SITE PLAN & SUBDIVISION FOR
1251 KINGS HIGHWAY, LLC

TOWN OF CHESTER
ORANGE COUNTY, NEW YORK

STORMWATER POLLUTION
PREVENTION PLAN NARRATIVE

PREPARED FOR:

-1251 KINGS HIGHWAY, LLC
-N.Y.S. DEPARTMENT OF ENVIRONMENTAL CONSERVATION
-THE TOWN OF CHESTER

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1. INTRODUCTION

1.1. Project Description

The site is located near the intersection of Kings Highway and Bellvale Road in the Town of Chester, Orange County, New York. The tax map designation for the parcel is Section 17, Block 1, Lot 99.221. The general land use in the nearby vicinity of the project site is the IP Zoning District, with the AR-3 and SR1 zones also located nearby.

The portion of the site that is proposed for development is characterized by a southeasterly sloping topography that descends from the northern portion of the site. Topography on the site reflects the local surrounding topography. The site was previously used as farm operation for the production of corn.

The soils on the property were identified using the soil classifications of the USDA Soil Conservation Service (SCS), Soil Survey of Orange County, New York and the USGS Soil Survey Database. The site soils consist primarily of the Mardin (MdB) series and the Erie (ErB) series. The Mardin soils consist of moderately well-drained to excessively well drained soils, while Erie soils consist of somewhat poorly drained to very poorly drained soils. The approximate soil boundaries and types are shown on the attached Pre & Post Development Drainage Analysis Maps.

The current proposed project will consist of two separate warehouse units on lot 2 and lot 3 that that are 40,000 SF each. Lot 1 will contain the existing dwelling with no other improvements proposed on this lot. There is an access driveway proposed for each warehouse, with two driveway cuts proposed on Kings Highway and one on Bellvale Road. The warehouse will contain parking, sidewalks, drainage facilities, a drilled well and a subsurface sewage disposal system. The proposed development will disturb more than one acre of soil. Under the requirements of the current SPDES General Permit for Stormwater Discharges from Construction Activity NYS GP-0-15-002, a Stormwater Pollution Prevention Plan (SWPPP) is required.

1.2. Existing Drainage Patterns

Generally, the pre-development site conditions are best described as a mixture of open woods, grass, corn fields, NYSDEC wetlands and impervious surface associated with the existing structures and pavement.

There are two major watersheds within the existing site. The pre-development runoff for Watershed #1 & #2 drains to the NYSDEC wetland located in the southern portion of the property. Runoff collects into a NYSDEC regulated wetland and ultimately leaves the site at the locations noted as Stormwater Design Point 1 & 2 (DP1 & DP2) shown on the attached Pre Development Stormwater Analysis Map.

1.3. Proposed Drainage Patterns

The pre development watershed boundaries are very similar to the post development condition. The proposed warehouse buildings and associated improvements discussed above are located within Watershed #1 & 2. The addition of the impervious surface increases post-developed runoff and pollutants in this watershed. To simplify the analysis for treatment and attenuation of post development stormwater flows, Watershed 1 & 2 was divided into Sub-Watersheds 1A & 1B as well as 2A & 2B, both of which drain into the NYSDEC regulated wetland.

2. STORMWATER MANAGEMENT

2.1. General

In general, increased imperviousness can change the volume and rate of runoff as well as the amount of suspended or dissolved substances entering local streams. In some cases, a change in the amount of impervious surfaces can change the distribution of water in a given area, affecting local water bodies, wetlands and associated fauna and flora. The project design includes measures to reduce the level of runoff and pollutants in post-development runoff in compliance with New York State DEC requirements. This will be achieved by the installation of infiltration facilities and a Bayfilter™ combined with a stormwater basin.

2.2. Stormwater Quantity

The drainage report has been prepared to analyze the impact of stormwater runoff at the major discharge points (DP1 & DP2) on the property. The impact of the proposed development on existing drainage patterns was evaluated for both the pre and post development conditions.

Information and data to prepare this report was obtained from the following sources:

- Topographic, Boundary and Planimetric information from Stephen P. Dolson, NYS L.S.
- Site Plan & Subdivision for 1251 Kings Highway, LLC as prepared by Arden Consulting Engineers, PLLC.
- The site soil information from Orange County Soil Conservation Service & USGS.
- Site evaluations as carried out by personnel from Arden Consulting Engineers, PLLC.

The TR-55 method was used to determine the pre-development and post-development runoff rates at the design points (DP1 & DP2) identified on the property, which is illustrated on the attached drawings entitled Pre Development Stormwater Analysis and Post Development

Stormwater Analysis.

Drainage summaries have been shown on Table 1 & 2, which outline the runoff volume from the 10 and 100 year storm events in the pre-development and post-development conditions, using a Type III storm distribution. The 24 hour rainfall values used for each storm occurrence were taken from the NYSDEC Stormwater Design Manual as listed below:

10 year storm = 5.0 in

100 year storm = 8.5 in

Details of the proposed stormwater facilities have been included on Pre & Post Development Drainage Analysis Maps and the project drawings. The Pre and Post Development Analysis Maps have been prepared to illustrate existing drainage areas and their configuration following construction on the site.

It is the overall goal of the SWPPP to provide for proper drainage control on a quality and quantity basis. The plan has been prepared so there will be no negative effect on downstream properties.

The hydrologic characteristics of the pre-development site conditions were modeled using HydroCad computer software. The model analyzes watershed conditions and provides hydrograph generation and routing based on the Natural Resources Conservation Service (NRCS) Technical Release 55 (TR-55) procedures. These procedures take into account the land cover and use on site, the underlying soils, the general topography and local rainfall distribution to model stormwater runoff volumes and flow rates resulting from the site.

Table 1 below summarizes the pre-development HydroCad modeling results for the design point (DP1) where runoff leaves the site.

Table 1

Pre-development Runoff to DP1 & DP2

Storm Frequency	DP1 (cfs)	DP2 (cfs)
10 year	45.10	61.87
100 year	92.16	118.12

2.3. Increase in Stormwater Runoff Rates

The post-development HydroCad modeling results for runoff from the site at the point where runoff reaches Stormwater Design Point 2 (DP2) are shown in Table 2 below.

Table 2 Post-development Runoff to DP1 & DP2		
Storm Frequency	DP1 (cfs)	DP2 (cfs)
10 year	40.90	61.84
100 year	91.43	109.68

Table 3 below compares the pre- and post-development runoff calculations.

Table 3 Pre- vs. Post-Development Runoff to DP1 & DP2 (cfs)				
Storm Frequency	DP1 Runoff (Pre)	DP1 Runoff (Post)	DP2 Runoff (Pre)	DP2 Runoff (Post)
10 year	45.10	40.90	61.87	61.84
100 year	92.16	91.43	118.12	109.68

The post-development rates of runoff are less than the existing condition. This requirement meets the standards of the SPDES General Permit for Stormwater Discharges.

3. STORMWATER QUALITY

3.1. Impervious Surfaces

The impervious cover used in this analysis represents the land use as described and shown on the project plans. The supporting calculations for the sizing of the permanent features are presented at the end of this report in Appendix B.

The New York State DEC requires the use of "Unified Stormwater Sizing Criteria" to ensure that water quality, channel erosion reduction, overbank flood protection and safe conveyance of extreme storms is achieved (New York State Stormwater Management Design Manual, January 2015). Water quality volume criteria is based on the following formula:

$$WQv = [(P)(Rv)(A)]/12$$

where:

WQv = water quality volume (in acre-feet)
P = 90% rainfall event number (in inches)
Rv =0.05 + 0.009(I), where I is percent impervious cover, and
A =site area in acres

Using this formula for calculating water quality volumes, the following required water quality volumes (WQv) were calculated for the watershed. Suitable area and storage volume are provided in the proposed stormwater facilities to meet water quality goals as defined by the

New York State DEC.

Runoff Reduction Volume (RRv) is the reduction of the total WQv by application of green infrastructure techniques and SMPs to replicate pre-development hydrology. The calculations for the RRv can be found in Appendix B. Without the use of stormwater quality management practices, the proposed expansion would result in an increase in the loadings of various chemical constituents to the receiving waters, potentially impairing the quality of those waters within Watershed #1 & #2. A summary has been provided below in Table 4.

TABLE 4
Water Quality Volume (WQv) & Runoff Reduction Volume (RRv) Summary

Watershed	WQv Needed (cf)	RRv Provided (cf)
1A	9,306	9,306
2A	10,120	10,120

An outdoor loading dock area is proposed within both watersheda which qualifies this area as a hot-spot location. The outdoor loading area in Watershed 1 will treat the WQv via the use of a sand filter. The outdoor loading area in Watershed 2 will treat the WQv via the use of an ADS Bayfilter Unit for which supporting calculations can be found in Appendix B. The Bayfilter will discharge into a stormwater basin to provide attenuation of post development stormwater flows. If RRv can be treated elsewhere on the site, then the hotspot area can go directly to a stormwater basin or any other non-infiltration practice. It is proposed to provide RRv for Watershed 2 by the Conservation of Natural Resources practice that consists of the protection of the NYSDEC Wetland and associated buffer.

Runoff from impervious surfaces related to roadways and parking lots poses a potential increase in road and vehicle-related contaminants in the stormwater diverted to treatment facilities. These include hydrocarbons derived primarily from crankcase oil drippings and uncombusted exhaust hydrocarbons. Furthermore, roadway runoff contains detectable levels of heavy and trace metal contaminants such as lead, zinc, copper, chromium and nickel. These types of potential impacts require appropriate mitigation measures to limit impacts to existing water quality.

Stormwater runoff will ultimately discharge as shown on the Post Development Stormwater Analysis Map. The facilities were designed to attenuate and bypass the 10 and 100 year rain event.

3.2. Sources of Pollutants

The New York State DEC lists several potential pollutants and their sources to be considered during site design. Nutrients, sediment, bacteria and various other components can potentially contribute to the reduction of water quality and impacts to downstream receiving waters and habitat for water dependent species.

Many of these constituents, i.e., nitrogen, phosphorus, bacteria and others, are expected to be accounted for in the capture and treatment of the water quality volume. The DEC guidelines have established that if the water quality volume from impervious surfaces is treated, the water quality goals of the State are met. A primary source of nutrients, i.e., the use of fertilizers, is discussed below.

Sediments are typically associated with runoff from unstabilized sites or are the result of erosion in watercourses that cannot handle the velocity of stormwater flows. They can also result from the sanding of impervious surfaces during winter storm events. Unstabilized sediments can be transported via storm flows to receiving wetlands and watercourses, altering the soil-water-air interface in wetlands and burying established vegetation. The current proposal will a sedimentation basin and an infiltration basin that will encourage infiltration of flows carrying unstabilized sediments.

Thermal impacts, i.e., the increase in water temperature caused by the process of water running off of parking lots, roofs and other impervious surfaces that are heated by the sun, are of greatest concern in areas where a site is directly tributary to a Class B creek. There are no Class B creeks near the site from which runoff from these watersheds will drain into. Furthermore, the majority of the site runoff will be treated by means of infiltration. Based on this information, no special consideration was given to moderating the temperature of stormwater leaving the site.

3.3. Use of Fertilizers and Pesticides

The applicant proposes the use of a variety of construction and maintenance techniques reflecting best management practices in order to limit impacts of stormwater runoff. No fertilizers containing phosphorous will be utilized in order to limit pollutants from the project to the maximum extent possible. Use of an infiltration trench with a sediment basin will serve to remove pollutants and attenuate stormwater runoff.

Phosphorus from fertilizer runs off lawns via stormwater and can enter surface waters and ground water, both of which can reach other water bodies. Using phosphorus-free lawn fertilizers is one step that will be taken to protect water quality. The project sponsor therefore proposes that any fertilizers used during construction will be phosphorus-free.

These combined systems have been designed to treat the NYSDEC water quality volume, and control peak flow runoff rates from the 10- and 100-year storm events.

4. PERFORMANCE CRITERIA

The following paragraphs and bullets describe the required performance criteria that have been met for the proposed Stormwater Management Practices (SMP's) as set forth in Chapter 6 of the NYSDEC Stormwater Design Manual (January 2015).

4.1. Stormwater Wet Pond (P2)

4.1.1. Feasibility

Required Elements

- Stormwater ponds shall not be located within jurisdictional waters, including wetlands.
- Evaluate the site to determine the Hazard Class, and to determine what design elements are required to ensure dam safety (see Guidelines for Design of Dams). For the most recent copy of this document, contact the New York State Department of Environmental Conservation, Dam Safety Division, at: 518-402-8151.
- Avoid direction of hotspot runoff to design P-5.
- Provide a 2' minimum separation between the pond bottom and groundwater in sole source aquifer recharge areas.

Design Guidance

- Designs P-2, P-3, and P-4 should have a minimum contributing drainage area of 25 acres. A 10-acre drainage is suggested for design P-1.
- The use of stormwater ponds (with the exception of design P-1, Micropool Extended Detention Pond) on trout waters is strongly discouraged, as available evidence suggests that these practices can increase stream temperatures.
- Avoid location of pond designs within the stream channel, to prevent habitat degradation caused bythese structures.
- A maximum drainage area of five acres is suggested for design P-5.

4.1.2. Conveyance

Inlet Protection

Required Elements

- A forebay shall be provided at each pond inflow point, unless an inflow point provides less than 10%of the total design storm flow to the pond.

Design Guidance

- Inlet areas should be stabilized to ensure that non-erosive conditions exist for at least the 2-year frequency storm event.
- Except in cold regions of the State, the ideal inlet configuration is a partially submerged (i.e., ½ full) pipe.

4.1.3. Adequate Outfall Protection

Required Elements

- The channel immediately below a pond outfall shall be modified to prevent erosion and conform to natural dimensions in the shortest possible distance, typically by use of appropriately-sized rip-rap placed over filter cloth. Typical examples include submerged earthen berms, concrete weirs, and gabion baskets.
- A stilling basin or outlet protection shall be used to reduce flow velocities from the principal spillway to non-erosive velocities (3.5 to 5.0 fps). (See Appendix L for a table of erosive velocities for grass and soil).

Design Guidance

- Outfalls should be constructed such that they do not increase erosion or have undue influence on the downstream geomorphology of the stream.
- Flared pipe sections that discharge at or near the stream invert or into a step-pool arrangement should be used at the spillway outlet.
- If a pond daylights to a channel with dry weather flow, care should be taken to minimize tree clearing along the downstream channel, and to reestablish a forested riparian zone in the shortest possible distance. Excessive use of riprap should be avoided to reduce stream warming.

Pond Liners

Design Guidance

- When a pond is located in gravelly sands or fractured bedrock, a liner may be needed to sustain a permanent pool of water. If geotechnical tests confirm the need for a liner, acceptable options include: (a) six to 12 inches of clay soil (minimum 50% passing the #200 sieve and a maximum permeability of 1 x 10-5 cm/sec), (b) a 30 mm poly-liner (c) bentonite, (d) use of chemical additives (*see NRCS Agricultural Handbook No. 386*, dated 1961, or *Engineering Field Manual*) or (e) a design prepared by a Professional Engineer registered in the State of New York.

4.1.4. Pretreatment

Required Elements

- A sediment forebay is important for maintenance and longevity of a stormwater treatment pond. Each pond shall have a sediment forebay or equivalent upstream pretreatment. The forebay shall consist of a separate cell, formed by an acceptable barrier. Typical examples include earthen berms, concrete weirs, and gabion baskets.
- The forebay shall be sized to contain 10% of the water quality volume (WQv), and shall be four to six feet deep. The forebay storage volume counts toward the total WQv requirement.
- The forebay shall be designed with non-erosive outlet conditions, given design exit velocities.
- Direct access for appropriate maintenance equipment shall be provided to the forebay.
- In sole source aquifers, 100% of the WQv for stormwater runoff from designated hotspots shall be provided in pretreatment.

Design Guidance

- A fixed vertical sediment depth marker should be installed in the forebay to measure sediment deposition over time.
- The bottom of the forebay may be hardened to ease sediment removal.

4.1.5. Treatment

Minimum Water Quality Volume (WQv)

Required Elements

Provide water quality treatment storage to capture the computed WQv from the contributing drainage area through a combination of permanent pool, extended detention (WQv-ED) and marsh. A wet pond provides 100% of Water Quality Volume in the Permanent Pool.

- Although both CPv and WQv-ED storage can be provided in the same practice, WQv cannot be met by simply providing Cpv storage for the one-year storm.

Design Guidance

- It is generally desirable to provide water quality treatment off-line when topography, hydraulic head and space permit (i.e., apart from stormwater quantity storage; see Appendix K for a schematic).
- Water quality storage can be provided in multiple cells. Performance is enhanced when multiple treatment pathways are provided by using multiple cells, longer flowpaths, high surface area to volume ratios, complex microtopography, and/or redundant treatment methods (combinations of pool, ED, and marsh).

Minimum Pond Geometry

Required Elements

- The minimum length to width ratio for the pond is 1.5:1 (i.e., length relative to width).
- Provide a minimum Surface Area :Drainage Area of 1:100.

Design Guidance

- To the greatest extent possible, maintain a long flow path through the system, and design ponds with irregular shapes.

4.1.6. Landscaping

Pond Benches

Required Elements

- The perimeter of all deep pool areas (four feet or greater in depth) shall be surrounded by two benches:

- Except when pond side slopes are 4:1 (h:v) or flatter, provide a safety bench that generally extends 15 feet outward (10’ to 12’ allowable on sites with extreme space limitations) from the normal water edge to the toe of the pond side slope. The maximum slope of the safety bench shall be 6%.

- Incorporate an aquatic bench that generally extends up to 15 feet inward from the normal shoreline, has an irregular configuration, and a maximum depth of 18 inches below the normal pool water surface elevation. The slope proceeding from the aquatic bench to the pond basin floor *shall* not exceed 2:1 (h:v).

Landscaping Plan

Required Elements

- A landscaping plan for a stormwater pond and its buffer shall be prepared to indicate how aquatic and terrestrial areas will be vegetatively stabilized and established.
- Aquatic vegetation must be established in the aquatic and safety benches before the Pond is rendered inservice.

Design Guidance

- Wherever possible, wetland plants should be encouraged in a pond design, either along the aquatic bench (fringe wetlands), the safety bench and side slopes (ED wetlands) or within shallow areas of the pool itself.
- The best elevations for establishing wetland plants, either through transplantation or volunteer colonization, are within six inches (plus or minus) of the normal pool.
- The soils of a pond buffer are often severely compacted during the construction process to ensurestability. The density of these compacted soils is so great that it effectively prevents root penetration, and therefore, may lead to premature mortality or loss of vigor. Consequently, it is advisable to excavate large and deep holes around the proposed planting sites, and backfill these with uncompacted topsoil.

    - As a rule of thumb, planting holes should be three times deeper and wider than the diameter of the rootball (of balled and burlap stock), and five times deeper and wider for container grown stock. This practice should enable the stock to develop unconfined root systems. Avoid species that require full shade, are susceptible to winterkill, or are prone to wind damage. Extra mulching around the base of the tree or shrub is strongly recommended as a means of conserving moisture and suppressing weeds.

Pond Buffers and Setbacks

Required Elements

- A pond buffer shall be provided that extends 25 feet outward from the maximum water surface elevation of the pond. The pond buffer shall be contiguous with other buffer areas that are required by existing regulations (e.g., stream buffers). An additional setback may be provided to permanent structures.
- Woody vegetation may not be planted or allowed to grow within 15 feet of the toe of the embankment and 25 feet from the principal spillway structure.

Design Guidance

- Existing trees should be preserved in the buffer area during construction. It is desirable to locate forest conservation areas adjacent to ponds. To help discourage resident geese populations, the buffer can be planted with trees, shrubs and native ground covers.
- Annual mowing of the pond buffer is only required along maintenance rights-of-way and the embankment. The remaining buffer can be managed as a meadow (mowing every other year) or forest.

4.1.7. Maintenance

Required Elements

- Maintenance responsibility for a pond and its buffer shall be vested with a responsible authority by means of a legally binding and enforceable maintenance agreement that is executed as a condition of plan approval.
- The principal spillway shall be equipped with a removable trash rack, and generally accessible from dry land.
- Sediment removal in the forebay shall occur every five to six years or after 50% of total forebay capacity has been lost.
- All required safety elements must be inspected and maintained on an annual basis, unless prior inspections indicate more frequent maintenance is required.
- All required maintenance elements must be included in a comprehensive operation and maintenance plan.

Design Guidance

- Sediments excavated from stormwater ponds that do not receive runoff from designated hotspots are generally not considered toxic or hazardous material, and can be safely disposed by either land application or land filling. Sediment testing may be required prior to sediment disposal when a hotspot land use is present (see Section 4.8 for a list of potential hotspots).
- Sediment removed from stormwater ponds should be disposed of according to an approved comprehensive operation and maintenance plan.

Maintenance Access

Required Elements

- A maintenance right of way or easement shall extend to the pond from a public or private road.

