	13.9	117.1	13.9	89
23 August	38.3	5.0	92	74.2	8.2	93	69.1	46.9	265.1	3.5	99	392.6	4.1	532.8	4.7	555.8	4.7	100
12 September	45.2	11.6	76	91.2	15.7	84	56.3	40.7	106.0	4.6	96	143.2	5.2	183.4	5.8	261.5	5.8	98
26 September	11.2	2.2	85	16.3	4.7	79	58.5	80.0	61.3	3.8	94	84.1	4.4	107.0	5.0	117.9	5.0	97
27 September	44.5	5.0	89	51.1	3.2	94	55.1	37.9	312.2	4.7	98	484.7	5.3	669.8	6.0	765.1	6.0	99
4 November	93.6	6.7	96	39.9	4.2	95	46.2	53.0	226.5	8.3	96	294.1	9.3	367.5	10.4	477.1	10.4	99
16 November	119.6	9.2	96	261.0	11.8	98	42.6	11.4	303.5	11.9	96	409.8	12.0	524.8	12.2	543.6	12.2	99
5 January 2011	68.6	13.0	84	152.2	15.9	91	69.4	52.2	170.6	6.7	96	234.6	7.7	307.3	8.7	693.2	8.7	99
10 January	20.7	3.1	86	80.7	6.6	92	68.0	24.8	86.1	2.4	97	131.5	2.7	179.4	3.0	211.1	3.0	99
25 January	32.3	3.5	89	69.8	7.1	90	68.1	30.1	48.1	3.7	92	64.8	3.9	82.4	4.1	105.8	4.1	96
7 February	20.4	4.4	79	34.8	5.3	85	75.8	54.5	128.7	6.3	95	202.7	6.9	285.9	7.6	438.3	7.6	98
9 March	22.0	4.3	81	30.5	8.3	73	57.8	31.2	29.4	2.3	92	38.8	2.6	48.7	2.8	78.2	2.8	97
28 March	56.5	11.6	84	68.4	12.7	86	54.5	24.8	64.8	3.5	95	83.3	4.5	102.8	5.6	102.8	5.6	96
30 March	44.9	5.1	89	104.5	7.3	93	60.2	5.6	206.7	5.7	97	278.6	6.5	361.6	7.3	443.7	7.3	98
20 April	65.7	7.9	93	143.7	11.4	96	44.7	22.8	343.0	4.6	99	466.5	5.3	606.7	6.1	921.7	6.1	100
14 May	33.9	11.3	67	77.1	12.5	84	65.7	10.2	255.9	5.3	98	357.9	5.3	470.6	5.3	487.3	5.3	99
6 June	54.2	10.6	85	85.6	13.2	88	54.9	25.4	93.5	5.4	94	125.1	5.9	158.9	6.4	237.5	9.0	97
27 June	54.3	10.1	82	131.4	12.8	91	62.5	29.6	297.8	7.4	98	391.5	8.6	487.5	9.8	591.7	9.8	98
Mean	41.7	8.2	78	86.3	11.0	87	52.8	38.9	177.0	6.1	94	260.8	6.9	353.1	7.8	482.3	7.9	98
Median	40.2	7.0	84	79.3	11.8	89	55.1	34.1	206.7	5.4	96	278.6	6.4	345.8	7.3	444.5	7.3	99
Std. dev.	25.9	4.0	15	51.4	4.8	8	15.8	21.8	100.9	3.0	8	156.3	3.4	225.5	3.8	338.3	3.8	2

Table 8 Event-based values for alkalinity, COD, and turbidity

Event Date	**Alkalinity [mg/L as $CaCO_3$]**		**Total COD [mg/L]**		**Turbidity (NTU)**		
	EMV_i	**EMV_e**	**EMV_i**	**EMV_e**	**EMV_i**	**EMV_e**	**PR%**
28 May 2010	29.2	22.7	80.9	68.2	35.6	14.1	60%
16 June	21.5	34.5	93.3	63.7	32.7	10.7	67%
21 June	12.6	19.1	27.5	21.8	4.7	3.0	36%
30 June	9.1	24.8	14.3	20.6	9.8	6.5	34%
15 July	17.0	42.8	56.3	34.0	31.2	7.1	77%
1 August	5.9	17.0	37.8	30.1	14.8	3.9	74%
6 August	26.0	42.2	94.1	14.4	51.9	1.4	97%
7 August	14.6	29.8	20.8	41.9	15.6	3.8	76%
23 August	28.5	83.5	95.8	38.7	46.6	5.3	89%
12 September	23.3	79.6	99.3	51.8	27.9	3.6	87%
26 September	39.6	84.1	132.2	48.0	21.4	3.3	85%
27 September	27.1	42.2	51.4	53.1	14.1	5.1	64%
4 November	36.5	125.1	135.7	55.3	82.5	5.5	93%
16 November	45.2	102.9	486.1	51.6	171.0	10.8	94%
5 January 2011	18.2	41.1	40.7	51.9	65.7	10.1	85%
10 January	15.9	38.9	66.6	26.7	38.0	3.3	91%
25 January	21.3	20.2	21.5	12.4	28.2	6.8	76%
7 February	13.5	18.1	39.3	23.9	30.0	5.9	80%
9 March	23.1	36.4	34.9	24.8	19.4	2.4	88%
28 March	47.3	114.4	459.4	51.6	61.1	3.5	94%
30 March	22.3	50.2	118.1	53.6	70.7	4.6	93%
20 April	6.5	30.4	364.3	58.9	112.2	2.4	98%
14 May	3.1	6.7	58.7	57.6	19.9	5.6	72%
6 June	9.7	89.3	219.3	96.1	38.4	3.7	90%
27 June	32.0	119.2	344.6	74.2	63.8	3.4	95%
Mean	22.0	52.6	127.7	45.0	44.3	5.4	80%
Median	21.5	41.1	80.9	51.6	32.7	4.6	85%
Std. dev.	11.9	35.8	137.5	20.3	36.7	3.1	17%

Table 9 Event-based values for Total Phosphorus and Total Nitrogen

Event Date	TN			TP		
	EMV_i [µg/L]	EMV_e [µg/L]	PR (%)	EMV_i [µg/L]	EMV_e [µg/L]	PR (%)
28 May 2010	4906	3378	66	2405	762	84
16 June	3110	1610	51	3256	876	74
21 June	4818	1885	62	5883	472	92
30 June	1885	1751	9	1216	619	50
15 July	2716	2202	26	3548	731	81
1 August	2033	1234	41	2342	920	62
6 August	5503	1566	79	2040	920	67
7 August	1170	763	37	1407	955	35
23 August	3424	2112	62	1570	883	65
12 September	2520	2628	-4	2135	1537	34
26 September	2716	1647	55	3035	1485	64
27 September	2265	760	67	3063	1730	45
4 November	3401	1122	83	5011	2409	76
16 November	5695	1252	88	8793	2574	84
5 January 2011	1879	553	75	3947	2104	54
10 January	1238	1118	16	3853	2496	39
25 January	1399	733	48	4497	1146	75
7 February	1182	816	32	2952	1177	60
9 March	1300	1195	10	887	806	11
28 March	6511	2955	64	7056	3751	58
30 March	4024	1345	67	4364	2474	44
20 April	10479	6500	66	6504	4769	59
14 May	3940	2202	45	2994	1480	51
6 June	4305	4388	23	2769	2368	35
27 June	5564	6579	-11	3228	2758	20
Mean	3519	2092	47	3550	1688	57
Median	3110	1610	51	3063	1480	59
Std. dev.	2161	1614	27	1914	1060	21

Table 10 Event-based values for Total Metals

Event Date	Total Zinc			Total Copper			Total Lead			Total Chromium		
	EMC$_i$ [μg/L]	EMC$_e$ [μg/L]	PR (%)	EMC$_i$ [μg/L]	EMC$_e$ [μg/L]	PR (%)	EMC$_i$ [μg/L]	EMC$_e$ [μg/L]	PR (%)	EMC$_i$ [μg/L]	EMC$_e$ [μg/L]	PR (%)
28 May 2010	BDL	BDL	----	BDL	BDL	----	24.0	37.6	22	BDL	BDL	----
16 June	BDL	BDL	----	20.9	BDL	----	26.8	35.9	-27	BDL	BDL	----
21 June	1100	11	99	646.6	24.8	96	118.0	23.5	81	BDL	BDL	----
30 June	100	68	32	75.0	BDL	----	23.0	BDL	----	2.6	1.9	30
15 July	1500	BDL	----	880.4	BDL	----	114.1	BDL	----	8.2	BDL	----
1 August	100	2	98	7.2	0.3	96	8.6	3.5	60	7.1	1.8	75
6 August	1500	345	77	361.0	0.1	100	98.4	5.0	96	5.7	0.2	98
7 August	700	217	69	149.6	0.1	100	38.9	2.0	95	1.6	0.2	89
23 August	1500	375	75	5.5	0.1	99	19.1	4.4	86	42.3	44.1	35
12 September	2000	880	56	3.1	0.1	96	9.4	1.5	86	55.5	55.3	8
26 September	6400	640	90	14.6	BDL	----	3.9	4.6	12	33.9	30.7	33
27 September	1200	1116	7	56.6	4.7	92	46.9	6.1	87	104.9	99.4	8
4 November	1600	400	75	79.5	0.4	100	71.7	4.5	97	49.7	41.4	58
16 November	1500	420	72	77.8	18.2	87	13.1	4.1	83	28.7	11.8	78
5 January 2011	2600	702	73	112.1	48.5	63	75.1	91.1	-6	122.5	108.5	23
10 January	3000	2760	8	46.5	14.1	72	34.9	9.3	75	42.9	29.6	36
25 January	4400	528	88	619.0	6.9	99	150.1	93.1	38	105.9	94.6	11
7 February	1300	793	39	113.7	51.3	55	104.5	62.8	40	78.0	97.3	-24
9 March	1500	450	70	366.5	44.7	88	20.1	0.1	100	82.8	65.8	23
28 March	1100	715	35	133.2	35.4	79	24.6	4.8	85	88.6	59.7	46
30 March	7600	760	90	85.2	13.3	85	120.2	9.4	92	117.7	66.3	44
20 April	1600	1536	4	197.3	20.4	94	249.1	127.8	72	157.9	105.2	63
14 May	600	270	55	57.5	17.7	70	27.8	6.5	77	96.2	56.9	42
6 June	1300	507	61	100.6	39.8	70	71.3	76.1	19	95.0	103.1	18
27 June	600	546	9	72.7	18.1	77	120.4	3.8	97	70.3	33.6	55
Mean	1948	638	58	178.4	17.9	86	64.6	26.8	64	63.5	52.7	40
Median	1500	518	70	82.4	15.9	90	38.9	6.1	81	62.9	55.3	36
Std. dev.	1852	594	31	231.4	17.5	14	58.4	37.0	37	45.0	37.9	30

Oil and Grease

The event-based influent and effluent concentrations and removal efficiencies of Total Oil and Grease for the 25 events are presented in **Table 11**. For the 25 qualifying storms, Total Oil and Grease removal efficiency ranged from 0 to 100% with a median of 62%.

Runoff water chemistry

Event-based water chemistry indices including pH, redox potential, conductivity, total dissolved solids (TDS), dissolved oxygen (DO), alkalinity, and total chemical oxygen demand (COD) were measured for a total of 25 storm events as shown in **Tables 8** and **12**. Raw influent and treated effluent samples were analyzed. Additionally, pH, redox potential, conductivity, salinity, and TDS inside the treatment unit were also continuously monitored during each storm event.

Influent runoff pH ranges from 6.5 to 7.5 with a median of 7.1, and the effluent pH ranges from 6.2 to 7.2 with a median of 6.8. Redox potential is a measure of a chemical species' tendency to acquire electrons and be reduced. Water with a high potential tends to gain electrons from new species introduced to the system and water with a low potential can lose electrons to new species; both paths are important for speciation. For the 25 events monitored in this study, influent runoff redox ranges from 285 to 443 mV with a median of 366 mV. Effluent runoff redox ranges from 291 to 488 mV with a median of 364 mV.

Electrical conductivity is a measure of the ability of water to transmit an electric current. Influent runoff conductivity ranges from 18.9 to 186.7 µS/cm with a median of 56.6 µS/cm. Conductivity is nearly doubled during treatment due to contact with stored high conductivity runoff in the JF4-2-1. Effluent runoff conductivity ranges from 41.2 to 422.6 µS/cm with a median of 97.8 µS/cm. Given that TDS is highly correlated to conductivity, TDS follows the same pattern. Influent runoff TDS ranges from 9.3 to 91.3 mg/L with a median of 29.8 mg/L. Effluent runoff TDS ranges from 20.1 to 206.9 mg/L with a median of 48.5 mg/L.

Influent runoff alkalinity ranges from 3.1 to 47.3 mg/L as $CaCO_3$ with a median of 21.5 mg/L. An increase in alkalinity is observed during treatment due to contact with stored runoff in the JF4-2-1, which has high alkalinity. Effluent runoff alkalinity ranges from 6.7 to 125.1 mg/L as $CaCO_3$ with a median of 41.1 mg/L.

Influent runoff total COD ranges from 14.3 to 486.1 mg/L with a median of 80.9 mg/L. Effluent runoff total COD ranges from 12.4 to 96.1 mg/L with a median of 51.6 mg/L. Influent runoff DO ranges from 3.3 to 8.4 mg/L with a median of 6.7 mg/L. Effluent runoff DO ranges from 2.8 to 8.4 mg/L with a median of 4.7 mg/L.

Head Loss

The peak and median driving head over the Jellyfish Filter JF4-2-1 deck level for each event is tabulated in **Table 13**. As shown, the driving head increases as the flow rate increases. For the 25 qualifying events, the median value of event-based median driving head over deck level is 83 mm (3.25 inches), and the median value of event-based peak driving head over deck level is 204 mm (8.05 inches). No water was bypassed around the treatment unit during the entire monitoring period, including during the two storms events which generated peak flow rates slightly in excess of the Maximum Treatment Flow Rate of 200 gpm.

Table 11 Event-based values for Total Oil and Grease

Event Date	Total Oil and Grease		
	EMC_i [mg/L]	EMC_e [mg/L]	PR (%)
28 May 2010	0.20	0.08	62
16 June	0.93	0.43	54
21 June	0.35	0.35	0
30 June	0.64	0.62	2
15 July	1.10	0.35	68
1 August	0.96	0.55	43
6 August	1.04	0.47	55
7 August	0.73	0.55	25
23 August	0.20	0.00	100
12 September	0.61	0.00	100
26 September	0.44	0.00	100
27 September	0.99	0.08	92
4 November	0.46	0.00	100
16 November	0.93	0.00	100
5 January 2011	0.61	0.00	100
10 January	0.55	0.16	72
25 January	0.64	0.00	100
7 February	1.04	0.00	100
9 March	1.56	1.45	7
28 March	4.06	1.17	71
30 March	2.34	2.32	1
20 April	1.74	0.78	55
14 May	1.74	1.56	10
6 June	1.74	0.78	55
27 June	1.16	0.78	33
Mean	1.07	0.50	60
Median	0.93	0.35	62
Std. dev.	0.82	0.60	37

Table 12 Event-based water chemistry values (all results are not concentrations, but are values)

Event Date	pH		Redox (mV)		DO (mg/L)		Temperature (ºC)		Conductivity (µS/cm)		TDS (mg/L)	
	EMV$_i$	EMVe	EMV$_i$	EMVe	EMV$_i$	EMVe	EMV$_i$	EMVe	EMV$_i$	EMVe	EMV$_i$	EMVe
28 May 2010	7.0	7.0	391	386	6.1	6.3	23.9	24.1	60.5	69.1	29.8	33.9
16 June	7.1	6.7	368	366	4.5	3.6	25.0	25.0	49.5	81.9	24.2	40.2
21 June	7.1	6.6	383	438	6.7	4.7	23.4	24.6	24.2	43.1	11.9	21.1
30 June	6.9	6.5	376	376	5.7	4.4	25.7	25.3	23.9	57.3	11.9	28.0
15 July	7.3	6.8	355	355	7.2	5.8	27.7	26.2	32.6	96.3	15.8	43.6
1 August	6.5	6.5	366	364	7.5	7.1	25.7	25.6	18.9	42.4	9.3	20.6
6 August	7.3	6.5	386	393	6.3	4.2	27.6	26.7	69.2	87.9	33.9	43.3
7 August	7.0	6.5	386	360	7.1	4.3	25.7	26.0	34.6	71.7	16.9	35.1
23 August	7.0	6.8	340	329	6.4	4.2	26.7	25.7	74.1	177.7	36.3	88.0
12 September	7.4	6.8	407	431	6.8	5.0	27.0	26.2	62.1	174.2	30.3	85.3
26 September	6.6	6.7	422	488	3.3	2.8	24.5	24.5	107.6	182.9	52.6	89.6
27 September	7.1	6.7	443	465	6.6	5.4	23.6	23.8	54.0	98.9	26.2	48.5
4 November	7.2	7.0	366	412	6.6	4.5	22.0	21.9	103.5	298.7	50.6	127.7
16 November	7.2	6.8	352	376	7.1	4.4	22.1	22.6	174.0	225.0	85.5	110.3
5 January 2011	7.5	6.7	399	364	8.3	7.4	21.4	22.1	38.6	107.1	18.9	52.5
10 January	7.2	6.8	331	350	8.3	5.0	19.8	20.2	47.0	97.8	32.9	68.0
25 January	7.1	7.0	336	323	8.1	7.6	18.8	19.9	48.4	65.7	26.7	25.5
7 February	7.2	7.2	353	356	8.3	8.4	22.2	23.1	30.6	41.2	15.2	20.1
9 March	7.4	7.1	357	366	8.4	8.3	17.8	17.8	40.6	86.7	20.1	42.6
28 March	7.1	7.1	321	315	7.2	5.3	22.8	22.3	186.7	257.3	91.3	126.0
30 March	7.2	7.0	379	321	7.5	6.1	21.8	21.7	62.1	121.5	30.3	60.1
20 April	6.9	6.5	375	384	5.5	4.4	24.3	23.0	159.8	422.6	78.3	206.9
14 May	7.4	7.2	352	363	4.6	4.3	24.8	23.9	56.6	88.9	27.8	43.4
6 June	7.2	7.0	303	300	6.7	4.7	26.7	26.2	109.2	391.5	53.5	191.7
27 June	7.0	6.2	285	291	6.3	4.3	26.4	25.6	95.0	322.9	46.6	158.2
Mean	7.1	6.8	365	371	6.7	5.3	23.9	23.8	70.5	148.4	35.1	72.4
Median	7.1	6.8	366	364	6.7	4.7	24.3	24.1	56.6	97.8	29.8	48.5
Std. dev.	0.2	0.3	35	48	1.3	1.5	2.7	2.3	46.6	110.8	22.7	53.4

Table 13 Event-based driving head over deck level

Event Date	Median head over deck level (inch)	Median head over deck level (mm)	Peak head over deck level (inch)	Peak head over deck level (mm)
28 May 2010	1.56	40	6.22	158
16 June	4.23	108	7.79	198
21 June	6.67	170	9.89	251
30 June	2.01	51	15.55	395
15 July	5.78	147	16.89	429
1 August	8.41	214	20.92	531
6 August	5.75	146	12.04	306
7 August	4.58	116	12.23	311
23 August	1.47	37	4.58	116
12 September	2.07	53	6.17	157
26 September	1.45	37	2.48	63
27 September	1.16	30	15.70	399
4 November	3.08	78	6.72	171
16 November	1.77	45	6.82	173
5 January 2011	2.40	61	11.72	298
10 January	1.49	38	8.05	204
25 January	3.25	83	6.88	175
7 February	5.43	138	12.18	309
9 March	2.73	69	7.23	184
28 March	3.36	85	6.02	153
30 March	6.96	177	15.69	398
20 April	4.59	117	6.42	163
14 May	4.25	108	19.65	499
6 June	0.65	16	6.56	167
27 June	5.61	143	16.76	426
Mean	3.63	92	10.45	265
Median	3.25	83	8.05	204
Std. dev.	2.11	54	5.06	129

5. Performance Verification

Field testing of an Imbrium Systems' Jellyfish® Filter model JF4-2-1 with second-generation filtration cartridges was conducted in accordance with the TARP field test protocol to document Jellyfish® Filter performance with respect to suspended solids removal and quantify water treatment performance. The field monitoring was carried out on the University of Florida campus with the full-scale unit loaded by rainfall-runoff from a surface parking watershed. A total of 25 monitored storm events, with 15 inches of cumulative rainfall depth, were treated by the JF4 during this study. These 25 storms produced the total runoff through the JF4 during the 13-month monitoring period. Of the 25 storms treated, two storms generated flows exceeding the maximum design flow of 200 gpm. No maintenance was required or conducted during the 13-month monitoring period spanning May 28, 2010 to June 27, 2011. The median d_{50} for influent and effluent particle sizes were 82 and 3 μm, respectively.
Treatment results generated median SSC and TSS removal efficiency results of 99% and 89%, respectively.

At the completion of the monitoring campaign, a 94.5% mass balance was obtained on particulate matter (PM) which validates the testing methods used throughout this study. This mass balance on PM is an independent approach that validates particulate influent and effluent monitoring. The results obtained in this field study demonstrated that the Jellyfish® Filter's particulate removal performance is reasonably insensitive to incoming particle size distribution (PSD) and runoff event duration.

6. Net Environmental Benefit

The Jellyfish® Filter requires no input of raw material, has no moving parts and therefore uses no water or energy other than that provided by stormwater runoff. For the 25 storm events monitored during the 13-month monitoring period the mass of materials captured and retained by the Jellyfish® Filter was 166 lbs. This material would otherwise have been released to the environment during the 25 rain events.

7. References

Berretta, C. and Sansalone, J.J. (2011). "Hydrologic transport and partitioning of phosphorus fractions." *J. Hydro*., 403 (1-2), 25-36.

Dickenson, J., and Sansalone, J. J. (2009). "Discrete phase model representation of particulate matter PM for simulating PM separation by hydrodynamic unit operations." *Environ. Sci. Technol.*, 43(21), 8220-8226.

Garofalo, G. and Sansalone, J. J.(2011). "Transient elution of particulate matter from hydrodynamic unit operations as a function of computational parameters and runoff hydrograph unsteadiness." *Chem. Eng. J.*.175, 150-159.

Kim, J. Y., and Sansalone, J.J. (2008). "Event-based size distribution of particulate matter transported during urban rainfall-runoff events."*Water Res.*, 42 (10-11), 2756-2768.

Kim, J. Y., and Sansalone, J. J. (2010). "Representation 447 of particulate matter COD in rainfall COD runoff from paved urban watersheds." *Water Air Soil Pollut.,* 205, 113-132.

Liu, B., Ying, G., and Sansalone, J. J. (2010). "Volumetric filtration of rainfall runoff. I:event-based separation of particulate matter." *J. Environ. Eng*., 136 (12), 1321-1330.

Sansalone, J.J. (2011). "TARP Field Test Performance Monitoring of a Jellyfish® Filter JF4-2-1", Performance Monitoring Report, University of Florida, Gainesville, FL, 1 November, 2011.

Sansalone J., Lin H. and Ying G., "Experimental and Field Studies of Type I Settling for Particulate Matter Transported by Urban Runoff", *ASCEJ. of Environ. Eng*, 135(10), 953-963, 2009.

Sansalone, J. J., and Kim, J. M. (2008). "Transport of Particulate Matter Fractions in Urban Source Area Pavement Surface Runoff." *J. Environ. Qual*. 37, 1883–1893.

Strecker, E. W., Quigley, M. M., Urbonas, B. R., Jones, J. E., and Clary, J. K. (2001)."Determining urban storm water BMP effectiveness." *J. Water Resour. PlannManage.,* 127(3), 144–149.

Van Buren, M.A., Watt, W. E., and Marsalek, J. (1997). "Application of the log-normal and normal distributions to stormwater quality parameters." *Water Res.,* 31(1), 95-104

APPENDIX A

INDIVIDUAL STORM REPORTS

Table A1: JF4 Summary: 28 May 2010 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	28 May 2010	Influent Volume:	7465 L (1972 gal)
Previous Dry Hours:	96	Event Duration:	112 min
Maximum Flow Rate:	4.30 L/s (68.2 gpm)	Number of Influent Samples:	19
Median Flow Rate:	0.98 L/s (15.5 gpm)	Number of Effluent Samples:	8
Mean Flow Rate:	1.12 L/s (17.8gpm)	Peak Rainfall Intensity:	76 mm/hr (3.0 inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	21 mm (0.81 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

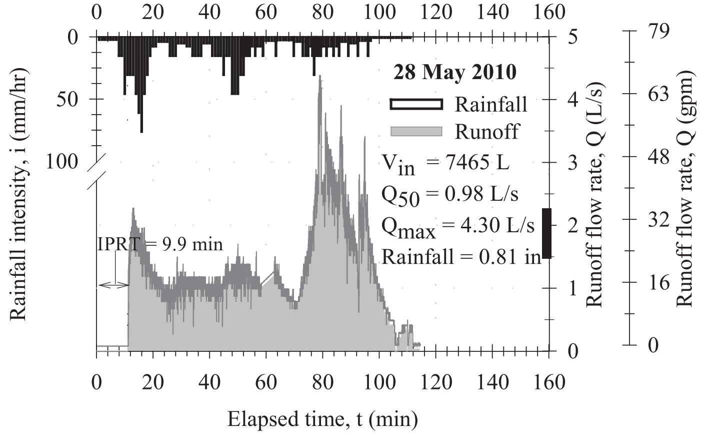


Figure A1: Hydrograph and hyetograph for 28 May 2010 event

On May 28, 2010, the Jellyfish Filter JF4-2-1 treated its first rainfall-runoff event, starting with a clean empty unit. The event occurred after 96 dry hours. The peak rainfall intensity is 3.0 in/hr and rainfall depth is 0.81 inches. The storm lasted approximately 112 minutes. The maximum, median, and mean runoff flow rates are 68 gpm, 16 gpm, and 18 gpm, respectively. The influent runoff volume is 1,972 gallons. Sampling occurred throughout the entire duration of the storm and the number of influent and effluent samples taken is 19 and 8, respectively. Fewer effluent than influent samples are collected since the JF4 unit is filling up for a substantial part of the storm. The influent and effluent TSS is 89.3 mg/L and 18.7 mg/L, respectively, and the removal efficiency is 90%. The influent and effluent SSC is 532.3 mg/L and 15.4 mg/L, respectively, and the removal efficiency is 99%.

Table A2: JF4 Summary: 16 June 2010 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	16 June 2010	Influent Volume:	5006 L (1323 gal)
Previous Dry Hours:	288	Event Duration:	61 min
Maximum Flow Rate:	5.36 L/s (85.0 gpm)	Number of Influent Samples:	11
Median Flow Rate:	0.65 L/s (10.3 gpm)	Number of Effluent Samples:	10
Mean Flow Rate:	2.21 L/s (35.1 gpm)	Peak Rainfall Intensity:	61 mm/hr (2.4 inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	16 mm (0.63 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

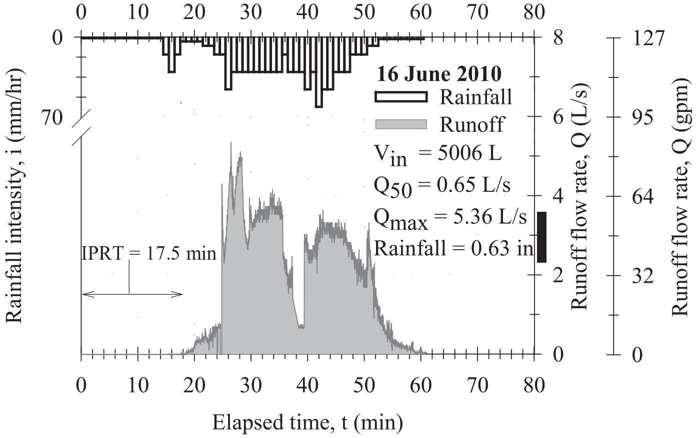


Figure A2: Hydrograph and hyetograph for 16 June 2010 event

On June 16, 2010, the JF4 unit treated its second rainfall-runoff event. The event occurred after 288 dry hours. The peak rainfall intensity is 2.4 in/hr and rainfall depth is 0.63 inches. The storm lasted approximately 61 minutes. The maximum, median, and mean runoff flow rates are 85 gpm, 10 gpm, and 35 gpm, respectively. The influent runoff volume is 1,323 gallons. Sampling occurred throughout the entire duration of the storm and the number of influent and effluent samples taken is 11 and 10, respectively. The influent and effluent TSS is 79.3 mg/L and 21.7 mg/L, respectively, and the removal efficiency is 74%. The influent and effluent SSC is 1401.7 mg/L and 18.1 mg/L, respectively, and the removal efficiency is 99%.

Table A3: JF4 Summary: 21 June 2010 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	21 June 2010	Influent Volume:	8695 L (2297 gal)
Previous Dry Hours:	96	Runoff Duration:	43 min
Maximum Flow Rate:	7.46 L/s (118.3 gpm)	Number of Influent Samples:	10
Median Flow Rate:	5.47 L/s (86.7 gpm)	Number of Effluent Samples:	10
Mean Flow Rate:	5.09 L/s (80.7 gpm)	Peak Rainfall Intensity:	122 mm/hr (4.8 inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	23 mm (0.92 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

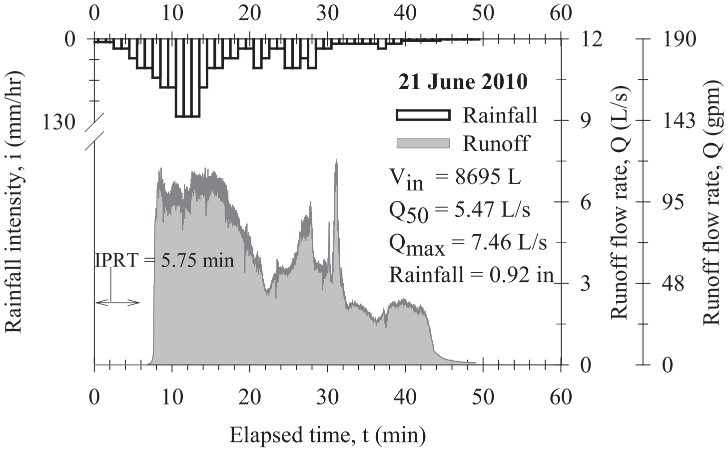


Figure A3: Hydrograph and hyetograph for 21 June 2010 event

On June 21, 2010, the JF4 unit treated its third rainfall-runoff event. The event occurred after 96 previous dry hours. The peak rainfall intensity is 4.8 in/hr and rainfall depth is 0.92 inches. The storm lasted approximately 43 minutes. The maximum, median, and mean runoff flow rates are 118 gpm, 87 gpm, and 81 gpm, respectively. The influent runoff volume is 2297 gallons. Sampling occurred throughout the entire duration of the storm and the number of influent and effluent samples taken is 10 and 10, respectively. The influent and effluent TSS is 105.5 mg/L and 15.2 mg/L, respectively, and the removal efficiency is 86%. The influent and effluent SSC is 1162.9 mg/L and 7.4 mg/L, respectively, and the removal efficiency is 99%.

Table A4: JF4 Summary: 30 June 2010 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	30 June 2010	Influent Volume:	5459 L (1442 gal)
Previous Dry Hours:	288	Runoff Duration:	50 min
Maximum Flow Rate:	9.13 L/s (144.8 gpm)	Number of Influent Samples:	11
Median Flow Rate:	3.30 L/s (52.3 gpm)	Number of Effluent Samples:	11
Mean Flow Rate:	3.95 L/s (62.6 gpm)	Peak Rainfall Intensity:	76 mm/hr (3.0 inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	13 mm (0.52 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

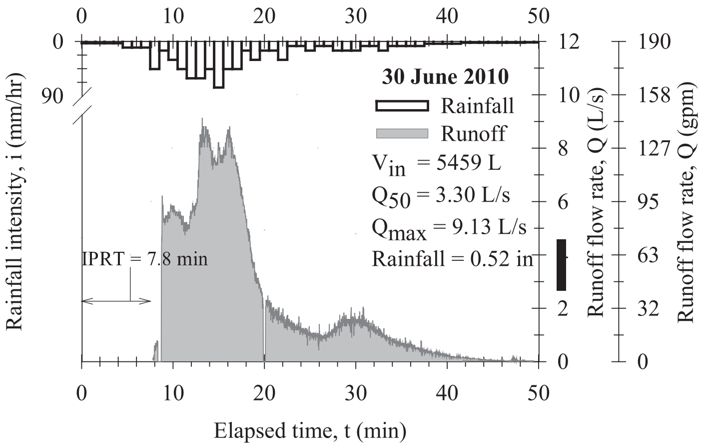


Figure A4: Hydrograph and hyetograph for 30 June 2010 event

On June 30, 2010, the JF4 unit treated its fourth rainfall-runoff event. The event occurred after 288 dry hours. The peak rainfall intensity is 3 in/hr and rainfall depth is 0.52 inches. The storm lasted approximately 50 minutes. The maximum, median, and mean runoff flow rates are 145 gpm, 52 gpm, and 63 gpm, respectively. The influent runoff volume is 1442 gallons. Sampling occurred throughout the entire duration of the storm and the number of influent and effluent samples taken is 11 and 11, respectively. The influent and effluent TSS is 25.2 mg/L and 7.4 mg/L, respectively, and the removal efficiency is 71%. The influent and effluent SSC is 444.5 mg/L and 5.4 mg/L, respectively, and the removal efficiency is 99%.

Table A5: JF4 Summary: 15 July 2010 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	15 July 2010	Influent Volume:	3608 L (953 gal)
Previous Dry Hours:	96	Runoff Duration:	28 min
Maximum Flow Rate:	13.26 L/s (210.2 gpm)	Number of Influent Samples:	10
Median Flow Rate:	1.44 L/s (22.9 gpm)	Number of Effluent Samples:	10
Mean Flow Rate:	3.12 L/s (49.4gpm)	Peak Rainfall Intensity:	91 mm/hr (3.6 inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	10 mm (0.38 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

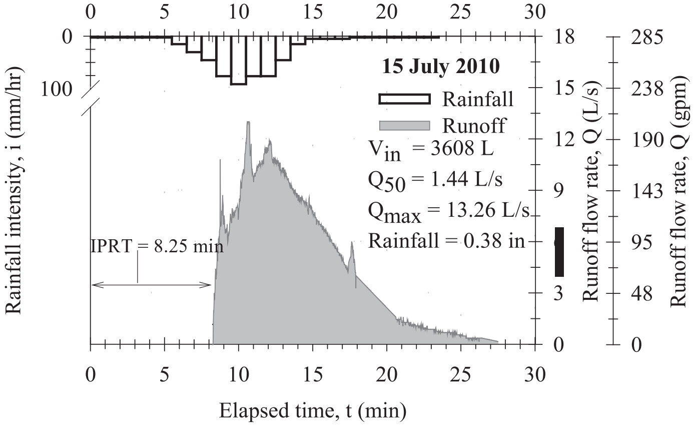


Figure A5: Hydrograph and hyetograph for 15 July 2010 event

On July 15, 2010, the JF4 unit treated its fifth rainfall-runoff event. The event occurred after 96 dry hours. The peak rainfall intensity is 3.6 in/hr and rainfall depth is 0.38 inches. The storm lasted approximately 28 minutes. The maximum, median, and mean runoff flow rates are 210 gpm, 23 gpm, and 49 gpm, respectively. The influent runoff volume is 953 gallons. Sampling occurred throughout the entire duration of the storm and the number of influent and effluent samples taken is 10 and 10, respectively. The influent and effluent TSS is 91.8 mg/L and 8.3 mg/L, respectively, and the removal efficiency is 92%. The influent and effluent SSC is 812.2 mg/L and 8.4 mg/L, respectively, and the removal efficiency is 99%.

Table A6: JF4 Summary: 1 August 2010 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	01 August 2010	Influent Volume:	11973 L (3163 gal)
Previous Dry Hours:	24	Event Duration:	36 min
Maximum Flow Rate:	14.25 L/s (225.9gpm)	Number of Influent Samples:	10
Median Flow Rate:	4.74 L/s (75.1gpm)	Number of Effluent Samples:	10
Mean Flow Rate:	5.47 L/s (86.7gpm)	Peak Rainfall Intensity:	127 mm/hr (5.0 inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	30 mm (1.18 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

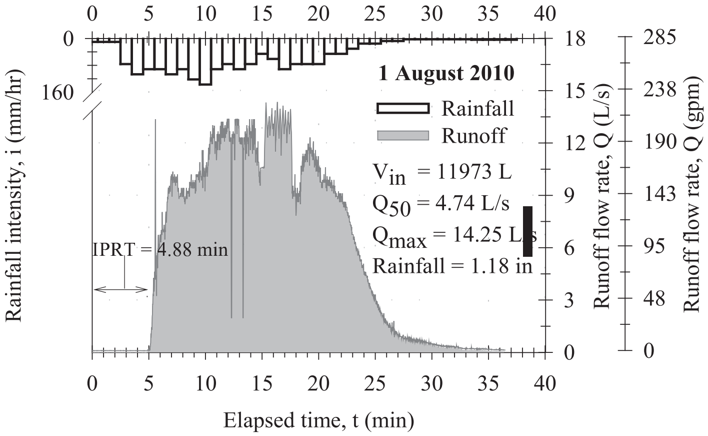


Figure A6: Hydrograph and hyetograph for 1 August 2010 event

On August 1, 2010, the JF4 unit treated a rainfall-runoff event. The event occurred after 24 dry hours. The peak rainfall intensity is 5.0 in/hr and rainfall depth is 1.18 inches. The storm lasted approximately 36 minutes. The maximum, median, and mean runoff flow rates are 226gpm, 75 gpm, and 87 gpm, respectively. The influent runoff volume is 3163 gallons. Sampling occurred throughout the entire duration of the storm and the number of influent and effluent samples taken is 10 and 10, respectively. The influent and effluent TSS is 130.2 mg/L and 15.4 mg/L, respectively, and the removal efficiency is 89%. The influent and effluent SSC is 245.1 mg/L and 7.7 mg/L, respectively, and the removal efficiency is 97%.

Table A7: JF4 Summary: 6 August 2010 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	6 August 2010	Influent Volume:	1395 L (368 gal)
Previous Dry Hours:	120	Event Duration:	104 min
Maximum Flow Rate:	6.80 L/s (107.8gpm)	Number of Influent Samples:	10
Median Flow Rate:	0.01 L/s (0.2gpm)	Number of Effluent Samples:	8
Mean Flow Rate:	0.27 L/s (4.3gpm)	Peak Rainfall Intensity:	51mm/hr (2.0inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	4 mm (0.14 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

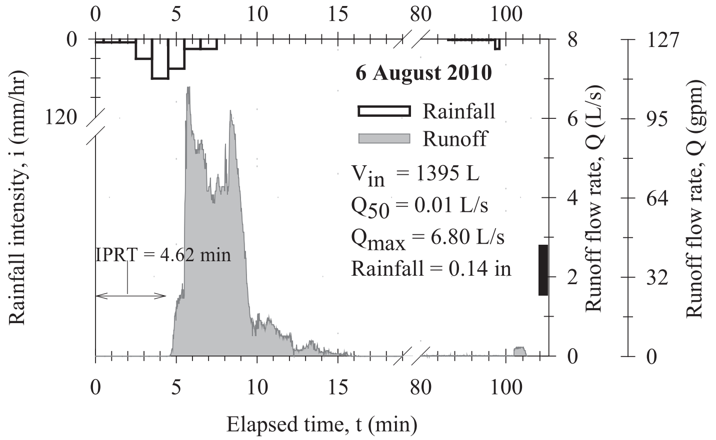


Figure A7: Hydrograph and hyetograph for 6 August 2010 event

On August 6, 2010, the JF4 unit treated a rainfall-runoff event. The event occurred after 120 dry hours. The peak rainfall intensity is 2.0 in/hr and rainfall depth is 0.14 inch. The storm lasted approximately 104 minutes. The maximum, median, and mean runoff flow rates are 108 gpm, 0.2 gpm, and 4.3 gpm, respectively. The influent runoff volume is 368 gallons. Sampling occurred throughout the entire duration of the storm and the number of influent and effluent samples taken is 10 and 10, respectively. The influent and effluent TSS is 77.5 mg/L and 15.0 mg/L, respectively, and the removal efficiency is 86%. The influent and effluent SSC is 308.4 mg/L and 7.3 mg/L, respectively, and the removal efficiency is 98%.

Table A8: JF4 Summary: 7 August 2010 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	7August 2010	Influent Volume:	2622 L (693 gal)
Previous Dry Hours:	24	Runoff Duration:	48 min
Maximum Flow Rate:	8.24L/s (130.6gpm)	Number of Influent Samples:	10
Median Flow Rate:	0.43 L/s (6.8gpm)	Number of Effluent Samples:	10
Mean Flow Rate:	0.90 L/s (14.3gpm)	Peak Rainfall Intensity:	61 mm/hr (2.4 inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	9 mm (0.34 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

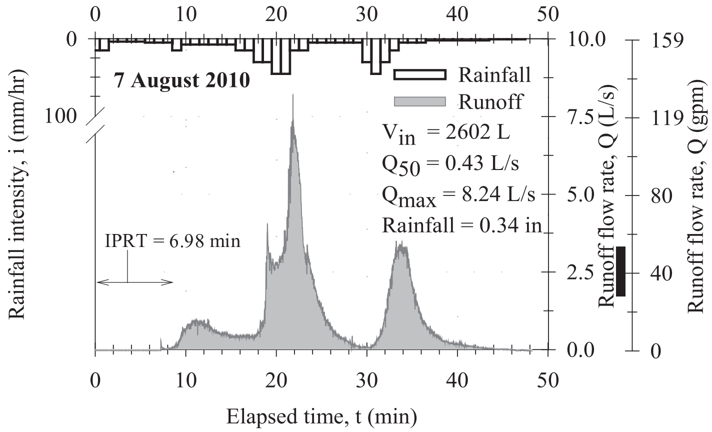


Figure A8: Hydrograph and hyetograph for 7 August 2010 event

On August 7, 2010, the JF4 unit treated a rainfall-runoff event. The event occurred after 24 dry hours. The peak rainfall intensity is 2.4 in/hr and rainfall depth is 0.34 inch. The storm lasted approximately 48 minutes. The maximum, median, and mean runoff flow rates are 131gpm, 7gpm, and 14gpm, respectively. The influent runoff volume is 693 gallons. Sampling occurred throughout the entire duration of the storm and the number of influent and effluent samples taken is 10 and 10, respectively. The influent and effluent TSS is 45.3 mg/L and 12.2 mg/L, respectively, and the removal efficiency is 74%. The influent and effluent SSC is 117.1 mg/L and 13.9 mg/L, respectively, and the removal efficiency is 89%.

Table A9: JF4 Summary: 23 August 2010 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	23 August 2010	Influent Volume:	312 L (82 gal)
Previous Dry Hours:	48	Runoff Duration:	42 min
Maximum Flow Rate:	1.25 L/s (19.8 gpm)	Number of Influent Samples:	10
Median Flow Rate:	0.01 L/s (0.2gpm)	Number of Effluent Samples:	10
Mean Flow Rate:	0.12 L/s (2.0gpm)	Peak Rainfall Intensity:	15 mm/hr(0.6 inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	3 mm (0.11 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

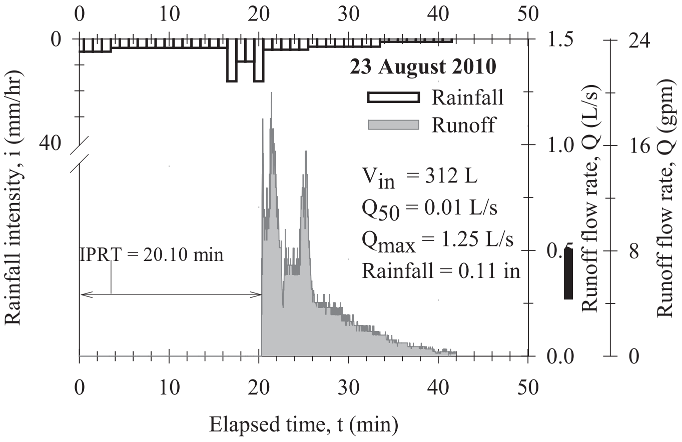


Figure A9: Hydrograph and hyetograph for 23 August 2010 event

On August 23, 2010, the JF4 unit treated a rainfall-runoff event. The event occurred after 48 dry hours. The peak rainfall intensity is 0.6 in/hr and rainfall depth is 0.11 inch. The storm lasted approximately 42 minutes. The maximum, median, and mean runoff flow rates are 20 gpm, 0.2 gpm, and 2 gpm, respectively. The influent runoff volume is 82 gallons. Sampling occurred throughout the entire duration of the storm and the number of influent and effluent samples taken is 10 and 10, respectively. The influent and effluent TSS is 74.2 mg/L and 8.2 mg/L, respectively, and the removal efficiency is 93%. The influent and effluent SSC is 555.8 mg/L and 4.7 mg/L, respectively, and the removal efficiency is 100%.

Table A10: JF4 Summary: 12 September 2010 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	12September 2010	Influent Volume:	1643 L (434 gal)
Previous Dry Hours:	172	Runoff Duration:	52 min
Maximum Flow Rate:	3.85L/s (61.0 gpm)	Number of Influent Samples:	10
Median Flow Rate:	0.10L/s (1.6 gpm)	Number of Effluent Samples:	10
Mean Flow Rate:	0.53L/s (8.4 gpm)	Peak Rainfall Intensity:	51 mm/hr (2.0 inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	7 mm (0.27 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

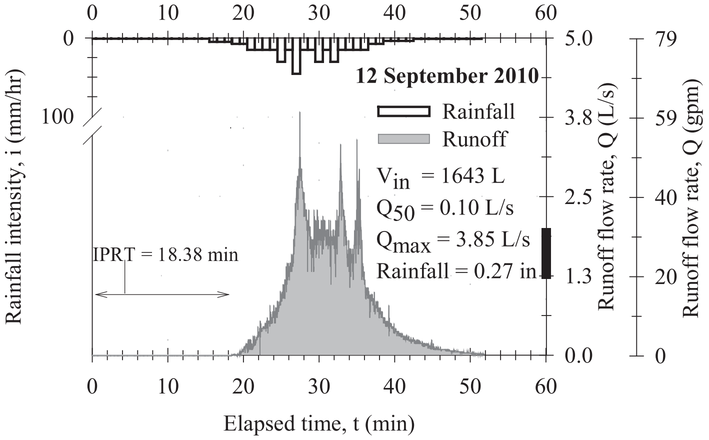


Figure A10: Hydrograph and hyetograph for 12 September 2010 event

On September 12, 2010, the JF4 unit treated a rainfall-runoff event. The event occurred after 172 dry hours. The peak rainfall intensity is 2.0 in/hr and rainfall depth is 0.27 inch. The storm lasted approximately 52 minutes. The maximum, median, and mean runoff flow rates are 61gpm, 2 gpm, and 8 gpm, respectively. The influent runoff volume is 434 gallons. Sampling occurred throughout the entire duration of the storm and the number of influent and effluent samples taken is 10 and 10, respectively. The influent and effluent TSS is 91.2 mg/L and 15.7 mg/L, respectively, and the removal efficiency is 84%. The influent and effluent SSC is 261.5 mg/L and 5.8 mg/L, respectively, and the removal efficiency is 98%.

Table A11: JF4 Summary: 26 September 2010 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	26September 2010	Influent Volume:	1129 L (298 gal)
Previous Dry Hours:	40	Runoff Duration:	78 min
Maximum Flow Rate:	0.45 L/s (7.1 gpm)	Number of Influent Samples:	10
Median Flow Rate:	0.26L/s (4.1 gpm)	Number of Effluent Samples:	10
Mean Flow Rate:	0.24L/s (3.8 gpm)	Peak Rainfall Intensity:	5 mm/hr (0.2 inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	4 mm (0.14 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

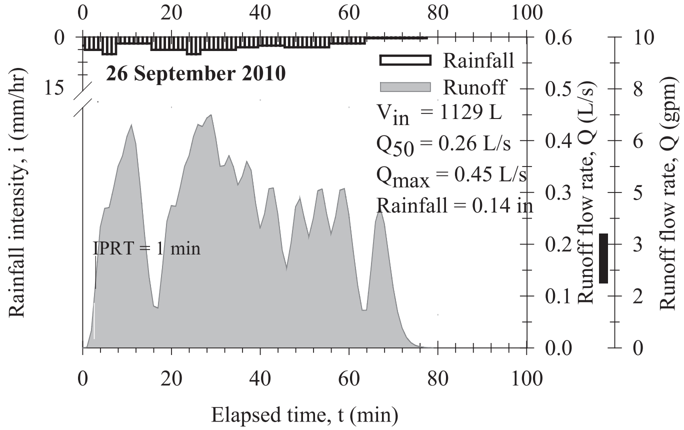


Figure A11: Hydrograph and hyetograph for 26 September 2010 event

On September 26, 2010, the JF4 unit treated a rainfall-runoff event. The event occurred after 40 dry hours. The peak rainfall intensity is 0.2 in/hr and rainfall depth is 0.14 inch. The storm lasted approximately 78 minutes. The maximum, median, and mean runoff flow rates are 7 gpm, 4 gpm, and 4 gpm, respectively. The influent runoff volume is 298 gallons. Sampling occurred throughout the entire duration of the storm and the number of influent and effluent samples taken is 10 and 10, respectively. The influent and effluent TSS is 16.3 mg/L and 4.7 mg/L, respectively, and the removal efficiency is 79%. The influent and effluent SSC is 117.9 mg/L and 5.0 mg/L, respectively, and the removal efficiency is 97%.

Table A12: JF4 Summary: 27 September 2010 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	27September 2010	Influent Volume:	3841 L (1015 gal)
Previous Dry Hours:	10	Runoff Duration:	388 min
Maximum Flow Rate:	10.94L/s (173.4gpm)	Number of Influent Samples:	10
Median Flow Rate:	0.04L/s (0.7gpm)	Number of Effluent Samples:	10
Mean Flow Rate:	0.16L/s (2.6 gpm)	Peak Rainfall Intensity:	91 mm/hr (3.6 inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	15 mm (0.6 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

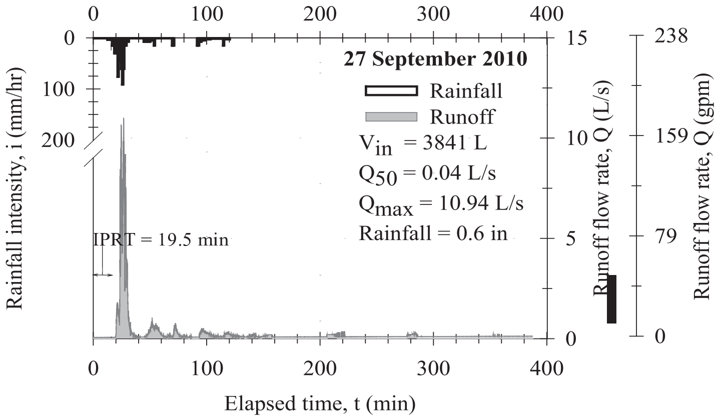


Figure A12: Hydrograph and hyetograph for 27 September 2010 event

On September 27, 2010, the JF4 unit treated a rainfall-runoff event. The event occurred after 10 dry hours. The peak rainfall intensity is 3.6 in/hr and rainfall depth is 0.60 inch. The storm lasted approximately 388 minutes. The maximum, median, and mean runoff flow rates are 173gpm, 0.7gpm, and 2.6gpm, respectively. The influent runoff volume is 1015 gallons. Sampling occurred throughout the entire duration of the storm and the number of influent and effluent samples taken is 10 and 10, respectively. The influent and effluent TSS is 51.1 mg/L and 3.2 mg/L, respectively, and the removal efficiency is 94%. The influent and effluent SSC is 765.1 mg/L and 6.0 mg/L, respectively, and the removal efficiency is 99%.

Table A13: JF4 Summary: 4 November 2010 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	4November 2010	Influent Volume:	994 L (263 gal)
Previous Dry Hours:	910	Runoff Duration:	43 min
Maximum Flow Rate:	3.53 L/s (56.0 gpm)	Number of Influent Samples:	11
Median Flow Rate:	0.12 L/s (1.8gpm)	Number of Effluent Samples:	11
Mean Flow Rate:	0.38 L/s (6.0gpm)	Peak Rainfall Intensity:	46 mm/hr (1.8 inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	5 mm (0.19 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

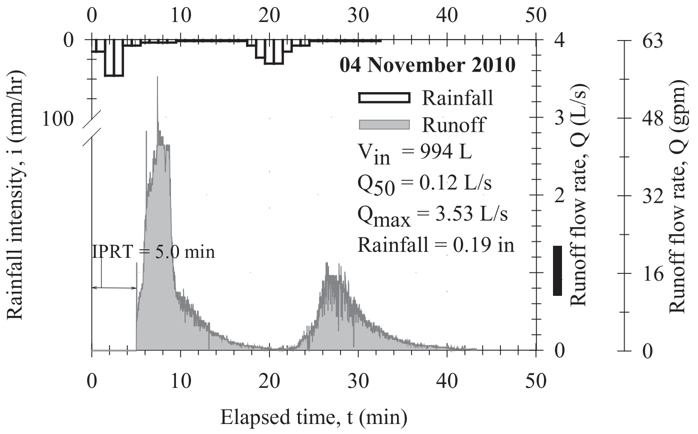


Figure A13: Hydrograph and hyetograph for 4 November 2010 event

On November 4, 2010, the JF4 unit treated a rainfall-runoff event. The event occurred after 910 dry hours. The peak rainfall intensity is 1.8 in/hr and rainfall depth is 0.19 inch. The storm lasted approximately 43 minutes. The maximum, median, and mean runoff flow rates are 56 gpm, 2 gpm, and 6 gpm, respectively. The influent runoff volume is 263 gallons. Sampling occurred throughout the entire duration of the storm and the number of influent and effluent samples taken is 11 and 11, respectively. The influent and effluent TSS is 39.9 mg/L and 4.2 mg/L, respectively, and the removal efficiency is 95%. The influent and effluent SSC is 477.1 mg/L and 10.4 mg/L, respectively, and the removal efficiency is 99%.

Table A14: JF4 Summary: 16 November 2010 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	16November 2010	Influent Volume:	305 L (81 gal)
Previous Dry Hours:	286	Runoff Duration:	34 min
Maximum Flow Rate:	1.75 L/s (27.7 gpm)	Number of Influent Samples:	11
Median Flow Rate:	0.02 L/s (0.3gpm)	Number of Effluent Samples:	11
Mean Flow Rate:	0.13 L/s (2.1gpm)	Peak Rainfall Intensity:	25 mm/hr (1.0 inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	3 mm (0.13 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

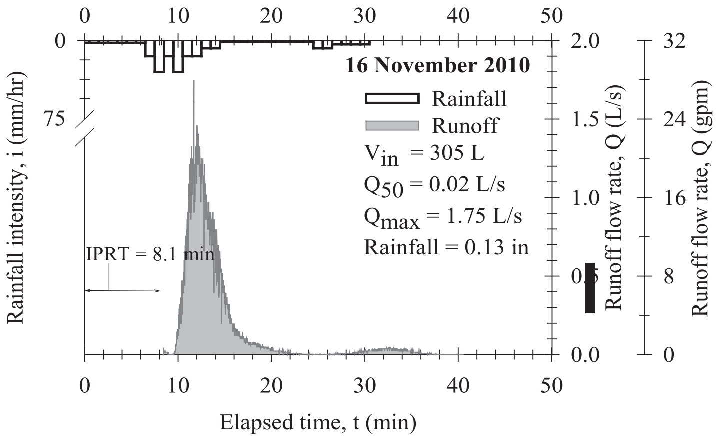


Figure A14: Hydrograph and hyetograph for 16 November 2010 event

On November 16, 2010, the JF4 unit treated a rainfall-runoff event. The event occurred after 286 dry hours. The peak rainfall intensity is 1.0 in/hr and rainfall depth is 0.13 inch. The storm lasted approximately 34 minutes. The maximum, median, and mean runoff flow rates are 28 gpm, 0.3gpm, and 2 gpm, respectively. The influent runoff volume is 81 gallons. Sampling occurred throughout the entire duration of the storm and the number of influent and effluent samples taken is 11 and 11, respectively. The influent and effluent TSS is 261.0 mg/L and 11.8 mg/L, respectively, and the removal efficiency is 98%. The influent and effluent SSC is 543.6 mg/L and 12.2 mg/L, respectively, and the removal efficiency is 99%.

Table A15: JF4 Summary: 5 January 2011 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	05 January 2011	Influent Volume:	5800 L (1532 gal)
Previous Dry Hours:	72 hr	Event Duration:	125 min
Maximum Flow Rate:	7.36 L/s (116.7gpm)	Number of Influent Samples:	10
Median Flow Rate:	0.16 L/s (2.6gpm)	Number of Effluent Samples:	10
Mean Flow Rate:	1.14 L/s (18.1gpm)	Peak Rainfall Intensity:	107 mm/hr (4.2 inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	21 mm (0.84 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

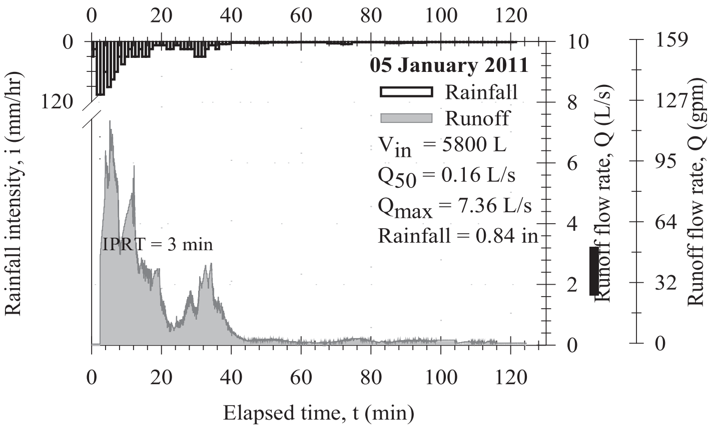


Figure A15: Hydrograph and hyetograph for 5 January 2011 event

On January 5, 2011, the JF4 unit treated a rainfall-runoff event. The event occurred after 72 dry hours. The peak rainfall intensity is 4.2 in/hr and rainfall depth is 0.84 inches. The storm duration is 125 minutes. The maximum, median, and mean runoff flow rates are 117 gpm, 3 gpm, and 18 gpm, respectively. The influent runoff volume is 1532 gallons. Sampling occurred during the entire duration of the storm and the number of influent and effluent samples taken is 10 and 10, respectively. This is a The influent and effluent TSS is 152.2 mg/L and 15.9 mg/L, respectively, and the removal efficiency is 91%. The influent and effluent SSC is 693.2 mg/L and 8.7 mg/L, respectively, and the removal efficiency is 99%.

Table A16: JF4 Summary: 10 January 2011 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	10 January 2011	Influent Volume:	1129 L (298 gal)
Previous Dry Hours:	106 hr	Event Duration:	26 min
Maximum Flow Rate:	3.32 L/s (52.6 gpm)	Number of Influent Samples:	8
Median Flow Rate:	0.01 L/s (0.2 gpm)	Number of Effluent Samples:	8
Mean Flow Rate:	0.41 L/s (6.5 gpm)	Peak Rainfall Intensity:	91 mm/hr (3.6inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	5 mm (0.20 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

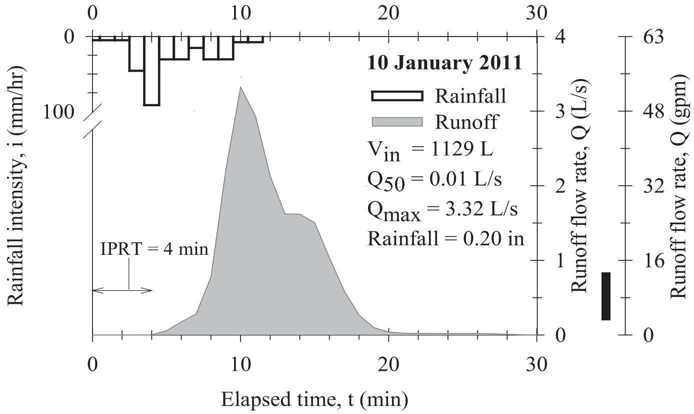


Figure A16: Hydrograph and hyetograph for 10 January 2011 event

On January 10, 2011, the JF4 unit treated a rainfall-runoff event. The event occurred after 106 dry hours. The peak rainfall intensity is 3.6 in/hr and rainfall depth is 0.20 inch. The storm lasted approximately 26 minutes. The maximum, median, and mean runoff flow rates are 53 gpm, 0.2 gpm, and 7 gpm, respectively. The influent runoff volume is 298 gallons. Sampling occurred throughout the entire duration of the storm and the number of influent and effluent samples taken is 8 and 8, respectively. The influent and effluent TSS is 80.7 mg/L and 6.6 mg/L, respectively, and the removal efficiency is 92%. The influent and effluent SSC is 211.1 mg/L and 3.0 mg/L, respectively, and the removal efficiency is 99%.