Design Guidance

- Maintenance access should be at least 12 feet wide, have a maximum slope of no more than 15%, and be appropriately stabilized to withstand maintenance equipment and vehicles.
- The maintenance access should extend to the forebay, safety bench, riser, and outlet and be designed to allow vehicles to turn around.

Non-clogging Low Flow Orifice

Required Elements

- A low flow orifice shall be provided, with the size for the orifice sufficient to ensure that no clogging shall occur. (See Appendix K for details of a low flow orifice and trash rack options).

Design Guidance

- The low flow orifice should be adequately protected from clogging by either an acceptable external trash rack (recommended minimum orifice of 3") or by internal

orifice protection that may allow for smaller diameters (recommended minimum orifice of 1").

- The preferred method is a submerged reverse-slope pipe that extends downward from the riser to an inflow point one foot below the normal pool elevation.
- Alternative methods are to employ a broad crested rectangular, V-notch, or proportional weir, protected by a half-round CMP that extends at least 12 inches below the normal pool.

  The use of horizontally extended perforated pipe protected by geotextile fabric and gravel is not recommended. Vertical pipes may be used as an alternative if a permanent pool is present.

Riser in Embankment

Required Elements

- The riser shall be located within the embankment for maintenance access, safety and aesthetics.

Design Guidance

• Access to the riser should be provided by lockable manhole covers, and manhole steps within easy reachof valves and other controls. The principal spillway opening should be "fenced" with pipe or rebar at 8-inch intervals (for safety purposes).

Pond Drain

Required Elements

- Except where local slopes prohibit this design, each pond shall have a drain pipe that can completely or partially drain the pond. The drain pipe shall have an elbow or protected intake within the pond to prevent sediment deposition, and a diameter capable of draining the pond within 24 hours.

Design Guidance

- Care should be exercised during pond drawdowns to prevent rapid drawdown and minimize downstream discharge of sediments or anoxic water. The approving jurisdiction should be notified before draining a pond.

Adjustable Gate Valve

Required Elements

- Both the WQv-ED outlet and the pond drain shall be equipped with an adjustable gate valve (typically a handwheel activated knife gate valve). A gate valve is not required if the WQv is discharged through a weir.
- Valves shall be located inside of the riser at a point where they (a) will not normally be inundated and (b) can be operated in a safe manner.

Design Guidance

- Both the WQv-ED pipe and the pond drain should be sized one pipe size greater than the calculated design diameter.
- To prevent vandalism, the handwheel should be chained to a ringbolt, manhole step or other fixed object.

Safety Features

Required Elements

- Side slopes to the pond shall not exceed 3:1 (h:v), and shall terminate at a safety bench.
- Side slope proceeding from aquatic bench to pond basin floor shall not exceed 2:1 (h:v).
- Both the safety bench and the aquatic bench must be landscaped to prevent access to the deep pool. The vegetation must be established before pond is rendered in-service.
- Warning signs must be posted prohibiting swimming, wading, and skating, warning of possible contamination or pollution of pond water, and indicating maximum depth of pond.
- The principal spillway opening shall not permit access by small children, and endwalls above pipe outfalls greater than 48 inches in diameter shall be fenced to prevent a hazard.
- When the pond slope requirements or any other required safety feature cannot be met perimeter fencing is required at or above the maximum water surface level provided that all required maintenance can still be performed.

5. EROSION & SEDIMENT CONTROL

5.1. General

During construction of the Project, extensive erosion and sediment control consisting of vegetative and structural measures will be implemented. These practices will be included in the final plans and will show the location and details of these controls. Among the techniques to be utilized are:

1. Staked haybales and silt fences around the downhill perimeter of the construction.
2. A stabilized construction entrance installed at the access point to the site.
3. Temporary seeding of all disturbed areas if they will remain bare for more than three weeks.
4. Permanent seeding and mulching as soon as possible after final grading.
5. Water spray for dust control.
6. The plans will indicate the proposed controls to be implemented during construction. However, adjustment of these controls may be required to accommodate localized field conditions.
7. Disturbed areas will be permanently stabilized by establishing a permanent vegetative cover. The exposed area will receive a minimum of 4 inch topsoil prior to seeding.

6. MAINTENANCE OF STORMWATER MANAGEMENT FACILITIES

6.1. General

The storm water management facilities shall be maintained by the Owner of the Project during and after construction. All storm water management facilities shall be routinely inspected and any necessary repairs made immediately in order to maintain all practices as designed. The Contractor and Owner shall utilize good housekeeping methods for all litter and debris that is generated during construction. This shall include for example, placing all wastes in a dumpster on a daily basis and emptying dumpsters on a regular basis. It is also recommended to store any chemicals that are utilized during construction in a safe place according to manufacturer's safety data sheets (MSDS).

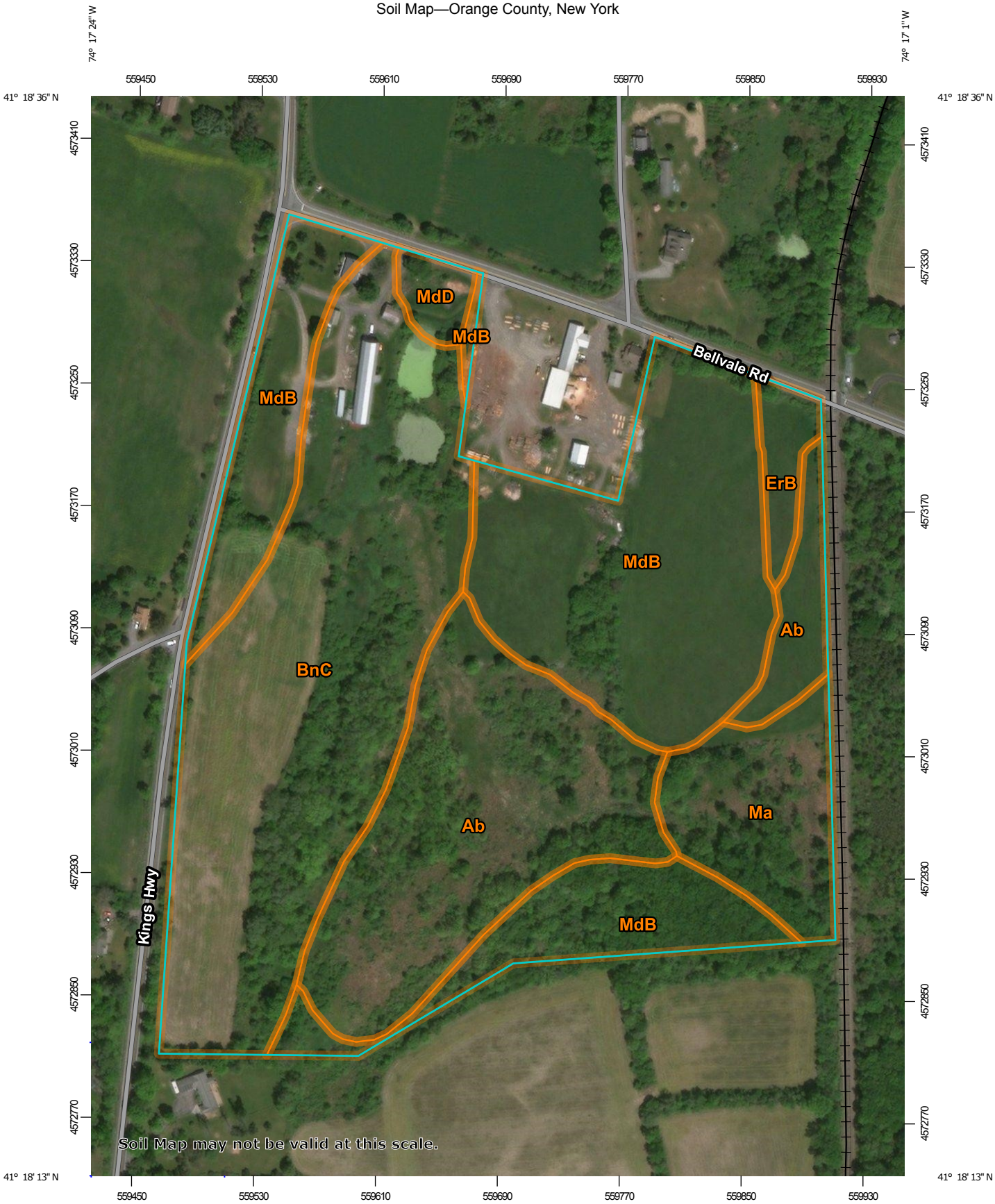
7. SUMMARY

7.1. General

Drainage from the proposed impervious surfaces will be collected primarily by the wet pond. The Soil Conservation Service TR-55 method has been utilized to evaluate the changes in stormwater runoff rates as a result of development of the site. The storm drainage system has been designed to collect and convey stormwater in a manner that would provide no increase in stormwater runoff rates downstream from the property. On-site retention, recharge and filtration via the use of infiltration facilities is necessary and has been provided to mitigate the increases in stormwater runoff rates and pollutants that would otherwise impact downstream conditions.

The proposed project has also been designed to minimize the extent of proposed grading and disturbance. The construction activity on the site will therefore not result in additional pollutant loadings and post development runoff to downstream water bodies. The proposed erosion and sediment practices will prevent the erosion and sediment deposits to downstream properties.

APPENDIX A



Map Scale: 1:3,440 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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 1:15,800.

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: Orange County, New York
Survey Area Data: Version 19, Sep 3, 2018

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

Date(s) aerial images were photographed: Oct 7, 2013—Feb 26, 2017

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
Ab	Alden silt loam	9.6	22.3%
BnC	Bath-Nassau channery silt loams, 8 to 15 percent slopes	14.3	33.2%
ErB	Erie gravelly silt loam, 3 to 8 percent slopes	0.9	2.0%
Ma	Madalin silt loam	3.2	7.5%
MdB	Mardin gravelly silt loam, 3 to 8 percent slopes	14.5	33.7%
MdD	Mardin gravelly silt loam, 15 to 25 percent slopes	0.6	1.4%
Totals for Area of Interest		**43.1**	**100.0%**

APPENDIX B

Version 1.8 Total Water Quality Volume Calculation

Last Updated: 11/09/2015 WQv(acre-feet) = [(P)(Rv)(A)] /12

Is this project subject to Chapter 10 of the NYS Design Manual (i.e. WQv is equal to post-development 1 year runoff volume)?.....	No

Design Point:	1A	
P=	1.30	*inch*

Manually enter P, Total Area and Impervious Cover.

Breakdown of Subcatchments						
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Description**
1	3.44	2.00	58%	0.57	9,306	
2						
3						
4						
5						
6						
7						
8						
9						
10						
Subtotal (1-30)	3.44	2.00	58%	0.57	**9,306**	**Subtotal 1**
Total	3.44	2.00	58%	0.57	**9,306**	**Initial WQv**

Identify Runoff Reduction Techniques By Area			
Technique	**Total Contributing Area** *(Acre)*	**Contributing Impervious Area** *(Acre)*	**Notes**
Conservation of Natural Areas	3.44	2.00	*minimum 10,000 sf*
Riparian Buffers	0.00	0.00	*maximum contributing length 75 feet to 150 feet*
Filter Strips	0.00	0.00	
Tree Planting	0.00	0.00	*Up to 100 sf directly connected impervious area may be subtracted per tree*
Total	**3.44**	**2.00**	

Recalculate WQv after application of Area Reduction Techniques					
	Total Area *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Runoff Coefficient Rv**	**WQv** *(ft^3)*
"<<Initial WQv"	3.44	2.00	58%	0.57	9,306
Subtract Area	-3.44	-2.00			
WQv adjusted after Area Reductions	**0.00**	**0.00**	0%	0.05	0
Disconnection of Rooftops		0.00			
Adjusted WQv after Area Reduction and Rooftop Disconnect	0.00	0.00	0%	0.05	**0**
WQv reduced by Area Reduction techniques					9,306

Conservation of Natural Areas

Design Point:	1A

Enter Site Data For Drainage Area to be Treated by Practice

Catchment Number	Total Area *(Acres)*	Impervious Area *(Acres)*	Percent Impervious *%*	Rv	WQv *(ft^3)*	Precipitation *(in)*	Description
1	3.44	2.00	0.58	0.57	9305.87	1.30	

Design Elements

Is Contiguous Area ≥ 10,000 ft2?	*Yes*
Will limits of disturbance be clearly shown on all construction drawings and marked in field/project development site with structural barriers?	*Yes*
Is the Conservation area located in an acceptable conservation easement instrument that ensures perpetual protection of proposed area?	*No*
Does the easement specify how the natural area vegetation will be managed and boundaries will be marked?	*No*
Does the conservation area receive runoff from other contributing areas?	*No*
Does Conservation Area drain to a Design Point?	*No*
Is Sheet Flow to Riparian Buffer or another area based practice already being Used for this area?	*No*

Are All Criteria in Section 5.3.1 Met?	*Yes*

Area Reduction Adjustments

Subtract	***3.44***	***Acres from Total Area***
Subtract	***2.00***	***Acres from Total Impervious Area***

Minimum RRv

Enter the Soils Data for the site		
Soil Group	Acres	S
A		55%
B		40%
C	2.70	30%
D	**0.74**	20%
Total Area	3.44	
Calculate the Minimum RRv		
S =	**0.28**	
Impervious =	2.00	*acre*
Precipitation	1.3	*in*
Rv	0.95	
Minimum RRv	**2,497**	***ft3***
	0.06	af

Version 1.8 Total Water Quality Volume Calculation

Last Updated: 11/09/2015 WQv(acre-feet) = [(P)(Rv)(A)] /12

Is this project subject to Chapter 10 of the NYS Design Manual (i.e. WQv is equal to post-development 1 year runoff volume)?.....	No

Design Point:	2A	
P=	1.30	*inch*

Manually enter P, Total Area and Impervious Cover.

Breakdown of Subcatchments

Catchment Number	Total Area *(Acres)*	Impervious Area *(Acres)*	Percent Impervious *%*	Rv	WQv *(ft^3)*	Description
1	3.65	2.18	60%	0.59	10,120	
2						
3						
4						
5						
6						
7						
8						
9						
10						
Subtotal (1-30)	3.65	2.18	60%	0.59	**10,120**	**Subtotal 1**
Total	3.65	2.18	60%	0.59	**10,120**	**Initial WQv**

Identify Runoff Reduction Techniques By Area

Technique	Total Contributing Area *(Acre)*	Contributing Impervious Area *(Acre)*	Notes
Conservation of Natural Areas	3.65	2.18	*minimum 10,000 sf*
Riparian Buffers	0.00	0.00	*maximum contributing length 75 feet to 150 feet*
Filter Strips	0.00	0.00	
Tree Planting	0.00	0.00	*Up to 100 sf directly connected impervious area may be subtracted per tree*
Total	**3.65**	**2.18**	

Recalculate WQv after application of Area Reduction Techniques

	Total Area *(Acres)*	Impervious Area *(Acres)*	Percent Impervious *%*	Runoff Coefficient Rv	WQv *(ft^3)*
"<<Initial WQv"	3.65	2.18	60%	0.59	10,120
Subtract Area	-3.65	-2.18			
WQv adjusted after Area Reductions	**0.00**	**0.00**	0%	0.05	0
Disconnection of Rooftops		0.00			
Adjusted WQv after Area Reduction and Rooftop Disconnect	0.00	0.00	0%	0.05	**0**
WQv reduced by Area Reduction techniques					10,120

Conservation of Natural Areas

Design Point:	2A

Enter Site Data For Drainage Area to be Treated by Practice						
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Precipitation** *(in)*
1	3.65	2.18	0.60	0.59	10119.90	1.30

Design Elements	
Is Contiguous Area ≥ 10,000 ft2?	*Yes*
Will limits of disturbance be clearly shown on all construction drawings and marked in field/project development site with structural barriers?	*Yes*
Is the Conservation area located in an acceptable conservation easement instrument that ensures perpetual protection of proposed area?	*No*
Does the easement specify how the natural area vegetation will be managed and boundaries will be marked?	*No*
Does the conservation area receive runoff from other contributing areas?	*No*
Does Conservation Area drain to a Design Point?	*No*
Is Sheet Flow to Riparian Buffer or another area based practice already being Used for this area?	*No*

Are All Criteria in Section 5.3.1 Met?	*Yes*

Area Reduction Adjustments		
Subtract	***3.65***	***Acres from Total Area***
Subtract	***2.18***	***Acres from Total Impervious Area***

Minimum RRv

Enter the Soils Data for the site		
Soil Group	Acres	S
A		55%
B		40%
C	2.45	30%
D	**1.20**	20%
Total Area	3.65	
Calculate the Minimum RRv		
S =	**0.27**	
Impervious =	2.18	*acre*
Precipitation	1.3	*in*
Rv	0.95	
Minimum RRv	**2,611**	***ft3***
	0.06	af

State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Bureau of Nonpoint Pollution Control
Division of Water Quality
Mail Code 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

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

BOB MARTIN
Commissioner

December 21, 2017

Daniel J. Figola, PE
General Manager
BaySaver Technologies, LLC
1030 Deer Hollow Drive
Mt. Airy, MD 21771

Re: MTD Laboratory Certification
BayFilter™ Enhanced Media Cartridge by BaySaver Technologies, LLC
Off-line Installation

TSS Removal Rate 80%

Dear Mr. Figola:

This revised certification letter supersedes the Department's prior certification dated January 10, 2017. The revision was completed to add another Enhanced Media Cartridge model (model 530) to the two previously certified EMC models, 545 and 545LP (now relabeled 522).

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). BaySaver Technologies, LLC has requested a Laboratory Certification for the BayFilter™ System.

This project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the afore-mentioned 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 for this device is published online at http://www.njcat.org/verification-process/technology-verification-database.html.

The NJDEP certifies the use of the BayFilter™ by BaySaver Technologies, LLC at a TSS removal rate of 80%, when designed, operated and maintained in accordance with the information provided in the Verification Appendix and subject to 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. The MTFR is calculated based on a verified loading rate of 0.5 gpm/sf of effective filtration treatment area for models 545 and 522, and 0.33 gpm/sq.ft. for model 530.

2. The BayFilter™ System shall be installed using the same configuration as the unit verified by NJCAT, and sized in accordance with the criteria specified in item 6 below.

3. This device 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 on-line at www.njstormwater.org.

5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the BayFilter™, which is attached to this document. However, it is recommended to review the maintenance website at http://www.baysaver.com/downloads/BayFilter-Technical-and-Design-Manual.pdf for any changes to the maintenance requirements.

6. Sizing Requirements:

   The example below demonstrates the sizing procedure for a BayFilter™ System.

   Example: A 0.25-acre impervious site is to be treated to 80% TSS removal using a BayFilter™ System. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs or 354.58 gpm.

   The selection of configuration for use in the BayFilter™ System is based upon both the MTFR and the maximum inflow drainage area. It is necessary to select the configuration using both methods and to rely on the method that results in the larger configuration determined by the two methods.

   Inflow Drainage Area Evaluation:

   The drainage area to the BayFilter™ System in this example is 0.25 acres. Based upon the information in Table 1 below, the following minimum configurations are required in a

BayFilter™ System to treat the impervious area without exceeding the maximum drainage area:

1. BayFilter™ 545 EMC: Configuration 4' manhole
2. BayFilter™ 530 EMC: Configuration 4' manhole
3. BayFilter™ 522 EMC: Configuration 4' by 6' vault

Maximum Treatment Flow Rate (MTFR) Evaluation:

The site runoff (Q) was determined 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=0.99x3.2x0.25=0.79 cfs=0.79x448.83 gpm=354.58 gpm

Based on a flow rate of 354.58 gpm, the following minimum configurations are required in a BayFilter™ System to treat the impervious area without exceeding the MTFR:

1. BayFilter™ 545 EMC: Configuration 8' by 10' vault
2. BayFilter™ 530 EMC: Configuration 8' by 12' vault
3. BayFilter™ 522 EMC: Configuration 8' by 16' vault

The MTFR Evaluation results will be used since that method results in the higher minimum configuration determined by the two methods.

The sizing table corresponding to the available system models are noted below. Additional specifications regarding each model can be found in the Verification Appendix under Table A-1 and Table A-2.

Table 1 BayFilter™ Models

Configuration	MTFR[1] (gpm)			Maximum Allowable Drainage Area[2] (acres)		
	545	530	522	545	530	522
4' manhole	45	30	22.5	0.44	0.44	0.22
4' by 6' vault	90	60	45	0.87	0.87	0.44
5' manhole	135	90	67.5	1.31	1.31	0.66
6' manhole	180	120	90	1.75	1.75	0.87
6' by 6' vault	180	120	90	1.75	1.75	0.87
7' manhole	225	150	112.5	2.18	2.18	1.09
8' manhole	315	210	157.5	3.06	3.06	1.53
8' by 10' vault	450	300	225	4.37	4.37	2.18

8' by 12' vault	585	390	292.5	5.68	5.68	2.84
8' by 14' vault	675	450	337.5	6.55	6.55	3.28
8' by 16' vault	810	540	405	7.86	7.86	3.93
10' by 16' vault	945	630	472.5	9.17	9.17	4.59
10' by 20' vault	1215	810	607.5	11.79	11.79	5.90

1. Based on 0.5 gpm/sq. ft. of effective filtration treatment area for 545 and 522. 0.33 gpm/sq.ft. for 530.
2. Based on the equation in the NJDEP Filter Protocol: Maximum Inflow Drainage Area (acres) = Weight of TSS before 10% loss in MTFR (lbs.)/600 lbs. per acre of drainage area annually.

Be advised a detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8. The plan must include all of the items identified in Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of 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 Shashi Nayak of my office at (609) 633-7021.

Sincerely,

James J. Murphy, Chief
Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan

cc: Chron File
Richard Magee, NJCAT
Vince Mazzei, NJDEP - DLUR
Ravi Patraju, NJDEP - BES
Gabriel Mahon, NJDEP - BNPC
Shashi Nayak, NJDEP – BNPC

BAYSAVER TECHNOLOGIES, INC.
Engineering Stormwater Solutions

BayFilter

Technical and Design Manual

www.BaySaver.com

BAYFILTER™ SYSTEM

Technical and Design Manual

© BaySaver Technologies, Inc.
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Chapter

1

Introduction

Founded in 1997, BaySaver Technologies, Inc. is a manufacturer of stormwater treatment technologies. BayFilter™ [1] is a stormwater filtration device designed to remove fine sediments, heavy metals, and phosphorus from stormwater runoff.

BayFilter™ relies on a spiral wound media filter cartridge with approximately 43 square feet of active filtration area. The filter cartridges are housed in a concrete structure that evenly distributes the flow between cartridges. System design is offline with an external bypass that routes high intensity storms away from the system to prevent sediment resuspension. Flow through the filter cartridges is gravity driven and self-regulating, which makes the BayFilter™ system a low maintenance, high performance stormwater treatment technology.

The BayFilter™ system has been extensively tested, and has consistently shown more than 80% removal of suspended sediment from influent water. The system also demonstrated the capability to remove more than 50% of the total phosphorus influent load, including a portion of the dissolved phosphorus.

This manual provides detailed technical information on the BayFilter™ system including its capabilities and limitations. The manual describes the steps involved in designing a BayFilter™ system as well as the installation and maintenance requirements of the system.

BaySaver Technologies is a complete stormwater solutions provider. We are always willing to assist design professionals to achieve the most efficient, economical systems for their clients and projects. Please call the BaySaver Technologies Inc. Engineering Department at 1.800.229.7283 for assistance.

[1] The BayFilter™ stormwater filtration system is protected by U.S. Patent #6869528, in addition to several pending patents.

Principles of Operation

The BayFilter™ system removes contaminants from stormwater runoff via media filtration. This Technical and Design Manual describes the principles by which the BayFilter™ system works to improve the quality of the environment throughout the United States.

Media Filtration

Media filtration has long been used in drinking water and wastewater treatment processes. This technology has proven effective at removing sediments, nutrients, heavy metals, and a wide variety of organic contaminants. The target pollutants, hydraulic retention time, filter media, pretreatment, and flow rate all affect the removal efficiency of the filter.

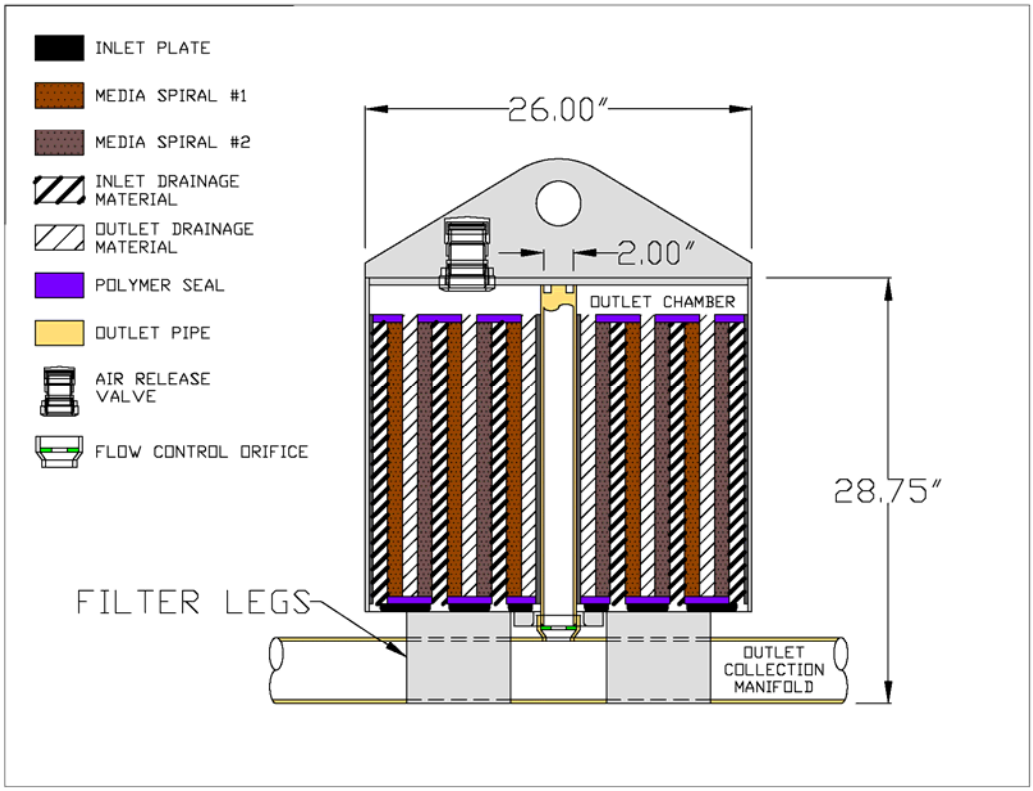
Mechanisms of Removal

The BayFilter™ removes pollutants from water by two mechanisms: 1) interception/attachment and 2) adsorption. Interception occurs when a pollutant becomes trapped within the filter media. A sediment particle, for example, may be carried into the filter media by the water and become stuck in the interstices of the media. Such a particle will typically remain trapped within the media until the media is removed or the filter is backwashed.

Attachment occurs when pollutants bind themselves to the surface of the filter media, and this happens primarily through adsorption. Adsorption is a surface process by which dissolved ions are removed from a solution and chemically bind themselves to the surface of the media. This occurs when the surface of the filter media particle contains sites that are chemically attractive to the dissolved ions. The BayFilter™ system uses a proprietary media containing activated alumina to enhance adsorption of anions such as phosphates.

The BayFilter™ Cartridge

The main building block of the BayFilter™ stormwater filtration system is the BayFilter™ cartridge (BFC), shown in Figure 1. The BFCs are housed in a structure which may be a vault, manhole or other structure. This structure contains the inlet and outlet pipes as well as an internal manifold that delivers treated water to the outlet of the BayFilter™ system.



Stormwater runoff enters the manhole or concrete structure via an inlet pipe and begins to fill the structure. When the water surface elevation in the vault/manhole reaches operating level, water flows through the BFC driven by a hydrostatic head. Within the BFC, the water flows through a proprietary filter media and drains via a vertical pipe. The vertical drain is connected to the under drain system which conveys filtered water to the outfall.

During a typical storm event, the BayFilter™ system has four cycles:

1. Vault fill and air release;

2. Uniform bed load hydrodynamic filtration;

3. Uniform bed load siphon filtration; and

4. Siphon break and hydrodynamic backwash.

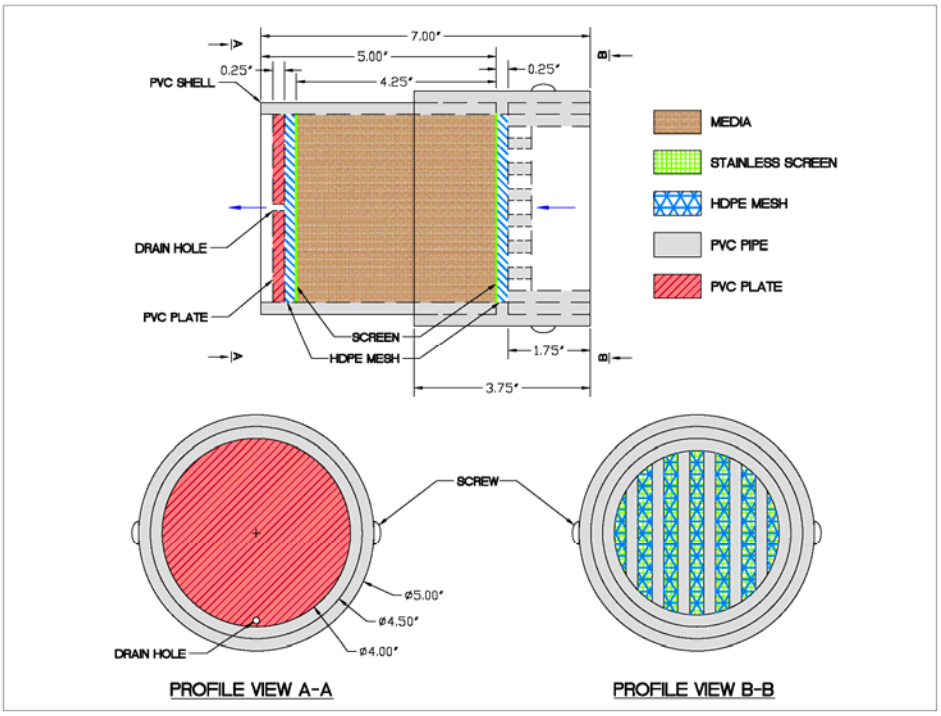


Figure 2: Drain Down Module

A detailed depiction of the BFC operating sequence is given in Appendix A.

The Drain Down Module

Each BayFilter™ Stormwater Treatment System will include a number of standard BFCs and at least one drain down module per BFC. The drain down module which has a flow capacity of 0.5 gpm, will allow the manhole/vault to empty after the siphon has broken and the standard BFCs are no longer operating. The drain down module prevents the system from retaining standing water between storm events, thereby reducing the chance of mosquitoes or other disease vectors breeding within the system and preventing the system from becoming anaerobic during dry periods. This cartridge also uses the same media as the BFC and has a removal efficiency in excess of 90 percent.

Performance Characteristics

The BayFilter™ has been extensively tested in the laboratory. This testing has been carried out using SIL-CO-SIL 106 as a sediment source. SIL-CO-SIL

106 is a silica product containing approximately 90% fine sediments (d_{50} = 23 microns), and is widely accepted as a sediment source for stormwater simulations by regulatory agencies such as the Washington State Department of Ecology (TAPE) program, New Jersey Department of Environmental Protection (TARP), as well as other leading agencies.

The BFC needs only 28" of depth of water to begin full flow operation. Once the full flow operation has been achieved, the BFC will operate to a depth of 6" at which time the siphon will break and the system will backwash. At this point the only flow is from the drain down cartridge which will drain the vault to a depth below 1".

Each BFC has a maximum nominal flow of 30 gpm. At this flow, each cartridge can treat 150 lbs of the total sediment load before maintenance. In addition, through the use of different size flow control orifice(s), the BFC flow is regulated. As the flow is lowered, the treated sediment load increases. For example, when the flow is lowered to 15 gpm, the cartridge is able to treat 300 lbs of the total sediment load before maintenance.

Chapter

2

Design Guidelines for the BayFilter™ System

Designing a BayFilter™ system is done in four phases: (1) determine the treatment train design; (2) locate the system on the site and incorporate it into the plans; (3) determine the number of cartridges, size of the flow restrictor disks and number of drain down modules necessary; and (4) select a system configuration. It is important to realize that the design process can be iterative until the desired design parameters are satisfied. Again, it is important to note that the BayFilter™ systems are designed offline. This section details the design process and provides examples for each of the three steps. During the design process, the engineer must consider factors in addition to regulatory requirements. These include:

- Site specific constraints
- Proposed system location
- System configuration (flow through or extended detention
- Pretreatment
- Efficiency requirements
- Pollutant loading (sediment load)
- Treatment flow rates and hydraulics
- Maintenance intervals

BayFilter™ Treatment Train Design

On-line and Off-line Systems

BayFilter™ systems are usually designed to treat moderate to low flow rates. In the vast majority of applications, the peak design flow through the storm

drain system will be significantly greater than the treatment design flow through BayFilter™. Because of this difference, a bypass structure is required for most BayFilter™ installations. Therefore, BayFilter™ systems are installed offline, utilizing an external bypass to route high flows around the system.

A schematic of an offline BayFilter™ system is shown in Figure 3 below. The bypass structure diverts low flows to the BayFilter™ system and allows high flows to pass to a separate outfall. The bypass structure will feature flow controls designed by an engineer to ensure that the required treatment flows are sent to the BayFilter™. The two effluent streams (the treated effluent from the BayFilter™ and the high intensity bypass) may be combined into a single stream or discharged to separate outfalls. These configurations typically involve higher flow per cartridge, but reduced treated sediment load per cartridge. These configurations are, however, usually limited more by flow sediment capacity.

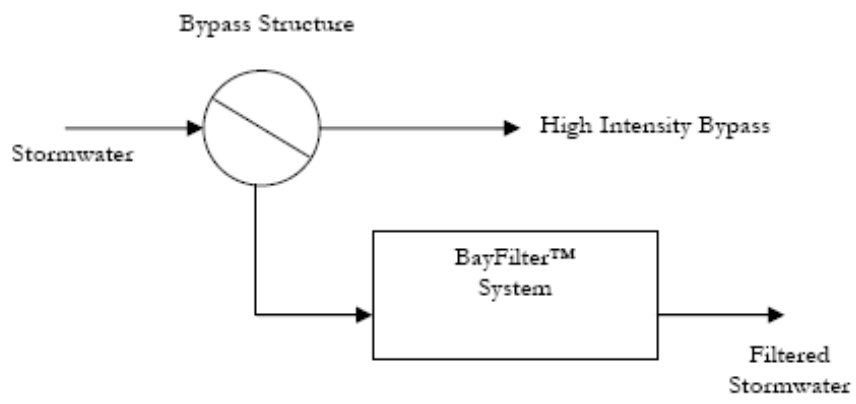


Figure 3: Offline BaySaver Technologies, Inc. System

In BayFilter™ installations sediment will accumulate in the vault as well as in the filter cartridges. In offline installations high intensity flows are routed away from the vault minimizing the risk of resuspending this accumulated sediment. In online applications it is possible for high flows to mobilize and release this sediment.

Pretreatment

The BayFilter™ system is designed to remove a minimum of 80% of suspended sediments and 50% of the total phosphorus load. If the anticipated sediment load is particularly heavy or if there will be a significant oil load, the system may require pretreatment.

Pretreatment may also be required by local regulations. Pretreatment systems will remove a portion of the influent pollutant load. BaySaver

Technologies, Inc. BaySeparator™ system is an ideal hydrodynamic separator that removes sediments and floatables from stormwater runoff.

Figure 4 shows a schematic of a typical BayFilter™ installation with pretreatment. Note that the pretreatment structure is downstream from the bypass. The system will work as long as 28" of head is achieved to activate the cartridge flow and will continue to work until it reaches the siphon break level (6"). Consult BaySaver Technologies, Inc. Engineering Department for verification based on your particular site conditions.

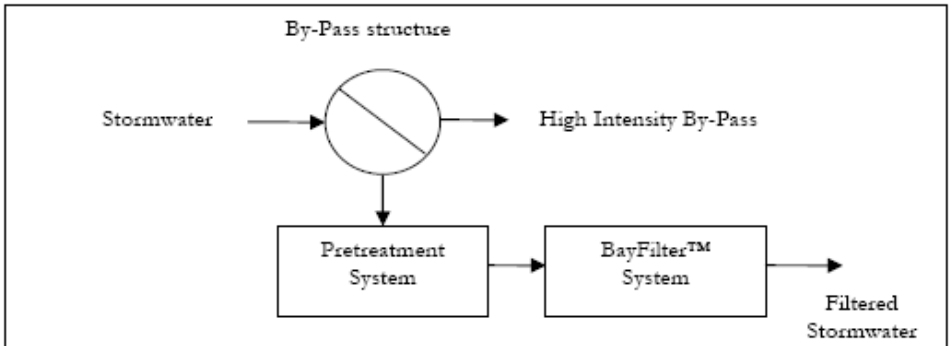


Figure 4: Off line BayFilter™ System with Pretreatment

Extended Detention Systems

In some applications, BayFilter™ systems will be installed in conjunction with extended detention systems. Extended detention systems attenuate peak flow rates within the storm drain system. In these cases, the BayFilter™ is placed downstream from an extended detention system, as shown in Figure 5.

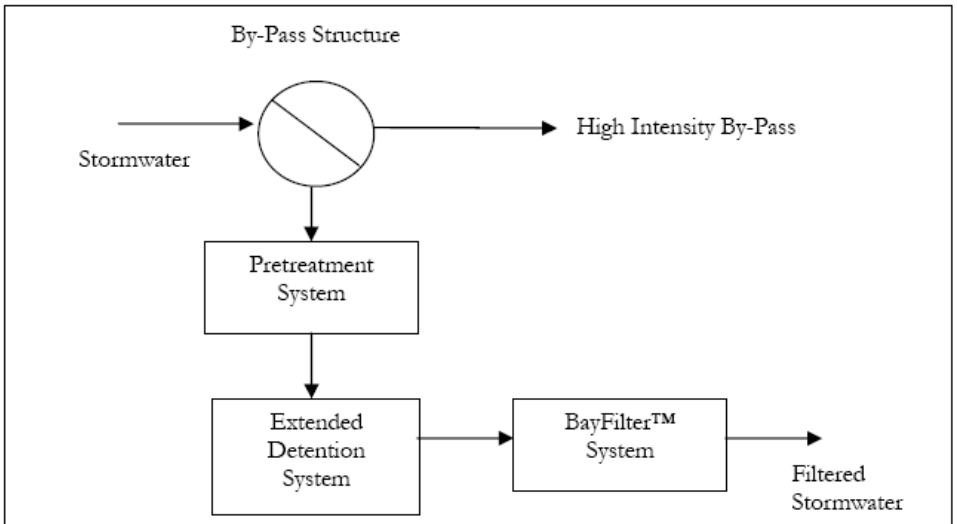


Figure 5: Offline BayFilter™ System with Extended Detentions

Systems with smaller drops can be designed as well. The system will work as long as 28" of head is achieved to activate the cartridge flow and will continue to work until it reaches the siphon break level (6"). Consult BaySaver Technologies, Inc. Engineering Department for verification based on your particular site conditions.

Selecting the Number of Cartridges

Each BayFilter™ system relies on a collection of individual cartridges to achieve the desired removal efficiency and it is important to correctly determine the number of filter cartridges required. Too few cartridges will result in a system that does not meet the performance specifications while too many cartridges will result in a system larger than necessary for the site.

To accurately determine the number of cartridges required for a BayFilter™ installation, three factors must be considered:

- **The flow capacity of the system**
- **Treated sediment load of the system**
- **Jurisdiction – specific sizing requirements (water quality volume)**

Each of the above factors when evaluated will determine a minimum of cartridges required to address that design parameter. Calculations for all three factors need to be done to determine which design parameter is the limiting factor. In each case it will be the computation that results in the highest minimum number of cartridges, the one that will determine the cartridge count. In other words, whichever item requires the most cartridges to meet any one particular design parameter will determine the minimum number of cartridges required for the system.

Required Data

To ensure that the correct number of cartridges is specified for the BayFilter™ system, the designer must be aware of the local regulatory requirements for stormwater treatment. Depending on the jurisdiction in which the project site is located, the engineer may have to meet minimum treatment flow rates, treatment volumes or some other criteria such as filter bed area. Some jurisdictions specify a methodology for calculating a minimum treatment flow rate for a given site. Other jurisdictions may require extended detention upstream from the filtration system or have volume-based rather than flow-based requirements.

Flow Capacity

At many sites regulatory requirements will specify a minimum treatment flow rate (Q_{TRT}) that must be passed through the stormwater treatment system. These regulatory requirements may also specify pretreatment or extended detention practices that need to be included in the site design. Some jurisdictions specify that the stormwater filtration systems be designed on the basis of filter area following prescribed methodologies.

In most cases pretreatment can be provided by a hydrodynamic separator like the BaySaver Technologies, Inc. BaySeparator™ system. Regardless of the pretreatment design, the minimum number of BayFilter™ cartridges can be determined by dividing the treatment flow rate by 30 gpm (0.067 cfs) and rounding up to the next whole number using Equation 1. This calculation provides the minimum number of BFCs that will be necessary to fully treat the water quality flow from the site. This computation does not take into account the sediment load portion of the design, which needs to be performed as well. The design flow per cartridge will ultimately be determined by the cartridge sediment load (Table 1). The step-by-step procedure is shown below.