Table A17: JF4 Summary: 25 January 2011 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	25 January 2011	Influent Volume:	12387 L (3273 gal)
Previous Dry Hours:	365 hr	Runoff Duration:	389 min
Maximum Flow Rate:	4.09L/s (64.8gpm)	Number of Influent Samples:	10
Median Flow Rate:	0.39 L/s (6.2gpm)	Number of Effluent Samples:	10
Mean Flow Rate:	0.53L/s (8.4gpm)	Peak Rainfall Intensity:	18mm/hr (0.7 inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	44mm (1.74 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

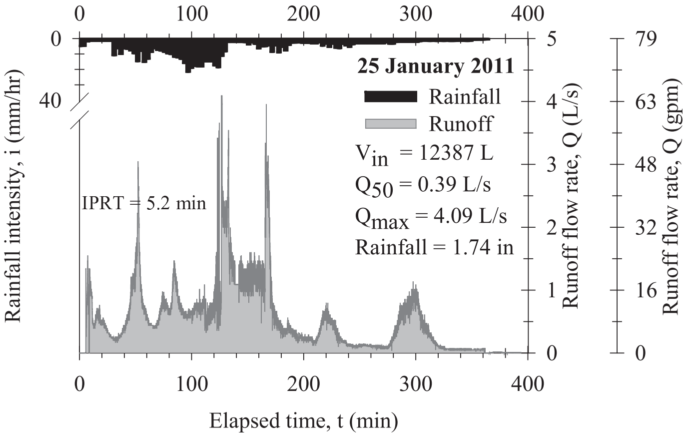


Figure A17: Hydrograph and hyetograph for 25 January 2011 event

On January 25, 2011, the JF4 unit treated a rainfall-runoff event. The event occurred after 365 dry hours. The peak rainfall intensity is 0.7 in/hr and rainfall depth is 1.74 inch. The storm lasted approximately 389 minutes. The maximum, median, and mean runoff flow rates are 65 gpm, 6 gpm, and 8 gpm, respectively. The influent runoff volume is 3273 gallons. Sampling occurred throughout the entire duration of the storm and the number of influent and effluent samples taken is 10 and 10, respectively. The influent and effluent TSS is 69.8 mg/L and 7.1 mg/L, respectively, and the removal efficiency is 90%. The influent and effluent SSC is 105.8 mg/L and 4.1 mg/L, respectively, and the removal efficiency is 96%.

Table A18: JF4 Summary: 7 February 2011 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	07 February 2011	Influent Volume:	13229 L (3495 gal)
Previous Dry Hours:	12 hr	Runoff Duration:	306 min
Maximum Flow Rate:	2.22 L/s (35.2gpm)	Number of Influent Samples:	11
Median Flow Rate:	0.77 L/s (12.1gpm)	Number of Effluent Samples:	11
Mean Flow Rate:	0.71 L/s (11.2gpm)	Peak Rainfall Intensity:	30 mm/hr (1.2 inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	32.8 mm (1.29 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

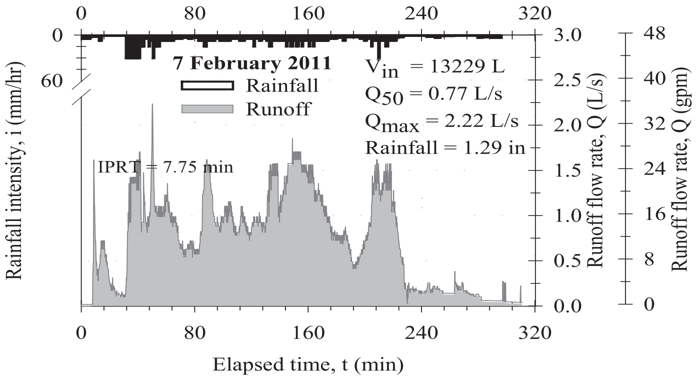


Figure A18: Hydrograph and hyetograph for 7 February 2011 event

On February 7, 2011, the JF4 unit treated a rainfall-runoff event. The event occurred after 12 dry hours. The peak rainfall intensity is 1.2 in/hr and rainfall depth is 1.29 inch. The storm lasted approximately 306 minutes. The maximum, median, and mean runoff flow rates are 35 gpm, 12 gpm, and 11 gpm, respectively. The influent runoff volume is 3495 gallons. Sampling occurred throughout the entire duration of the storm and the number of influent and effluent samples taken is 11 and 11, respectively. The influent and effluent TSS is 34.8 mg/L and 5.3 mg/L, respectively, and the removal efficiency is 85%. The influent and effluent SSC is 438.3 mg/L and 7.6 mg/L, respectively, and the removal efficiency is 98%.

Table A19: JF4 Summary: 9 March 2011 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	09 March 2011	Influent Volume:	10051 L (2656gal)
Previous Dry Hours:	79 hr	Runoff Duration:	691min
Maximum Flow Rate:	3.13L/s (49.7 gpm)	Number of Influent Samples:	12
Median Flow Rate:	0.10L/s (1.6 gpm)	Number of Effluent Samples:	12
Mean Flow Rate:	0.24L/s (3.8 gpm)	Peak Rainfall Intensity:	15mm/hr (0.6 inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	29.2 mm (1.15 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

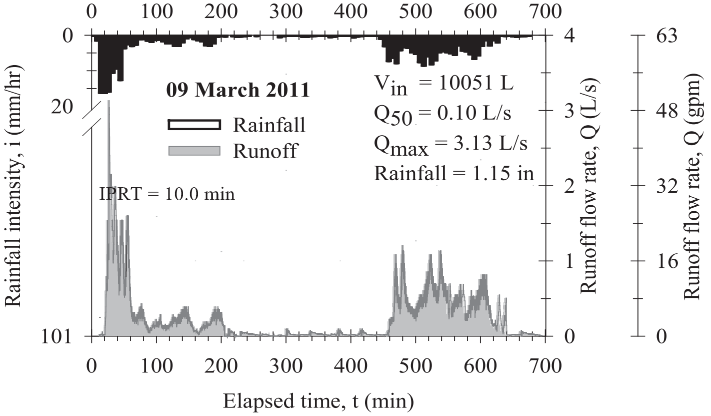


Figure A19: Hydrograph and hyetograph for 9 March 2011 event

On March 9, 2010, the JF4 unit treated a rainfall-runoff event. The event occurred after 79 dry hours. The peak rainfall intensity is 0.6 in/hr and rainfall depth is 1.15 inch. The storm lasted approximately 691 minutes. The maximum, median, and mean runoff flow rates are 50 gpm, 2 gpm, and 4 gpm, respectively. Influent volume is 2656 gallons. Sampling occurred throughout the entire duration of the storm and the number of influent and effluent samples taken is 12 and 12, respectively. The influent and effluent TSS is 30.5 mg/L and 8.3 mg/L, respectively, and the removal efficiency is 73%. The influent and effluent SSC is 78.2 mg/L and 2.8 mg/L, respectively, and the removal efficiency is 97%.

Table A20: JF4 Summary: 28 March 2011 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	28 March 2011	Influent Volume:	522 L (138 gal)
Previous Dry Hours:	438 hr	Event Duration:	66 min
Maximum Flow Rate:	1.03 L/s (16.4gpm)	Number of Influent Samples:	12
Median Flow Rate:	0.06 L/s (0.9gpm)	Number of Effluent Samples:	10
Mean Flow Rate:	0.13 L/s (2.1gpm)	Peak Rainfall Intensity:	33 mm/hr (1.3 inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	2.5 mm (0.10 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

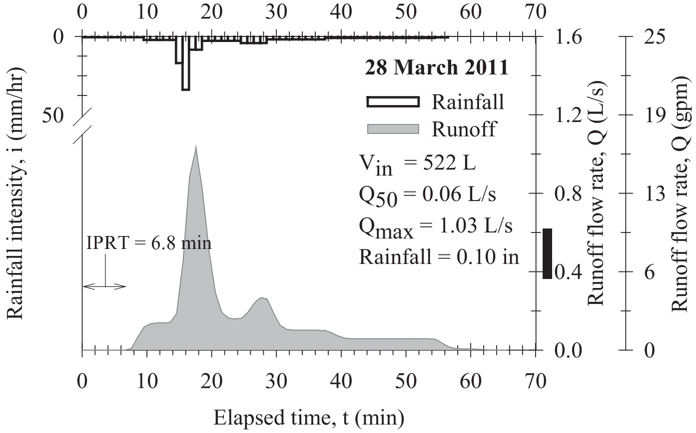


Figure A20: Hydrograph and hyetograph for 28 March 2011 event

On March 28, 2011, the JF4 unit treated a rainfall-runoff event. The event occurred after 438 dry hours. The peak rainfall intensity is 1.3 in/hr and rainfall depth is 0.10 inch. The storm lasted approximately 66 minutes. The maximum, median, and mean runoff flow rates are 16 gpm, 1 gpm, and 2 gpm, respectively. The influent runoff volume is 138 gallons. Sampling occurred throughout the entire duration of the storm and the number of influent and effluent samples taken is 12 and 10, respectively. The influent and effluent TSS is 68.4 mg/L and 12.7 mg/L, respectively, and the removal efficiency is 86%. The influent and effluent SSC is 102.8 mg/L and 5.6 mg/L, respectively, and the removal efficiency is 96%.

Table A21: JF4 Summary: 30 March 2011 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	30 March 2011	Influent Volume:	3707L (979gal)
Previous Dry Hours:	48 hr	Event Duration:	179 min
Maximum Flow Rate:	5.61 L/s (89.0gpm)	Number of Influent Samples:	12
Median Flow Rate:	0.10 L/s (1.6gpm)	Number of Effluent Samples:	12
Mean Flow Rate:	0.29 L/s (4.5gpm)	Peak Rainfall Intensity:	76 mm/hr (3.0 inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	15 mm (0.60 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

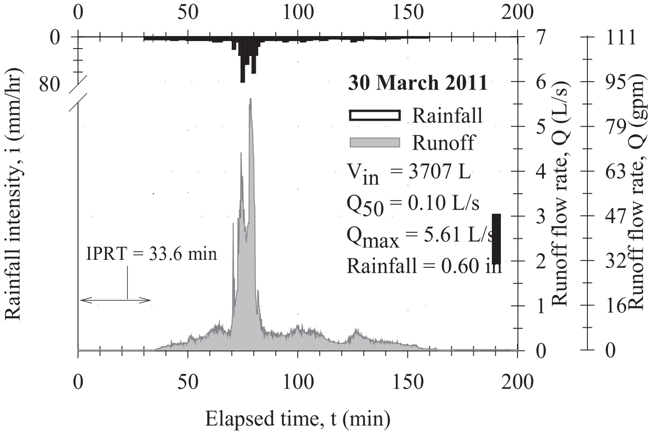


Figure A21: Hydrograph and hyetograph for 30 March 2011 event

On March 30, 2011, the JF4 unit treated a rainfall-runoff event. The event occurred after 48 dry hours. The peak rainfall intensity is 3 in/hr and rainfall depth is 0.60 inch. The storm lasted approximately 179 minutes. The maximum, median, and mean runoff flow rates are 89 gpm, 2 gpm, and 5 gpm, respectively. The influent runoff volume is 979 gallons. Sampling occurred throughout the entire duration of the storm and the number of influent and effluent samples taken is 12 and 12, respectively. The influent and effluent TSS is 104.5 mg/L and 7.3 mg/L, respectively, and the removal efficiency is 93%. The influent and effluent SSC is 443.7 mg/L and 7.3 mg/L, respectively, and the removal efficiency is 98%.

Table A22: JF4 Summary: 20 April 2011 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	20 April 2011	Influent Volume:	206 L (54 gal)
Previous Dry Hours:	196 hr	Event Duration:	61 min
Maximum Flow Rate:	3.28 L/s (52.0gpm)	Number of Influent Samples:	12
Median Flow Rate:	0.01 L/s (0.1gpm)	Number of Effluent Samples:	12
Mean Flow Rate:	0.06 L/s (0.9gpm)	Peak Rainfall Intensity:	15 mm/hr (0.6 inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	4 mm (0.14 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

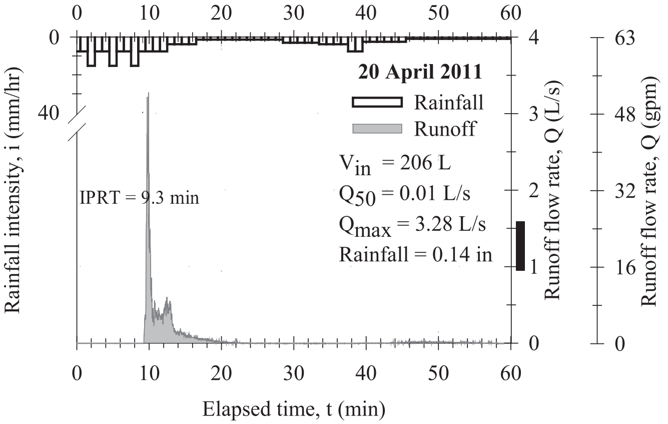


Figure A22: Hydrograph and hyetograph for 20 April 2011 event

On April 20, 2011, the JF4 unit treated a rainfall-runoff event. The event occurred after 196 dry hours. The peak rainfall intensity is 0.6 in/hr and rainfall depth is 0.14 inch. The storm lasted approximately 61 minutes. The maximum, median, and mean runoff flow rates are 52 gpm, 0.1 gpm, and 0.9 gpm, respectively. The influent runoff volume is 54 gallons. Sampling occurred throughout the entire duration of the storm and the number of influent and effluent samples taken is 12 and 12, respectively. The influent and effluent TSS is 143.7 mg/L and 11.4 mg/L, respectively, and the removal efficiency is 96%. The influent and effluent SSC is 921.7 mg/L and 6.1 mg/L, respectively, and the removal efficiency is 100%.

Table A23: JF4 Summary: 14 May 2011 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	14May 2011	Influent Volume:	11256 L (2974 gal)
Previous Dry Hours:	188 hr	Event Duration:	295 min
Maximum Flow Rate:	7.53 L/s (119.3gpm)	Number of Influent Samples:	19
Median Flow Rate:	0.02 L/s (0.36gpm)	Number of Effluent Samples:	19
Mean Flow Rate:	0.63 L/s (9.98gpm)	Peak Rainfall Intensity:	137 mm/hr (5.4 inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	50 mm (1.98 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

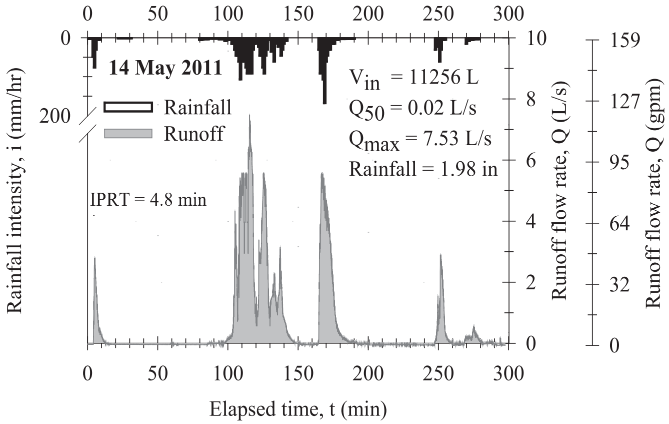


Figure A23: Hydrograph and hyetograph for 14 May 2011 event

On May 14, 2011, the JF4 unit treated a rainfall-runoff event. The event occurred after 188 dry hours. The peak rainfall intensity is 5.4 in/hr and rainfall depth is 1.98 inch. The storm lasted approximately 295 minutes. The maximum, median, and mean runoff flow rates are 119.3gpm, 0.4 gpm, and 10.0gpm, respectively. The influent runoff volume is 2,974 gallons. Sampling occurred throughout the entire duration of the storm and the number of influent and effluent samples taken is 19 and 19, respectively. The influent and effluent TSS is 77.1 mg/L and 12.5 mg/L, respectively, and the removal efficiency is 84%. The influent and effluent SSC is 487.3 mg/L and 5.3 mg/L, respectively, and the removal efficiency is 99%.

Table A24: JF4 Summary:6 June 2011 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	6 June 2011	Influent Volume:	960 L (254 gal)
Previous Dry Hours:	541 hr	Event Duration:	69 min
Maximum Flow Rate:	1.55 L/s (24.5gpm)	Number of Influent Samples:	10
Median Flow Rate:	0.01 L/s (0.1gpm)	Number of Effluent Samples:	10
Mean Flow Rate:	0.23 L/s (3.7gpm)	Peak Rainfall Intensity:	23 mm/hr (0.9 inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	4 mm (0.16 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

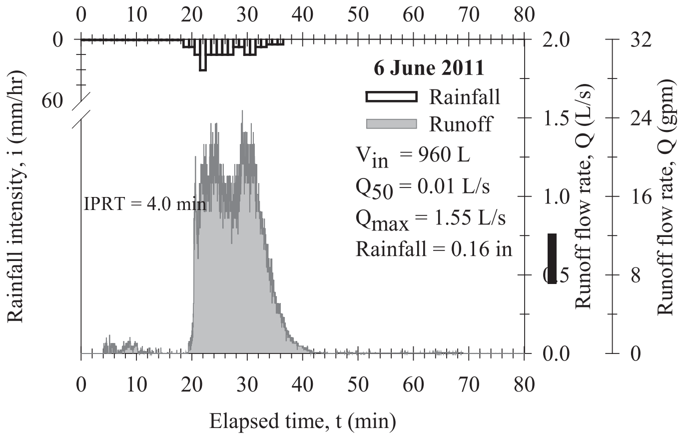


Figure A24: Hydrograph and hyetograph for 6 June 2011 event

On June 6, 2011, the JF4 unit treated a rainfall-runoff event. The event occurred after 541 dry hours. The peak rainfall intensity is 0.9 in/hr and rainfall depth is 0.16 inch. The storm lasted approximately 69 minutes. The maximum, median, and mean runoff flow rates are 24.5 gpm, 0.1 gpm, and 3.7 gpm, respectively. The influent runoff volume is 254 gallons. Sampling occurred throughout the entire duration of the storm and the number of influent and effluent samples taken is 10 and 10, respectively. The influent and effluent TSS is 85.6 mg/L and 13.2 mg/L, respectively, and the removal efficiency is 88%. The influent and effluent SSC is 237.5 mg/L and 9.0 mg/L, respectively, and the removal efficiency is 97%.

Table A25: JF4 Summary: 27 June 2011 Hydrology

Event Information		JF4 Unit Treatment Run information	
Event Date:	27 June 2011	Influent Volume:	3383 L (894 gal)
Previous Dry Hours:	88 hr	Event Duration:	50 min
Maximum Flow Rate:	3.35 L/s (53.2gpm)	Number of Influent Samples:	10
Median Flow Rate:	0.12 L/s (2.0gpm)	Number of Effluent Samples:	10
Mean Flow Rate:	0.64 L/s (10.1gpm)	Peak Rainfall Intensity:	43 mm/hr (1.7 inch/hr)
Experimental Site:	UF Engineering Surface Parking	Rainfall Depth:	11 mm (0.45 inch)
TARP Qualifying:	YES	Site Location:	Gainesville, FL

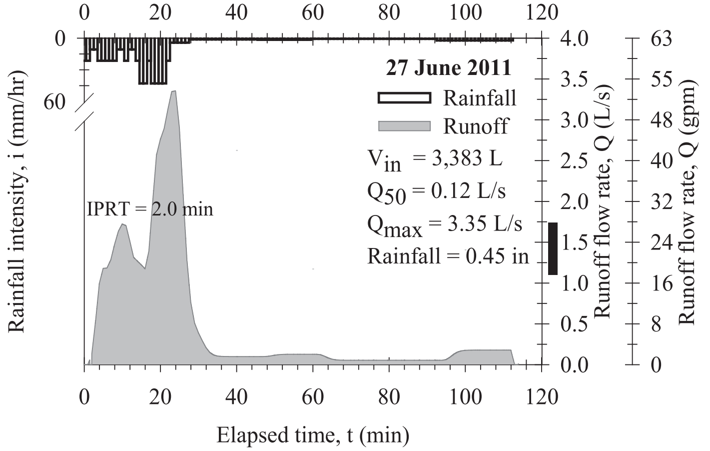


Figure A25: Hydrograph and hyetograph for 27 June 2011 event

On June 27, 2011, the JF4 unit treated a rainfall-runoff event. The event occurred after 88 dry hours. The peak rainfall intensity is 1.7 in/hr and rainfall depth is 0.45 inch. The storm lasted approximately 50 minutes. The maximum, median, and mean runoff flow rates are 53gpm, 2gpm, and 10 gpm, respectively. The influent runoff volume is 894 gallons. Sampling occurred throughout the entire duration of the storm and the number of influent and effluent samples taken is 10 and 10, respectively. The influent and effluent TSS is 131.4 mg/L and 12.8 mg/L, respectively, and the removal efficiency is 91%. The influent and effluent SSC is 591.7 mg/L and 9.8 mg/L, respectively, and the removal efficiency is 98%.

APPENDIX B

HYDRAULIC TESTING

Extensive hydraulic testing was conducted at the University of Florida on a new clean 54-inch long Jellyfish® filtration cartridge with the standard orifice sizes in the cartridge lid (35 mm orifice for the draindown cartridge and 70 mm for the hi-flo cartridge). In addition, hydraulic testing was conducted on the Jellyfish® Filter JF4-2-1 with clean cartridges prior to commissioning as well as with dirty cartridges at the conclusion of the monitoring period (25 monitored storm events and 15 inches of cumulative rainfall).

Figure B1 depicts the hydraulic response curve for a new clean 54-inch Jellyfish® filtration cartridge with a 35 mm orifice in the cartridge lid, which is the standard lid orifice for the draindown cartridge. Test results demonstrate a flow capacity of 44 gpm at 18 inches of driving head. Imbrium Systems assigns a design treatment flow rate of 40 gpm to the draindown cartridge used in the Jellyfish® Filter JF4-2-1.

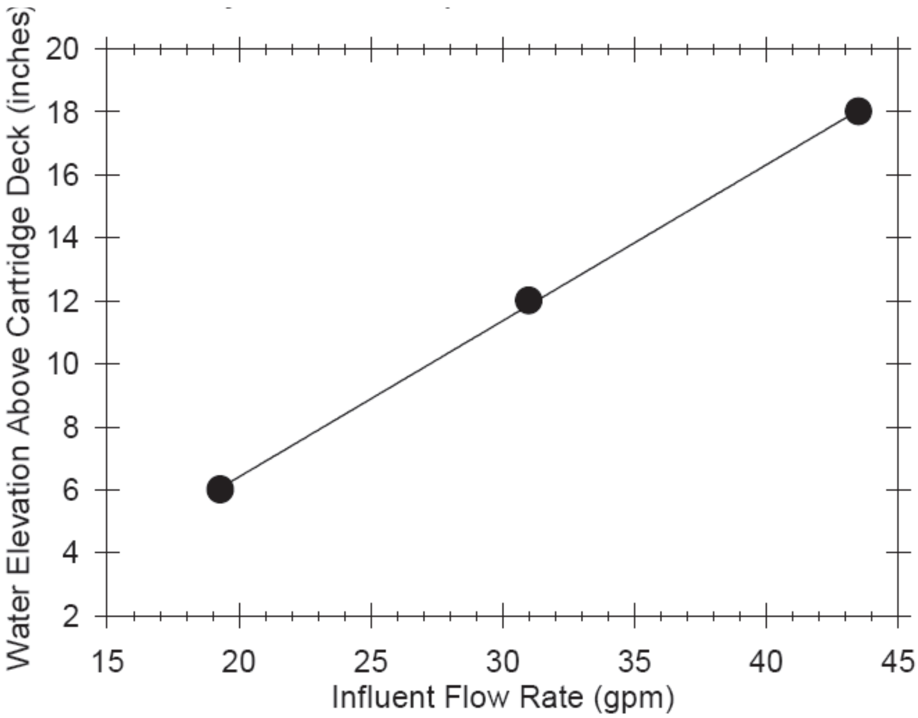


Figure B1: Hydraulic response of a clean 54-inch long Jellyfish filtration cartridge with a 35 mm lid orifice, used as the draindown cartridge in the JF4-2-1.

Figure B2 depicts the hydraulic response curve for a new clean 54-inch Jellyfish filtration cartridge with a 70 mm orifice in the cartridge lid, which is the standard lid orifice for each of the hi-flo cartridges. Test results demonstrate a flow capacity of 116 gpm at 18 inches of driving head and 88 gpm at 12 inches of driving head. Since each hi-flo cartridge is located within the 6-inch high backwash pool weir, the net available driving head for the hi-flo cartridge is 12 inches. Imbrium Systems assigns a design treatment flow rate of 80 gpm to each hi-flo cartridge used in the Jellyfish® Filter JF4-2-1.

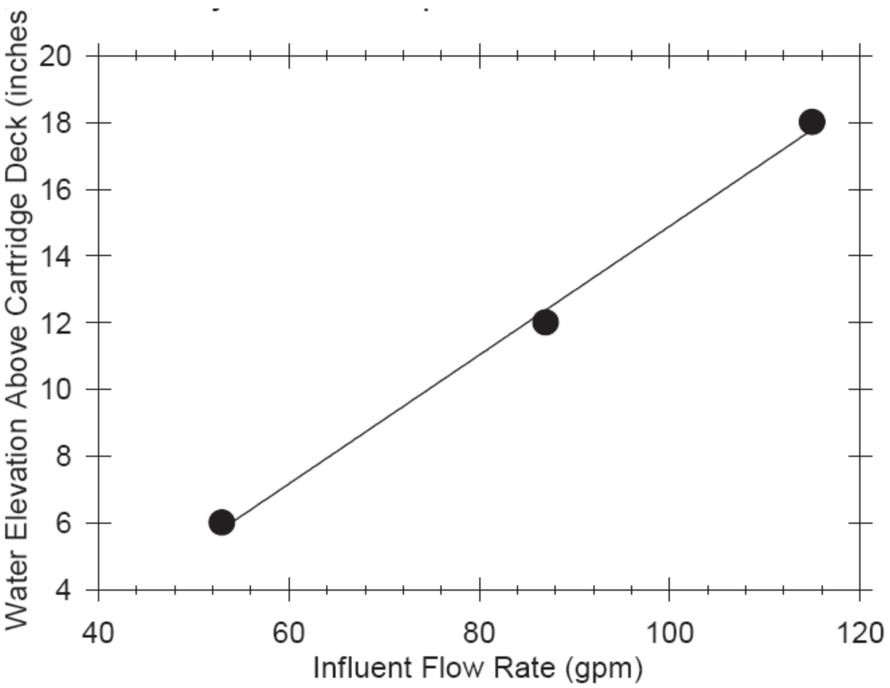


Figure B2: Hydraulic response of a clean 54-inch long Jellyfish filtration cartridge with a 70 mm lid orifice, used for each hi-flo cartridge in the JF4-2-1.

Figure B3 depicts the hydraulic response curves for the Jellyfish® Filter JF4-2-1, which uses three 54-inch long Jellyfish filtration cartridges, one deployed as the draindown cartridge and two deployed as hi-flo cartridges. Hydraulic testing was performed with clean new cartridges prior to commissioning the system for field testing, and with dirty cartridges at the conclusion of monitoring after 25 storm events and 15 inches of cumulative rainfall. Test results demonstrate a flow capacity of 200 gpm at 18 inches of driving head for the JF4-2-1 with clean cartridges, which is the design treatment flow rate of the system. The hydraulic response curves are virtually identical for the system with clean cartridges and with dirty cartridges up to 18 inches of driving head.

The divergence of the curves beyond 18 inches of driving head is attributed to a difference in the height of the pressure relief pipe during the hydraulic tests. During hydraulic testing with clean cartridges, the pressure relief pipe height was 18 inches. At driving head greater than 18 inches, the pressure relief pipe began to overflow, resulting in a relatively flat response curve from that point forward as flow rate increased. The pressure relief pipe height was subsequently increased to 24 inches prior to commissioning the system in order to eliminate any possibility of internal bypassing of water during the monitoring period, An external bypass was installed around the treatment unit and configured to begin bypassing influent if driving head exceeded 18 inches during a storm event. Hydraulic testing was performed on the JF4-2-1 with the dirty cartridges after the external bypass was disassembled and with the 24-inch high pressure relief pipe intact, resulting in a response curve with gradually increasing slope as flow rate increased with driving head between 18 and 24 inches.

After completing hydraulic testing on the JF4-2-1 with dirty cartridges, the draindown time of water within the 6-inch high backwash pool weir was measured and ranged from 101-120 seconds. The backwash pool is designed as a passive self-cleaning mechanism, and provides a reverse flow of water through the hi-flo cartridges when influent flow ceases. Water below the cartridge deck is displaced through the draindown cartridge and discharged to the top of the cartridge deck and subsequently to the outlet pipe. The backwash pool draindown time of approximately 2 minutes indicated that the degree of PM occlusion on the dirty hi-flo and draindown cartridges did not appear to significantly impede water flow through the cartridges during passive backwash.

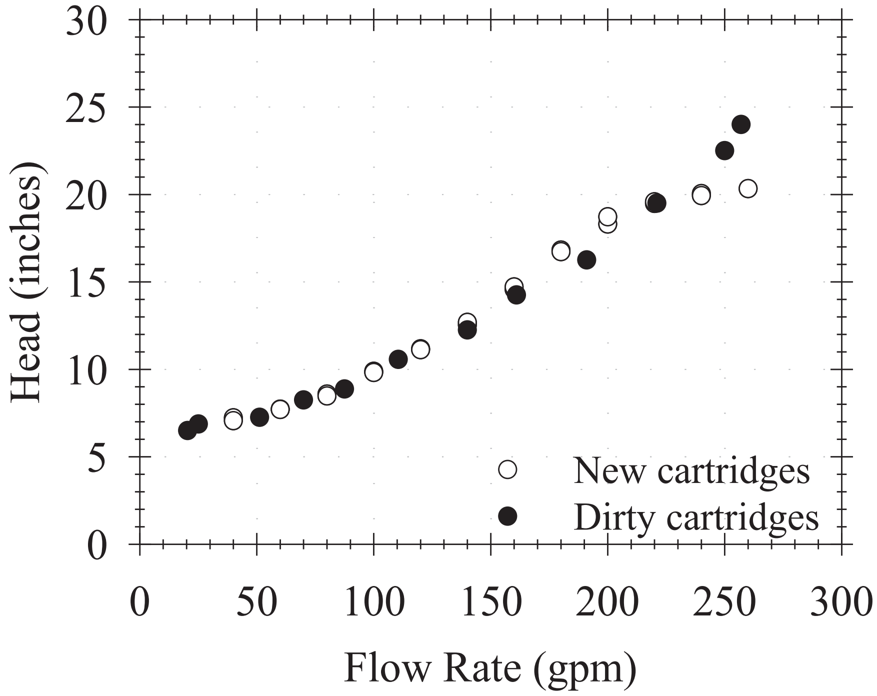


Figure B3: Hydraulic response of the Jellyfish® Filter JF4-2-1 with clean cartridges prior to commissioning and with dirty cartridges after the monitoring period (25 storm events, 15 inches of cumulative rainfall, 29,851 gallons of treated runoff, and 166 pounds of captured PM mass)

After completing hydraulic testing of the JF4-2-1 with the dirty cartridges, a manual back-flush of the dirty cartridges was performed using a Jellyfish® Cartridge Back-flush Pipe to simulate a typical annual maintenance activity. The back-flush pipe is a 40-inch tall, 12-inch diameter hollow tube fitted with a flush valve and flapper on the inside bottom, and a compressible gasket on the lower end. In order to manually back-flush a cartridge, the cartridge lid is removed and the back-flush pipe is placed over the cartridge receptacle with the compressible gasket resting squarely on the receptacle. The pipe is filled with clean water using a hose, and the weight of the water causes the compressible gasket to form a water-tight seal on the receptacle. A wire connected to the internal flapper valve is then pulled, which raises the flapper and allows the contents of the pipe to drain out and back-flush the cartridge. Since the pipe is 40 inches tall, the head of back-flush water is significantly higher than the typical 18 inches of driving head that a cartridge might experience during peak treatment forward flow. The pipe is designed to provide a significant back-flush volume and relatively high back-flush flow rate in order to effectively remove accumulated sediment from the filter surfaces. The back-flush pipe holds approximately 18 gallons of water when full, with 14 gallons of that total in the uppermost 30 inches of pipe, which is the distance from the top of the pipe to the top of the flapper valve when in the open position.

The time to drain the uppermost 30 inches of back-flush pipe volume (14 gallons) was measured for all three cartridges and determined to be approximately 8 seconds in each case, which equates to an average back-flush flow rate of approximately 105 gpm for each cartridge. Hydraulic testing was subsequently performed on the JF4-2-1 with the manually back-flushed cartridges. As expected, the hydraulic response curve was virtually identical to the system with clean new cartridges and with dirty cartridges as determined earlier. This indicates that the degree of sediment occlusion on the dirty cartridges was not significant enough to result in an increase in hydraulic capacity after manual back-flushing. Prior to manual back-flushing of the cartridges, 158 pounds of dry basis pollutant mass was recovered from the sump. After manual back-flushing of the cartridges, a very small amount of additional pollutant mass (0.1 pounds dry basis) was recovered from the sump. This indicates that each dirty cartridge contained sufficient porosity to allow passage of a relatively high back-flush flow rate such that minimal PM was dislodged from the cartridges, despite the presence of 2.6 pounds of PM mass on each cartridge (established by later manual rinsing of each cartridge as described below).

After completing hydraulic testing of the JF4-2-1 with manually backwashed cartridges, the cartridges were removed from the system and rinsed with a garden hose sprayer as part of the PM mass recovery and to simulate a typical maintenance activity. Accumulated PM was easily removed from the cartridges with rinsing, and a pollutant mass of 2.6 pounds (dry basis) was recovered from each cartridge, for a total of approximately 8 pounds. PM mass recovered from the sump was 158 pounds, for a total dry basis PM mass recovery of 166 pounds. Data are shown in **Table B-1**. The uniform and relatively low quantity of pollutant mass found on the cartridges indicates that self-cleaning mechanisms are effective in removing accumulated PM from both the hi-flo cartridges and the draindown cartridge.

Hydraulic testing was subsequently performed on the JF4-2-1 with the manually rinsed cartridges. As expected, the hydraulic response curve was virtually identical to the system with clean new cartridges, with dirty cartridges, and with manually backwashed cartridges as determined earlier. **Figure B4.**

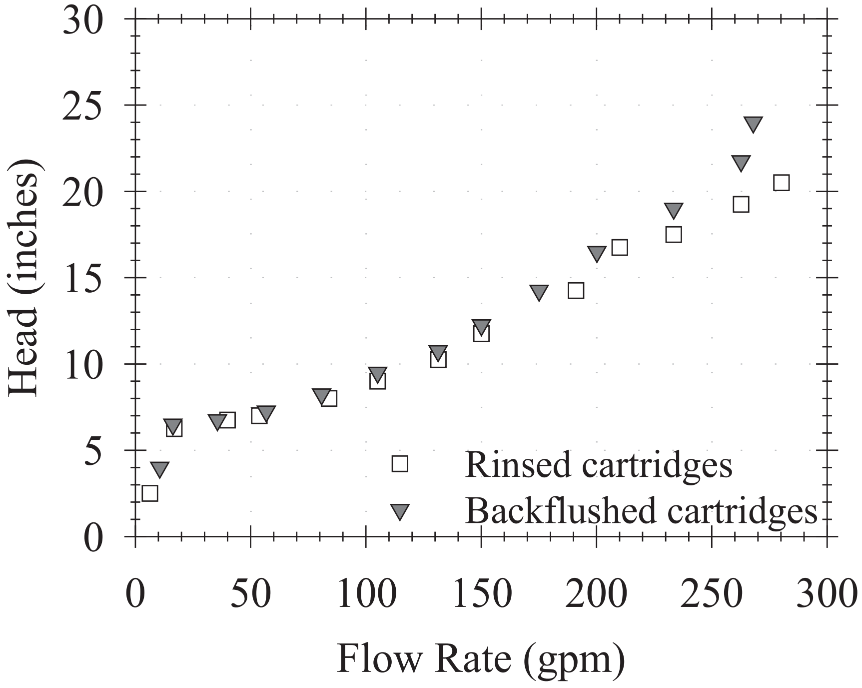


Figure B4: Hydraulic response of the JF4-2-1 with manually back-flushed cartridges and with manually rinsed cartridges

Table B-1 Mass balance results utilizing measured functional and granulometric fractions of sediment, settleable and suspended PM

Rainfall-runoff Event	Influent									Effluent							
	Vol.	Sediment PM		Settleable PM		Suspended PM		Total PM		Vol.	Sediment PM		Settleable PM		Suspended PM		Tota
		EMC	Mass	EMC	Mass	EMC	Mass	EMC	Mass		EMC	Mass	EMC	Mass	EMC	Mass	EMC
	L	mg/L	g	mg/L	g	mg/L	g	mg/L	g	L	mg/L	g	mg/L	g	mg/L	g	mg/L
28-May-10	7454	435.9	3249.6	45.4	338.6	43.7	325.9	525.1	3914.2	3682	6.2	22.9	6.9	25.2	11.9	43.8	25.0
16-Jun	4997	1333.5	6663.5	66.9	334.5	67.9	339.3	1468.3	7337.3	4665	7.1	33.2	2.0	9.4	20.1	93.6	29.2
21-Jun	8683	1781.6	15469.0	22.2	192.5	13.7	119.2	1817.5	15780.7	8460	5.6	47.6	1.8	15.1	9.9	83.7	17.3
30-Jun	5451	504.0	2747.3	20.6	112.5	19.2	104.9	543.9	2964.7	5330	8.0	42.5	1.5	8.2	5.7	30.5	15.2
15-Jul	3602	938.6	3381.1	68.2	245.6	23.7	85.3	1030.5	3712.0	3296	5.2	17.0	1.4	4.6	6.9	22.9	13.5
1-Aug	11990	243.2	2916.0	22.8	272.8	18.5	222.2	284.5	3411.0	11676	4.8	55.9	8.4	98.4	6.9	80.9	20.1
6-Aug	1395	390.3	544.4	29.5	41.2	48.0	66.9	467.8	652.5	1024	13.1	13.5	2.9	3.0	12.0	12.3	28.1
7-Aug	2620	222.5	582.9	32.3	84.5	13.1	34.3	267.9	701.8	2540	1.6	4.0	5.1	13.1	6.9	17.5	13.6
23-Aug	310	533.9	165.5	41.9	13.0	44.6	13.8	620.4	192.3	193	2.6	0.5	3.1	0.6	4.7	0.9	10.4
12-Sep	1641	165.0	270.7	68.7	112.7	67.4	110.6	301.2	494.1	1508	2.7	4.1	4.1	6.2	11.5	17.4	18.4
26-Sep	1126	224.5	252.9	0.9	1.0	2.0	2.2	227.4	256.1	835	7.9	6.6	2.2	1.8	2.0	1.7	12.1
27-Sep	3837	875.1	3357.4	50.0	192.0	44.5	170.8	969.6	3720.2	3765	3.2	11.9	2.1	7.8	5.0	18.7	10.2
4-Nov	994	486.4	483.5	38.6	38.4	92.8	92.3	617.8	614.2	510	3.7	1.9	2.9	1.5	6.5	3.3	13.1
16-Nov	306	318.4	97.5	131.9	40.4	118.2	36.2	568.6	174.1	166	18.0	3.0	2.4	0.4	8.4	1.4	28.9
5-Jan-11	5791	841.4	4872.3	49.8	288.4	40.9	236.8	932.1	5397.5	4948	3.2	15.7	2.8	14.1	12.9	63.9	18.9
10-Jan	1126	454.0	511.4	60.1	67.7	20.8	23.4	534.9	602.5	1047	1.4	1.5	3.6	3.8	3.1	3.2	8.1
25-Jan	12387	410.6	5085.8	37.7	467.3	32.4	401.8	480.7	5954.9	12353	1.1	14.0	2.1	25.4	2.0	24.6	5.2
7-Feb	13211	738.5	9756.9	16.7	221.2	23.0	304.4	778.3	10282.5	12928	2.4	31.1	0.8	10.8	4.2	54.7	7.5
9-Mar	10036	69.6	699.0	8.5	85.6	13.3	133.5	91.5	918.1	9805	0.5	5.3	0.6	5.8	0.9	9.1	2.1
28-Mar	522	65.4	34.1	13.0	6.8	36.4	19.0	114.8	59.9	423	1.9	0.8	2.1	0.9	8.0	3.4	12.0
30-Mar	3761	386.9	1455.3	54.3	204.3	34.0	127.7	475.2	1787.3	3678	0.8	3.0	1.8	6.6	4.6	16.7	7.2
20-Apr	204	1010.4	206.2	30.9	6.3	24.8	5.1	1066.1	217.6	113	1.8	0.2	2.6	0.3	7.1	0.8	11.5
14-May	10864	790.9	8591.9	59.6	647.5	44.5	483.6	895.0	9723.0	10697	2.0	21.2	1.3	14.0	11.2	119.5	14.5
6-Jun	964	307.6	296.5	30.8	29.7	53.3	51.4	391.7	377.6	733	1.1	0.8	2.5	1.8	10.4	7.6	13.9
27-Jun	3379	514.8	1739.7	67.6	228.6	47.6	161.0	630.1	2129.3	3175	4.6	14.6	2.3	7.3	8.9	28.2	15.8

Total influent PM = 81.4 kg (179 lb)
Total effluent PM = 1.4 kg (3 lb)
Mass difference between influent and effluent = 79.9 kg (176 lb)
Independent PM Recovery based on cleaning out and backwashing unit and recovering PM = 75.5 kg (166 lb)
% mass recovery = 94.5%

Notes: Sediment PM includes all biogenic material including leaves, sticks, detritus.
Settleable PM based on SM 2540F.
Suspended PM based on 60 min. quiescent settling in Imhoff cone.

References for details: Sansalone and Kim (2008), Kim and Sansalone (2008) and Sansalone et. al. (2009)

Maryland
Department of
the Environment

Larry Hogan
Governor

Boyd Rutherford
Lieutenant Governor

Ben Grumbles
Secretary

Alternative/Innovative Technology List of Approved Stormwater Practices (August 2017)

Practice Name	Manufacturer	Practice Type	Approval Type	BMP Category	BMP Code	Approval Date
StormCap™	Flex Membrane International /Stormwater Capture Co.	Green Roof	Alternative Surface	A	AGRE	7 /21/2017
Silva Cell Pavement System	DeepRoot Green Infrastructure LLC	Bioretention/Pavement System	ESD-All, Structural WQv, Structural Component	E, S	MMBR, FBIO	6 /16/2017
KBI FlexiPave	K.B. Industries	Permeable Pavement	Alternative Surface	A	APRP	5 /17/2017
StormTreat System	StormTreat Systems, Inc.	Submerged Gravel Wetland & Bioretention/Filter	ESD-All, Structural WQv	E, S	MSGW, MMBR, FBIO	5 /15/2017
LiveRoof Hybrid Green Roof System	LiveRoof Global, LLC	Green Roof	Alternative Surface	A	AGRE	2 /28/2017
StormPro	Environment 21, LLC	Hydrodynamic Separator	Pretreatment	X	XOGS	2 /7 /2017
VR Max Vegetated Roof System	Tremco Incorporated	Green Roof	Alternative Surface	A	AGRE	11/4 /2016
FocalPoint Bioretention Systems	ACF-Convergent Alliance	Bioretention	MS4 Retrofit, ESD WQv Only	E, S	MMBR, FBIO	9 /8 /2016
Suntree Nutrient Separating Baffle Box	Suntree Technologies	Hydrodynamic Separator	Pretreatment	S	XOGS	9 /8 /2016

Practice Name	Manufacturer	Practice Type	Approval Type	BMP Category	BMP Code	Approval Date
Columbia Green Technologies Green Roof Systems	Columbia Green Roof Technologies	Green Roof System	Alternative Surface	A	AGRE	9 /2 /2016
PaverGuide	PaverGuide, Inc.	Base/Storage Reservoir for Permeable Pavers	Alternative Surface	A	APRP	8 /29/2016
HydroBlox	HydroBlox Technologies, Inc.	Drainage/Conveyance Alternative	Structural Component	X	XOTH	5 /31/2016
Henry Green Roof Products	Henry Company	Green Roof System	Alternative Surface	E	AGRE	2 /5 /2016
Opti RTC Continuous Monitoring and Adaptive Control (CMAC)	OptiRTC, Inc.	Structural control component for wet ponds	Structural Component	X	XOTH	1 /27/2016
PerkFilter	Oldcastle Precast	Cartridge (Sand) Filter	Structural WQv	S	FSND	9 /16/2015
Hydropack Green Roof System	Vegetal i.D. Inc.	Green Roof	Alternative Surface	A	AGRE	9 /10/2015
Modular Wetland System - Linear	Modular Wetland Systems, Inc.	Bioretention/Micro-Bioretention/Submerged Gravel Wetland	MS4 Retrofit, ESD WQv Only, Structural WQv	E, S	MMBR, MSWG, FBIO	9 /8 /2015
AWD SITEDRAIN Strip 9624	American Wick Drain	Underdrain Alternative	Structural Component	X	XOTH	4 /6 /2015
MP Eco-Grid	USA EcoSystems	Reinforced Turf System	Alternative Surface	E	ARTF	1 /22/2015
Rotondo Bio-Filter	Rotondo Env. Solutions, LLC	Bioretention System	MS4 Retrofit	E, S	MMBR, FBIO	1 /9 /2015
Hydrotech Green Roofing System	American Hydrotech, LLC	Green Roof System	Alternative Surface	E	AGRE	1 /9 /2015
Stormcrete	Porous Technologies, LLC	Permeable Pavement	Alternative Surface	E	AGRE	12/9 /2014
Green Roof Outfitters Modular Roof System	Green Roof Outfitters, LLC	Modular Green Roof	Alternative Surface	E	AGRE	11/20/2014

Practice Name	Manufacturer	Practice Type	Approval Type	BMP Category	BMP Code	Approval Date
Eco-Roof	Eco-Roofs, LLC	Green Roof System	Alternative Surface	E	AGRE	4 /18/2014
StormTank StormShield	Brentwood Industries, Inc.	Vault/Filter System	Pretreatment	S	XOGS	3 /5 /2014
Rotondo Bio-Pod	Rotondo Env. Solutions, LLC	Permeable Pavement/Vault System	Pretreatment	S	XOTH	1 /7 /2014
AquaLok GLU	FGP Enterprises, LLC	Rainwater Harvesting	ESD-All	E	MRWH	1 /7 /2014
Clay Brick Pavers	The Brick Industry	Permeable Pavement	Alternative Surface	E	APRP	8 /12/2013
CrystalClean Separator	CrystalStream Technologies	Hydrodynamic Device	Pretreatment	S	XOGS	5 /30/2013
Aqua Bric/Bio-Pave	Filterra Bioretention Systems	Interlocking Paving System	Alternative Surface, ESD-All, Structural WQv	E	APRP	3 /19/2013
SAFL Baffle	Upstream Technologies	OGS/Filter System	Pretreatment	S	XOGS	3 /12/2013
COREgravel	Core Systems	Reinforced Turf	Alternative Surface	E	ARTF	3 /12/2013
EZ Roll Grass and Gravel Pavers	NDS, Inc.	Reinforced Turf	Alternative Surface	E	ARTF	3 /12/2013
EcoCline Living Roof System	Furbish Company	Green Roof	Alternative Surface	E	AGRE, AGRI	2 /25/2013
Filterra Bioretention System	Filterra Bioretention Systems	Bioretention	ESD WQv Only, Structural WQv	E, S	MMBR, FBIO	2 /22/2013
Grasscrete	Storm-Services, LLC	Reinforced Turf	Alternative Surface	E	ARTF	12/3 /2012
Nicolock Pavers	Nicolock Paving Stones	Permeable Paver	Alternative Surface	E	APRP	8 /3 /2012
AquaLok Panels	FGP Enterprises, LLC	Green Roof/ Rainwater Harvesting	Alternative Surface, ESD-All	E	AGRE, MRWH	6 /20/2012

Practice Name	Manufacturer	Practice Type	Approval Type	BMP Category	BMP Code	Approval Date
PaveDrain	Ernest Maier, Inc.	Permeable Pavement	Alternative Surface	E	APRP	3 /29/2012
Jellyfish Filter	Imbrium Systems Corporation	Cartridge/Membrane Filter	Structural WQv	S	FUND	3 /12/2012
Floating Treatment Wetlands	BlueWing Env. Solutions	Modular Wetland	Pretreatment	S	XOTH	3 /8 /2012
StormBasin	Fabco Industries, Inc.	OGS/Filter	Pretreatment	S	XOGS	2 /13/2012
StormSafe	Fabco Industries, Inc.	Vault/Filter System	Pretreatment	S	XOGS	2 /13/2012
StormSack	Fabco Industries, Inc.	Catch Basin Insert	Pretreatment	S, A	XOGS, CBC	2 /13/2012
PhosphoSorb Media	ConTech Construction	Filter Media	Structural WQv	S	FUND	11/18/2011
BaySeparator	BaySaver Technologies, Inc.	Hydrodynamic Device	Pretreatment	S	XOGS	8 /10/2011
FlexStorm	Nyloplast	Catch Basin Insert	Pretreatment	S, A	XOGS, CBC	5 /17/2011
V2B1 Hydrodynamic Separator	Environment 21	Hydrodynamic Device	Pretreatment	S	XOGS	10/6 /2010
Flo-Gard	Oldcastle Precast	Inlet Filter	Pretreatment	S	XOTH	8 /19/2010
Sorbtive Media	Imbrium Systems Corporation	Filtering Media	Structural WQv	S	ND, FPER, FO	10/21/2009
Sorbtive Filter	Imbrium Systems Corporation	Filter	Structural WQv	S	ND, FUND, FP	9 /11/2009
UrbanGreen	Contech Construction Product	Filter	Structural WQv	S	FBIO	6 /3 /2009
StormTank	Brentwood Industries	Storage Tank	Pretreatment	S	XFLD	11/6 /2008
FloGard Dual Vortex Separator (DVS)	Oldcastle Precast	Hydrodynamic Device	Pretreatment	X	XOGS	3 /25/2008
ADS/Hancor WQU	ADS Hancor	Hydrodynamic Device	Pretreatment	S	XOGS	3 /25/2008
StormTech Isolator	StormTech, LLC	Storage Tank	Structural Component	S	XFLD	11/7 /2007
No Fault/Smarte Surface	Human & Rohde	Permeable Surfaces	Alternative Surface	E	APRP, ARTF	6 /1 /2007
Flo-Guard Plus	Oldcastle	Catch Basin Insert	Pretreatment	S, A	XOGS, CBC	3 /27/2007

Practice Name	Manufacturer	Practice Type	Approval Type	BMP Category	BMP Code	Approval Date
Up-Flo Filter	Hydro International	Catch Basin Insert	Pretreatment	S, A	XOGS, CBC	2 /6 /2007
Storm-Pure	Nyloplast	Catch Basin Insert	Pretreatment	S, A	XOGS, CBC	11/20/2006
BayFilter	BaySaver Technologies, Inc.	Cartridge Filter	Structural WQv	S	FUND	10/12/2006
Aqua Swirl	AquaShield, Inc.	Hydrodynamic Device	Pretreatment	S	XOGS	5 /5 /2006
Stormfilter	Stormwater Management, Inc.	Cartridge Filter	Structural WQv	S	FUND	4 /11/2005
Terre Kleen	Terre Hill Concrete Products	Hydrodynamic Device	Pretreatment	S	XOGS	3 /28/2005
Ultra-Urban Filter	Abtech Industries	Catch Basin Insert	Pretreatment	S, A	XOGS, CBC	2 /15/2005
Vortfilter	Vortechnics, Inc.	Cartridge Filter	Pretreatment	S	FUND	1 /6 /2005
CDS Media Filtration System	CDS Technologies, Inc	Cartridge Filter	Structural WQv	S	FUND	12/30/2004
FirstDefense	Hydro International	Hydrodynamic Device	Pretreatment	S	XOGS	11/30/2004
Vortechs & Vort Sentry	Vortechnics, Inc.	Hydrodynamic Device	Pretreatment	S	XOGS	6 /1 /2004
Downstream Defender	Hydro International	Hydrodynamic Device	Pretreatment	S	XOGS	5 /4 /2004
CDS Oil / Grit Separator	CDS Technologies, Inc	Hydrodynamic Device	Pretreatment	S	XOGS	8 /15/2003
Aqua Filter	AquaShield, Inc.	Cartridge Filter	Structural WQv	S	FUND	6 /23/2003
BaySaver	BaySaver, Inc.	Hydrodynamic Device	Pretreatment	S	XOGS	6 /11/2002
Stormceptor	Imbrium Systems Corporation	Hydrodynamic Device	Pretreatment	S	XOGS	4 /16/2001

Please contact each vendor/manufacturer for approval letters and more specific product information for each of the above-listed practices. Any formal request to MDE concerning an alternative/innovative technology should be submitted to MDE’s Sediment, Stormwater, and Dam Safety Program, 1800 Washington Boulevard, Baltimore, MD 21230. If there are any questions concerning these practices, please contact the Maryland Department of the Environment, Water and Science Administration at 410-537-3543 or at www.mde.maryland.gov.

MDE

MARYLAND DEPARTMENT OF THE ENVIRONMENT
1800 Washington Boulevard • Baltimore MD 21230
410-537-3000 • 1-800-633-6101 • www.mde.state.md.us

Martin O'Malley
Governor

Anthony G. Brown
Lieutenant Governor

Robert M. Summers, Ph.D.
Secretary

March 12, 2012

Mr. Scott Perry, CPSWQ
Managing Director
Imbrium Systems Corporation
7564 Standish Place, Suite 112
Rockville, MD 20850-2745

Dear Mr. Perry:

Thank you for your February 7, 2012 submission to the Maryland Department of the Environment (MDE) for the Jellyfish® Filter. Your submission presents an overview of the technology behind the Jellyfish® Filter and presents field test summaries. MDE has evaluated your information and offers the following:

Imbrium Systems has asked that the Jellyfish® Filter be classified as an Environmental Site Design (ESD) Practice. In Maryland, environmental site design (ESD) must be used to the maximum extent practicable (MEP) to reduce runoff and mimic natural hydrologic conditions. The use of ESD planning techniques and treatment practices must be exhausted before any approved structural practices may be used. In addition, these practices are designed to mimic the natural hydrologic functions of a site. Currently, MDE is developing a protocol for evaluating ESD practices; however, this is a work in progress. For these reasons, the Jellyfish® Filter cannot be classified as an ESD practice at this time.

Based on your independent field monitoring data, the Jellyfish® Filter meets the 80% Total Suspended Solids (TSS) and 40% Total Phosphorous (TP) removal rates required to be considered as a stand-alone structural practice for water quality treatment. Therefore, the Jellyfish® Filter may be used provided it is designed and constructed according to the specifications in the **2000 Maryland Stormwater Design Manual** (Manual). This means that all mandatory performance criteria in Chapter 3 of the Manual must be met including pretreatment equal to 25% and storage of 75% of the computed water quality design volume.

Thank you again for your submission and we look forward to working with you in the future. If there are any questions concerning these issues, please contact me or Mary Dela Dewa at 410-537-3753 or via email at *mdewa@mde.state.md.us*

Sincerely,

Brian S. Clevenger
Water Management Administration

WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

January 2021

GENERAL USE LEVEL DESIGNATION FOR BASIC (TSS) AND PHOSPHORUS TREATMENT
For
Contech Environmental Solutions Jellyfish® Filter

Ecology's Decision:

1. Based on Contech Environmental Solution's application submissions, Ecology hereby issues a General use level designation (GULD) for Basic (TSS) and Phosphorus Treatment for Contech's Jellyfish® Filter:
    - Sized at a hydraulic loading rate of no greater than 0.21 gpm/sf filter surface for hi-flo cartridges and 0.11 gpm/sf filter surface for draindown cartridges

Table 1. Jellyfish® cartridge hydraulic loading rates and sediment capture capacity[1] associated with various filter cartridge sizes.

Cartridge Length	**Design Treatment Flow Rate**	**Design Sediment Mass Loading Capacity**
15 inches	Hi-Flo 22 gpm Draindown 11 gpm	Hi-Flo 35 lbs Draindown 17 lbs
27 inches	Hi-Flo 40 gpm Draindown 20 gpm	Hi-Flo 63 lbs Draindown 31 lbs
40 inches	Hi-Flo 60 gpm Draindown 30 gpm	Hi-Flo 93 lbs Draindown 46 lbs
54 inches	Hi-Flo 80 gpm Draindown 40 gpm	Hi-Flo 125 lbs Draindown 63 lbs

[1] Design sediment mass loading capacity based on laboratory testing using silica sediment.

2. Ecology approves Jellyfish® Filter units at the design treatment flow rates shown in Table 1. Total Jellyfish Filter system design treatment capacity is the sum of the design treatment capacity of individual cartridges and must equal or exceed the water quality design flow rate. Calculate the water quality design flow rate that must be treated by an individual treatment system using the following procedures:
    - Western Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using the latest version of the Western Washington Hydrology Model or other Ecology-approved continuous runoff model.
    - Eastern Washington: For treatment installed upstream of detention or retention, the water quality design flow rate is the peak 15-minute flow rate as calculated using one of the three methods described in Chapter 2.7.6 of the 2019 Stormwater Management Manual for Eastern Washington (SWMMEW) or local manual.
    - Entire State: For treatment installed downstream of detention, the water quality design flow rate is the full 2-year release rate of the detention facility.
3. The GULD has no expiration date but may be amended or revoked by Ecology.

Ecology's Conditions of Use:

Jellyfish® Filter units shall comply with the following conditions:

1. Design, assemble, install, operate, and maintain Jellyfish® Filter units in accordance with Contech's applicable manuals and documents and this Ecology Decision.
2. Contech uses sediment-loading capacity, in conjunction with the water quality design flow rate, to determine the target maintenance interval.
3. Jellyfish® Filters shall conform to specifications submitted to and approved by Ecology.
4. Maintenance: The required inspection/maintenance interval for stormwater treatment devices is often dependent on the efficiency of the device and the degree of pollutant loading from a particular drainage basin. Therefore, Ecology does not endorse or recommend a "one size fits all" maintenance cycle for a particular model/size of manufactured filter treatment device.
    - The Jellyfish® Filter is designed for a target maintenance interval of 12 months. Maintenance includes floatable trash, debris, and oil removal; sediment removal; and the rinsing or replacement of filter cartridges.
    - A Jellyfish® Filter tested in Dundee, OR averaged a 3.2 month maintenance interval. Construction activities were ongoing in the drainage basin and near the monitoring site during the first two years of the study. Monitoring personnel observed significant amounts of roadway sediments and organic debris in the runoff, and TSS concentrations were higher than typical for roadway runoff. The runoff that occurred during the study may be unusual, and the maintenance interval the Jellyfish® Filter required may not be indicative of other, more typical, sites.

  - Owner/s operators must inspect Jellyfish® Filter systems for a minimum of twelve months from the start of post-construction operation to determine site-specific inspection/maintenance schedules and requirements. Owners/operators must conduct inspections monthly during the wet season, and every other month during the dry season. (According to the SWMMWW, the wet season in westerns Washington is October 1 to April 30. According to the SWMMEW, the wet season in eastern Washington is October 1 to June 30.) After the first year of operation, owners/operators must conduct inspections based on the findings during the first year of inspections.
  - Conduct inspections by qualified personnel, follow manufacturer's guidelines, and use methods capable of determining either a decrease in treated effluent flow rate and/or a decrease in pollutant removal ability.

5. Install the Jellyfish® Filter in such a manner such that flows exceeding the maximum operating rate of the system are bypassed and will not resuspend captured sediment.
6. Discharges from the Jellyfish® Filter units shall not cause or contribute to water quality standards violations in receiving waters.