1. Determine the required treatment flow rate (Q_{TRT}) based on locally approved methodologies for the project site. This may involve the use of the Rational Method, TR-55 or another locally specified hydrologic model. If a locally approved methodology is not specified, BaySaver Technologies, Inc. recommends using one of these commonly accepted models.

2. Using the treatment flow rate, calculate the minimum numbers of BayFilter™ cartridges required to treat that flow using Equation 1.

$$\#Cartridges = \frac{Q_{TRT}(cfs) * 448.8 \frac{gpm}{cfs}}{Q_{BFC}}$$

Equation 1

The minimum number of BFCs is equal to the maximum treatment flow rate divided by Q_{BFC}, rounded up to the next whole number. In most cases, Q_{BFC} will be 30 gpm (0.067 cfs) per cartridge.

Sediment Load Capacity

Once the minimum number of BFCs required to treat the flow is known, the engineer must ensure that the number of BFCs specified will be capable of handling the sediment load from the site. BayFilter™ systems are typically designed around a maintenance cycle. It is important to note that the number of BFCs required to treat the anticipated total system sediment load is a minimum

number. For any site, it is necessary to calculate the minimum number of BFCs required to treat both the peak flow rate and the total system sediment load (as discussed in this section). The number of BFCs required for the site is the greater of the calculated numbers.

To ensure that the BayFilter™ will function acceptably with annual maintenance, it is necessary to calculate the incoming annual sediment load from the site.

1. Calculate the annual treated runoff volume according to Equation 2. In Equation 3, V_{TRT} is the annual treated runoff volume, P is the

$$V_{TRT}\left(ft^3\right) = P * A * c * \frac{1ft}{12in} * \frac{43560\,ft^2}{acre} * \%\,Capture$$

Equation 2

average annual precipitation (in inches), A is the area of the site (in acres), c is the runoff coefficient of the site (c is dimensionless), and % Capture is the fraction of the total runoff that is treated by the stormwater quality system. If % Capture is not otherwise specified, a default value of 0.90 can be used.

2. Using the annual treated runoff volume, calculate the anticipated total system sediment load to BayFilter™ according to Equation 3. In Equation 3, L is the mass of sediment that BayFilter™ is exposed to annually (in pounds), V_{TRT} is the annual treated runoff volume as calculated in step 1 (in ft^3), and TSS_{IN} is the influent concentration of TSS in the runoff (in mg/L). The influent TSS concentration (TSS_{IN})

$$L = V_{TRT} * TSS_{IN} * \frac{28.3L}{ft^3} * \frac{kg}{10^6\,mg} * \frac{2.2lbs}{kg}$$

Equation 3

depends greatly on the site and the surrounding land use. In the absence of readily available data, BaySaver Technologies, Inc. recommends using a minimum event mean concentration (EMC) TSS value of 60 mg/l. The impact of the on the filter cartridge will also be less if the filtration system is preceded by pretreatment. In these cases, the influent TSS to the BayFilter™ system need to be reduced to reflect pretreatment sediment removal. The BaySaver Technologies' Engineering Department can assist with these calculations.

3. Once the total annual system sediment load (L) is calculated, the engineer must ensure that the number of cartridges specified will be able to remove that sediment load at the specified design flow rate. Divide the total system sediment load L by the capacity of each BFC and note the associated BFC flow rate. Round up to the next whole number to get the minimum number of BFCs required to treat this sediment load at the required flow rate per BFC.

Water Quality Volume

In some cases the BayFilter™ system will have to be placed downstream from an extended detention facility or local regulations will specify a treatment volume rather than a treatment flow rate. In these cases the minimum number of BFCs may not be determined using the treatment flow rate calculation. Instead, the minimum number of cartridges for this system depends on the controlled discharge rate Q_{TRT} from the upstream detention facility or the filtration system.

1. Determine the WQv for the site. This may vary significantly from one jurisdiction to the next based on local regulations. Maryland for instance requires that new developments treat the first one inch of water coming off of the site.

2. Most jurisdictions will also specify a drain down time for the detention system. This is usually in the 24 to 40 hour range. It is recommended that the maximum drain down time not exceed 40 hours, beyond which the detained water could potentially become anoxic. BayFilter systems should instead be designed with an initial drain down time of less than 40 hours. Then, as the filter cartridges become occluded, the drain down time will gradually increase to 40 hours. Once it takes in excess of 40 hours for the detention system to fully drain out then the BayFilter system should be maintained.

3. Once you have determined the WQv and the drain down time, the quantity of BayFilter cartridges can be determined by dividing the WQv by the drain down time and then dividing the resulting number by the treatment flow rate of a BayFilter cartridge. For volume based BayFilter systems, the treatment flow rate of each cartridge should be limited to 15 gpm. For example if:

   WQv = 10,000cf

   Drain down time = 24hrs (1440min)

   BFC flow rate = 15gpm

   Number of BFC's = ((10,000cf/86,400)*448.83)/15gpm

   Number of BFC's = 4

Determine the Size of the Flow Restrictor Disk:

The BayFilter cartridges have a flow restrictor disk that controls the initial filtration rate of the cartridge until the media within the cartridge becomes partially filled with solids; at which time the media becomes the flow restriction and the flow restrictor disk is rendered moot. The flow restrictor is initially sized to restrict the WQv release to 24 hours. Over time as the filters become partially restricted this will exceed the 24 hours. When the BayFilter Cartridges no longer release the WQv within 40 hours, the cartridges must be maintained.

1. Continuing from our previous example, if the desired drain down time is 24 hours and the site requires 4 BayFilter Cartridges, then the actual per cartridge flow rate is calculated by:

   Per Cartridge Flow Rate (gpm) = ((WQv/86,400) * 448.83)/# of BFC's

   Per Cartridge Flow Rate (gpm) = (10,000cf/86400) * 448.83/4

   Per Cartridge Flow Rate (gpm) = 13gpm

2. From this, the orifice size can be determined based on the chart below:

BFC Cartridge Flow in (GPM)

Head	***Orifice Diameter (Inches)***							
(ft)	***1.32"***	***1.24"***	***1.14"***	***0.80"***	***0.75"***	***0.70"***	***0.60"***	***0.50"***
5				13.5	11.6	9.9	6.6	4.4
4.8				12.9	11.1	9.4	6.4	4.3
4.6			30.3	12.4	10.7	9.0	6.2	4.2
4.4			29.6	12.1	10.4	8.7	6.1	4.1
4.2			29.2	11.5	9.9	8.3	5.9	4.0
4.0			26.1	10.8	9.4	8.1	5.8	3.9
3.8			22.8	10.2	8.8	7.4	5.6	3.8
3.5			19.4	9.7	8.3	7.1	5.5	3.7
3.3			18.4	9.3	8.0	6.7	5.3	3.6
3.1		30.4	17.7	8.8	7.6	6.4	5.1	3.5
3.0		24.3	15.7	8.3	7.1	6.0	5.0	3.3
2.7		22.4	14.0	8.0	6.9	5.8	4.8	3.2
2.5*	30.5	20.5	12.4	7.7	6.7	5.6	4.6	3.1

*** Note when the head is below 2.5 it continues to function at the equivalent head of 2.5 because the system goes into siphon.**

Determining the Number of Drain Down Modules (DDM's):

The number of drain down modules is almost always equal to the number of BayFilter cartridges. Their purpose is to remove any excess standing water from the BayFilter vault once the siphon has broken. Therefore, in rare instances it may be beneficial to add additional drain down modules to a system if very high influent sediment loads are expected.

Preparing Site Plans for the BayFilter™ System

Once the BayFilter™ system has been selected, the chosen system must be included on the site plans.

Location

The location of BayFilter™ on the site will be determined by several factors; maintenance access, the unit's footprint, available drop, available depth, and the surface elevation of the receiving waters must all be considered when selecting the system's location. The location and configuration must be in compliance with MCDPS's underground SWM Structure regulations

The BayFilter™ system must be installed in an area that is accessible to maintenance equipment. The maintenance of a BayFilter™ system requires a vacuum truck as well as the removal and replacement of the filter cartridges. The manhole covers, and or Access Hatches of the BayFilter™ must be placed in locations that can be easily reached by such a vehicle.

The BayFilter™ should be placed in a location that minimizes its interference with other existing or planned underground utilities.

Standard Details and Notes

All of the standard details and notes for the plans are available in AutoCAD and .pdf format from BaySaver Technologies, Inc. They are also be available on the Website at www.BaySaver.com

BayFilter System Configuration

There are four (4) types of BayFilter systems:

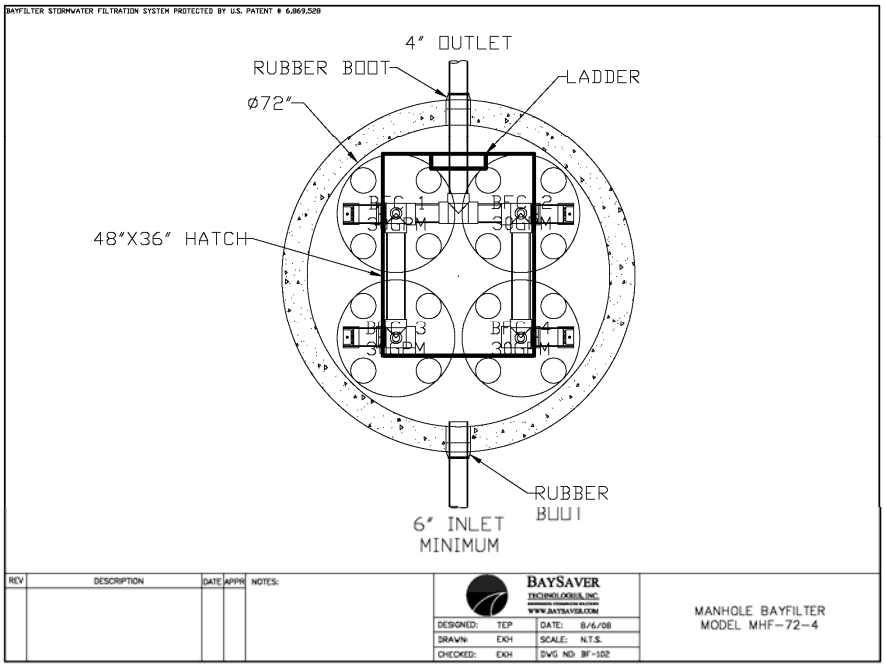
1.) Manhole: Standard precast manholes with O-Ring gasket joints

2.) Precast vault: Monolithically poured concrete vault (base and walls)

3.) Box culvert vault: Must be made by MCDPS approved supplier

4.) Cast in place vault: Custom designed for site.

Manhole BayFilter™



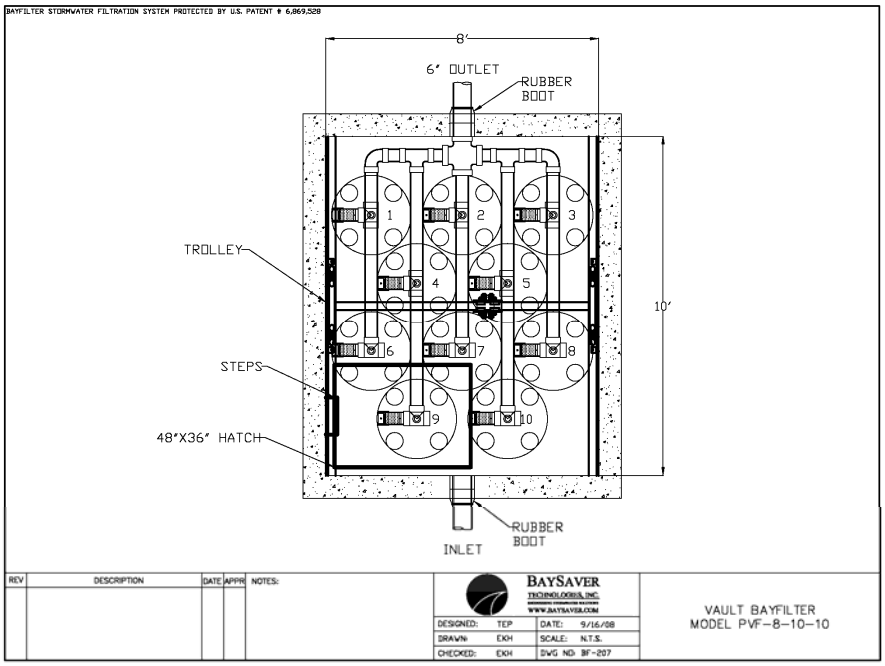
Manhole BayFilter™ systems have a small footprint, and can be fit into site plans easily without interfering with other underground utilities. Manhole BayFilter™ systems are ideal for applications downstream from water quality detention structures. Please consult with the BaySaver Technologies, Inc. Engineering Department for more details.

Access to the Manhole BayFilter™ for inspection or maintenance is achieved through a minimum 30" diameter frame and cover. In each Manhole BayFilter™ system, the BFCs are arranged so that a maintenance worker can stand on the floor of the manhole while installing or removing the cartridges. Please refer to Appendix C for engineering drawings showing the available Manhole BayFilter™ configurations.

Available manhole filter systems include:

BayFilter™ Model	Manhole Size	Maximum Number of BFCs	Maximum Treatment Flow gpm (cfs)
MHF-60-3	60”	3	90 (0.20)
MHF-72-4	72”	4	120 (0.27)
MHF-84-5	84”	5	150 (0.33)
MHF-96-7	96”	7	210 (0.47)

Precast Vault BayFilter™



When more BFCs are required, Precast Vault BayFilter™ systems may be used on larger sites or sites with more impervious area. The Precast Vault BayFilter™ system is larger than the Manhole BayFilter™. Constructed within a precast concrete vault, it has a treatment capacity ranging from 240 gpm (0.53 cfs) in an 8’ x 10’ vault to 2,010 gpm (4.48 cfs) in a 10’ x 48’ vault. Should precast vaults of the dimensions outlined not be available locally, these structures can be cast in place. The table below shows the available Precast Vault BayFilter™ systems, along with the maximum number of filter cartridges and treatment capacities. The minimum system drop is typically 28” however this can be

reduced on a site specific basis by BaySaver Technologies, Inc. in conjunction with an engineer.

The figure above shows the layout of a PVF-8-10-10, an 8' x 10' precast vault BayFilter™ system. The system comprises ten standard BFCs and 10 drain down modules. Unlike the manhole BayFilter™, the outlet manifold in the precast vault BayFilter™ does not connect directly to the outlet pipe. Instead, each of the under drain lines enters an outlet manifold which drains to the outlet pipe.

Box Culvert BayFilter™

Like the manhole BayFilter™, access to the box culvert BayFilter™ is provided through the hinged access hatch. The box culvert BayFilter™ is constructed in 10' x 6' sections. Each vault has at least one access hatch. The BFCs and outlet manifolds are arranged to allow maintenance personnel to stand on the concrete floor while working inside the structure. The BayFilter™ cartridges and under drain manifold components are supplied by BaySaver Technologies, Inc. together with the precast vaults. Please refer to Appendix C for a complete set of box culvert BayFilter™ configurations.

Available precast vault and box culvert filter systems include:

BayFilter™ Model	Vault Size (ft x ft)	Maximum Number of BFCs	Maximum Treatment Flow gpm (cfs)
PVF-8-10-10	8' x 10'	10	300 (0.67)
PVF-8-12-13	8' x 12'	13	390 (0.87)
PVF-8-14-15	8' x 14'	15	450 (1.00)
PVF-8-16-18	8' x 16'	18	540 (1.20)
PVF-10-16-21	10’ x 16'	21	630 (1.40)
PVF-10-20-27	10 x 20'	27	810 (1.80)
PVF-10-26-33	10' x 26'	33	990 (2.21)
PVF-10-32-42	10' x 32'	42	1,260 (2.81)
PVF-10-38-51	10' x 38'	51	1,530 (3.41)
PVF-10-40-54	10' x 40'	54	1,620 (3.61)

PVF-10-44-60	10' x 40'	60	1,800 (4.01)
PVF-10-48-66	10' x 48'	66	1,980 (4.41)

Cast-in-place BayFilter™

For sites requiring more than 66 BFCs or for projects on which a large precast vault or box culvert BayFilter™ is not feasible, BaySaver Technologies, Inc. can supply custom-designed BayFilter™ systems. These custom systems utilize a cast in place vault or other system, and can be designed around specific site constraints. High flow rates, shallow installations, very flat sites, limited footprints, and other design considerations can be addressed with a cast in place system. For more information on custom BayFilter™ designs, please contact BaySaver Technologies, Inc. directly.

Chapter

3

Installation of the BayFilter™ System

BayFilter™ systems are installed along with the storm drain. Installation procedures vary depending on the configuration of the BayFilter™ system. Installation instructions for manhole BayFilter™ systems and precast vault BayFilter™ systems are contained in this section.

Custom BayFilter™ systems may have particular installation issues that will be addressed during the design. Installation instruction for a custom BayFilter™ will be included with the custom design documents.

Installation of a BayFilter™ System

1. Contact utility locator to mark any nearby underground utilities and make sure it is safe to excavate.

2. Reference the site plan and stake out the location of the BayFilter™ manhole/vault.

3. Excavate the hole, providing any sheeting and shoring necessary to comply with all federal, state and local safety regulations.

4. Level the subgrade to the proper elevation. Verify the elevation against the manhole/vault dimensions, the invert elevations, and the site plans. Adjust the base aggregate, if necessary.

5. Have the soil bearing capacity verified by a licensed engineer for the required load bearing capacity. On solid subgrade, set the first section of the BayFilter™ manhole/vault.

6. Check the level and elevation of the first section to ensure it is correct before adding any riser sections.

7. If additional section(s) are required, add a watertight seal to the first section of the BayFilter™ manhole/vault. Set additional section(s) of the manhole/vault, adding a watertight seal to each joint.

8. Install the trolley system (if applicable). See separate instruction sheet.

9. Install the PVC outlet manifold. Glue all PVC joints with the exception of the BayFilter cartridge coupling.

10. Install the PVC outlet pipe in BayFilter™ manhole/vault.

11. Install the inlet pipe to the BayFilter™ manhole/vault.

12. Install BayFilter Drain Down Modules (DDM) with red mark aligned to the top of the manifold system.

13. After the site is stabilized, remove any accumulated sediment or debris from the vault and install the flow disks and the BayFilter™ cartridges.

Tool List:

- PVC glue and primer
- Crane / lifting mechanism to lower cartridges in to the vault (each cartridge weighs 350 lb)
- Screwdriver or nut driver for Fernco couplers

- Soft blow hammer
- Saw (in case PVC manifold length needs to be adjusted)

Trolley Installation Instructions

1. Attach the mounting brackets to the track.

2. Mark a horizontal line 6" down from the ceiling of the vault structure on the two long walls.

3. Each track is split in sections. The length and number of sections vary depending on the vault. It is generally better to start installing longer track sections first. Hold a section in place and align the top of the brackets with the horizontal line on the wall. Mark the center of the hole in each bracket and remove the track.

4. Using a hammer drill and ¼" bit, drill a hole approximately 3" deep at each mark.

5. Hold the track back in place and realign the brackets with the holes. Place a plastic spacer block behind each bracket and using the supplied ¼" x 3¼" anchor bolts mount the track in place. Only install one section of track at this stage.

6. Repeat this procedure on the opposite wall of the vault directly across from the first section.

7. Bolt the 4 trolleys to the aluminum I-beam as shown in the attached diagram. Make sure that the wheels for each trolley are mounted an equal distance from the top of the I-beam.

8. Lift the I-beam in to place and insert the trolleys in to the track.

9. Using the supplied couplers, install the second sections of track via the same procedure. Continue until the track runs the length of the vault or as designed.

Chapter

4

Maintenance of the BayFilter™ System

The BayFilter™ system requires periodic maintenance to continue operating at the design efficiency. The maintenance process comprises the removal and replacement of each BayFilter™ cartridge and drain down module and the cleaning of the vault or manhole with a vacuum truck. BayFilter™ maintenance should be performed by a BaySaver Technologies, Inc. certified maintenance contractor.

The maintenance cycle of the BayFilter™ system will be driven mostly by the actual solids load on the filter. The system should be periodically monitored to be certain it is operating correctly. Since stormwater solids loads can be variable, it is possible that the maintenance cycle could be more or less than the projected duration.

The BayFilter systems in New Development applications are designed to treat the WQv in 24 hours initially. Later in the cycle these cartridges will flow at a slower rate, and when the WQv does not drain down within +/- 40 hours after the storm event, the system must be maintained.

When a BayFilter™ system is first installed, it is recommended that it be inspected every six (6) months. When the filter system exhibits flows below design levels the system should be maintained. Filter cartridge replacement should also be considered when sediment levels are at or above the level of the 4 inch manifold system. Please contact the BaySaver Technologies Inc. Engineering Department for maintenance cycle estimations or assistance at 1.800.229.7283.