Applicant: CONTECH Engineered Solutions

Applicant's Address: 11835 NE Glenn Widing Dr
Portland, OR 97220

Application Documents:

- *Jellyfish® Filter Dundee, OR, General Use Level Designation Technical Evaluation Report*, Prepared by CONTECH Engineered Solutions, December 28, 2020
- Application Letter for CULD for Jellyfish Filter - Basic Treatment, Phosphorus Treatment, and Oil Treatment, dated April 27, 2012.
- Letter from Imbrium Systems dated September 4, 2012 regarding the draft CULD/PULD document.
- *TAPE Analysis of Jellyfish Filter UF Field Study Data*, prepared by Stormwater Management Services, LLC.
- *TARP Field Test Performance Monitoring of a Jellyfish Filter JF4-2-1. Performance Monitoring Report for JF4-2-1* Prepared By: University of Florida, Engineering School of Sustainable Infrastructure and Environment (ESSIE), University of Florida, Gainesville, FL 32611. Final Version: 01 November 2011.
- *Jellyfish Filter Systems Evaluation Report in Consideration for Pilot Level Designation (PLD) for Imbrium Systems Corporation*, by Gary R. Minton, PhD, PE, with Resource Planning Associates in Seattle, Washington May 7, 2008 (updated July 1, 2008).

- *NJCAT Technology Verification, Jellyfish Fine Sediment Filter*, by the New Jersey Corporation for Advanced Technology (NJCAT) Program Imbrium Systems Corporation, June 2008

Applicant's Use Level Request:

- General use level designation as a Basic (TSS) and Phosphorus Treatment device in accordance with Ecology's 2019 Stormwater Management Manual for Western Washington.

Applicant's Performance Claims:

Based on results from a laboratory and field-testing, the applicant claims the Jellyfish® Filter, operating at a hydraulic loading rate of no more than 0.21 gpm/sf for hi-flo cartridges and 0.11 gpm/sf for draindown cartridges, is able to remove:

- 80% of total suspended solids (TSS) for influent concentrations greater than 100 mg/L and achieve a 20 mg/L effluent for influent concentrations less than 100 mg/L.
- 50% of total phosphorus for influent concentrations 0.1 to 0.5 mg/L

Recommendations:

Ecology finds that:

- Contech Engineered Solutions has shown Ecology, through laboratory and field testing, that the Jellyfish® Filter is capable of attaining Ecology's Basic (TSS) and Total Phosphorus treatment goals.

Findings of Fact:

Field Testing 2017-2020

Contech completed field testing in Dundee, OR on a Jellyfish® Filter unit containing six 54-inch hi-flo cartridges and one 54-inch draindown cartridge. This combination of cartridges resulted in a design flow capacity of 520 gpm (1.16 cfs). Since Contech conducted the field evaluation they contracted with Herrera Environmental Consultants to provide third party oversight.

- The field evaluation was completed between March 2017 and April 2020. Throughout the evaluation a total of 23 individual storm events (18 flow-weighted composite samples and 5 peak flow grab samples) were sampled to evaluate system performance. All sampled events met the TAPE sampling event qualification criteria, while 21 of the 23 events met the influent requirements for TSS and/or total phosphorus. Peak flows during these 21 events ranged from 26% to 106% of the design treatment capacity of 520 gpm, with a mean peak flow rate of 67% of design.
- Of the 23 TAPE qualified events, 21 met the requirements for TSS analysis (16 flow weighted composite; 5 peak flow grab samples). Influent concentrations ranged from 24 mg/L to 755 mg/L, with a mean concentration of 208 mg/L. Concentrations that exceeded the upper end of TAPE influent range were capped at 200 mg/L prior to calculating the pollutant removal efficiency. For all samples with influent concentrations greater than 100 mg/L the bootstrap estimate of the lower 95 percent confidence limit (LCL95) of the mean TSS reduction was 82%, meeting the 80% performance goal for Basic Treatment. The TAPE bootstrap calculator could not be used on samples with influent concentrations

between 20 mg/L to 100 mg/L due to the limited number of events available (n=6). For these events the mean and median effluent TSS concentrations were 19.7 and 18.1 mg/L respectively, again meeting the 20 mg/L effluent goal for Basic Treatment.

- Of the 23 TAPE qualified events, 18 met the requirements for total phosphorus analysis (13 flow-weighted composite; 5 peak flow grab samples). Influent concentrations ranged from 0.211 mg/L to 1.75 mg/L, with a mean concentration of 0.535 mg/L. Concentrations that exceeded the upper end of TAPE influent range were capped at 0.5 mg/L prior to calculating the pollutant removal efficiency. The LCL 95 mean percent removal goal was 70.1%, meeting the 50% performance goal for Phosphorus Treatment.
- Median particle sized distribution results from three samples showed 20% of sediment >250 µm, 31% of sediment between 62.5 to 250 µm, and 51% of sediment <62.5 µm. This demonstrates the influent to the Jellyfish consisted of primarily silt-sized particles (3.9 to 62.5 µm) and is thus representative of Pacific Northwest Stormwater.
- Contech encountered several unanticipated events and challenges that disrupted the sampling and/or resulted in lost data: the Jellyfish was taken offline twice to avoid atypical sediment loading that was the result of construction within the drainage basin; monitoring was suspended to repair or replace equipment that was damaged from vandalism and extreme weather; and, a cyber-attack on Contech storage drives resulted in a loss of approximately 15% of non-sampled flow and precipitation data.

Field Testing 2010-2011

Results (second-generation membrane filtration cartridges) – University of Florida (Gainesville, FL) installed and tested a Jellyfish JF4-2-1. The University conducted monitoring of the system from May 28, 2010 to June 27, 2011, with runoff from 15.01 inches of rainfall. The monitoring followed the Technology Acceptance Reciprocity Partnership (TARP) field test protocol, per the guidelines of the New Jersey Department of Environmental Projection (NJDEP). The New Jersey Corporation for Advanced Technology (NJCAT), on May 14, 2012 certified the Jellyfish Filter for 80 percent TSS removal.

- The JF4-2-1 operating at a maximum treatment flow rate of 200 gpm provided a median total suspended solids (TSS) removal of 89 percent, and a median suspended sediment concentration (SSC) removal of 99 percent. Influent TSS concentrations ranged from 16.3 to 261.0 mg/L. TSS concentrations in the range of 20-100 mg/L were reduced to less than 20 mg/L for 16 of 17 events. Average TSS removal for influent TSS between 100-200 mg/L was 90 percent.

- Other median pollutant removals included: total phosphorus, 59 percent; total nitrogen, 51 percent; total copper, 90 percent; and total zinc 70 percent.

- Total oil and grease influent concentrations ranged from 0.2 to 4.1 mg/L, with a median removal efficiency of 62 percent.

- No maintenance was required or carried out during the 13-month monitoring period. Curves of head loss versus flow rate were nearly identical for the system with fresh cartridges (beginning of monitoring) and dirty cartridges (end of monitoring period). The sump and filter cartridges captured 166 pounds of dry basis particulate matter.

- Runoff treated by the JF4-2-1 was from a nearby parking lot (approximately 75 percent pavement and 25 percent planting islands). Depending on storm event intensity and wind direction, the drainage area varied from 0.12 to 0.20 acres.

Laboratory Testing and Results

Imbrium conducted testing at the Monteco Limited Research & Development Centre (RDC) in Mississauga, Ontario with third party testing oversight provided by Prof. James Li of Ryerson University in Toronto. The laboratory set-up used a single cartridge fitted into a tank sized to be 1/7 the volume of a full-scale 7-cartridge Jellyfish Filter system. Based on the lab test results:

- A Jellyfish Filter system fitted with a single Jellyfish cartridge or multiple Jellyfish cartridges can remove greater than 86% Sil-Co-Sil 106 (mean particle size 22 microns) within a 95% confidence interval of +/- 1.3% at the system's 100% operating rate with influent sediment concentrations ranging from 100 to 300 mg/L. For systems using 12-inch diameter cartridges, each cartridge containing 91filtration tentacles of 54-inch length, the 100% operating rate is 50 gpm per cartridge operating at 12 inches driving head (i.e., 0.66 gpm/ft2). Each (of the) 91 filtration tentacles is composed of three 18-inch long segments for a total length of 54 inches with 76 ft2 of surface area (first generation membrane filtration cartridges).
- Test runs at 100 mg/L influent concentration resulted in effluent concentrations ranging from 12 to 21 mg/L. Ten of the 11 test runs had effluent less than 20 mg/L (as required for Basic Treatment).
- Sampling of effluent found an average D90 of about 14 microns indicating the Jellyfish Filter System is capable of removing most particles above 15 microns.

Other Jellyfish Filter Related Issues Recommended to be Addressed by the Company:

1. Conduct hydraulic testing to obtain information about maintenance requirements on a site with runoff that is more typical of the Pacific Northwest.

Technology Description: Download at: http://www.conteches.com/products/stormwater-management/treatment/jellyfish-filter

Contact Information:

Applicant:
Jeremiah Lehman
Contech Engineered Solutions, LLC.
11815 Glenn Widing Dr
Portland, OR 97220
(503) 258-3136
jlehman@conteches.com

Applicant website: www.conteches.com

Ecology web link: http://www.ecy.wa.gov/programs/wq/stormwater/newtech/index.html

Ecology:

Douglas C. Howie, P.E.
Department of Ecology
Water Quality Program
(360) 407-6444
douglas.howie@ecy.wa.gov

Revision History

Date	**Revision**
August 2008	PULD granted
January 2012	PULD Extension granted
September 2012	CULD for Basic treatment; PULD for Oil and Phosphorus treatment.
January 2013	Modifications to format document in line with other Use Level Documents, Changes dates for QAPP, TER, and Expiration
August 2014	Revised contact information and due dates for QAPP, TER, and expiration
March 2015	Revised Contact Information to Contech from Imbrium
November 2016	Revised Contech contact information
March 2018	Revised TER delivery and Expiration dates, Changed text from Imbrium to Contech in selected locations
April 2019	Revised TER delivery and Expiration dates
September 2020	Revised TER delivery and Expiration dates
January 2021	GULD Granted

OPERATION & MAINTENANCE MANUALS AND INSPECTION CHECKLISTS

CONTECH®
ENGINEERED SOLUTIONS

Jellyfish® Filter Maintenance Guide

Jellyfish®

Jellyfish®

JELLYFISH® FILTER
INSPECTION & MAINTENANCE GUIDE

Jellyfish units are often just one of many structures in a more comprehensive stormwater drainage and treatment system.

In order for maintenance of the Jellyfish filter to be successful, it is imperative that all other components be properly maintained. The maintenance and repair of upstream facilities should be carried out prior to Jellyfish maintenance activities.

In addition to considering upstream facilities, it is also important to correct any problems identified in the drainage area. Drainage area concerns may include: erosion problems, heavy oil loading, and discharges of inappropriate materials.

TABLE OF CONTENTS

1.0 Inspection and Maintenance Overview

The primary purpose of the Jellyfish® Filter is to capture and remove pollutants from stormwater runoff. As with any filtration system, these pollutants must be removed to maintain the filter's maximum treatment performance. Regular inspection and maintenance are required to insure proper functioning of the system.

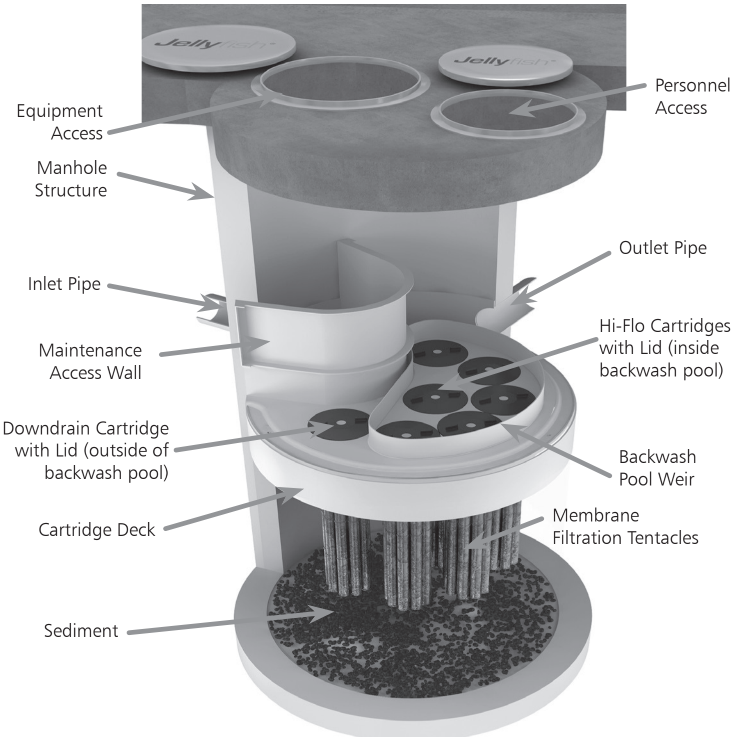
Maintenance frequencies and requirements are site specific and vary depending on pollutant loading. Additional maintenance activities may be required in the event of non-storm event runoff, such as base-flow or seasonal flow, an upstream chemical spill or due to excessive sediment loading from site erosion or extreme runoff events. It is a good practice to inspect the system after major storm events.

Inspection activities are typically conducted from surface observations and include:

- Observe if standing water is present
- Observe if there is any physical damage to the deck or cartridge lids
- Observe the amount of debris in the Maintenance Access Wall (MAW) or inlet bay for vault systems

Maintenance activities include:

- Removal of oil, floatable trash and debris
- Removal of collected sediments
- Rinsing and re-installing the filter cartridges
- Replace filter cartridge tentacles, as needed



Note: Separator Skirt not shown

2.0 Inspection Timing

Inspection of the Jellyfish Filter is key in determining the maintenance requirements for, and to develop a history of, the site's pollutant loading characteristics. In general, inspections should be performed at the times indicated below; *or per the approved project stormwater quality documents (if applicable), whichever is more frequent*.

1. A minimum of quarterly inspections during the first year of operation to assess the sediment and floatable pollutant accumulation, and to ensure proper functioning of the system.
2. Inspection frequency in subsequent years is based on the inspection and maintenance plan developed in the first year of operation. Minimum frequency should be once per year.
3. Inspection is recommended after each major storm event.
4. Inspection is required immediately after an upstream oil, fuel or other chemical spill.

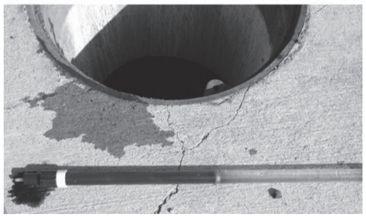
3.0 Inspection Procedure

The following procedure is recommended when performing inspections:

1. Provide traffic control measures as necessary.
2. Inspect the MAW or inlet bay for floatable pollutants such as trash, debris, and oil sheen.
3. Measure oil and sediment depth in several locations, by lowering a sediment probe until contact is made with the floor of the structure. Record sediment depth, and presences of any oil layers.
4. Inspect cartridge lids. Missing or damaged cartridge lids to be replaced.
5. Inspect the MAW (where appropriate), cartridge deck and receptacles, and backwash pool weir, for damaged or broken components.

3.1 Dry weather inspections

- Inspect the cartridge deck for standing water, and/or sediment on the deck.
- No standing water under normal operating conditions.
- Standing water inside the backwash pool, but not outside the backwash pool indicates, that the filter cartridges need to be rinsed.



Inspection Utilizing Sediment Probe

- Standing water outside the backwash pool is not anticipated and may indicate a backwater condition caused by high water elevation in the receiving water body, or possibly a blockage in downstream infrastructure.
- Any appreciable sediment (≥1/16”) accumulated on the deck surface should be removed.

3.2 Wet weather inspections

- Observe the rate and movement of water in the unit. Note the depth of water above deck elevation within the MAW or inlet bay.
- Less than 6 inches, flow should be exiting the cartridge lids of each of the draindown cartridges (i.e. cartridges located outside the backwash pool).
- Greater than 6 inches, flow should be exiting the cartridge lids of each of the draindown cartridges and each of the hi-flo cartridges (i.e. cartridges located inside the backwash pool), and water should be overflowing the backwash pool weir.
- 18 inches or greater and relatively little flow is exiting the cartridge lids and outlet pipe, this condition indicates that the filter cartridges need to be rinsed.

4.0 Maintenance Requirements

Required maintenance for the Jellyfish Filter is based upon results of the most recent inspection, historical maintenance records, or the site specific water quality management plan; whichever is more frequent. In general, maintenance requires some combination of the following:

1. Sediment removal for depths reaching 12 inches or greater, or within 3 years of the most recent sediment cleaning, whichever occurs sooner.
2. Floatable trash, debris, and oil removal.
3. Deck cleaned and free from sediment.
4. Filter cartridges rinsed and re-installed as required by the most recent inspection results, or within 12 months of the most recent filter rinsing, whichever occurs sooner.
5. Replace tentacles if rinsing does not restore adequate hydraulic capacity, remove accumulated sediment, or if damaged or missing. It is recommended that tentacles should remain in service no longer than 5 years before replacement.
6. Damaged or missing cartridge deck components must be repaired or replaced as indicated by results of the most recent inspection.
7. The unit must be cleaned out and filter cartridges inspected immediately after an upstream oil, fuel, or chemical spill. Filter cartridge tentacles should be replaced if damaged or compromised by the spill.

5.0 Maintenance Procedure

The following procedures are recommended when maintaining the Jellyfish Filter:

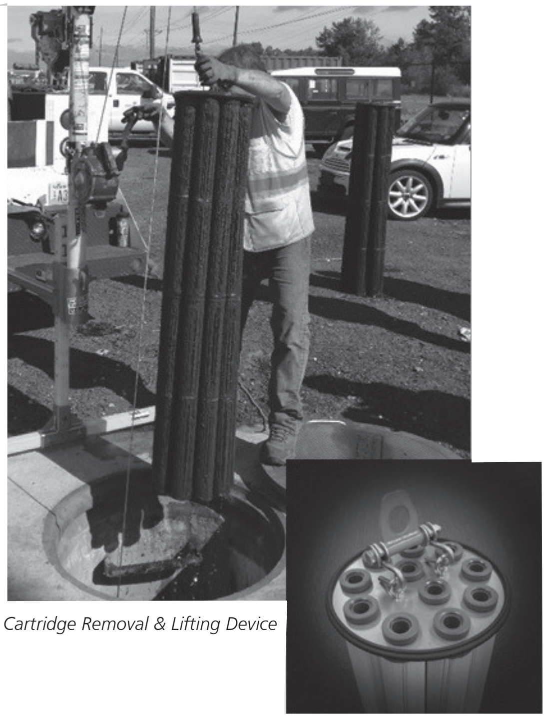
1. Provide traffic control measures as necessary.
2. Open all covers and hatches. Use ventilation equipment as required, according to confined space entry procedures. *Caution: Dropping objects onto the cartridge deck may cause damage*.
3. Perform Inspection Procedure prior to maintenance activity.
4. To access the cartridge deck for filter cartridge service, descend into the structure and step directly onto the deck. Caution: Do not step onto the maintenance access wall (MAW) or backwash pool weir, as damage may result. Note that the cartridge deck may be slippery.
5. Maximum weight of maintenance crew and equipment on the cartridge deck not to exceed 450 lbs.

5.1 Filter Cartridge Removal

1. Remove a cartridge lid.
2. Remove cartridges from the deck using the lifting loops in the cartridge head plate. Rope or a lifting device (available from Contech) should be used. ***Caution: Should a snag occur, do not force the cartridge upward as damage to the tentacles may result. Wet cartridges typically weigh between 100 and 125 lbs***.
3. Replace and secure the cartridge lid on the exposed empty receptacle as a safety precaution. Contech does not recommend exposing more than one empty cartridge receptacle at a time.

5.2 Filter Cartridge Rinsing

1. Remove all 11 tentacles from the cartridge head plate. Take care not to lose or damage the O-ring seal as well as the plastic threaded nut and connector.



Cartridge Removal & Lifting Device

2. Position tentacles in a container (or over the MAW), with the threaded connector (open end) facing down, so rinse water is flushed through the membrane and captured in the container.
3. Using the Jellyfish rinse tool (available from Contech) or a low-pressure garden hose sprayer, direct water spray onto the tentacle membrane, sweeping from top to bottom along the length of the tentacle. Rinse until all sediment is removed from the membrane. ***Caution: Do not use a high pressure sprayer or focused stream of water on the membrane. Excessive water pressure may damage the membrane***.

4. Collected rinse water is typically removed by vacuum hose.
5. Reassemble cartridges as detailed later in this document. Reuse O-rings and nuts, ensuring proper placement on each tentacle.

5.3 Sediment and Flotables Extraction

1. Perform vacuum cleaning of the Jellyfish Filter only after filter cartridges have been removed from the system. Access the lower chamber for vacuum cleaning only through the maintenance access wall (MAW) opening. Be careful not to damage the flexible plastic separator skirt that is attached to the underside of the deck on manhole systems. Do not lower the vacuum wand through a cartridge receptacle, as damage to the receptacle will result.
2. Vacuum floatable trash, debris, and oil, from the MAW opening or inlet bay. Alternatively, floatable solids may be removed by a net or skimmer.

Vacuuming Sump Through MAW

3. Pressure wash cartridge deck and receptacles to remove all sediment and debris. Sediment should be rinsed into the sump area. Take care not to flush rinse water into the outlet pipe.
4. Remove water from the sump area. Vacuum or pump equipment should only be introduced through the MAW or inlet bay.
5. Remove the sediment from the bottom of the unit through the MAW or inlet bay opening.

Vacuuming Sump Through MAW

6. For larger diameter Jellyfish Filter manholes (≥8-ft) and some vaults complete sediment removal may be facilitated by removing a cartridge lid from an empty receptacle and inserting a jetting wand (not a vacuum wand) through the receptacle. Use the sprayer to rinse loosened sediment toward the vacuum hose in the MAW opening, being careful not to damage the receptacle.

5.4 Filter Cartridge Reinstallation and Replacement

1. Cartridges should be installed after the deck has been cleaned. It is important that the receptacle surfaces be free from grit and debris.
2. Remove cartridge lid from deck and carefully lower the filter cartridge into the receptacle until head plate gasket is seated squarely in receptacle. ***Caution: Do not force the cartridge downward; damage may occur.***
3. Replace the cartridge lid and check to see that both male threads are properly seated before rotating approximately 1/3 of a full rotation until firmly seated. Use of an approved rim gasket lubricant may facilitate installation. See next page for additional details.
4. If rinsing is ineffective in removing sediment from the tentacles, or if tentacles are damaged, provisions must be made to replace the spent or damaged tentacles with new tentacles. Contact Contech to order replacement tentacles.

5.5 Chemical Spills

Caution: If a chemical spill has been captured, do not attempt maintenance. Immediately contact the local hazard response agency and contact Contech.

5.6 Material Disposal

The accumulated sediment found in stormwater treatment and conveyance systems must be handled and disposed of in accordance with regulatory protocols. It is possible for sediments to contain measurable concentrations of heavy metals and organic chemicals (such as pesticides and petroleum products). Areas with the greatest potential for high pollutant loading include industrial areas and heavily traveled roads. Sediments and water must be disposed of in accordance with all applicable waste disposal regulations. When scheduling maintenance, consideration must be made for the disposal of solid and liquid wastes. This typically requires coordination with a local landfill for solid waste disposal. For liquid waste disposal a number of options are available including a municipal vacuum truck decant facility, local waste water treatment plant or on-site treatment and discharge.

Jellyfish Filter Components & Filter Cartridge Assembly and Installation

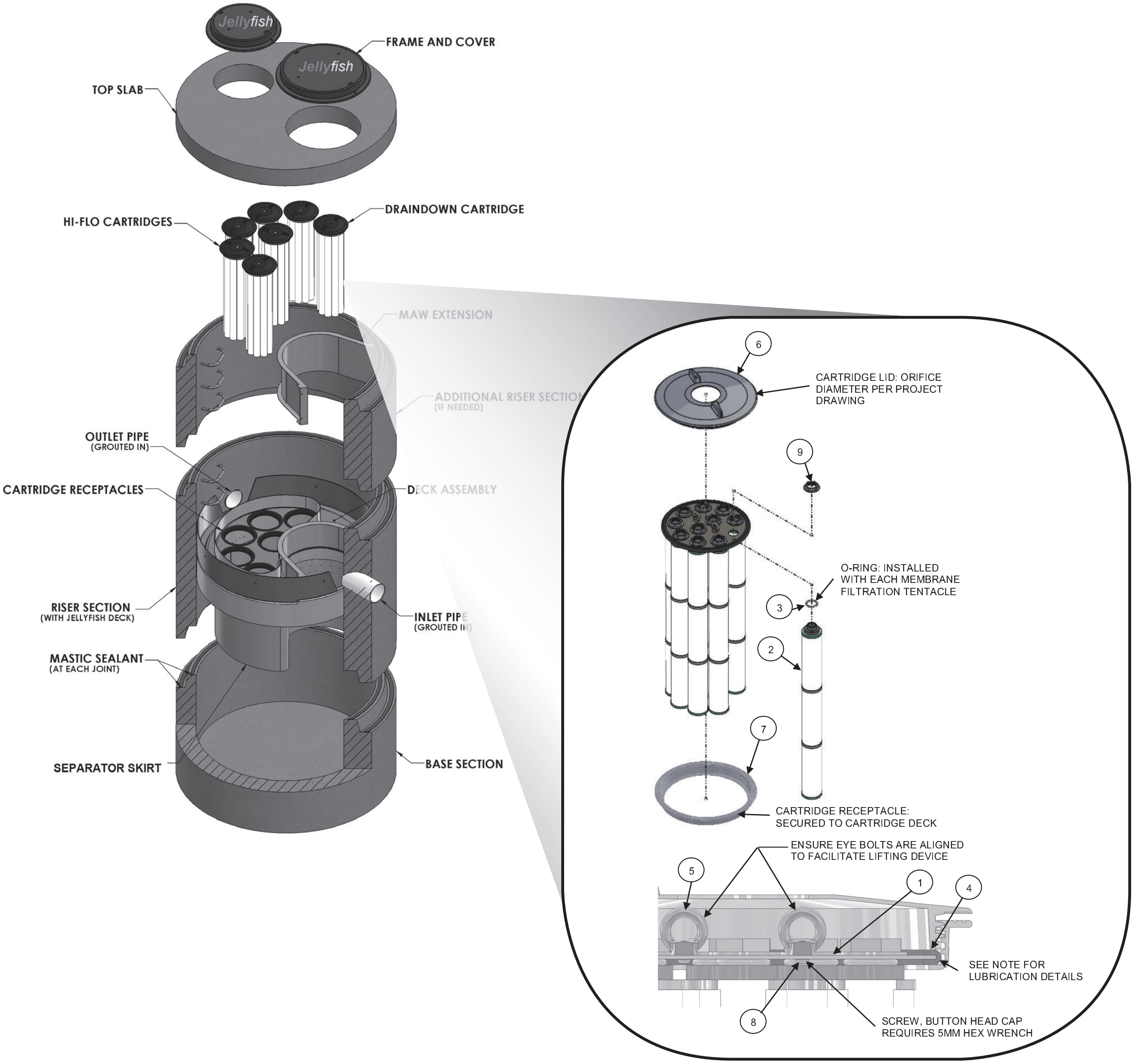


TABLE 1: BOM

ITEM NO.	DESCRIPTION
1	JF HEAD PLATE
2	JF TENTACLE
3	JF O-RING
4	JF HEAD PLATE GASKET
5	JF CARTRIDGE EYELET
6	JF 14IN COVER
7	JF RECEPTACLE
8	BUTTON HEAD CAP SCREW M6X14MM SS
9	JF CARTRIDGE NUT

TABLE 2: APPROVED GASKET LUBRICANTS

PART NO.	MFR	DESCRIPTION
78713	LA-CO	LUBRI-JOINT
40501	HERCULES	DUCK BUTTER
30600	OATEY	PIPE LUBRICANT
PSLUBXL1Q	PROSELECT	PIPE JOINT LUBRICANT

NOTES:

Head Plate Gasket Installation:

Install Head Plate Gasket (Item 4) onto the Head Plate (Item 1) and liberally apply a lubricant from Table 2: Approved Gasket Lubricants onto the gasket where it contacts the Receptacle (Item 7) and Cartridge Lide (ITem 6). Follow Lubricant manufacturer's instructions.

Lid Assembly:

Rotate Cartridge Lid counter-clockwise until both male threads drop down and properly seat. Then rotate Cartridge Lid clock-wise approximately one-third of a full rotation until Cartridge Lid is firmly secured, creating a watertight seal.

Jellyfish Filter Inspection and Maintenance Log

Owner:				Jellyfish Model No:		
Location:				GPS Coordinates:		
Land Use:	Commercial:		Industrial:		Service Station:	
Roadway/Highway:			Airport:		Residential:	

Date/Time:						
Inspector:						
Maintenance Contractor:						
Visible Oil Present: (Y/N)						
Oil Quantity Removed:						
Floatable Debris Present: (Y/N)						
Floatable Debris Removed: (Y/N)						
Water Depth in Backwash Pool						
Draindown Cartridges externally rinsed and recommissioned: (Y/N)						
New tentacles put on Draindown Cartridges: (Y/N)						
Hi-Flo Cartridges externally rinsed and recommissioned: (Y/N)						
New tentacles put on Hi-Flo Cartridges: (Y/N)						
Sediment Depth Measured: (Y/N)						
Sediment Depth (inches or mm):						
Sediment Removed: (Y/N)						
Cartridge Lids intact: (Y/N)						
Observed Damage:						
Comments:						

Jellyfish®

CONTECH®
ENGINEERED SOLUTIONS

800.338.1122
www.ContechES.com

Support

- Drawings and specifications are available at www.conteches.com/jellyfish.
- Site-specific design support is available from Contech Engineered Solutions.
- Find a Certified Maintenance Provider at www.conteches.com/ccmp

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, wastewater treatment and earth stabilization products. For information on other Contech segment offerings, visit ContechES.com or call 800.338.1122

The product(s) described may be protected by one or more of the following US patents: 5,322,629; 5,624,576; 5,707,527; 5,759,415; 5,788,848; 5,985,157; 6,027,639; 6,350,374; 6,406,218; 6,641,720; 6,511,595; 6,649,048; 6,991,114; 6,998,038; 7,186,058; related foreign patents or other patents pending.