Maintenance Procedures

1. Remove the manhole covers and open all access hatches.

2. Before entering the system make sure the air is safe per OSHA Standards or use a breathing apparatus. Use low O_2, high CO, or other applicable warning devices per regulatory requirements.

3. Using a vacuum truck remove any liquid and sediments that can be removed prior to entry.

4. Using a small lift or the boom of the vacuum truck, remove the used cartridges by lifting them out.

5. Any cartridges that cannot be readily lifted directly out of the vault should be removed from their location and carried to the lifting point using the Trolley system installed in the Vault (if applicable).

6. When all cartridges and drain down modules are removed, remove the balance of the solids and water; then loosen the stainless clamps on the Fernco couplings in the pipe manifold; remove the drain pipes as well. Carefully cap the manifold and the Fernco's and rinse the floor removing the balance of the collected solids.

7. Clean the manifold pipes, inspect, and reinstall.

8. Install the exchange cartridges and close all covers.

9. The used cartridges must be sent back to BaySaver Technologies, Inc. for exchange/recycling and credit on undamaged units.

Chapter

5

BayFilter™ System Costs and Availability

BayFilter™ systems are available throughout the United States from ADS. Material, installation, and maintenance costs can vary significantly with location. For BayFilter™ pricing in your area, please contact ADS at 1-800-821-6710.

BayFilter™ cartridges and outlet components can be shipped anywhere in the continental United States. Manholes and precast vaults are also supplied by BaySaver Technologies, Inc. as part of a complete stormwater filtration system.

Appendix

A

BayFilter™ Detailed Operating Sequence

The cycle operation of a BayFilter™ is as follows:

A. Vault Fill and Air Release: Water enters the system through an inlet pipe which fills the BayFilter™ vault. As the vault fills, water enters the cartridge through the inlet plate on the bottom.

As the water level rises in the vault, air from inside the BFC is exhausted via an air release valve. This operation is critical for the proper functioning of the siphon, which drives the BayFilter™ during periods of low water level in the vault. (Refer to Figure A-1 for details on this operation).

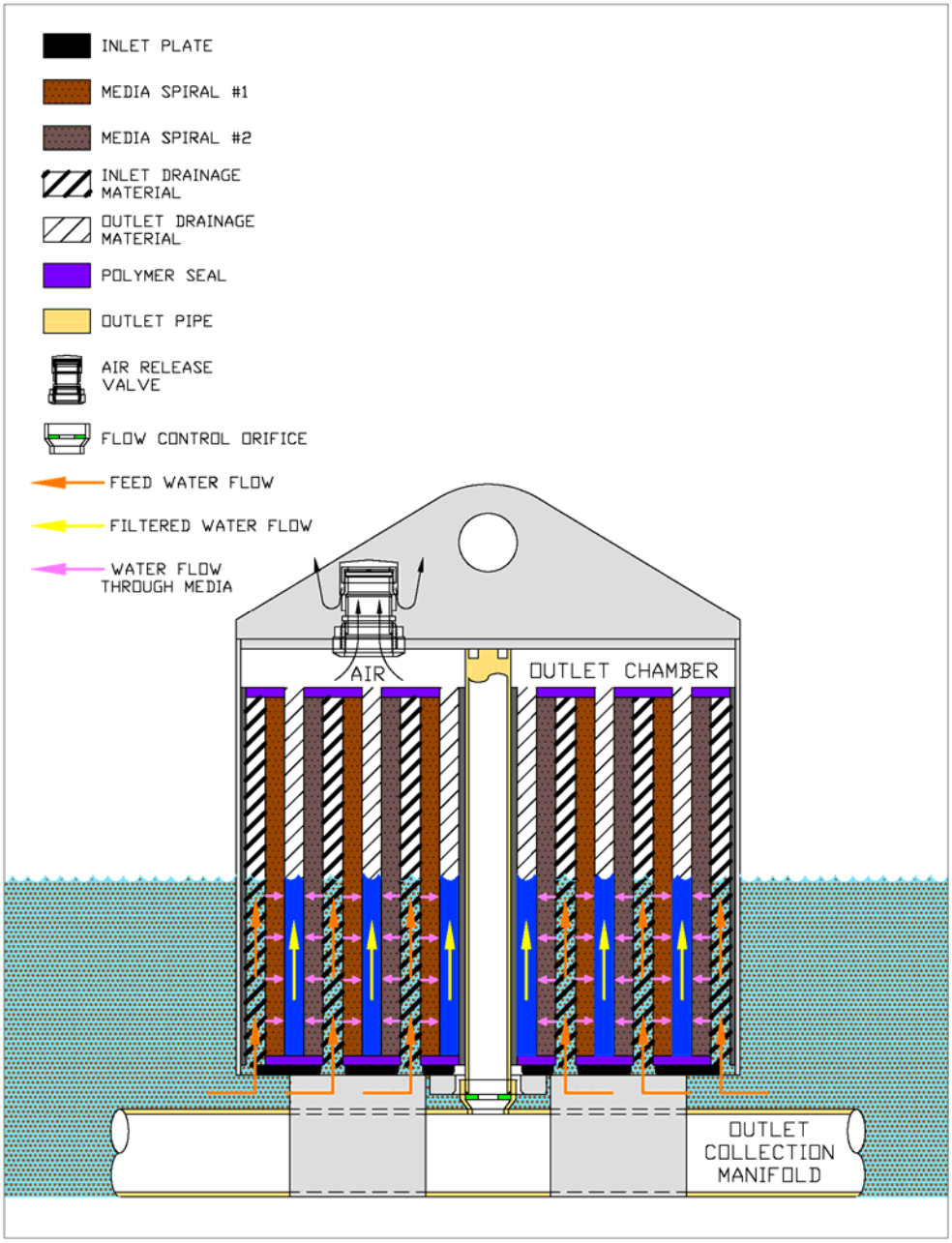


Figure A-1: Vault filling operation and release

B. Filtration: As water enters the continuous inlet drainage spiral, air is exhausted. Water then flows horizontally through the engineered media. Next it flows to the outlet drainage spiral which is also one continuous piece material. Filtered water then flows vertically to the outlet chamber located at the top of the filter media inside of the cartridge. Finally, filtered water flows in to the center outlet drain and leaves the system via the outlet manifold below the inlet plate. (Figure A-2)

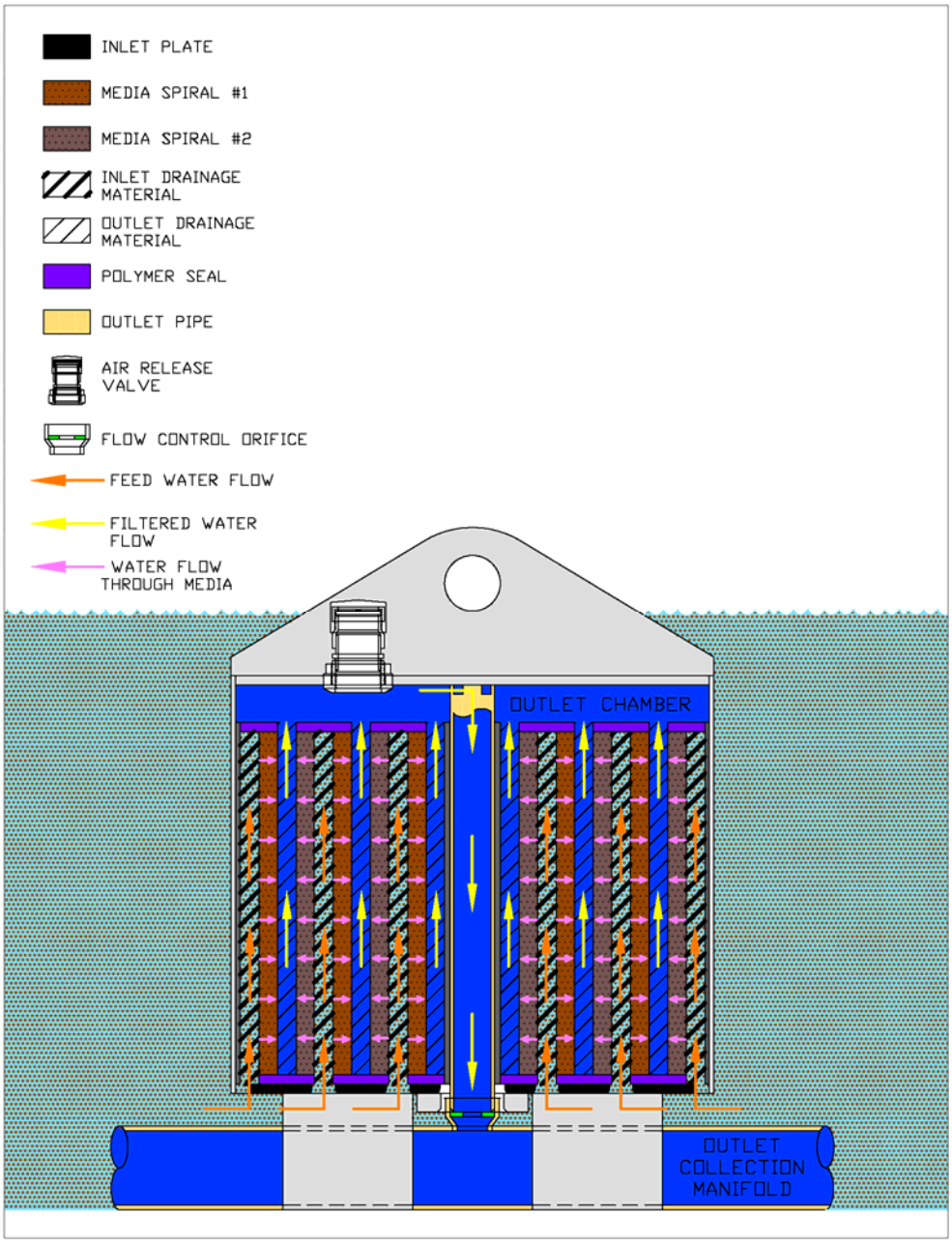


Figure A-2: Normal filter operation

C. Siphon Filtration: After the water level in the vault falls below the top of the filter cartridge, a siphon is established and water will continue to flow (Figure A-3) until the siphon is broken. During siphon the water level in the vault will decrease until it reaches the base of the BFC; air then enters the filter cartridge and breaks the siphon. This cause's filtration flow to stop and hydrodynamic backwash begins.

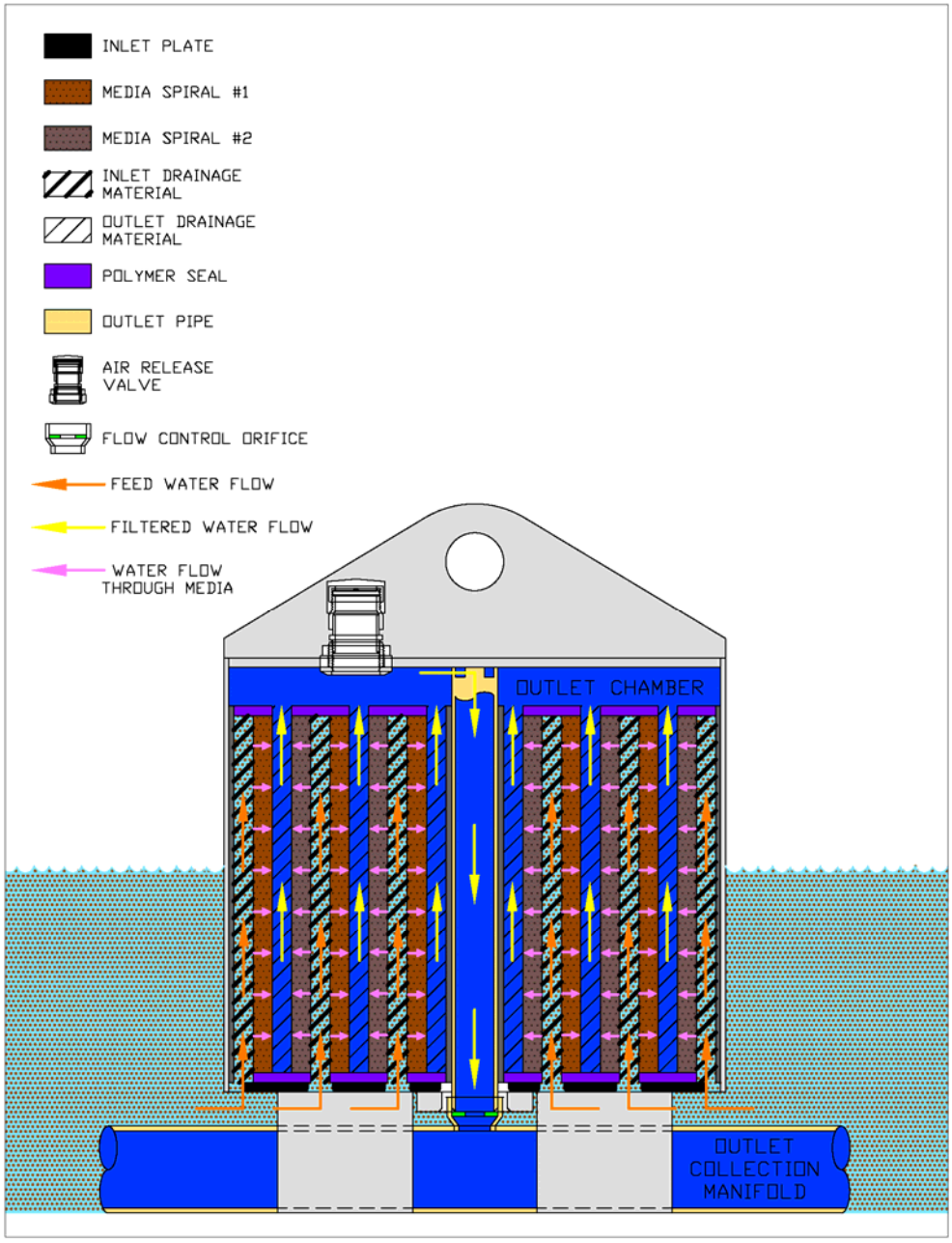


Figure A-3: Siphon filtration

D. When air enters the filter, the siphon breaks (Figure A-4), and a gravity-driven backwash occurs with all of the water flowing from the outlet chamber backwards through the filter media (Figure A-5). This backwash has the effect of dislodging particles captured in the filtration layers and re-establishing porosity. Dislodged particles are transported back in to the filter vault and accumulate on the filter vault floor.