Jellyfish Maintenance 8/19

CONTECH®
ENGINEERED SOLUTIONS

Cascade Separator® Inspection and Maintenance Guide

CASCADE
separator®

Maintenance

The Cascade Separator® system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects sediment and debris will depend upon on-site activities and site pollutant characteristics. For example, unstable soils or heavy winter sanding will cause the sediment storage sump to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (i.e. spring and fall). However, more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment wash-down areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

A visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet chamber, flumes or outlet channel. The inspection should also quantify the accumulation of hydrocarbons, trash and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided in this Inspection and Maintenance Guide.

Access to the Cascade Separator unit is typically achieved through one manhole access cover. The opening allows for inspection and cleanout of the center chamber (cylinder) and sediment storage sump, as well as inspection of the inlet chamber and slanted skirt. For large units, multiple manhole covers allow access to the chambers and sump.

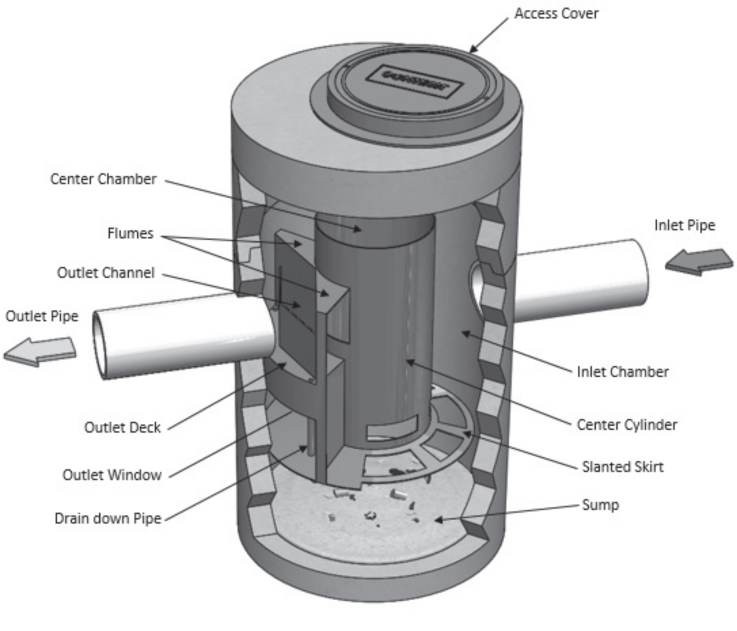
The Cascade Separator system should be cleaned before the level of sediment in the sump reaches the maximum sediment depth and/or when an appreciable level of hydrocarbons and trash has accumulated. If sorbent material is used, it must be replaced when significant discoloration has occurred. Performance may be impacted when maximum sediment storage capacity is exceeded. Contech recommends maintaining the system when sediment level reaches 50% of maximum storage volume. The level of sediment is easily determined by measuring the distance from the system outlet invert (standing water level) to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Finer, silty particles at the top of the pile typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the chart in this document to determine if the height of the sediment pile off the bottom of the sump floor exceeds 50% of the maximum sediment storage.

Cleaning

Cleaning of a Cascade Separator system should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole cover and insert the vacuum tube down through the center chamber and into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The areas outside the center chamber and the slanted skirt should also be washed off if pollutant build-up exists in these areas.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. Then the system should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and to ensure proper safety precautions. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the Cascade Separator system must be done in accordance with local regulations. In many locations, disposal of evacuated sediments may be handled in the same manner as disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal. If any components are damaged, replacement parts can be ordered from the manufacturer.



Cascade Separator® Maintenance Indicators and Sediment Storage Capacities

Model Number	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y³	m³
CS-3	3	0.9	1.5	0.5	0.4	0.3
CS-4	4	1.2	1.5	0.5	0.7	0.5
CS-5	5	1.3	1.5	0.5	1.1	0.8
CS-6	6	1.8	1.5	0.5	1.6	1.2
CS-8	8	2.4	1.5	0.5	2.8	2.1
CS-10	10	3.0	1.5	0.5	4.4	3.3
CS-12	12	3.6	1.5	0.5	6.3	4.8

Note: The information in the chart is for standard units. Units may have been designed with non-standard sediment storage depth.

A Cascade Separator unit can be easily cleaned in less than 30 minutes.

A vacuum truck excavates pollutants from the systems.

Cascade Separator® Inspection & Maintenance Log

Cascade Model:

Location:

Date	Depth Below Invert to Top of Sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The depth to sediment is determined by taking a measurement from the manhole outlet invert (standing water level) to the top of the sediment pile. Once this measurement is recorded, it should be compared to the chart in the maintenance guide to determine if the height of the sediment pile off the bottom of the sump floor exceeds 50% of the maximum sediment storage. Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.
2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

SUPPORT

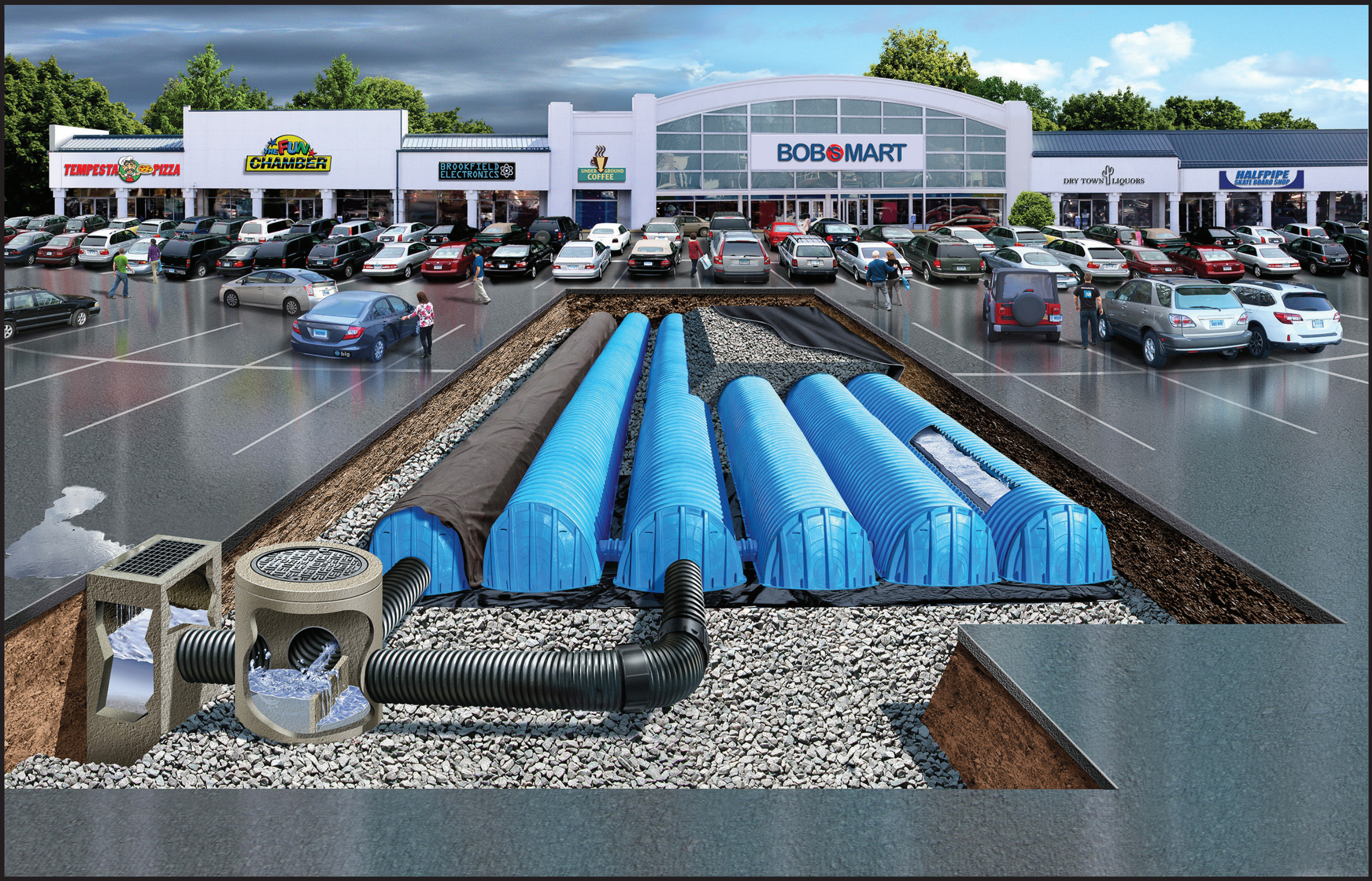
- Drawings and specifications are available at www.ContechES.com.
- Site-specific design support is available from our engineers.

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, and earth stabilization products. For information, visit www.ContechES.com or call 800.338.1122

CONTECH®
ENGINEERED SOLUTIONS
800.925.5240
www.ContechES.com

CONTACTOR® & RECHARGER®

STORMWATER MANAGEMENT SOLUTIONS



OPERATION & MAINTENANCE GUIDELINES

FOR CULTEC STORMWATER MANAGEMENT SYSTEMS

STORMWATER MANAGEMENT SOLUTIONS

CULTEC

Published by
CULTEC, Inc.
P.O. Box 280
878 Federal Road
Brookfield, Connecticut 06804 USA
www.cultec.com

Disclaimers:
The drawings, photographs and illustrations shown in this document are for illustrative purposes only and are not necessarily to scale.
Actual designs may vary.

CULTEC reserves the right to make design and/or specification changes at any time without notice at CULTEC's sole discretion.

CULTEC, the CULTEC logo, RECHARGER, CONTACTOR, HVLV, PAC, STORMFILTER, STORMGENIE and The Chamber with The Stripe are registered trademarks of CULTEC, Inc.
Chamber of Choice, HD, 100, 125, 150, 150XL, 180, 280, 330, 330XL, 360, V8, 902, Field Drain Panel, C-1, C-2, C-3, C-4, EZ-24, Landscape Series are trademarks of CULTEC, Inc. © Copyright on all drawings, illustrations, photos, charts - CULTEC, Inc. All rights reserved.

Protected by one or more of the following patents owned by Cultec, Inc.:
U.S. Patents 6,129,482; 6,322,288; 6,854,925; 7,226,241; 7,806,627; 8,366,346; 8,425,148; U.S. Designs D613,819; D638,095; D668,318; Canadian Patent 2,450,565; 2,591,255; Canadian Designs 129144; 135983; 159073; 160977; and/or other U.S. or Foreign Patent(s) or Patent(s) Pending.

Contact Information:
For general information on our other products and services, please contact our offices within the United States at (800)428-5832, (203)775-4416 ext. 202, or e-mail us at custservice@cultec.com.

For technical support, please call (203)775-4416 ext. 203 or e-mail tech@cultec.com.

Visit www.cultec.com/downloads.html for Product Downloads and CAD details.

Doc ID: CLT057 01-20
January 2020

These instructions are for single-layer traffic applications only. For multi-layer applications, contact CULTEC.
All illustrations and photos shown herein are examples of typical situations. Be sure to follow the engineer's drawings.
Actual designs may vary.

This manual contains guidelines recommended by CULTEC, Inc. and may be used in conjunction with, but not to supersede, local regulations or regulatory authorities. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Introduction

The CULTEC Subsurface Stormwater Management System is a high-density polyethylene (HDPE) chamber system arranged in parallel rows surrounded by washed stone. The CULTEC chambers create arch-shaped voids within the washed stone to provide stormwater detention, retention, infiltration, and reclamation. Filter fabric is placed between the native soil and stone interface to prevent the intrusion of fines into the system. In order to minimize the amount of sediment which may enter the CULTEC system, a sediment collection device (stormwater pretreatment device) is recommended upstream from the CULTEC chamber system. Examples of pretreatment devices include, but are not limited to, an appropriately sized catch basin with sump, pretreatment catchment device, oil grit separator, or baffled distribution box. Manufactured pretreatment devices may also be used in accordance with CULTEC chambers. Installation, operation, and maintenance of these devices shall be in accordance with manufacturer's recommendations. Almost all of the sediment entering the stormwater management system will be collected within the pretreatment device.

Best Management Practices allow for the maintenance of the preliminary collection systems prior to feeding the CULTEC chambers. The pretreatment structures shall be inspected for any debris that will restrict inlet flow rates. Outfall structures, if any, such as outlet control must also be inspected for any obstructions that would restrict outlet flow rates. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Operation and Maintenance Requirements

I. Operation

CULTEC stormwater management systems shall be operated to receive only stormwater run-off in accordance with applicable local regulations. CULTEC subsurface stormwater management chambers operate at peak performance when installed in series with pretreatment. Pretreatment of suspended solids is superior to treatment of solids once they have been introduced into the system. The use of pretreatment is adequate as long as the structure is maintained and the site remains stable with finished impervious surfaces such as parking lots, walkways, and pervious areas are properly maintained. If there is to be an unstable condition, such as improvements to buildings or parking areas, all proper silt control measures shall be implemented according to local regulations.

II. Inspection and Maintenance Options

A. The CULTEC system may be equipped with an inspection port located on the inlet row.
The inspection port is a circular cast box placed in a rectangular concrete collar. When the lid is removed, a 6-inch (150 mm) pipe with a screw-in plug will be exposed. Remove the plug. This will provide access to the CULTEC Chamber row below. From the surface, through this access, the sediment may be measured at this location. A stadia rod may be used to measure the depth of sediment if any in this row. If the depth of sediment is in excess of 3 inches (76 mm), then this row should be cleaned with high pressure water through a culvert cleaning nozzle. This would be carried out through an upstream manhole or through the CULTEC StormFilter Unit (or other pre-treatment device). CCTV inspection of this row can be deployed through this access port to deter mine if any sediment has accumulated in the inlet row.

B. If the CULTEC bed is not equipped with an inspection port, then access to the inlet row will be through an upstream manhole or the CULTEC StormFilter.

1. **Manhole Access**
This inspection should only be carried out by persons trained in confined space entry and sewer inspection services. After the manhole cover has been removed a gas detector must be lowered into the manhole to ensure that there are not high concentrations of toxic gases present. The inspector should be lowered into the manhole with the proper safety equipment as per OSHA requirements. The inspector may be able to observe sediment from this location. If this is not possible, the inspector will need to deploy a CCTV robot to permit viewing of the sediment.

2. **StormFilter Access**
Remove the manhole cover to allow access to the unit. Typically a 30-inch (750 mm) pipe is used as a riser from the StormFilter to the surface. As in the case with manhole access, this access point requires a technician trained in confined space entry with proper gas detection equipment. This individual must be equipped with the proper safety equipment for entry into the StormFilter. The technician will be lowered onto the StormFilter unit. The hatch on the unit must be removed. Inside the unit are two filters which may be removed according to StormFilter maintenance guidelines. Once these filters are removed the inspector can enter the StormFilter unit to launch the CCTV camera robot.

C. The inlet row of the CULTEC system is placed on a polyethylene liner to prevent scouring of the washed stone beneath this row. This also facilitates the flushing of this row with high pressure water through a culvert cleaning nozzle. The nozzle is deployed through a manhole or the StormFilter and extended to the end of the row. The water is turned on and the inlet row is back-flushed into the manhole or StormFilter. This water is to be removed from the manhole or StormFilter using a vacuum truck.

III. Maintenance Guidelines

The following guidelines shall be adhered to for the operation and maintenance of the CULTEC stormwater management system:

A. The owner shall keep a maintenance log which shall include details of any events which would have an effect on the system's operational capacity.

B. The operation and maintenance procedure shall be reviewed periodically and changed to meet site conditions.

C. Maintenance of the stormwater management system shall be performed by qualified workers and shall follow applicable occupational health and safety requirements.

D. Debris removed from the stormwater management system shall be disposed of in accordance with applicable laws and regulations.

IV. Suggested Maintenance Schedules

A. **Minor Maintenance**
The following suggested schedule shall be followed for routine maintenance during the regular operation of the stormwater system:

Frequency	Action
Monthly in first year	Check inlets and outlets for clogging and remove any debris, as required.
Spring and Fall	Check inlets and outlets for clogging and remove any debris, as required.
One year after commissioning and every third year following	Check inlets and outlets for clogging and remove any debris, as required.

B. **Major Maintenance**
The following suggested maintenance schedule shall be followed to maintain the performance of the CULTEC stormwater management chambers. Additional work may be necessary due to insufficient performance and other issues that might be found during the inspection of the stormwater management chambers. (See table on next page)

	Frequency	Action
Inlets and Outlets	Every 3 years	• Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.
	Spring and Fall	• Check inlet and outlets for clogging and remove any debris as required.
CULTEC Stormwater Chambers	2 years after commissioning	• Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. • Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.
	9 years after commissioning every 9 years following	• Clean stormwater management chambers and feed connectors of any debris. • Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique. • Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.
	45 years after commissioning	• Clean stormwater management chambers and feed connectors of any debris. • Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required. • Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique. • Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection. • Attain the appropriate approvals as required. • Establish a new operation and maintenance schedule.
Surrounding Site	Monthly in 1st year	• Check for depressions in areas over and surrounding the stormwater management system.
	Spring and Fall	• Check for depressions in areas over and surrounding the stormwater management system.
	Yearly	• Confirm that no unauthorized modifications have been performed to the site.

For additional information concerning the maintenance of CULTEC Subsurface Stormwater Management Chambers, please contact CULTEC, Inc. at 1-800-428-5832.

WQMP
Operation & Maintenance (O&M) Plan

Project Name:____

Prepared for:

Project Name: ____

Address:____

City, State Zip:____

Prepared on:

Date:____

This O&M Plan describes the designated responsible party for implementation of this WQMP, including: operation and maintenance of all the structural BMP(s), conducting the training/educational program and duties, and any other necessary activities. The O&M Plan includes detailed inspection and maintenance requirements for all structural BMPs, including copies of any maintenance contract agreements, manufacturer's maintenance requirements, permits, etc.

8.1.1 Project Information

Project name	
Address	
City, State Zip	
Site size	
List of structural BMPs, number of each	
Other notes	

8.1.2 Responsible Party

The responsible party for implementation of this WQMP is:

Name of Person or HOA Property Manager	
Address	
City, State Zip	
Phone number	
24-Hour Emergency Contact number	
Email	

8.1.3 Record Keeping

Parties responsible for the O&M plan shall retain records for at least 5 years.

All training and educational activities and BMP operation and maintenance shall be documented to verify compliance with this O&M Plan. A sample Training Log and Inspection and Maintenance Log are included in this document.

8.1.4 Electronic Data Submittal

This document along with the Site Plan and Attachments shall be provided in PDF format. AutoCAD files and/or GIS coordinates of BMPs shall also be submitted to the City.

Appendix ____

BMP SITE PLAN

Site plan is preferred on minimum 11” by 17” colored sheets, as long as legible.

BMP OPERATION & MAINTENANCE LOG

Project Name: ______________________________

Today's Date:______________________________

Name of Person Performing Activity (Printed):______________________________

Signature: ______________________________

BMP Name (As Shown in O&M Plan)	**Brief Description of Implementation, Maintenance, and Inspection Activity Performed**

Minor Maintenance

Frequency		**Action**
Monthly in first year		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
☐ Month 1	Date:	
☐ Month 2	Date:	
☐ Month 3	Date:	
☐ Month 4	Date	
☐ Month 5	Date:	
☐ Month 6	Date:	
☐ Month 7	Date:	
☐ Month 8	Date:	
☐ Month 9	Date:	
☐ Month 10	Date:	
☐ Month 11	Date:	
☐ Month 12	Date:	
Spring and Fall		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
☐ Spring	Date:	
☐ Fall	Date:	
☐ Spring	Date:	
☐ Fall	Date:	
☐ Spring	Date:	
☐ Fall	Date:	
☐ Spring	Date:	
☐ Fall	Date:	
☐ Spring	Date:	
☐ Fall	Date:	
☐ Spring	Date:	
☐ Fall	Date:	
One year after commissioning and every third year following		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
☐ Year 1	Date:	
☐ Year 4	Date:	
☐ Year 7	Date:	
☐ Year 10	Date:	
☐ Year 13	Date:	
☐ Year 16	Date:	
☐ Year 19	Date:	
☐ Year 22	Date:	

Major Maintenance

	Frequency		Action
Inlets and Outlets	**Every 3 years**		Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.
			Notes
	☐ Year 1	Date:	
	☐ Year 4	Date:	
	☐ Year 7	Date:	
	☐ Year 10	Date:	
	☐ Year 13	Date:	
	☐ Year 16	Date:	
	☐ Year 19	Date:	
	☐ Year 22	Date:	
	Spring and Fall		Check inlet and outlets for clogging and remove any debris, as required.
			Notes
	☐ Spring	Date:	
	☐ Fall	Date:	
	☐ Spring	Date:	
	☐ Fall	Date:	
	☐ Spring	Date:	
	☐ Fall	Date:	
	☐ Spring	Date:	
	☐ Fall	Date:	
	☐ Spring	Date:	
	☐ Fall	Date:	
	☐ Spring	Date:	
	☐ Fall	Date:	
CULTEC Stormwater Chambers	**2 years after commissioning**		☐ Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. ☐ Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.
			Notes
	☐ Year 2	Date:	

Major Maintenance

	Frequency		Action
CULTEC Stormwater Chambers	**9 years after commissioning every 9 years following**		☐ Clean stormwater management chambers and feed connectors of any debris. ☐ Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique. ☐ Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.
			Notes
	☐ Year 9	Date:	
	☐ Year 18	Date:	
	☐ Year 27	Date:	
	☐ Year 36	Date:	
	45 years after commissioning		☐ Clean stormwater management chambers and feed connectors of any debris. ☐ Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required. ☐ Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique. ☐ Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection. ☐ Attain the appropriate approvals as required. ☐ Establish a new operation and maintenance schedule.
			Notes
	☐ Year 45	Date:	

Major Maintenance

	Frequency		Action
Surrounding Site	**Monthly in 1st year**		☐ Check for depressions in areas over and surrounding the stormwater management system.
			Notes
	☐ Month 1	Date:	
	☐ Month 2	Date:	
	☐ Month 3	Date:	
	☐ Month 4	Date:	
	☐ Month 5	Date:	
	☐ Month 6	Date:	
	☐ Month 7	Date:	
	☐ Month 8	Date:	
	☐ Month 9	Date:	
	☐ Month 10	Date:	
	☐ Month 11	Date:	
	☐ Month 12	Date:	
	Spring and Fall		☐ Check for depressions in areas over and surrounding the stormwater management system.
			Notes
	☐ Spring	Date:	
	☐ Fall	Date:	
	☐ Spring	Date:	
	☐ Fall	Date:	
	☐ Spring	Date:	
	☐ Fall	Date:	
	☐ Spring	Date:	
	☐ Fall	Date:	
	☐ Spring	Date:	
	☐ Fall	Date:	
	☐ Spring	Date:	
	☐ Fall	Date:	
	Yearly		☐ Confirm that no unauthorized modifications have been performed to the site.
			Notes
	☐ Year 1	Date:	
	☐ Year 2	Date:	
	☐ Year 3	Date:	
	☐ Year 4	Date:	
	☐ Year 5	Date:	
	☐ Year 6	Date:	
	☐ Year 7	Date:	

CULTEC

CULTEC, Inc.
878 Federal Road • P.O. Box 280 • Brookfield, CT 06804 USA
P: (203) 775-4416 • Toll Free: 1(800) 4-CULTEC • www.cultec.com

RETENTION • DETENTION • INFILTRATION • WATER QUALITY

Contactor® & Recharger®

Stormwater Chambers The Chamber With The Stripe®

Operation and Maintenance Guidelines

CULTEC

Operation & Maintenance

This manual contains guidelines recommended by CULTEC, Inc. and may be used in conjunction with, but not to supersede, local regulations or regulatory authorities. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Introduction

The CULTEC Subsurface Stormwater Management System is a high-density polyethylene (HDPE) chamber system arranged in parallel rows surrounded by washed stone. The CULTEC chambers create arch-shaped voids within the washed stone to provide stormwater detention, retention, infiltration, and reclamation. Filter fabric is placed between the native soil and stone interface to prevent the intrusion of fines into the system. In order to minimize the amount of sediment which may enter the CULTEC system, a sediment collection device (stormwater pretreatment device) is recommended upstream from the CULTEC chamber system. Examples of pretreatment devices include, but are not limited to, an appropriately sized catch basin with sump, pretreatment catchment device, oil grit separator, or baffled distribution box. Manufactured pretreatment devices may also be used in accordance with CULTEC chambers. Installation, operation, and maintenance of these devices shall be in accordance with manufacturer's recommendations. Almost all of the sediment entering the stormwater management system will be collected within the pretreatment device.

Best Management Practices allow for the maintenance of the preliminary collection systems prior to feeding the CULTEC chambers. The pretreatment structures shall be inspected for any debris that will restrict inlet flow rates. Outfall structures, if any, such as outlet control must also be inspected for any obstructions that would restrict outlet flow rates. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Operation and Maintenance Requirements

I. Operation

CULTEC stormwater management systems shall be operated to receive only stormwater run-off in accordance with applicable local regulations. CULTEC subsurface stormwater management chambers operate at peak performance when installed in series with pretreatment. Pretreatment of suspended solids is superior to treatment of solids once they have been introduced into the system. The use of pretreatment is adequate as long as the structure is maintained and the site remains stable with finished impervious surfaces such as parking lots, walkways, and pervious areas are properly maintained. If there is to be an unstable condition, such as improvements to buildings or parking areas, all proper silt control measures shall be implemented according to local regulations.

II. Inspection and Maintenance Options

A. The CULTEC system may be equipped with an inspection port located on the inlet row. The inspection port is a circular cast box placed in a rectangular concrete collar. When the lid is removed, a 6-inch (150 mm) pipe with a screw-in plug will be exposed. Remove the plug. This will provide access to the CULTEC Chamber row below. From the surface, through this access, the sediment may be measured at this location. A stadia rod may be used to measure the depth of sediment if any in this row. If the depth of sediment is in excess of 3 inches (76 mm), then this row should be cleaned with high pressure water through a culvert cleaning nozzle. This would be carried out through an upstream manhole or through the CULTEC StormFilter Unit (or other pre-treatment device). CCTV inspection of this row can be deployed through this access port to determine if any sediment has accumulated in the inlet row.

B. If the CULTEC bed is not equipped with an inspection port, then access to the inlet row will be through an upstream manhole or the CULTEC StormFilter.

1. Manhole Access
This inspection should only be carried out by persons trained in confined space entry and sewer inspection services. After the manhole cover has been removed a gas detector must be lowered into the manhole to ensure that there are not high concentrations of toxic gases present. The inspector should be lowered into the manhole with the proper safety equipment as per OSHA requirements. The inspector may be able to observe sediment from this location. If this is not possible, the inspector will need to deploy a CCTV robot to permit viewing of the sediment.

2. **StormFilter Access**
Remove the manhole cover to allow access to the unit. Typically a 30-inch (750 mm) pipe is used as a riser from the StormFilter to the surface. As in the case with manhole access, this access point requires a technician trained in confined space entry with proper gas detection equipment. This individual must be equipped with the proper safety equipment for entry into the StormFilter. The technician will be lowered onto the StormFilter unit. The hatch on the unit must be removed. Inside the unit are two filters which may be removed according to StormFilter maintenance guidelines. Once these filters are removed the inspector can enter the StormFilter unit to launch the CCTV camera robot.

C. The inlet row of the CULTEC system is placed on a polyethylene liner to prevent scouring of the washed stone beneath this row. This also facilitates the flushing of this row with high pressure water through a culvert cleaning nozzle. The nozzle is deployed through a manhole or the StormFilter and extended to the end of the row. The water is turned on and the inlet row is back-flushed into the manhole or StormFilter. This water is to be removed from the manhole or StormFilter using a vacuum truck.

III. Maintenance Guidelines

The following guidelines shall be adhered to for the operation and maintenance of the CULTEC stormwater management system:

A. The owner shall keep a maintenance log which shall include details of any events which would have an effect on the system's operational capacity.

B. The operation and maintenance procedure shall be reviewed periodically and changed to meet site conditions.

C. Maintenance of the stormwater management system shall be performed by qualified workers and shall follow applicable occupational health and safety requirements.

D. Debris removed from the stormwater management system shall be disposed of in accordance with applicable laws and regulations.

IV. Suggested Maintenance Schedules

A. **Minor Maintenance**
The following suggested schedule shall be followed for routine maintenance during the regular operation of the stormwater system:

Frequency	Action
Monthly in first year	Check inlets and outlets for clogging and remove any debris as required.
Spring and Fall	Check inlets and outlets for clogging and remove any debris as required.
One year after commissioning and every third year following	Check inlets and outlets for clogging and remove any debris as required.

B. **Major Maintenance**
The following suggested maintenance schedule shall be followed to maintain the performance of the CULTEC stormwater management chambers. Additional work may be necessary due to insufficient performance and other issues that might be found during the inspection of the stormwater management chambers. (See table on next page)

Major Maintenance *(continued)*

	Frequency	Action
Inlets and Outlets	Every 3 years	• Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.
	Spring and Fall	• Check inlet and outlets for clogging and remove any debris as required.
CULTEC Stormwater Chambers	2 years after commissioning	• Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. • Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.
	9 years after commissioning every 9 years following	• Clean stormwater management chambers and feed connectors of any debris. • Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique. • Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.
	45 years after commissioning	• Clean stormwater management chambers and feed connectors of any debris. • Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required. • Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique.
	45 to 50 years after commissioning	• Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection. • Attain the appropriate approvals as required. • Establish a new operation and maintenance schedule.
Surrounding Site	Monthly in 1st year	• Check for depressions in areas over and surrounding the stormwater management system.
	Spring and Fall	• Check for depressions in areas over and surrounding the stormwater management system.
	Yearly	• Confirm that no unauthorized modifications have been performed to the site.

For additional information concerning the maintenance of CULTEC Subsurface Stormwater Management Chambers, please contact CULTEC, Inc. at 1-800-428-5832.

CULTEC
Chamber of Choice™

CULTEC, Inc.
878 Federal Road • P.O. Box 280 • Brookfield, CT 06804
Phone: 203-775-4416 • Toll Free: 800-4-CULTEC • Fax: 203-775-1462
Web: www.cultec.com • E-mail: custservice@cultec.com

Jellyfish Filter Inspection and Maintenance Log

Owner:				Jellyfish Model No:		
Location:				GPS Coordinates:		
Land Use:	Commercial:		Industrial:		Service Station:	
	Roadway/Highway:		Airport:		Residential:	

Date/Time:						
Inspector:						
Maintenance Contractor:						
Visible Oil Present: (Y/N)						
Oil Quantity Removed:						
Floatable Debris Present: (Y/N)						
Floatable Debris Removed: (Y/N)						
Water Depth in Backwash Pool						
Draindown Cartridges externally rinsed and recommissioned: (Y/N)						
New tentacles put on Draindown Cartridges: (Y/N)						
Hi-Flo Cartridges externally rinsed and recommissioned: (Y/N)						
New tentacles put on Hi-Flo Cartridges: (Y/N)						
Sediment Depth Measured: (Y/N)						
Sediment Depth (inches or mm):						
Sediment Removed: (Y/N)						
Cartridge Lids intact: (Y/N)						
Observed Damage:						
Comments:						

Cascade Separator® Inspection & Maintenance Log

Cascade Model:			Location:		
Date	Depth Below Invert to Top of Sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The depth to sediment is determined by taking a measurement from the manhole outlet invert (standing water level) to the top of the sediment pile. Once this measurement is recorded, it should be compared to the chart in the maintenance guide to determine if the height of the sediment pile off the bottom of the sump floor exceeds 50% of the maximum sediment storage. Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.
2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

SUPPORT

- Drawings and specifications are available at www.ContechES.com.
- Site-specific design support is available from our engineers.

Contech Engineered Solutions LLC provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, sanitary sewer, stormwater, and earth stabilization products. For information, visit www.ContechES.com or call 800.338.1122

CONTECH®
ENGINEERED SOLUTIONS
800.925.5240
www.ContechES.com

BMP OPERATION & MAINTENANCE LOG

Project Name: ____

Today's Date:____

Name of Person Performing Activity (Printed):____

Signature: ____

BMP Name (As Shown in O&M Plan)	Brief Description of Implementation, Maintenance, and Inspection Activity Performed

Minor Maintenance

Frequency		**Action**
Monthly in first year		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
☐ Month 1	Date:	
☐ Month 2	Date:	
☐ Month 3	Date:	
☐ Month 4	Date	
☐ Month 5	Date:	
☐ Month 6	Date:	
☐ Month 7	Date:	
☐ Month 8	Date:	
☐ Month 9	Date:	
☐ Month 10	Date:	
☐ Month 11	Date:	
☐ Month 12	Date:	
Spring and Fall		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
☐ Spring	Date:	
☐ Fall	Date:	
☐ Spring	Date:	
☐ Fall	Date:	
☐ Spring	Date:	
☐ Fall	Date:	
☐ Spring	Date:	
☐ Fall	Date:	
☐ Spring	Date:	
☐ Fall	Date:	
☐ Spring	Date:	
☐ Fall	Date:	
One year after commissioning and every third year following		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
☐ Year 1	Date:	
☐ Year 4	Date:	
☐ Year 7	Date:	
☐ Year 10	Date:	
☐ Year 13	Date:	
☐ Year 16	Date:	
☐ Year 19	Date:	
☐ Year 22	Date:	

Major Maintenance

	Frequency		Action
Inlets and Outlets	**Every 3 years**		Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.
			Notes
	☐ Year 1	Date:	
	☐ Year 4	Date:	
	☐ Year 7	Date:	
	☐ Year 10	Date:	
	☐ Year 13	Date:	
	☐ Year 16	Date:	
	☐ Year 19	Date:	
	☐ Year 22	Date:	
	Spring and Fall		Check inlet and outlets for clogging and remove any debris, as required.
			Notes
	☐ Spring	Date:	
	☐ Fall	Date:	
	☐ Spring	Date:	
	☐ Fall	Date:	
	☐ Spring	Date:	
	☐ Fall	Date:	
	☐ Spring	Date:	
	☐ Fall	Date:	
	☐ Spring	Date:	
	☐ Fall	Date:	
	☐ Spring	Date:	
	☐ Fall	Date:	
CULTEC Stormwater Chambers	**2 years after commissioning**		☐ Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. ☐ Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.
			Notes
	☐ Year 2	Date:	

Major Maintenance

	Frequency		Action
CULTEC Stormwater Chambers	**9 years after commissioning every 9 years following**		☐ Clean stormwater management chambers and feed connectors of any debris. ☐ Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique. ☐ Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.
			Notes
	☐ Year 9	Date:	
	☐ Year 18	Date:	
	☐ Year 27	Date:	
	☐ Year 36	Date:	
	45 years after commissioning		☐ Clean stormwater management chambers and feed connectors of any debris. ☐ Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required. ☐ Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique. ☐ Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection. ☐ Attain the appropriate approvals as required. ☐ Establish a new operation and maintenance schedule.
			Notes
	☐ Year 45	Date:	

Major Maintenance

	Frequency		Action
Surrounding Site	**Monthly in 1st year**		☐ Check for depressions in areas over and surrounding the stormwater management system.
			Notes
	☐ Month 1	Date:	
	☐ Month 2	Date:	
	☐ Month 3	Date:	
	☐ Month 4	Date:	
	☐ Month 5	Date:	
	☐ Month 6	Date:	
	☐ Month 7	Date:	
	☐ Month 8	Date:	
	☐ Month 9	Date:	
	☐ Month 10	Date:	
	☐ Month 11	Date:	
	☐ Month 12	Date:	
	Spring and Fall		☐ Check for depressions in areas over and surrounding the stormwater management system.
			Notes
	☐ Spring	Date:	
	☐ Fall	Date:	
	☐ Spring	Date:	
	☐ Fall	Date:	
	☐ Spring	Date:	
	☐ Fall	Date:	
	☐ Spring	Date:	
	☐ Fall	Date:	
	☐ Spring	Date:	
	☐ Fall	Date:	
	☐ Spring	Date:	
	☐ Fall	Date:	
	Yearly		☐ Confirm that no unauthorized modifications have been performed to the site.
			Notes
	☐ Year 1	Date:	
	☐ Year 2	Date:	
	☐ Year 3	Date:	
	☐ Year 4	Date:	
	☐ Year 5	Date:	
	☐ Year 6	Date:	
	☐ Year 7	Date:	

STORMWATER MANAGEMENT SYSTEM

Project Name: **Location:**

Site Status: **Weather Condition:**

Inspector: **Date:** **Time:**

Maintenance Item	**Satisfactory/ Unsatisfactory**	**Comments**
DRAINAGE STRUCTURES & DRAINAGE PIPE		
Drainage Structures		
1. Debris & accumulated sediment removed		
2. Sumps capacity; less than half full		
3. Grate/cover bolted and clear		
4. Concrete/masonry condition of structures		
a. cracks or displacement		
b. Minor spalling (<1")		
c. Major spalling (exposed rebar)		
d. Joint failures		
e. Water tightness		
5. Pipe connections		
Drainage Pipe		
1. Debris & accumulated sediment removed		
2. Pipe connections		
Other		
1. Complaints from residents		
2. Aesthetics		
3. Signs of hydrocarbon build-up		
4. Any public hazards (specify)		
5. Adjacent area free of debris?		
6. Surrounding area is fully stabilized? (no evidence of eroding material in structures)		

STORMWATER MANAGEMENT SYSTEM

Project Name:	**Location:**
Site Status:	**Weather Condition:**

Inspector:	**Date:**	**Time:**

Comments:

Actions to be Taken:

SITE LOGBOOK

APPENDIX F
CONSTRUCTION SITE INSPECTION AND MAINTENANCE LOG BOOK

STATE POLLUTANT DISCHARGE ELIMINATION SYSTEM FOR CONSTRUCTION ACTIVITIES

SAMPLE CONSTRUCTION SITE LOG BOOK

Table of Contents

I. PRE-CONSTRUCTION MEETING DOCUMENTS

Project Name ____

Permit No. ____________________________________ **Date of Authorization** _______________

Name of Operator ____

Prime Contractor ____

a. Preamble to Site Assessment and Inspections

The Following Information To Be Read By All Person's Involved in The Construction of Stormwater Related Activities:

The Operator agrees to have a qualified inspector[1] conduct an assessment of the site prior to the commencement of construction[2] and certify in this inspection report that the appropriate erosion and sediment controls described in the SWPPP have been adequately installed or implemented to ensure overall preparedness of the site for the commencement of construction.

Prior to the commencement of construction, the Operator shall certify in this site logbook that the SWPPP has been prepared in accordance with the State's standards and meets all Federal, State and local erosion and sediment control requirements. A preconstruction meeting should be held to review all of the SWPPP requirements with construction personnel.

When construction starts, site inspections shall be conducted by the qualified inspector at least every 7 calendar days. The Operator shall maintain a record of all inspection reports in this site logbook. The site logbook shall be maintained on site and be made available to the permitting authorities upon request.

Prior to filing the Notice of Termination or the end of permit term, the Operator shall have a qualified inspector perform a final site inspection. The qualified inspector shall certify that the site has undergone final stabilization[3] using either vegetative or structural stabilization methods and that all temporary erosion and sediment controls (such as silt fencing) not needed for long-term erosion control have been removed. In addition, the Operator must identify and certify that all permanent structures described in the SWPPP have been constructed and provide the owner(s) with an operation and maintenance plan that ensures the structure(s) continuously functions as designed.

---

1 Refer to "Qualified Inspector" inspection requirements in the current SPDES General Permit for Stormwater Discharges from Construction Activity for complete list of inspection requirements.

2 "Commencement of construction" means the initial removal of vegetation and disturbance of soils associated with clearing, grading or excavating activities or other construction activities.

3 "Final stabilization" means that all soil-disturbing activities at the site have been completed and a uniform, perennial vegetative cover with a density of eighty (80) percent has been established or equivalent stabilization measures (such as the use of mulches or geotextiles) have been employed on all unpaved areas and areas not covered by permanent structures.

b. Pre-construction Site Assessment Checklist
(NOTE: Provide comments below as necessary)

1. Notice of Intent, SWPPP, and Contractors Certification:

Yes No NA
[ ] [ ] [ ] Has a Notice of Intent been filed with the NYS Department of Conservation?
[ ] [ ] [ ] Is the SWPPP on-site? Where?_______________________________
[ ] [ ] [ ] Is the Plan current? What is the latest revision date?_______________
[ ] [ ] [ ] Is a copy of the NOI (with brief description) onsite? Where?_______________
[ ] [ ] [ ] Have all contractors involved with stormwater related activities signed a contractor's certification?

2. Resource Protection

Yes No NA
[ ] [ ] [ ] Are construction limits clearly flagged or fenced?
[ ] [ ] [ ] Important trees and associated rooting zones, on-site septic system absorption fields, existing vegetated areas suitable for filter strips, especially in perimeter areas, have been flagged for protection.
[ ] [ ] [ ] Creek crossings installed prior to land-disturbing activity, including clearing and blasting.

3. Surface Water Protection

Yes No NA
[ ] [ ] [ ] Clean stormwater runoff has been diverted from areas to be disturbed.
[ ] [ ] [ ] Bodies of water located either on site or in the vicinity of the site have been identified and protected.
[ ] [ ] [ ] Appropriate practices to protect on-site or downstream surface water are installed.
[ ] [ ] [ ] Are clearing and grading operations divided into areas <5 acres?

4. Stabilized Construction Access

Yes No NA
[ ] [ ] [ ] A temporary construction entrance to capture mud and debris from construction vehicles before they enter the public highway has been installed.
[ ] [ ] [ ] Other access areas (entrances, construction routes, equipment parking areas) are stabilized immediately as work takes place with gravel or other cover.
[ ] [ ] [ ] Sediment tracked onto public streets is removed or cleaned on a regular basis.

5. Sediment Controls

Yes No NA
[ ] [ ] [ ] Silt fence material and installation comply with the standard drawing and specifications.
[ ] [ ] [ ] Silt fences are installed at appropriate spacing intervals
[ ] [ ] [ ] Sediment/detention basin was installed as first land disturbing activity.
[ ] [ ] [ ] Sediment traps and barriers are installed.

6. Pollution Prevention for Waste and Hazardous Materials

Yes No NA
[ ] [ ] [ ] The Operator or designated representative has been assigned to implement the spill prevention avoidance and response plan.
[ ] [ ] [ ] The plan is contained in the SWPPP on page ______
[ ] [ ] [ ] Appropriate materials to control spills are onsite. Where? ___________________

II. CONSTRUCTION DURATION INSPECTIONS

a. Directions:

Inspection Forms will be filled out during the entire construction phase of the project.

Required Elements:

1) On a site map, indicate the extent of all disturbed site areas and drainage pathways. Indicate site areas that are expected to undergo initial disturbance or significant site work within the next 14-day period;

2) Indicate on a site map all areas of the site that have undergone temporary or permanent stabilization;

3) Indicate all disturbed site areas that have not undergone active site work during the previous 14-day period;

4) Inspect all sediment control practices and record the approximate degree of sediment accumulation as a percentage of sediment storage volume (for example, 10 percent, 20 percent, 50 percent);

5) Inspect all erosion and sediment control practices and record all maintenance requirements such as verifying the integrity of barrier or diversion systems (earthen berms or silt fencing) and containment systems (sediment basins and sediment traps). Identify any evidence of rill or gully erosion occurring on slopes and any loss of stabilizing vegetation or seeding/mulching. Document any excessive deposition of sediment or ponding water along barrier or diversion systems. Record the depth of sediment within containment structures, any erosion near outlet and overflow structures, and verify the ability of rock filters around perforated riser pipes to pass water; and

6) Immediately report to the Operator any deficiencies that are identified with the implementation of the SWPPP.

CONSTRUCTION DURATION INSPECTIONS Page 1 of ______

SITE PLAN/SKETCH

Inspector (print name) **Date of Inspection**

Qualified Inspector (print name) **Qualified Inspector Signature**

The above signed acknowledges that, to the best of his/her knowledge, all information provided on the forms is accurate and complete.

Maintaining Water Quality

Yes No NA
[ ] [ ] [ ] Is there an increase in turbidity causing a substantial visible contrast to natural conditions at the outfalls?
[ ] [ ] [ ] Is there residue from oil and floating substances, visible oil film, or globules or grease at the outfalls?
[ ] [ ] [ ] All disturbance is within the limits of the approved plans.
[ ] [ ] [ ] Have receiving lake/bay, stream, and/or wetland been impacted by silt from project?

Housekeeping

1. General Site Conditions

Yes No NA
[ ] [ ] [ ] Is construction site litter, debris and spoils appropriately managed?
[ ] [ ] [ ] Are facilities and equipment necessary for implementation of erosion and sediment control in working order and/or properly maintained?
[ ] [ ] [ ] Is construction impacting the adjacent property?
[ ] [ ] [ ] Is dust adequately controlled?

2. Temporary Stream Crossing

Yes No NA
[ ] [ ] [ ] Maximum diameter pipes necessary to span creek without dredging are installed.
[ ] [ ] [ ] Installed non-woven geotextile fabric beneath approaches.
[ ] [ ] [ ] Is fill composed of aggregate (no earth or soil)?
[ ] [ ] [ ] Rock on approaches is clean enough to remove mud from vehicles & prevent sediment from entering stream during high flow.

3. Stabilized Construction Access

Yes No NA
[ ] [ ] [ ] Stone is clean enough to effectively remove mud from vehicles.
[ ] [ ] [ ] Installed per standards and specifications?
[ ] [ ] [ ] Does all traffic use the stabilized entrance to enter and leave site?
[ ] [ ] [ ] Is adequate drainage provided to prevent ponding at entrance?

Runoff Control Practices

1. Excavation Dewatering

Yes No NA
[ ] [ ] [ ] Upstream and downstream berms (sandbags, inflatable dams, etc.) are installed per plan.
[ ] [ ] [ ] Clean water from upstream pool is being pumped to the downstream pool.
[ ] [ ] [ ] Sediment laden water from work area is being discharged to a silt-trapping device.
[ ] [ ] [ ] Constructed upstream berm with one-foot minimum freeboard.

CONSTRUCTION DURATION INSPECTIONS

Page 3 of ______

Runoff Control Practices (continued)

2. Flow Spreader

Yes No NA
[ ] [ ] [ ] Installed per plan.
[ ] [ ] [ ] Constructed on undisturbed soil, not on fill, receiving only clear, non-sediment laden flow.
[ ] [ ] [ ] Flow sheets out of level spreader without erosion on downstream edge.

3. Interceptor Dikes and Swales

Yes No NA
[ ] [ ] [ ] Installed per plan with minimum side slopes 2H:1V or flatter.
[ ] [ ] [ ] Stabilized by geotextile fabric, seed, or mulch with no erosion occurring.
[ ] [ ] [ ] Sediment-laden runoff directed to sediment trapping structure

4. Stone Check Dam

Yes No NA
[ ] [ ] [ ] Is channel stable? (flow is not eroding soil underneath or around the structure).
[ ] [ ] [ ] Check is in good condition (rocks in place and no permanent pools behind the structure).
[ ] [ ] [ ] Has accumulated sediment been removed?.

5. Rock Outlet Protection

Yes No NA
[ ] [ ] [ ] Installed per plan.
[ ] [ ] [ ] Installed concurrently with pipe installation.

Soil Stabilization

1. Topsoil and Spoil Stockpiles

Yes No NA
[ ] [ ] [ ] Stockpiles are stabilized with vegetation and/or mulch.
[ ] [ ] [ ] Sediment control is installed at the toe of the slope.

2. Revegetation

Yes No NA
[ ] [ ] [ ] Temporary seedings and mulch have been applied to idle areas.
[ ] [ ] [ ] 4 inches minimum of topsoil has been applied under permanent seedings

Sediment Control Practices

1. Silt Fence and Linear Barriers

Yes No NA
[ ] [ ] [ ] Installed on Contour, 10 feet from toe of slope (not across conveyance channels).
[ ] [ ] [ ] Joints constructed by wrapping the two ends together for continuous support.
[ ] [ ] [ ] Fabric buried 6 inches minimum.
[ ] [ ] [ ] Posts are stable, fabric is tight and without rips or frayed areas.
Sediment accumulation is ___% of design capacity.

Sediment Control Practices (continued)

2. Storm Drain Inlet Protection (Use for Stone & Block; Filter Fabric; Curb; or, Excavated; Filter Sock or Manufactured practices)

Yes No NA
[ ] [ ] [ ] Installed concrete blocks lengthwise so open ends face outward, not upward.
[ ] [ ] [ ] Placed wire screen between No. 3 crushed stone and concrete blocks.
[ ] [ ] [ ] Drainage area is 1acre or less.
[ ] [ ] [ ] Excavated area is 900 cubic feet.
[ ] [ ] [ ] Excavated side slopes should be 2:1.
[ ] [ ] [ ] 2” x 4” frame is constructed and structurally sound.
[ ] [ ] [ ] Posts 3-foot maximum spacing between posts.
[ ] [ ] [ ] Fabric is embedded 1 to 1.5 feet below ground and secured to frame/posts with staples at max 8-inch spacing.
[ ] [ ] [ ] Posts are stable, fabric is tight and without rips or frayed areas.
[ ] [ ] [ ] Manufactured insert fabric is free of tears and punctures.
[ ] [ ] [ ] Filter Sock is not torn or flattened and fill material is contained within the mesh sock.
Sediment accumulation ___% of design capacity.

3. Temporary Sediment Trap

Yes No NA
[ ] [ ] [ ] Outlet structure is constructed per the approved plan or drawing.
[ ] [ ] [ ] Geotextile fabric has been placed beneath rock fill.
[ ] [ ] [ ] Sediment trap slopes and disturbed areas are stabilized.
Sediment accumulation is ___% of design capacity.

4. Temporary Sediment Basin

Yes No NA
[ ] [ ] [ ] Basin and outlet structure constructed per the approved plan.
[ ] [ ] [ ] Basin side slopes are stabilized with seed/mulch.
[ ] [ ] [ ] Drainage structure flushed and basin surface restored upon removal of sediment basin facility.
[ ] [ ] [ ] Sediment basin dewatering pool is dewatering at appropriate rate.
Sediment accumulation is ___% of design capacity.

Note: Not all erosion and sediment control practices are included in this listing. Add additional pages to this list as required by site specific design. All practices shall be maintained in accordance with their respective standards.

Construction inspection checklists for post-development stormwater management practices can be found in Appendix F of the New York Stormwater Management Design Manual.

CONSTRUCTION DURATION INSPECTIONS

b. Modifications to the SWPPP (To be completed as described below)

The Operator shall amend the SWPPP whenever:

1. There is a significant change in design, construction, operation, or maintenance which may have a significant effect on the potential for the discharge of pollutants to the waters of the United States and which has not otherwise been addressed in the SWPPP; or
2. The SWPPP proves to be ineffective in:
   a. Eliminating or significantly minimizing pollutants from sources identified in the SWPPP and as required by this permit; or
   b. Achieving the general objectives of controlling pollutants in stormwater discharges from permitted construction activity; and
3. Additionally, the SWPPP shall be amended to identify any new contractor or subcontractor that will implement any measure of the SWPPP.

Modification & Reason:

MAINTENANCE AND INSPECTION CHECKLIST

Stormwater Pond/Wetland Operation, Maintenance and Management Inspection Checklist

Project ______________________________

Location: ______________________________

Site Status: ______________________________

Date: ______________________________

Time: ______________________________

Inspector: ______________________________

Maintenance Item	Satisfactory/ Unsatisfactory	Comments
1. Embankment and emergency spillway (Annual, After Major Storms)		
1. Vegetation and ground cover adequate		
2. Embankment erosion		
3. Animal burrows		
4. Unauthorized planting		
5. Cracking, bulging, or sliding of dam		
a. Upstream face		
b. Downstream face		
c. At or beyond toe		
downstream		
upstream		
d. Emergency spillway		
6.Pond, toe & chimney drains clear and functioning		
7.Seeps/leaks on downstream face		
8.Slope protection or riprap failure		
9. Vertical/horizontal alignment of top of dam "As-Built"		

Maintenance Item	**Satisfactory/ Unsatisfactory**	**Comments**
10. Emergency spillway clear of obstructions and debris		
11. Other (specify)		
2. Riser and principal spillway (Annual)		
Type: Reinforced concrete ______ Corrugated pipe _______ Masonry _______ 1. Low flow orifice obstructed		
2. Low flow trash rack. a. Debris removal necessary		
b. Corrosion control		
3. Weir trash rack maintenance a. Debris removal necessary		
b. corrosion control		
4. Excessive sediment accumulation insider riser		
5. Concrete/masonry condition riser and barrels a. cracks or displacement		
b. Minor spalling (<1")		
c. Major spalling (rebars exposed)		
d. Joint failures		
e. Water tightness		
6. Metal pipe condition		
7. Control valve a. Operational/exercised		
b. Chained and locked		
8. Pond drain valve a. Operational/exercised		
b. Chained and locked		
9. Outfall channels functioning		
10. Other (specify)		

Maintenance Item	**Satisfactory/ Unsatisfactory**	**Comments**
3. Permanent Pool (Wet Ponds) (monthly)		
1. Undesirable vegetative growth		
2. Floating or floatable debris removal required		
3. Visible pollution		
4. Shoreline problem		
5. Other (specify)		
4. Sediment Forebays		
1.Sedimentation noted		
2. Sediment cleanout when depth < 50% design depth		
5. Dry Pond Areas		
1. Vegetation adequate		
2. Undesirable vegetative growth		
3. Undesirable woody vegetation		
4. Low flow channels clear of obstructions		
5. Standing water or wet spots		
6. Sediment and / or trash accumulation		
7. Other (specify)		
6. Condition of Outfalls (Annual , After Major Storms)		
1. Riprap failures		
2. Slope erosion		
3. Storm drain pipes		
4.Endwalls / Headwalls		
5. Other (specify)		
7. Other (Monthly)		
1. Encroachment on pond, wetland or easement area		

Maintenance Item	**Satisfactory/ Unsatisfactory**	**Comments**
2. Complaints from residents		
3.Aesthetics a. Grass growing required		
b. Graffiti removal needed		
c. Other (specify)		
4. Conditions of maintenance access routes.		
5. Signs of hydrocarbon build-up		
6. Any public hazards (specify)		
8. Wetland Vegetation (Annual)		
1. Vegetation healthy and growing Wetland maintaining 50% surface area coverage of wetland plants after the second growing season. (If unsatisfactory, reinforcement plantings needed)		
2. Dominant wetland plants: Survival of desired wetland plant species Distribution according to landscaping plan?		
3. Evidence of invasive species		
4. Maintenance of adequate water depths for desired wetland plant species		
5. Harvesting of emergent plantings needed		
6. Have sediment accumulations reduced pool volume significantly or are plants “choked” with sediment		
7. Eutrophication level of the wetland.		
8. Other (specify)		

Comments:

Actions to be Taken:

Infiltration Trench Operation, Maintenance, and Management Inspection Checklist

Project:
Location:
Site Status:

Date:

Time:

Inspector:

MAINTENANCE ITEM	SATISFACTORY / UNSATISFACTORY	COMMENTS
1. Debris Cleanout (Monthly)		
Trench surface clear of debris		
Inflow pipes clear of debris		
Overflow spillway clear of debris		
Inlet area clear of debris		
2. Sediment Traps or Forebays (Annual)		
Obviously trapping sediment		
Greater than 50% of storage volume remaining		
3. Dewatering (Monthly)		
Trench dewaters between storms		
4. Sediment Cleanout of Trench (Annual)		
No evidence of sedimentation in trench		
Sediment accumulation doesn’t yet require cleanout		
5. Inlets (Annual)		

MAINTENANCE ITEM	**SATISFACTORY / UNSATISFACTORY**	**COMMENTS**
Good condition		
No evidence of erosion		
6. Outlet/Overflow Spillway (Annual)		
Good condition, no need for repair		
No evidence of erosion		
7. Aggregate Repairs (Annual)		
Surface of aggregate clean		
Top layer of stone does not need replacement		
Trench does not need rehabilitation		

Comments:

Actions to be Taken:

Sand/Organic Filter Operation, Maintenance and Management Inspection Checklist

Project:
Location:
Site Status:

Date:

Time:

Inspector:

MAINTENANCE ITEM	SATISFACTORY / UNSATISFACTORY	COMMENTS
1. Debris Cleanout (Monthly)		
Contributing areas clean of debris		
Filtration facility clean of debris		
Inlet and outlets clear of debris		
2. Oil and Grease (Monthly)		
No evidence of filter surface clogging		
Activities in drainage area minimize oil and grease entry		
3. Vegetation (Monthly)		
Contributing drainage area stabilized		
No evidence of erosion		
Area mowed and clipping removed		
4. Water Retention Where Required (Monthly)		
Water holding chambers at normal pool		
No evidence of leakage		
5. Sediment Deposition (Annual)		

MAINTENANCE ITEM	SATISFACTORY / UNSATISFACTORY	COMMENTS
Filter chamber free of sediments		
Sedimentation chamber not more than half full of sediments		
6. Structural Components (Annual)		
No evidence of structural deterioration		
Any grates are in good condition		
No evidence of spalling or cracking of structural parts		
7. Outlet/Overflow Spillway (Annual)		
Good condition, no need for repairs		
No evidence of erosion (if draining into a natural channel)		
8. Overall Function of Facility (Annual)		
Evidence of flow bypassing facility		
No noticeable odors outside of facility		

Comments:

Actions to be Taken:

Bioretention Operation, Maintenance and Management Inspection Checklist

Project:
Location:
Site Status:

Date:

Time:

Inspector:

MAINTENANCE ITEM	SATISFACTORY / UNSATISFACTORY	COMMENTS
1. Debris Cleanout (Monthly)		
Bioretention and contributing areas clean of debris		
No dumping of yard wastes into practice		
Litter (branches, etc.) have been removed		
2. Vegetation (Monthly)		
Plant height not less than design water depth		
Fertilized per specifications		
Plant composition according to approved plans		
No placement of inappropriate plants		
Grass height not greater than 6 inches		
No evidence of erosion		
3. Check Dams/Energy Dissipaters/Sumps (Annual, After Major Storms)		
No evidence of sediment buildup		

MAINTENANCE ITEM	**SATISFACTORY / UNSATISFACTORY**	**COMMENTS**
Sumps should not be more than 50% full of sediment		
No evidence of erosion at downstream toe of drop structure		
4. Dewatering (Monthly)		
Dewaters between storms		
No evidence of standing water		
5. Sediment Deposition (Annual)		
Swale clean of sediments		
Sediments should not be > 20% of swale design depth		
6. Outlet/Overflow Spillway (Annual, After Major Storms)		
Good condition, no need for repair		
No evidence of erosion		
No evidence of any blockages		
7. Integrity of Filter Bed (Annual)		
Filter bed has not been blocked or filled inappropriately		

Comments:

Actions to be Taken:

Open Channel Operation, Maintenance, and Management Inspection Checklist

Project:
Location:
Site Status:

Date:

Time:

Inspector:

MAINTENANCE ITEM	SATISFACTORY/ UNSATISFACTORY	COMMENTS
1. Debris Cleanout (Monthly)		
Contributing areas clean of debris		
2. Check Dams or Energy Dissipators (Annual, After Major Storms)		
No evidence of flow going around structures		
No evidence of erosion at downstream toe		
Soil permeability		
Groundwater / bedrock		
3. Vegetation (Monthly)		
Mowing done when needed		
Minimum mowing depth not exceeded		
No evidence of erosion		
Fertilized per specification		
4. Dewatering (Monthly)		
Dewaters between storms		

MAINTENANCE ITEM	SATISFACTORY/ UNSATISFACTORY	COMMENTS
5. Sediment deposition (Annual)		
Clean of sediment		
6. Outlet/Overflow Spillway (Annual)		
Good condition, no need for repairs		
No evidence of erosion		

Comments:

____

____

____

____

____

____

____

Actions to be Taken:

____

____

____

____

____

____

____

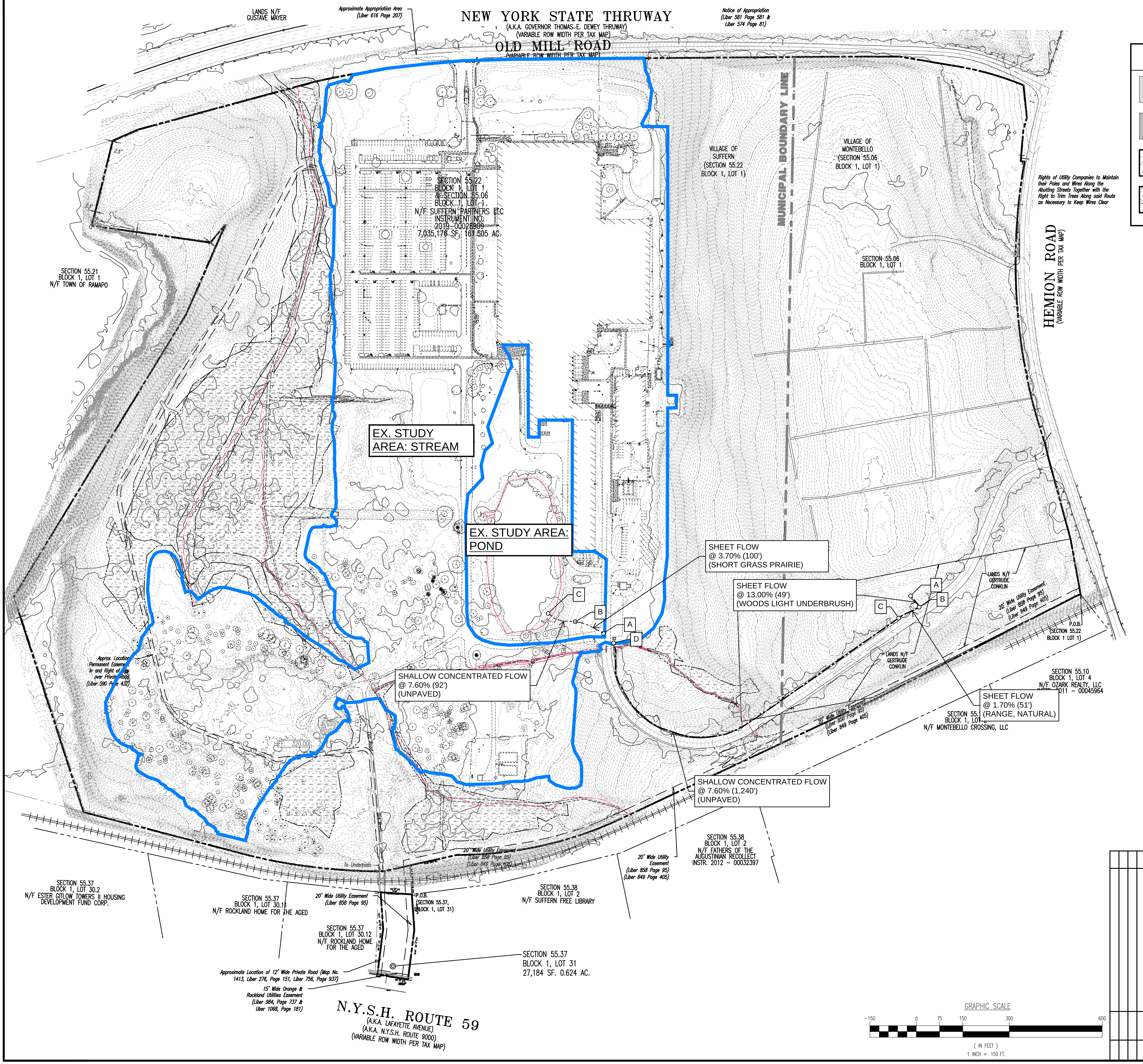
____

This page is left intentionally blank

Appendix H

EXISTING AND PROPOSED DRAINAGE AREA MAPS

THIS PLAN TO BE UTILIZED FOR STORMWATER/DRAINAGE ANALYSIS PURPOSES ONLY



PAVEMENT LEGEND

▨	PROPOSED LIGHT DUTY PAVEMENT
▨	PROPOSED HEAVY DUTY PAVEMENT
▨	PROPOSED STANDARD CONCRETE
▨	PROPOSED HEAVY DUTY CONCRETE

N
E
W
S

Rev.	Date	Comments	By
2	09/01/22	REV. PER TOWNSHIP AND COUNTY COMMENTS	ALPH
1	04/25/22	REV. PER CLIENT AND COUNTY COMMENTS	CAM

THIS PLAN SET IS FOR PERMITTING PURPOSES ONLY AND MAY NOT BE USED FOR CONSTRUCTION

DYNAMIC ENGINEERING

LAND DEVELOPMENT CONSULTING • PERMITTING • GEOTECHNICAL • ENVIRONMENTAL • SURVEY • PLANNING & ZONING

1904 Main Street
Lake Como, NJ 07719
T: 732.974.0198
F: 732.974.3521
www.dynamicec.com

Offices conveniently located in:
Lake Como, New Jersey T: 732.974.0198 | Chester, New Jersey T: 908.879.9229 | Newark, New Jersey T: 973.755.7200 | Toms River, New Jersey T: 732.678.0000
Allen, Texas T: 972.534.2100 | Austin, Texas T:512.646.2646 | Houston, Texas T: 281.789.6400 | Delray Beach, Florida T: 561.921.8570
Newtown, Pennsylvania T: 267.685.0276 | Philadelphia, Pennsylvania T: 215.253.4888 | Bethlehem, Pennsylvania T: 610.598.4400

TITLE:
EXISTING DRAINAGE AREA MAP

PROJECT: **BROOKFIELD PROPERTIES**
PROPOSED INDUSTRIAL PARK AT 25 OLD MILL ROAD
SECTION 55.22 BLOCK 1, LOT 1
OLD MILL ROAD AND HEMION ROAD (CR 93)
VILLAGE OF SUFFERN, ROCKLAND COUNTY, NEW YORK

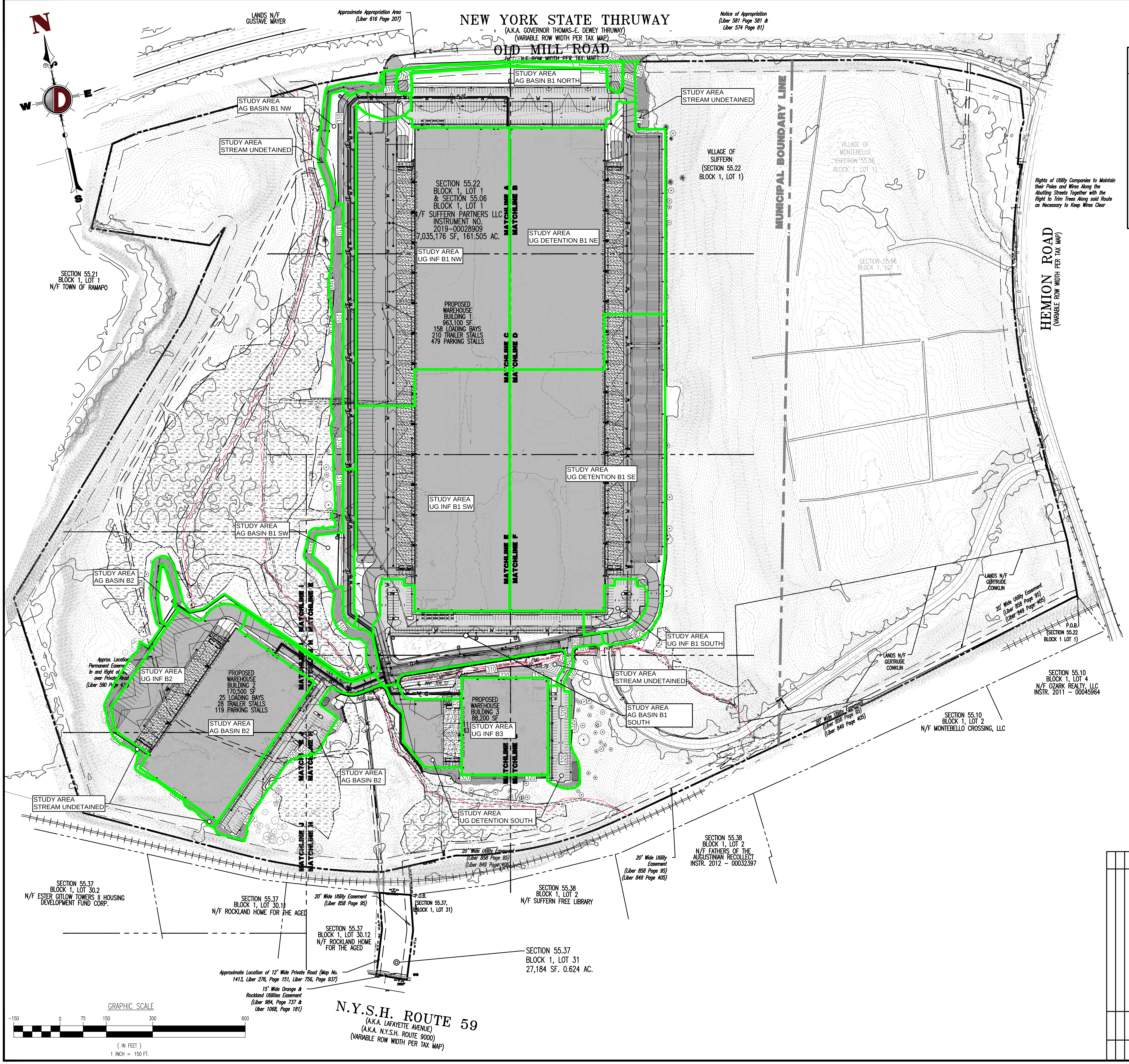
JOB No: 3709-99-004
DATE: 07/28/2022
DRAWN BY: ALPH
SCALE: (H) 1"=150' (V)
DESIGNED BY: JMS
CHECKED BY: JMS
CHECKED BY: -
SHEET No: 1 OF 3
Rev. # 2

JOHN A. PALUS
PROFESSIONAL ENGINEER
NEW YORK LICENSE No. 087502

JOSHUA M. SEWALD
PROFESSIONAL ENGINEER
NEW YORK LICENSE No. 097639

811 PROTECT YOURSELF
ALL STATES REQUIRE NOTIFICATION OF EXCAVATORS, DESIGNERS, OR ANY PERSON PREPARING TO DISTURB THE EARTH'S SURFACE ANYWHERE IN ANY STATE
Know what's below. Call before you dig.
FOR STATE SPECIFIC DIRECT PHONE NUMBERS VISIT: WWW.CALL811.COM

Plotted: 07/28/22 - 9:07 AM, By: areyes, - Product Ver: 24.1s (LMS Tech)
File: P:\DECPC PROJECTS\3709 Brookfield Properties\99-004 Suffern NY\Dwg\DA Maps\D370999004ED0.dwg, ---> EXISTING DRAINAGE MAP



PAVEMENT LEGEND

- ▢ PROPOSED LIGHT DUTY PAVEMENT
- ▨ PROPOSED HEAVY DUTY PAVEMENT
- ▢ PROPOSED STANDARD CONCRETE
- ▨ PROPOSED HEAVY DUTY CONCRETE

GRADING/UTILITY GRAPHIC LEGEND

PROPERTY LINE (PARCEL IN QUESTION)
OFF-SITE PROPERTY LINES

— C — C —	EXIST. CABLE LINE	— C —	PROP. CABLE LINE
— E — E —	EXIST. ELECTRIC LINE	— E — E —	PROP. ELECTRIC LINE
— FO — FO —	EXIST. FIBER OPTIC LINE	— FO —	PROP. FIBER OPTIC LINE
— G — G —	EXIST. GAS LINE	— G — G —	PROP. GAS LINE
— OH — OH —	EXIST. OVERHEAD WIRES	— OH —	PROP. OVERHEAD WIRES
— T — T —	EXIST. TELEPHONE LINE	— T — T —	PROP. TELEPHONE LINE
— UGET — UGET	EXIST. UNDERGROUND ELEC./TELE. SERVICE (NO. & SIZE OF CONDUITS NOT DEFINED)	— UGET —	PROP. UNDERGROUND ELEC./TELE. SERVICE (NO. & SIZE OF CONDUITS NOT DEFINED)
— W — W —	EXIST. WATER LINE	— W —	PROP. WATER LINE
— S — S — OR	EXIST. SANITARY SEWER LINE	— S — S — OR	PROP. SANITARY SEWER LINE
	EXIST. STORM DRAIN LINE		PROP. STORM DRAIN LINE
17	EXIST. MINOR CONTOUR & ELEVATION	XX	PROP. FINISH GRADE CONTOUR & ELEVATION
10	EXIST. MAJOR CONTOUR & ELEVATION		
MW	EXIST. MONITORING WELL		
TP-#	APPROX. TEST PIT LOCATION		
× 8.9	EXIST. SPOT ELEVATIONS	G: 000.00	PROP. GRADE SPOT ELEV.
× G: 8.90	EXIST. GUTTER ELEV.	TC: 000.00 G: 000.00	PROP. TOP OF CURB & FINISHED GRADE ELEV.
× TC: 8.90	EXIST. TOP OF CURB ELEV.		
× FF: 8.90	EXIST. FINISH FLOOR ELEV.	FF: 000.00	PROP. FINISHED FLOOR ELEV.
× GF: 8.90	EXIST. GARAGE FLOOR ELEV.	TW: 000.00 GL: 000.00	PROP. TOP OF WALL & FINISHED GRADE @ LOW SIDE OF WALL (ACTUAL BOTTOM OF WALL FOOTING TO BE ESTABLISHED BY WALL DESIGNER)
	EXIST. FIRE HYDRANT		
WV	EXIST. WATER VALVE	TC: 000.00 GH: 000.00 GL: 000.00	PROP. TOP OF EXTENDED CURB, (GH) FINISHED GRADE @ HIGH SIDE OF EXTENDED CURB & (GL) FINISHED GRADE @ LOW SIDE OF EXTENDED CURB
GV	EXIST. GAS VALVE		
GM	EXIST. GAS METER		
EM	EXIST. ELECTRIC METER		
Elbox	EXIST. ELECTRIC BOX		PROP. DIRECTION OF DRAINAGE FLOW ARROW
C/O	EXIST. CLEAN OUT	WV	PROP. WATER VALVE
W	EXIST. WELL	GV	PROP. GAS VALVE
WSO	EXIST. WATER SHUT OFF VALVE		PROP. STORM CLEANOUT
TEL	EXIST. TELEPHONE BOX		PROP. SANITARY CLEANOUT
CATV	EXIST. CABLE TV BOX		PROP. AREA LIGHT
	EXIST. UTILITY POLE		PROP. OUTLET CONTROL STRUCTURE
	EXIST. GUY WIRE		PROP. DRAINAGE MANHOLE
	EXIST. LIGHT POLE		PROP. SANITARY SEWER MANHOLE
	EXIST. BUILDING LIGHT		PROP. 'A' INLET
	EXIST. SHOE BOX LIGHT		PROP. 'B' INLET
	EXIST. COBRA LIGHT POLE		PROP. 'E' INLET
	EXIST. TRAFFIC SIGNAL POLE		PROP. YARD INLET
	EXIST. MANHOLE		PROP. FLARED END SECTION
	EXIST. "A" INLET		PROP. HEADWALL
	EXIST. "B" INLET		
	EXIST. "E" INLET		
	EXIST. YARD INLET		
	EXIST. FLARED END SECTION		
	EXIST. HEADWALL		

THIS PLAN SET IS FOR PERMITTING PURPOSES ONLY AND MAY NOT BE USED FOR CONSTRUCTION

Rev.	Date	Comments	By
2	09/01/22	REV. PER TOWNSHIP AND COUNTY COMMENTS	ALPH
1	04/25/22	REV. PER CLIENT AND COUNTY COMMENTS	CAM

DYNAMIC ENGINEERING
LAND DEVELOPMENT CONSULTING • PERMITTING • GEOTECHNICAL • ENVIRONMENTAL • SURVEY • PLANNING & ZONING
1904 Main Street
Lake Como, NJ 07719
T: 732.974.0198
F: 732.974.3521
www.dynamicec.com
Offices conveniently located in:
Lake Como, New Jersey T: 732.974.0198 | Chester, New Jersey T: 908.879.9229 | Newark, New Jersey T: 973.755.7200 | Toms River, New Jersey T: 732.678.0000
Allen, Texas T: 972.534.2100 | Austin, Texas T:512.646.2646 | Houston, Texas T: 281.789.6400 | Delray Beach, Florida T: 561.921.8570
Newtown, Pennsylvania T: 267.685.0276 | Philadelphia, Pennsylvania T: 215.253.4888 | Bethlehem, Pennsylvania T: 610.598.4400

TITLE: **PROPOSED DRAINAGE AREA MAP**

PROJECT: **IV2 ROCKLAND LOGISTICS, LLC**
PROPOSED INDUSTRIAL PARK AT 25 OLD MILL ROAD
SECTION 55.22 BLOCK 1, LOT 1; SECTION 55.37, BLOCK 1, LOT 31
OLD MILL ROAD AND HEMION ROAD (CR 93)
VILLAGE OF SUFFERN, ROCKLAND COUNTY, NEW YORK

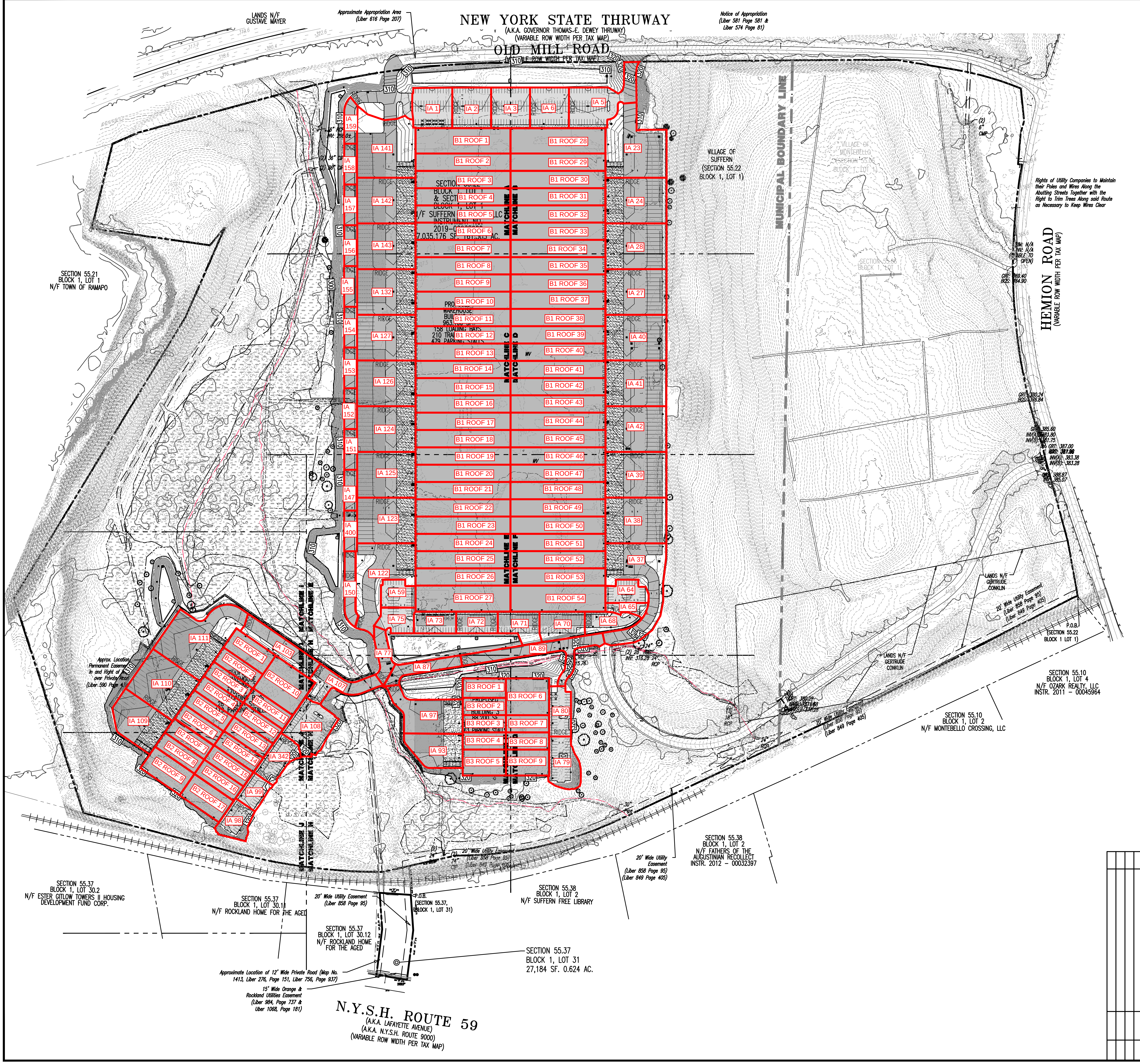
JOB No: 3709-99-004
DATE: 12/17/2021
DRAWN BY: CAM
SCALE: (H) 1"=150' (V)
DESIGNED BY: JMS
CHECKED BY: JMS
CHECKED BY: _
SHEET No: 2 OF 13
Rev. # 2

JOHN A. PALUS
PROFESSIONAL ENGINEER
NEW YORK LICENSE No. 087502

JOSHUA M. SEWALD
PROFESSIONAL ENGINEER
NEW YORK LICENSE No. 097639

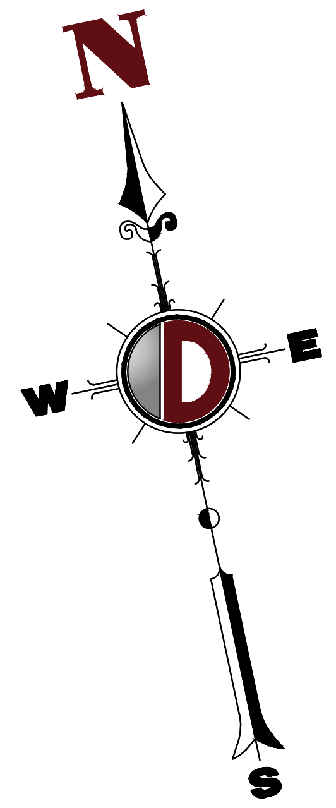
811 Know what's below. Call before you dig.
PROTECT YOURSELF
ALL STATES REQUIRE NOTIFICATION OF EXCAVATORS, DESIGNERS, OR ANY PERSON PREPARING TO DISTURB THE EARTH'S SURFACE ANYWHERE IN ANY STATE
FOR STATE SPECIFIC DIRECT PHONE NUMBERS VISIT: WWW.CALL811.COM

Plotted: 01/12/23 - 8:42 AM, By: areyes, - Product Ver: 24.2s (LMS Tech)
File: P:\DECPC PROJECTS\3709 Brookfield Properties\99-004 Suffern NY\Dwg\Site Plans\D370999004SC2.dwg, ---> 38 OVERALL DRAINAGE PLAN



PAVEMENT LEGEND

░	PROPOSED LIGHT DUTY PAVEMENT
▒	PROPOSED HEAVY DUTY PAVEMENT
⁘	PROPOSED STANDARD CONCRETE
⁙	PROPOSED HEAVY DUTY CONCRETE



GRADING/UTILITY GRAPHIC LEGEND

PROPERTY LINE (PARCEL IN QUESTION)
OFF-SITE PROPERTY LINES

— C — C —	EXIST. CABLE LINE	—— C ——	PROP. CABLE LINE
— E — E —	EXIST. ELECTRIC LINE	—— E —— E ——	PROP. ELECTRIC LINE
— FO — FO —	EXIST. FIBER OPTIC LINE	—— FO ——	PROP. FIBER OPTIC LINE
— G — G —	EXIST. GAS LINE	—— G —— G ——	PROP. GAS LINE
— OH — OH —	EXIST. OVERHEAD WIRES	—— OH ——	PROP. OVERHEAD WIRES
— T — T —	EXIST. TELEPHONE LINE	—— T —— T ——	PROP. TELEPHONE LINE
— UGET — UGET —	EXIST. UNDERGROUND ELEC./TELE. SERVICE (NO. & SIZE OF CONDUITS NOT DEFINED)	—— UGET ——	PROP. UNDERGROUND ELEC./TELE. SERVICE (NO. & SIZE OF CONDUITS NOT DEFINED)
— W — W —	EXIST. WATER LINE	—— W ——	PROP. WATER LINE
— S — S — OR ═	EXIST. SANITARY SEWER LINE	—— S —— S —— OR ═	PROP. SANITARY SEWER LINE
═ ═ ═	EXIST. STORM DRAIN LINE	═══	PROP. STORM DRAIN LINE
— 17 —	EXIST. MINOR CONTOUR & ELEVATION	—— XX ——	PROP. FINISH GRADE CONTOUR & ELEVATION
— 10 —	EXIST. MAJOR CONTOUR & ELEVATION		
MW	EXIST. MONITORING WELL		
TP-#	APPROX. TEST PIT LOCATION		
× 8.9	EXIST. SPOT ELEVATIONS	G: 000.00	PROP. GRADE SPOT ELEV.
× G: 8.90	EXIST. GUTTER ELEV.	TC: 000.00 G: 000.00	PROP. TOP OF CURB & FINISHED GRADE ELEV.
× TC: 8.90	EXIST. TOP OF CURB ELEV.	FF: 000.00	PROP. FINISHED FLOOR ELEV.
× FF: 8.90	EXIST. FINISH FLOOR ELEV.	TW: 000.00 GL: 000.00	PROP. TOP OF WALL & FINISHED GRADE @ LOW SIDE OF WALL (ACTUAL BOTTOM OF WALL FOOTING TO BE ESTABLISHED BY WALL DESIGNER)
× GF: 8.90	EXIST. GARAGE FLOOR ELEV.	TC: 000.00 GH: 000.00 GL: 000.00	PROP. TOP OF EXTENDED CURB, (GH) FINISHED GRADE @ HIGH SIDE OF EXTENDED CURB & (GL) FINISHED GRADE @ LOW SIDE OF EXTENDED CURB
	EXIST. FIRE HYDRANT		PROP. DIRECTION OF DRAINAGE FLOW ARROW
WV	EXIST. WATER VALVE	WV	PROP. WATER VALVE
GV	EXIST. GAS VALVE	GV	PROP. GAS VALVE
GM	EXIST. GAS METER		PROP. STORM CLEANOUT
EM	EXIST. ELECTRIC METER		PROP. SANITARY CLEANOUT
Elbox	EXIST. ELECTRIC BOX		PROP. AREA LIGHT
C/O	EXIST. CLEAN OUT		PROP. OUTLET CONTROL STRUCTURE
W	EXIST. WELL	D	PROP. DRAINAGE MANHOLE
WSO	EXIST. WATER SHUT OFF VALVE	S	PROP. SANITARY SEWER MANHOLE
TEL	EXIST. TELEPHONE BOX		PROP. 'A' INLET
CATV	EXIST. CABLE TV BOX		PROP. 'B' INLET
	EXIST. UTILITY POLE		PROP. 'E' INLET
	EXIST. GUY WIRE		PROP. YARD INLET
	EXIST. LIGHT POLE		PROP. FLARED END SECTION
	EXIST. BUILDING LIGHT		PROP. HEADWALL
	EXIST. SHOE BOX LIGHT		
	EXIST. COBRA LIGHT POLE		
	EXIST. TRAFFIC SIGNAL POLE		
	EXIST. MANHOLE		
	EXIST. "A" INLET		
	EXIST. "B" INLET		
	EXIST. "E" INLET		
	EXIST. YARD INLET		
	EXIST. FLARED END SECTION		
	EXIST. HEADWALL		

SEE SHEET 03 OF 100 FOR GRADING PLAN NOTES

GRAPHIC SCALE

–150 0 75 150 300 600

(IN FEET)
1 INCH = 150 FT.

THIS PLAN SET IS FOR PERMITTING PURPOSES ONLY AND MAY NOT BE USED FOR CONSTRUCTION

Rev.	Date	Comments	By
2	09/01/22	REV. PER TOWNSHIP AND COUNTY COMMENTS	ALPH
1	04/25/22	REV. PER CLIENT AND COUNTY COMMENTS	CAM

DYNAMIC ENGINEERING
LAND DEVELOPMENT CONSULTING • PERMITTING • GEOTECHNICAL • ENVIRONMENTAL • SURVEY • PLANNING & ZONING
1904 Main Street
Lake Como, NJ 07719
T: 732.974.0198
F: 732.974.3521
www.dynamicec.com
Offices conveniently located in:
Lake Como, New Jersey T: 732.974.0198 | Chester, New Jersey T: 908.879.9229 | Newark, New Jersey T: 973.755.7200 | Toms River, New Jersey T: 732.678.0000
Allen, Texas T: 972.534.2100 | Austin, Texas T:512.646.2646 | Houston, Texas T: 281.789.6400 | Delray Beach, Florida T: 561.921.8570
Newtown, Pennsylvania T: 267.685.0276 | Philadelphia, Pennsylvania T: 215.253.4888 | Bethlehem, Pennsylvania T: 610.598.4400

TITLE:
OVERALL GRADING PLAN

PROJECT: **IV2 ROCKLAND LOGISTICS, LLC**
PROPOSED INDUSTRIAL PARK AT 25 OLD MILL ROAD
SECTION 55.22 BLOCK 1, LOT 1; SECTION 55.37, BLOCK 1, LOT 31
OLD MILL ROAD AND HEMION ROAD (CR 93)
VILLAGE OF SUFFERN, ROCKLAND COUNTY, NEW YORK

JOB No: 3709-99-004
DATE: 12/17/2021
DRAWN BY: CAM
DESIGNED BY: JMS
CHECKED BY: JMS
CHECKED BY: –
SCALE: (H) 1"=150'
(V) .
SHEET No: 3
OF 3
Rev. # 2

JOHN A. PALUS
PROFESSIONAL ENGINEER
NEW YORK LICENSE No. 087502

JOSHUA M. SEWALD
PROFESSIONAL ENGINEER
NEW YORK LICENSE No. 097639

811 Know what's below. Call before you dig.
PROTECT YOURSELF
ALL STATES REQUIRE NOTIFICATION OF EXCAVATORS, DESIGNERS, OR ANY PERSON PREPARING TO DISTURB THE EARTH'S SURFACE ANYWHERE IN ANY STATE
FOR STATE SPECIFIC DIRECT PHONE NUMBERS VISIT: WWW.CALL811.COM

Plotted: 01/12/23 – 8:38 AM, By: areyes, – Product Ver: 24.2s (LMS Tech)
File: P:\DECPC PROJECTS\3709 Brookfield Properties\99-004 Suffern NY\Dwg\Site Plans\D370999004SXG.dwg, ---> 27 OVERALL GRADING PLAN

PRELIMINARY AND FINAL MAJOR SITE PLANS (ATTACHED SEPARATELY)