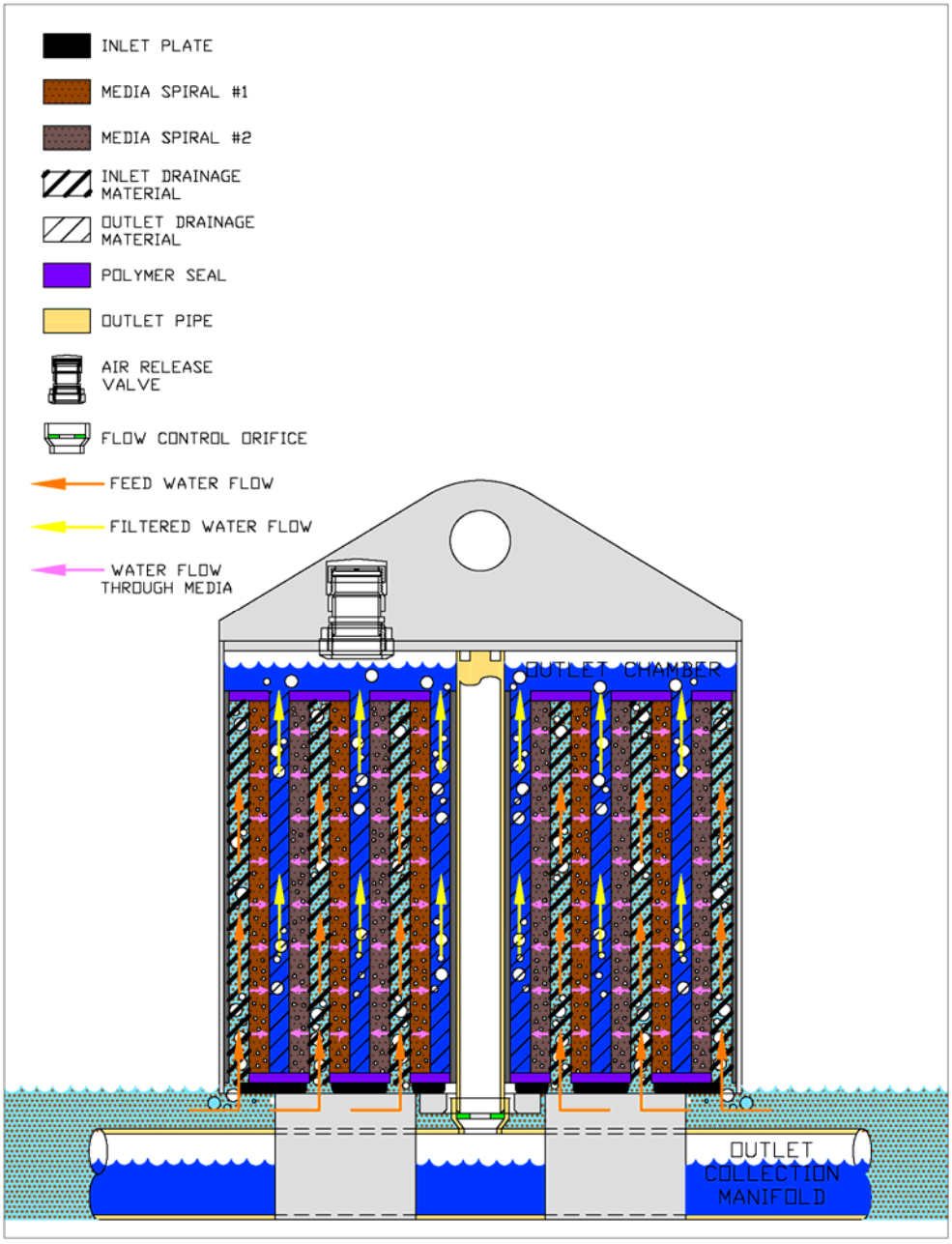


Figure A-4: Siphon Break

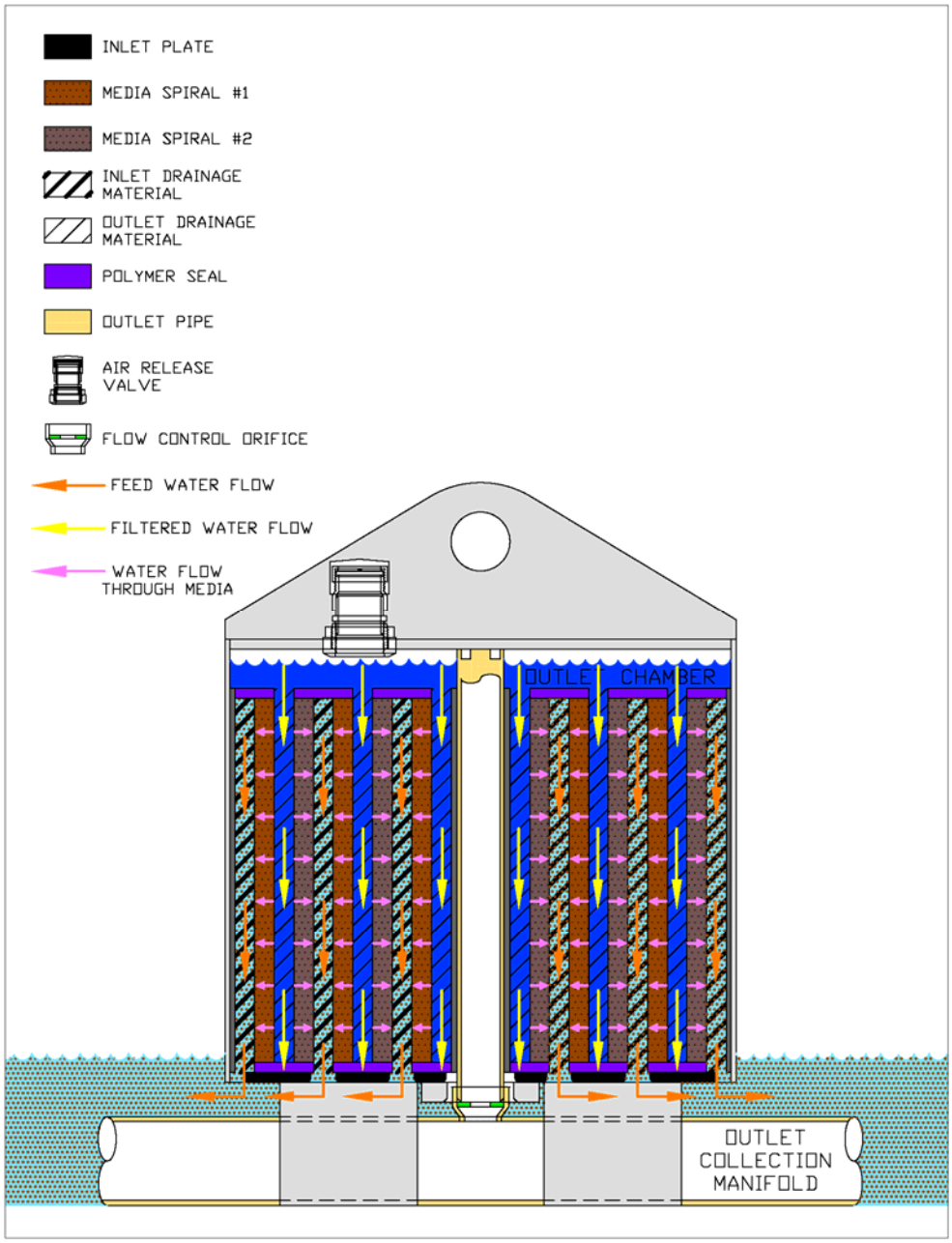
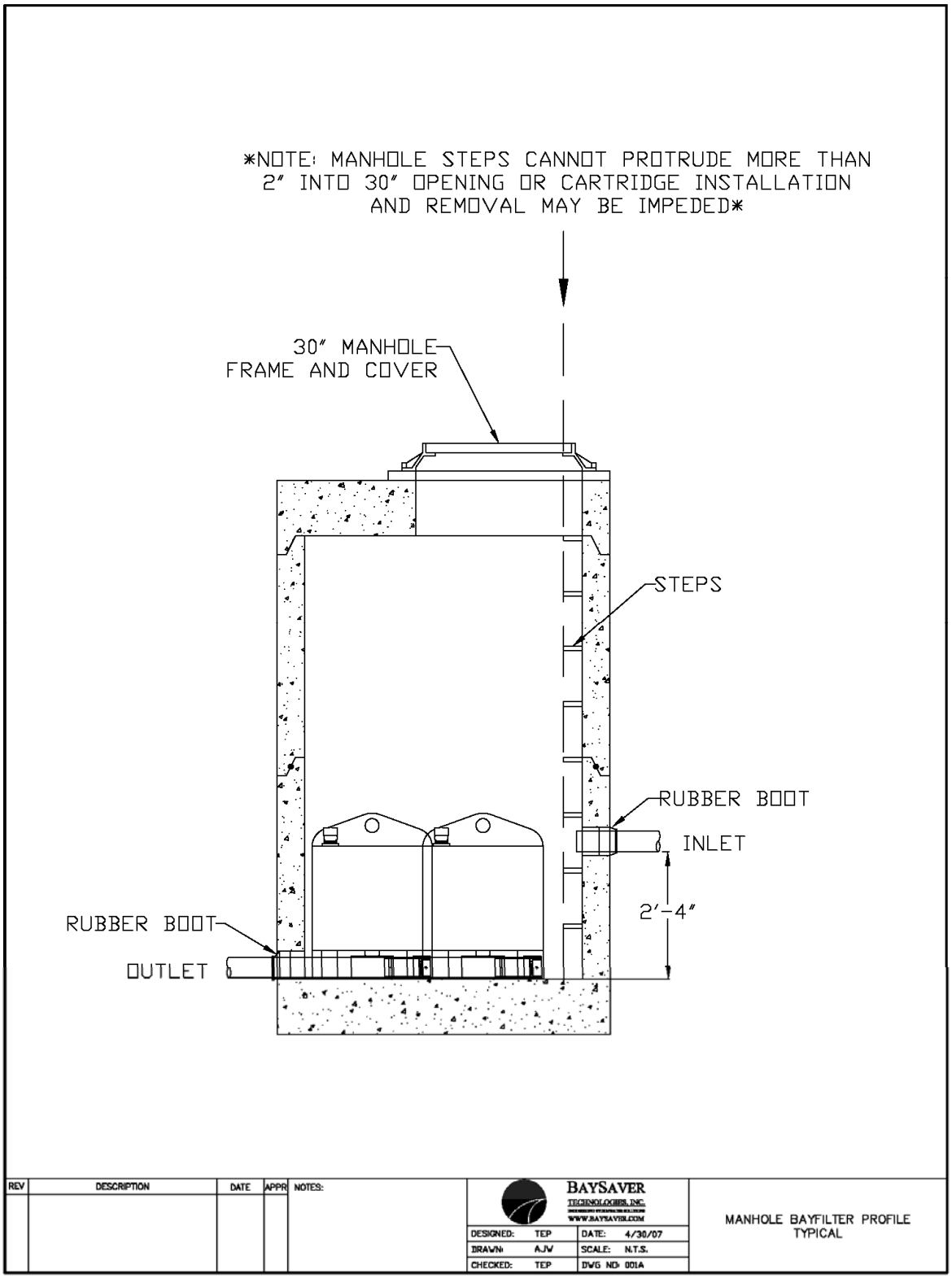


Figure A-5: Backwash

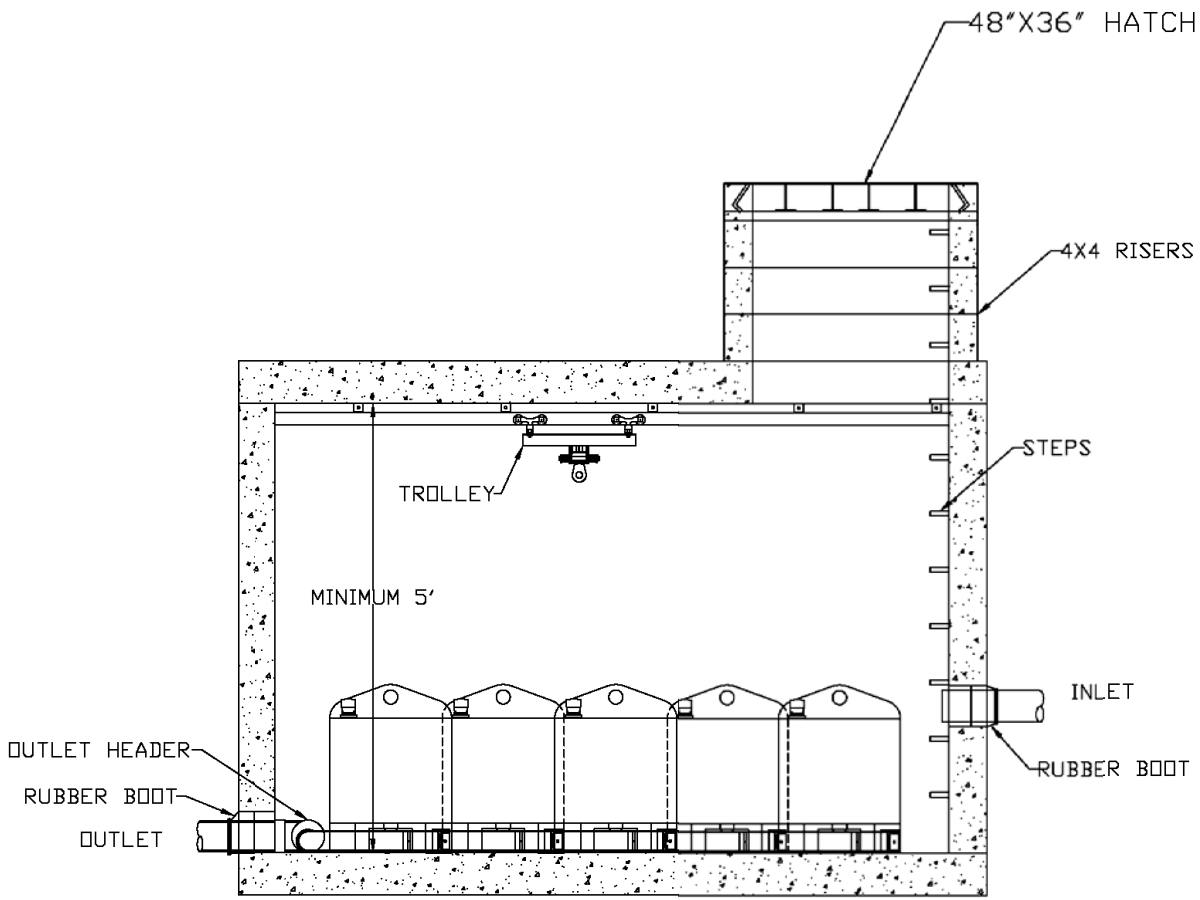
Appendix

B

System Drawings


NOTE: MANHOLE STEPS CANNOT PROTRUDE MORE THAN 2" INTO 30" OPENING OR CARTRIDGE INSTALLATION AND REMOVAL MAY BE IMPEDED
30" MANHOLE FRAME AND COVER
STEPS
RUBBER BOOT
INLET
2'-4"
RUBBER BOOT
OUTLET
REV
DESCRIPTION
DATE
APPR
NOTES:
BAYSAVER
TECHNOLOGIES, INC.
WWW.BAYSAVER.COM
DESIGNED: TEP
DATE: 4/30/07
DRAWN: AJW
SCALE: N.T.S.
CHECKED: TEP
DWG NO: 001A
MANHOLE BAYFILTER PROFILE
TYPICAL

BAYFILTER STORMWATER FILTRATION SYSTEM PROTECTED BY U.S. PATENT # 6,869,528



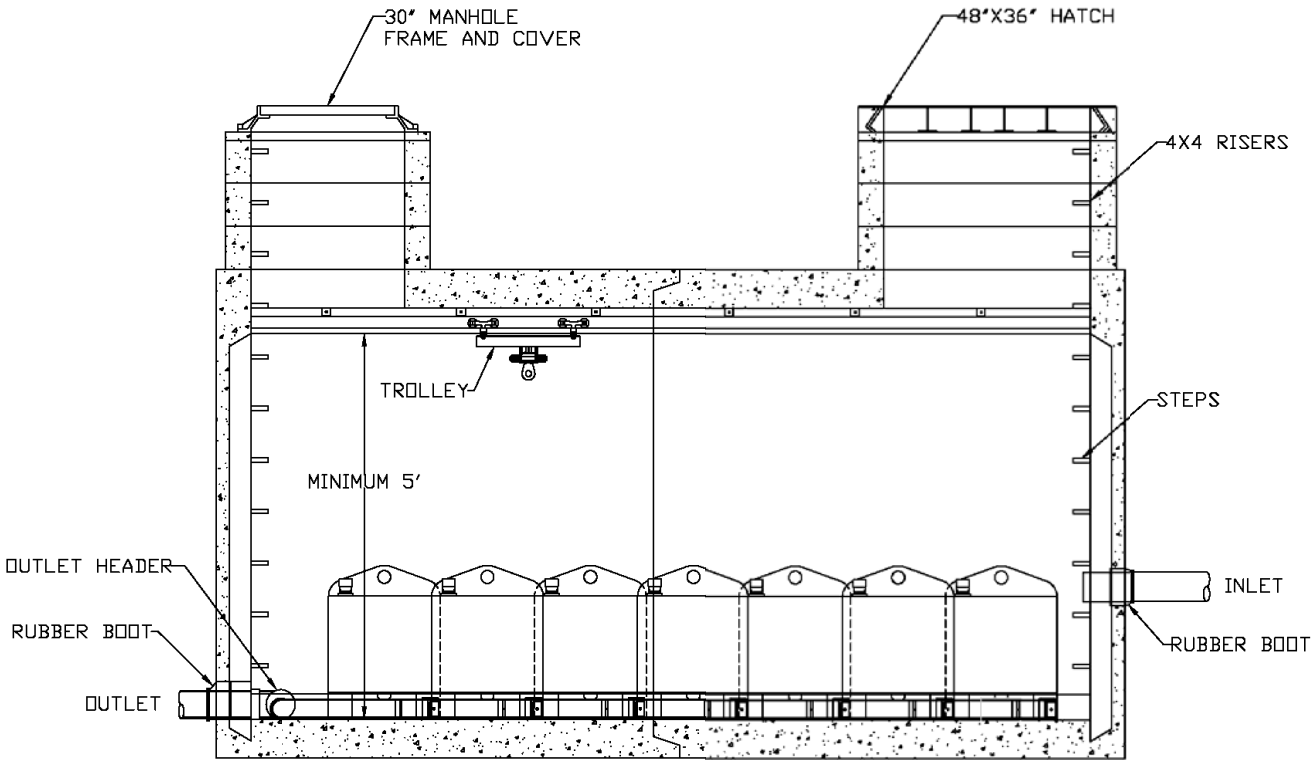
REV	DESCRIPTION	DATE	APPR	NOTES:

BAYSAVER TECHNOLOGIES, INC.
WWW.BAYSAVER.COM

DESIGNED:	TEP	DATE:	4/30/07
DRAWN:	AJW	SCALE:	N.T.S.
CHECKED:	AJW	DWG NO:	BF-208

VAULT BAYFILTER PROFILE
TYPICAL

BAYFILTER STORMWATER FILTRATION SYSTEM PROTECTED BY U.S. PATENT # 6,869,528

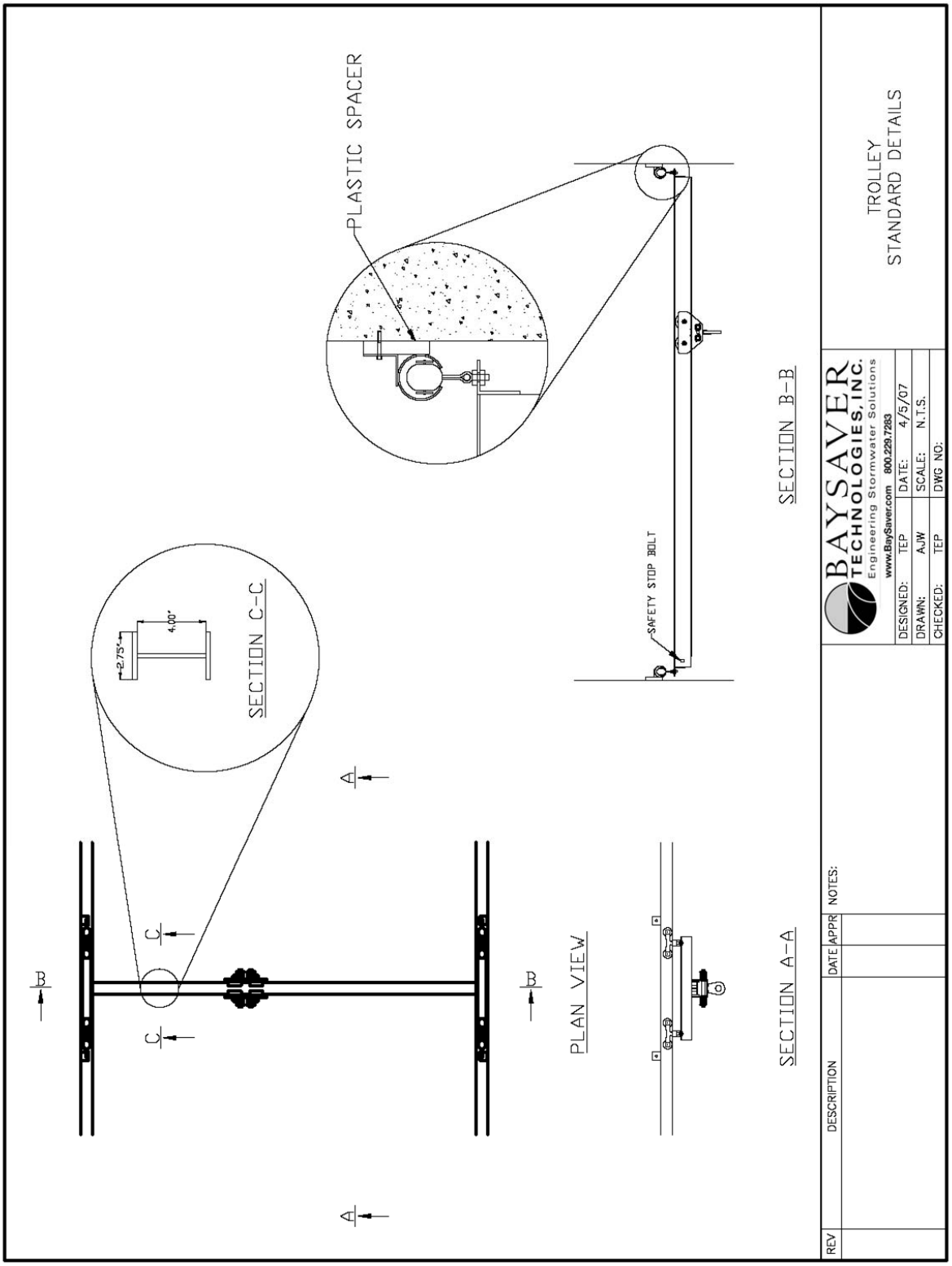


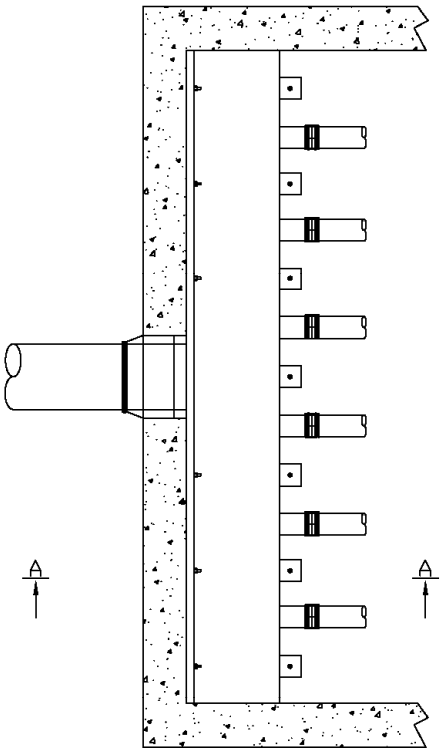
REV	DESCRIPTION	DATE	APPR	NOTES:

BAYSAVER TECHNOLOGIES, INC.
WWW.BAYSAVER.COM

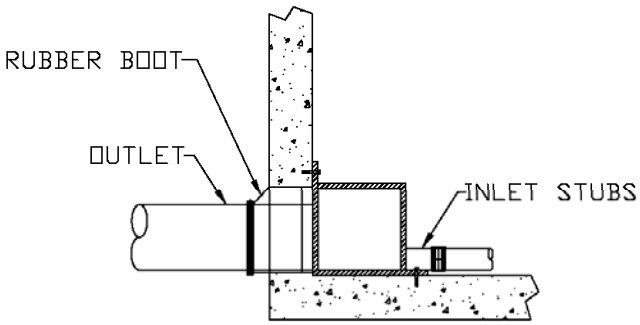
DESIGNED:	TEP	DATE:	4/30/07
DRAWN:	AJW	SCALE:	N.T.S.
CHECKED:	AJW	DWG NO:	BF-209

BOX CULVERT BAYFILTER PROFILE
TYPICAL


PLASTIC SPACER
SECTION C-C
2.75"
4.00"
SECTION B-B
SAFETY STOP BOLT
PLAN VIEW
SECTION A-A
A
B
C
TROLLEY
STANDARD DETAILS
BAYSAVER
TECHNOLOGIES, INC.
Engineering Stormwater Solutions
www.BaySaver.com 800.229.7283
DESIGNED: TEP
DATE: 4/5/07
DRAWN: AJW
SCALE: N.T.S.
CHECKED: TEP
DWG NO:
REV
DESCRIPTION
DATE
APPR
NOTES:



PLAN VIEW



SECTION A-A

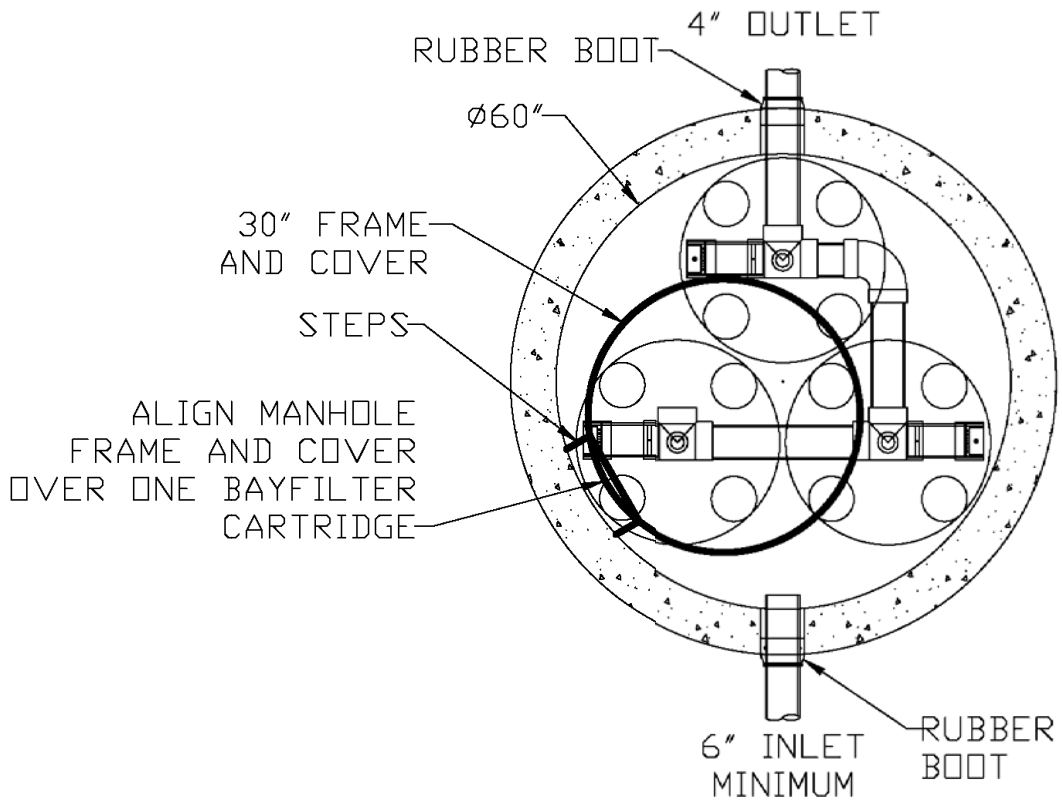
REV	DESCRIPTION	DATE	APPR	NOTES:

BAYSAVER TECHNOLOGIES, INC.
WWW.BAYSAVER.COM

DESIGNED:	TEP	DATE:	5/1/07
DRAWN:	AJW	SCALE:	N.T.S.
CHECKED:	JAM	DWG NO:	

OUTLET HEADER
STANDARD DETAIL

BAYFILTER STORMWATER FILTRATION SYSTEM PROTECTED BY U.S. PATENT # 6,869,528



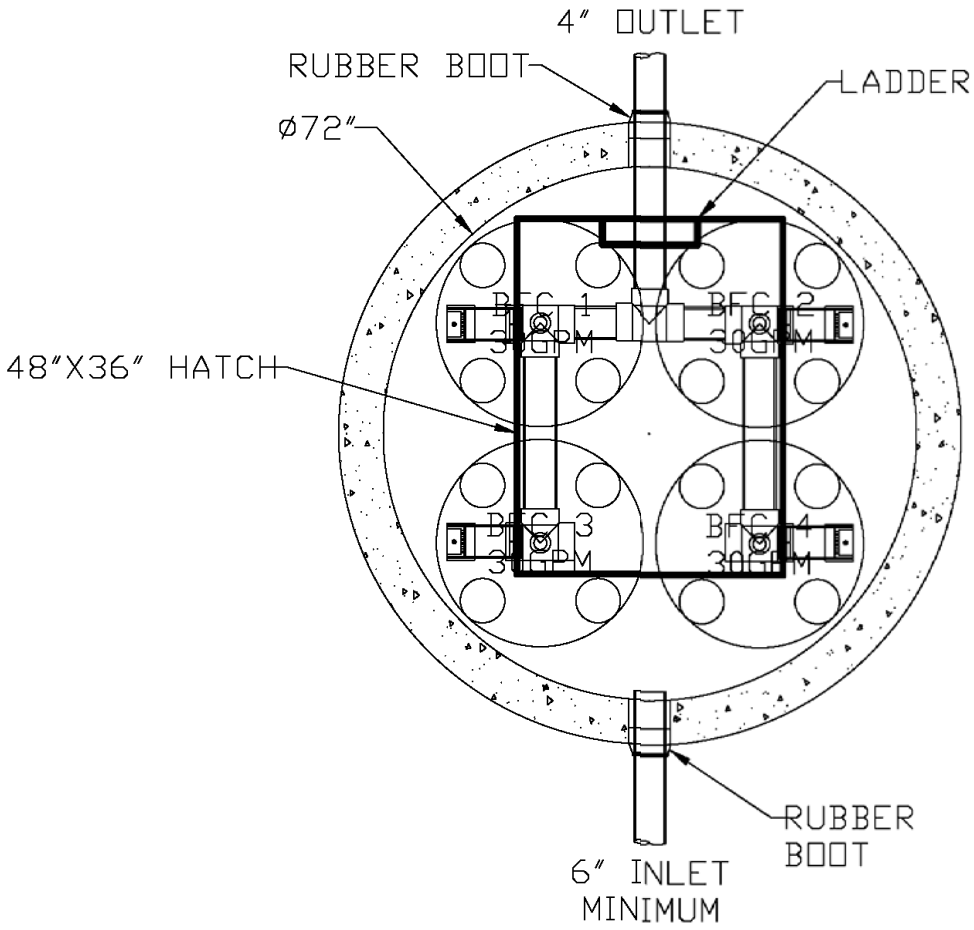
REV	DESCRIPTION	DATE	APPR	NOTES:

BAYSAVER TECHNOLOGIES, INC.
WWW.BAYSAVER.COM

DESIGNED:	TEP	DATE:	11/7/08
DRAWN:	EKH	SCALE:	N.T.S.
CHECKED:	EKH	DWG NO:	BF-101

MANHOLE BAYFILTER
MODEL MHF-60-3

BAYFILTER STORMWATER FILTRATION SYSTEM PROTECTED BY U.S. PATENT # 6,869,528



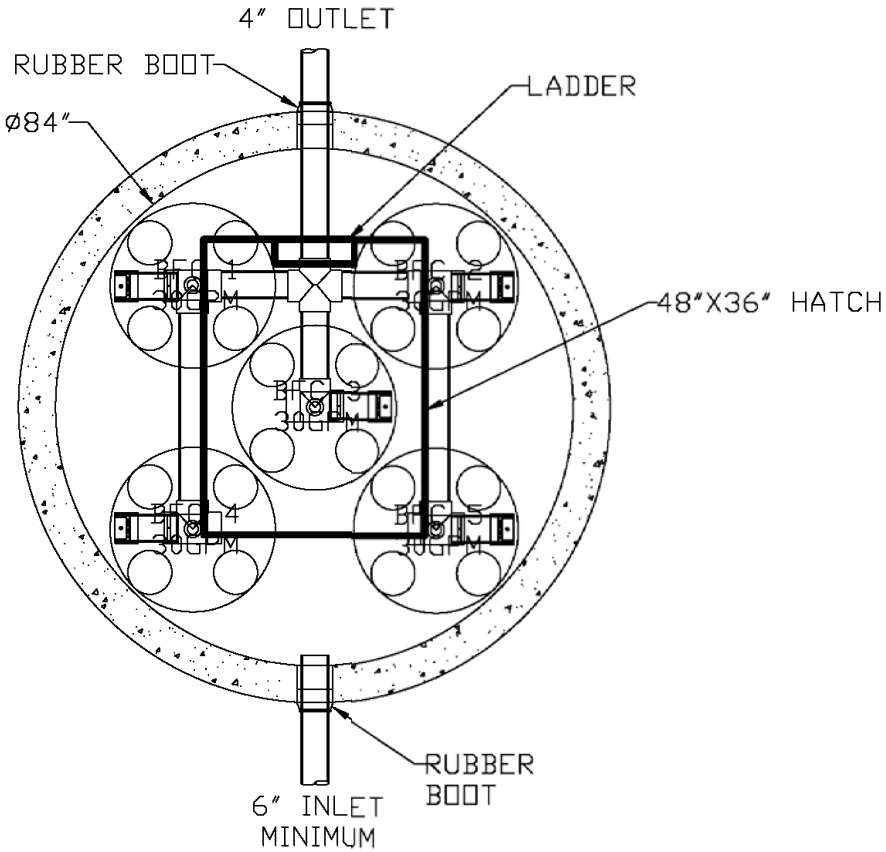
REV	DESCRIPTION	DATE	APPR	NOTES:

BAYSAVER TECHNOLOGIES, INC.
WWW.BAYSAVER.COM

DESIGNED:	TEP	DATE:	8/6/08
DRAWN:	EKH	SCALE:	N.T.S.
CHECKED:	EKH	DWG NO:	BF-102

MANHOLE BAYFILTER
MODEL MHF-72-4

BAYFILTER STORMWATER FILTRATION SYSTEM PROTECTED BY U.S. PATENT # 6,869,528



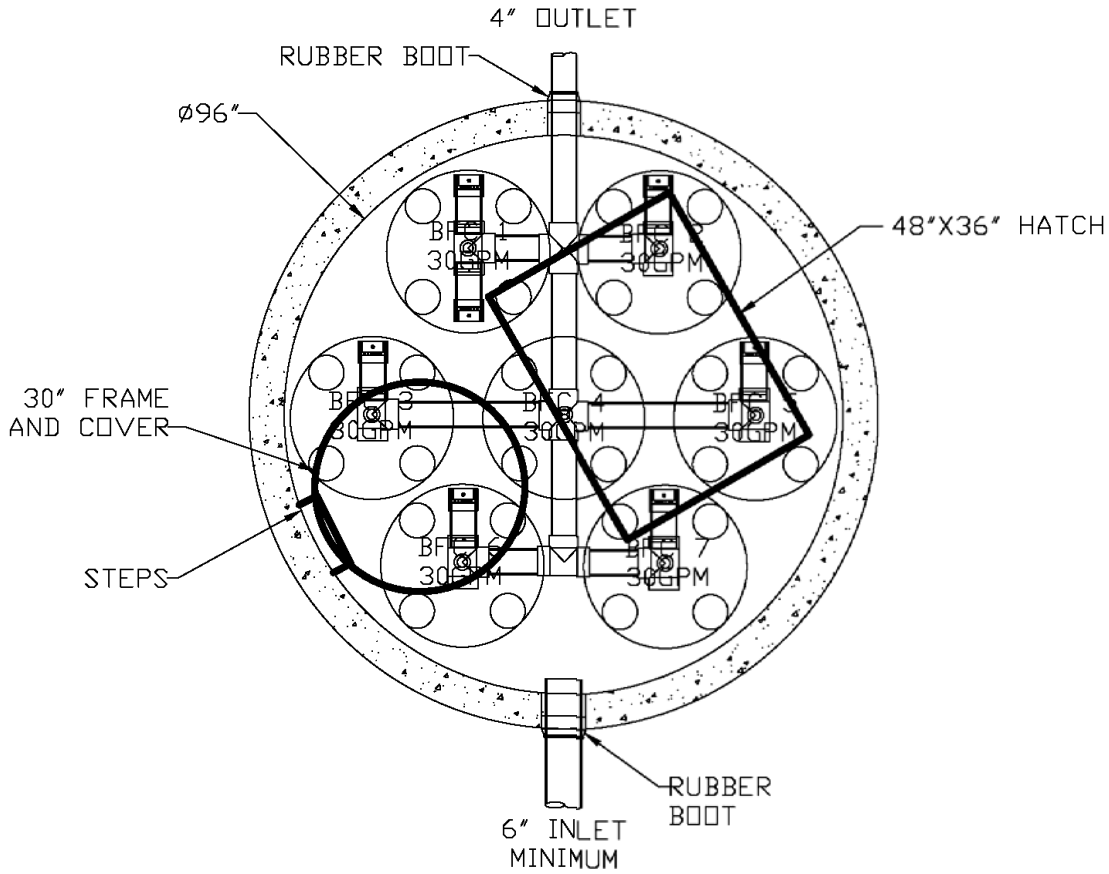
REV	DESCRIPTION	DATE	APPR	NOTES:

BAYSAVER TECHNOLOGIES, INC.
WWW.BAYSAVER.COM

DESIGNED:	TEP	DATE:	3/7/07
DRAWN:	AJW	SCALE:	N.T.S.
CHECKED:	AJW	DWG NO:	BF-103

MANHOLE BAYFILTER
MODEL MHF-84-5

BAYFILTER STORMWATER FILTRATION SYSTEM PROTECTED BY U.S. PATENT # 6,869,528



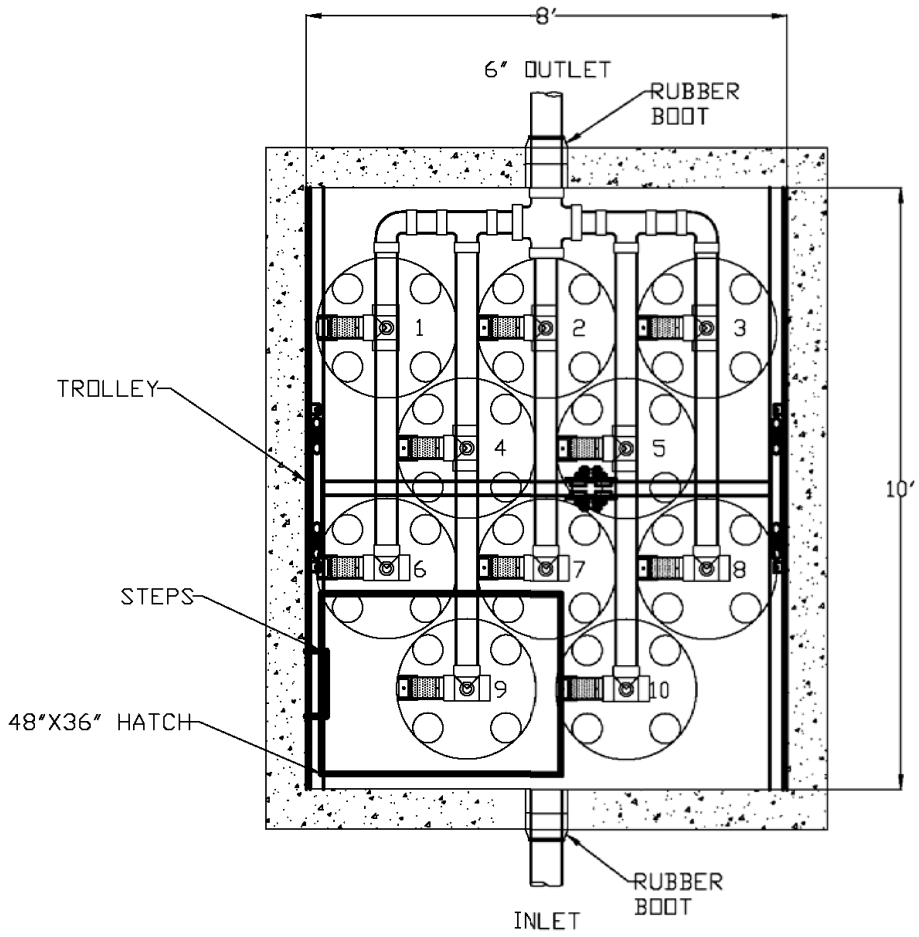
REV	DESCRIPTION	DATE	APPR	NOTES:

BAYSAVER TECHNOLOGIES, INC.
WWW.BAYSAVER.COM

DESIGNED:	TEP	DATE:	9/16/08
DRAWN:	EKH	SCALE:	N.T.S.
CHECKED:	EKH	DWG NO:	BF-104

MANHOLE BAYFILTER
MODEL MHF-96-7

BAYFILTER STORMWATER FILTRATION SYSTEM PROTECTED BY U.S. PATENT # 6,869,528



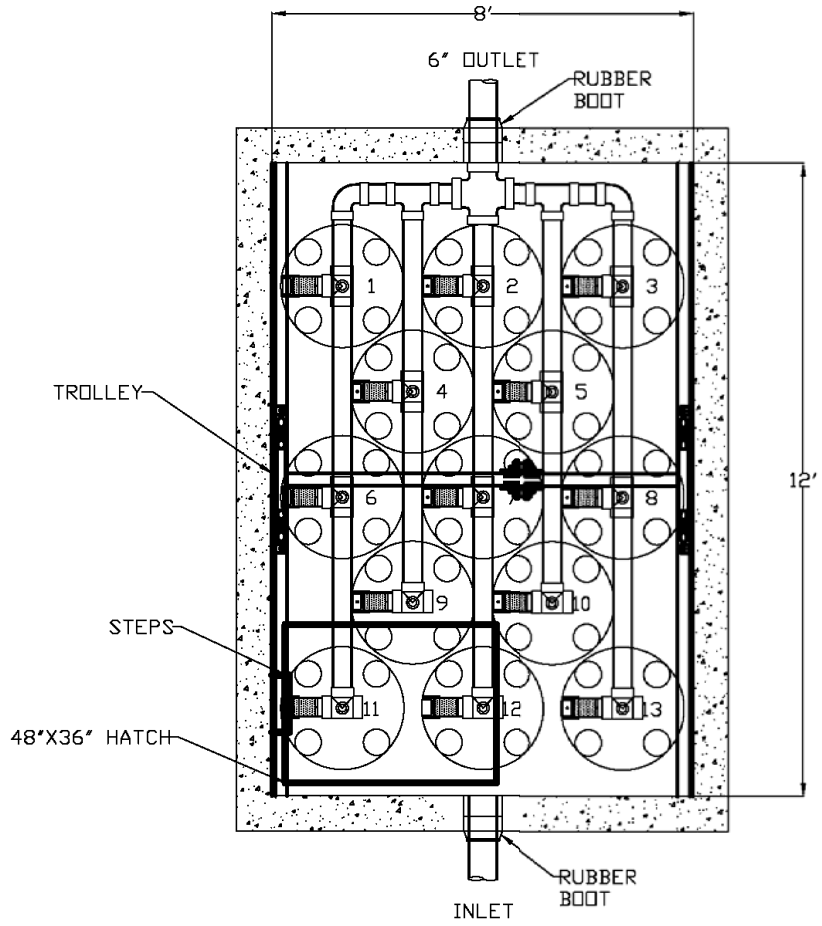
REV	DESCRIPTION	DATE	APPR	NOTES:

BAYSAVER TECHNOLOGIES, INC.
WWW.BAYSAVER.COM

DESIGNED:	TEP	DATE:	9/16/08
DRAWN:	EKH	SCALE:	N.T.S.
CHECKED:	EKH	DWG NO:	BF-207

VAULT BAYFILTER
MODEL PVF-8-10-10

BAYFILTER STORMWATER FILTRATION SYSTEM PROTECTED BY U.S. PATENT # 6,869,528



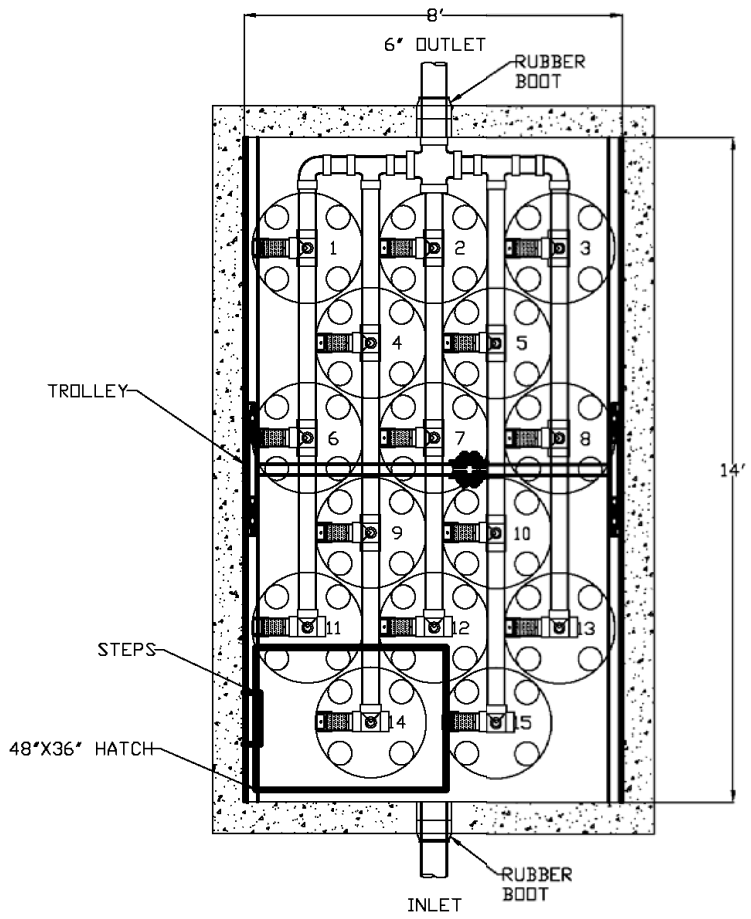
REV	DESCRIPTION	DATE	APPR	NOTES:

BAYSAVER TECHNOLOGIES, INC.
WWW.BAYSAVER.COM

DESIGNED:	TEP	DATE:	9/16/08
DRAWN:	EKH	SCALE:	N.T.S.
CHECKED:	EKH	DWG NO:	BF-208

VAULT BAYFILTER
MODEL PVF-8-12-13

BAYFILTER STORMWATER FILTRATION SYSTEM PROTECTED BY U.S. PATENT # 6,869,528



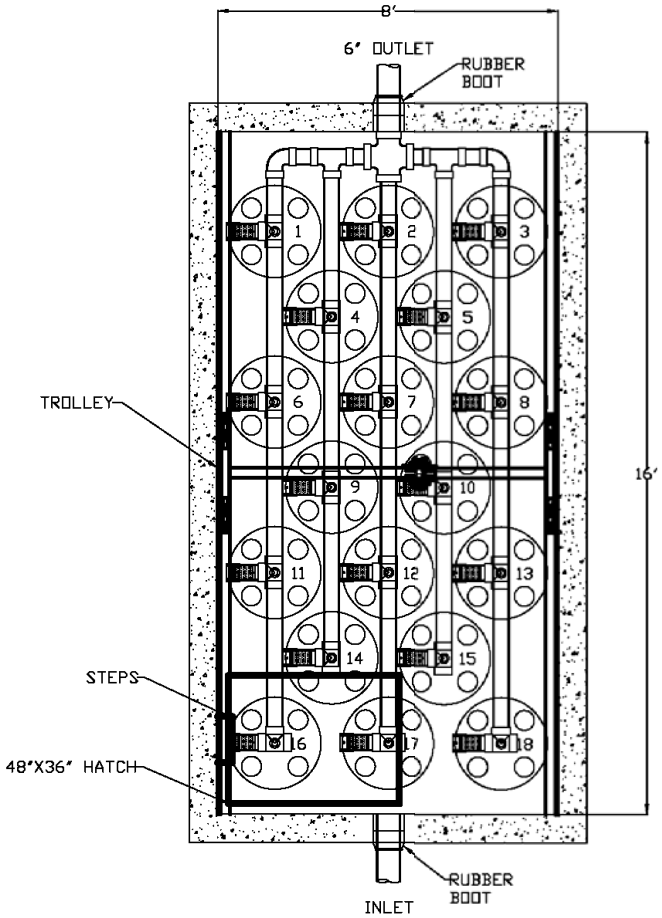
REV	DESCRIPTION	DATE	APPR	NOTES:

BAYSAVER TECHNOLOGIES, INC.
WWW.BAYSAVER.COM

DESIGNED:	TEP	DATE:	9/16/08
DRAWN:	EKH	SCALE:	N.T.S.
CHECKED:	EKH	DWG NO:	BF-209

VAULT BAYFILTER
MODEL PVF-8-14-15

BAYFILTER STORMWATER FILTRATION SYSTEM PROTECTED BY U.S. PATENT # 6,869,528



REV	DESCRIPTION	DATE	APPR	NOTES:

BAYSAVER TECHNOLOGIES, INC.
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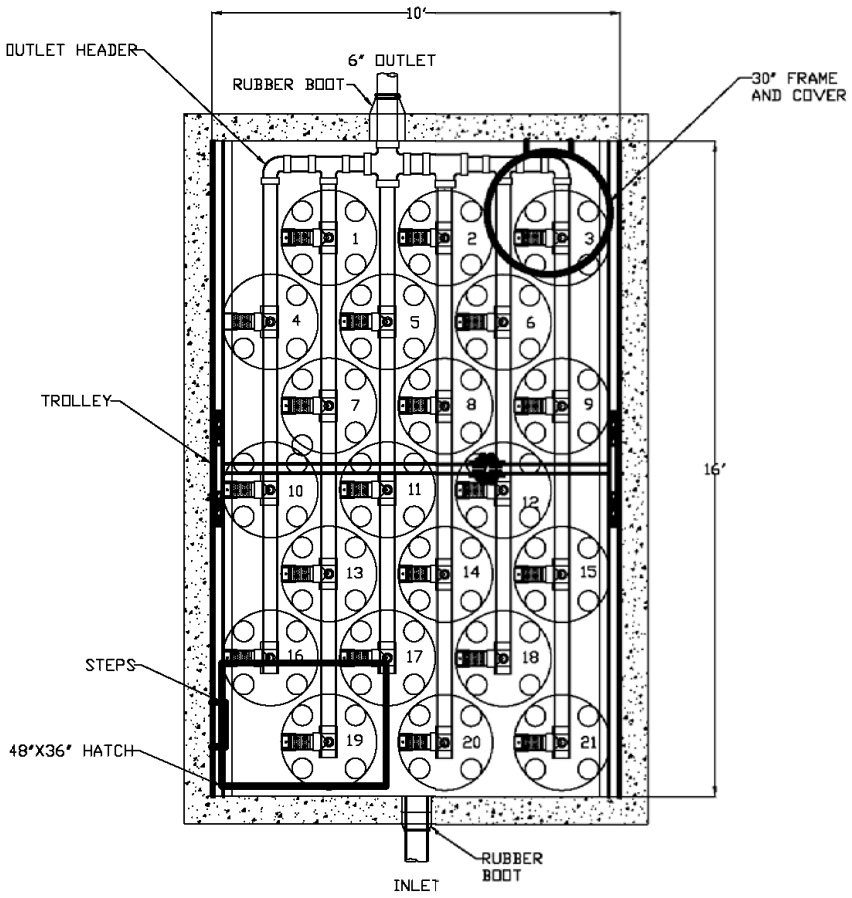
DESIGNED:	TEP	DATE:	3/7/07
DRAWN:	AJW	SCALE:	N.T.S.
CHECKED:	AJW	DWG NO:	BF-210

VAULT BAYFILTER
MODEL PVF-8-16-18

BAYFILTER STORMWATER FILTRATION SYSTEM PROTECTED BY U.S. PATENT # 6,869,528



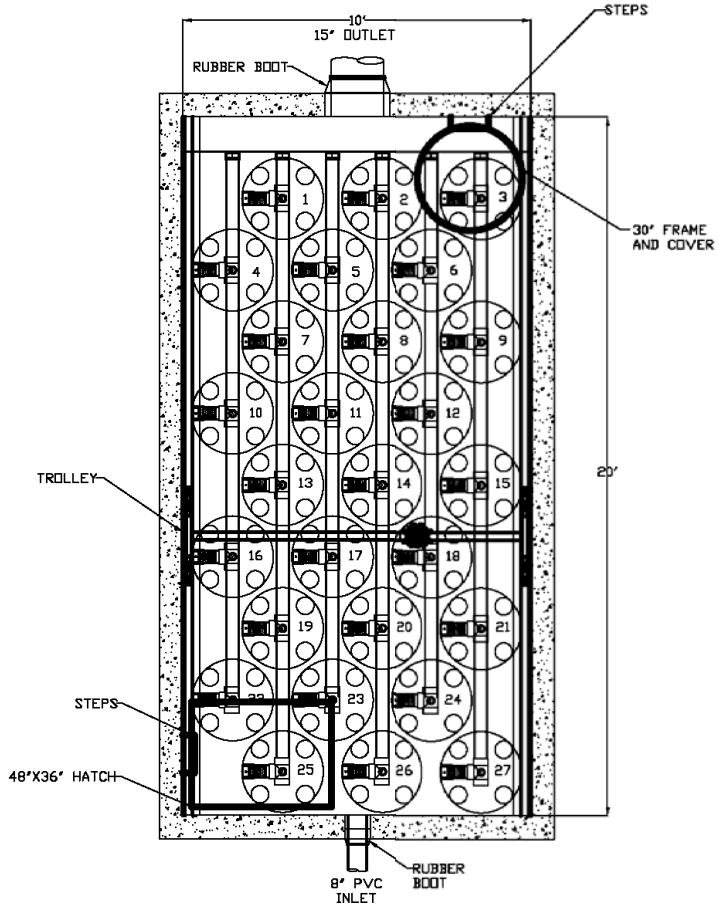
REV	DESCRIPTION	DATE	APPR	NOTES:

BAYSAVER
TECHNOLOGIES, INC.
WWW.BAYSAVER.COM

DESIGNED:	TEP	DATE:	11/14/07
DRAWN:	EKH	SCALE:	N.T.S.
CHECKED:	AJW	DWG NO:	BF-203

VAULT BAYFILTER
MODEL PVF-10-16-21
PRELIMINARY

BAYFILTER STORMWATER FILTRATION SYSTEM PROTECTED BY U.S. PATENT # 6,869,528



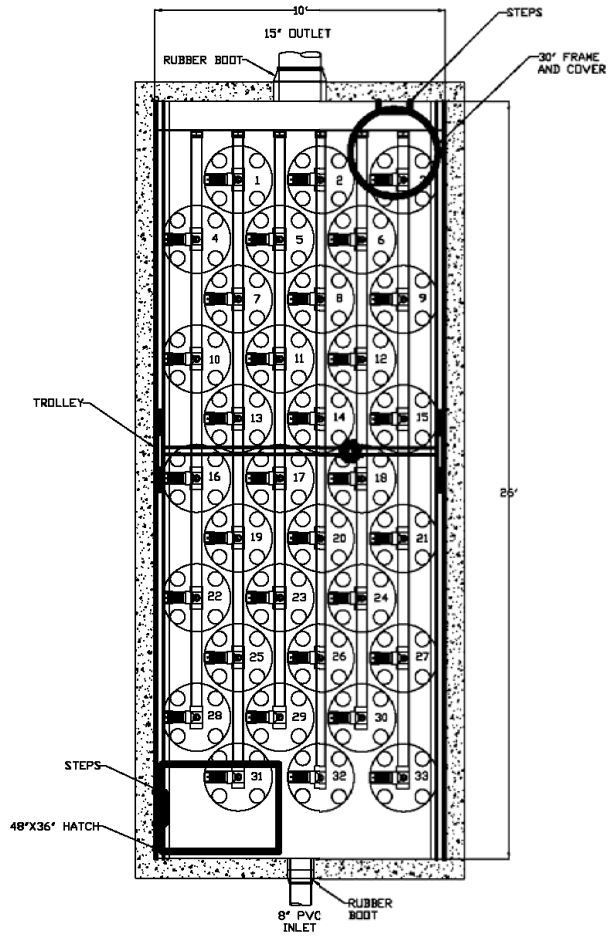
REV	DESCRIPTION	DATE	APPR	NOTES:

BAYSAVER
TECHNOLOGIES, INC.
WWW.BAYSAVER.COM

DESIGNED:	TEP	DATE:	11/14/07
DRAWN:	EKH	SCALE:	N.T.S.
CHECKED:	AJW	DWG NO:	BF-203

VAULT BAYFILTER
MODEL PVF-10-20-27
PRELIMINARY

BAYFILTER STORMWATER FILTRATION SYSTEM PROTECTED BY U.S. PATENT # 6,869,528



REV	DESCRIPTION	DATE	APPR	NOTES:

BAYSAVER
TECHNOLOGIES, INC.
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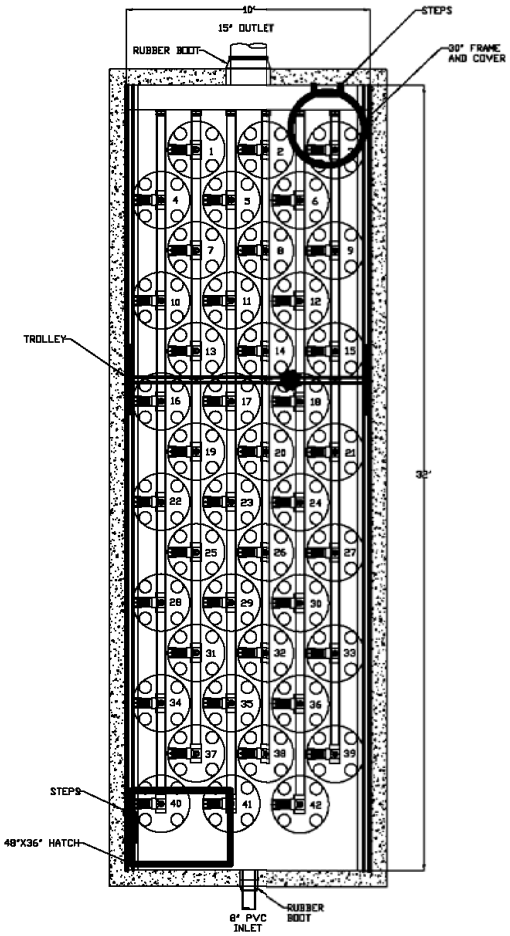
DESIGNED:	TEP	DATE:	11/14/07
DRAWN:	EKH	SCALE:	N.T.S.
CHECKED:	AJW	DWG NO:	BF-203

VAULT BAYFILTER
MODEL PVF-10-26-33
PRELIMINARY

BAYFILTER STORMWATER FILTRATION SYSTEM PROTECTED BY U.S. PATENT # 6,869,528



REV	DESCRIPTION	DATE	APPR	NOTES:

BAYSAVER
TECHNOLOGIES, INC.
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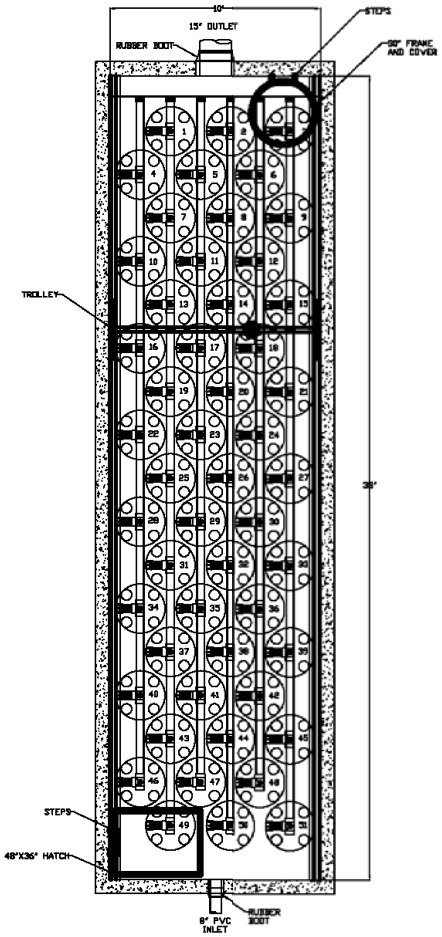
DESIGNED:	TEP	DATE:	9/30/08
DRAWN:	EKH	SCALE:	N.T.S.
CHECKED:	EKH	DWG NO:	BF-204

VAULT BAYFILTER
PRELIMINARY
MODEL PVF-10-32-42

BAYFILTER STORMWATER FILTRATION SYSTEM PROTECTED BY U.S. PATENT # 6,869,528



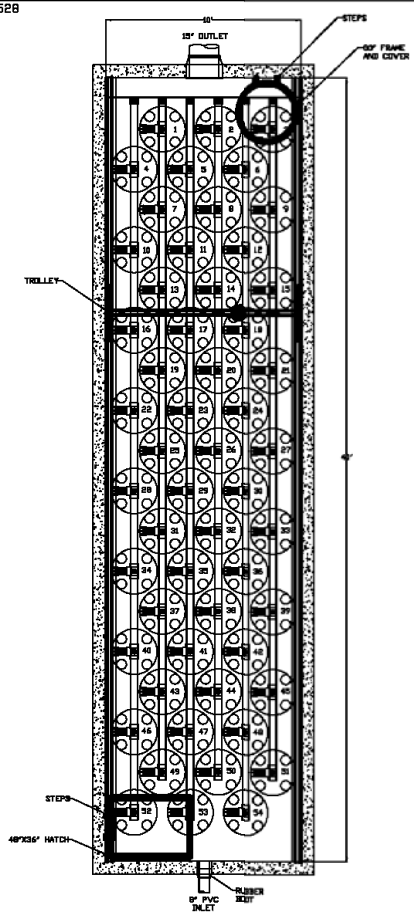
REV	DESCRIPTION	DATE	APPR	NOTES:

BAYSAVER
TECHNOLOGIES, INC.
WWW.BAYSAVER.COM

DESIGNED:	TEP	DATE:	11/14/07
DRAWN:	EKH	SCALE:	N.T.S.
CHECKED:	AJW	DWG NO:	BF-203

VAULT BAYFILTER
MODEL PVF-10-38-51
PRELIMINARY

BAYFILTER STORMWATER FILTRATION SYSTEM PROTECTED BY U.S. PATENT # 6,869,528



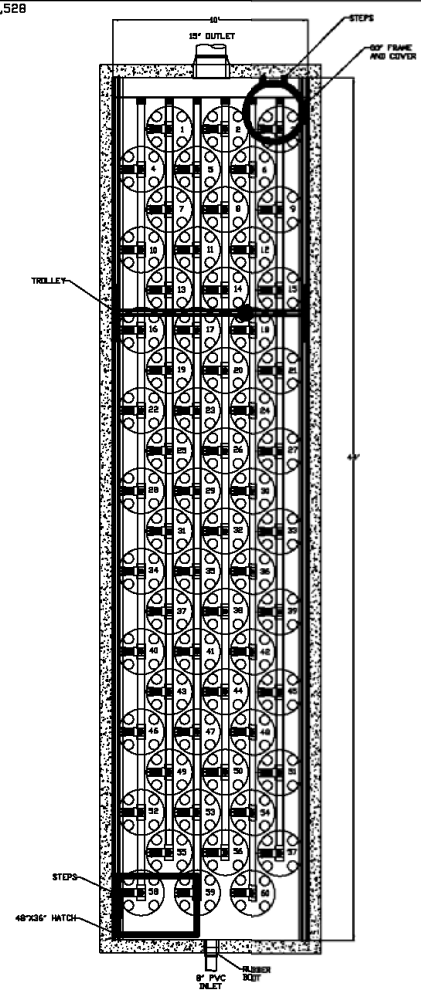
REV	DESCRIPTION	DATE	APPR	NOTES:

BAYSAVER
TECHNOLOGIES, INC.
WWW.BAYSAVER.COM

DESIGNED:	TEP	DATE:	9/29/08
DRAWN:	EKH	SCALE:	N.T.S.
CHECKED:	EKH	DWG NO:	BF-203

VAULT BAYFILTER
MODEL PVF-10-40-54
PRELIMINARY

BAYFILTER STORMWATER FILTRATION SYSTEM PROTECTED BY U.S. PATENT # 6,869,528



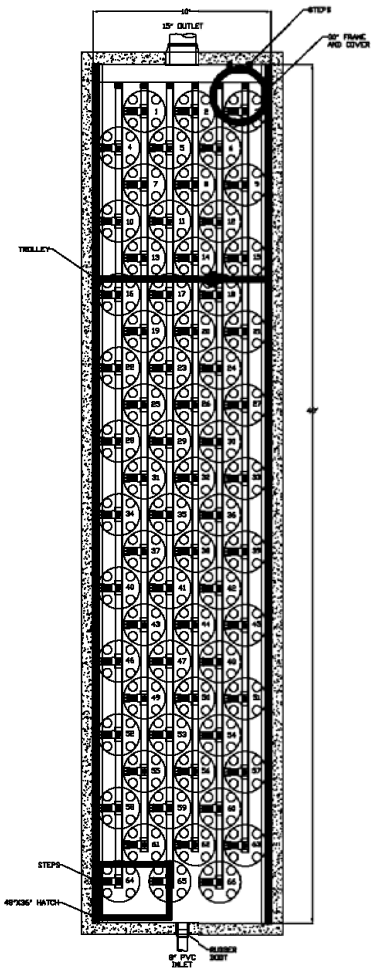
REV	DESCRIPTION	DATE	APPR	NOTES:

BAYSAVER
TECHNOLOGIES, INC.
WWW.BAYSAVER.COM

DESIGNED:	TEP	DATE:	9/29/08
DRAWN:	EKH	SCALE:	N.T.S.
CHECKED:	EKH	DWG NO:	BF-203

VAULT BAYFILTER
MODEL PVF-10-44-60
PRELIMINARY

BAYFILTER STORMWATER FILTRATION SYSTEM PROTECTED BY U.S. PATENT # 6,869,528



REV	DESCRIPTION	DATE	APPR	NOTES:

BAYSAVER
TECHNOLOGIES, INC.
WWW.BAYSAVER.COM

DESIGNED:	TEP	DATE:	9/29/08
DRAWN:	EKH	SCALE:	N.T.S.
CHECKED:	EKH	DWG NO:	BF-203

VAULT BAYFILTER
MODEL PVF-10-48-66
PRELIMINARY

Appendix

C

Project Information Sheet

BAYSAVER TECHNOLOGIES, INC.
Engineering Stormwater Solutions

BayFilter™ Sizing Form

Project Contact Information		
Company Name		Date
Contact Name	☐Engineer ☐Developer ☐Contractor	
Project Name	Email	
Telephone	Fax	
City	State Zip	
Site Characteristics ☐Residential ☐Commercial ☐Industrial ☐Mixed		Due Date
Additional comments/project information		

Design and Sizing Parameters	
Total Drainage Area (acres)	Impervious Area (acres)
Required Treatment Flow CFS (if applicable)	Water Quality Volume to be Detained ☐75% ☐100% Other
Water Quality Volume (ft^3)	Project Location: City ST

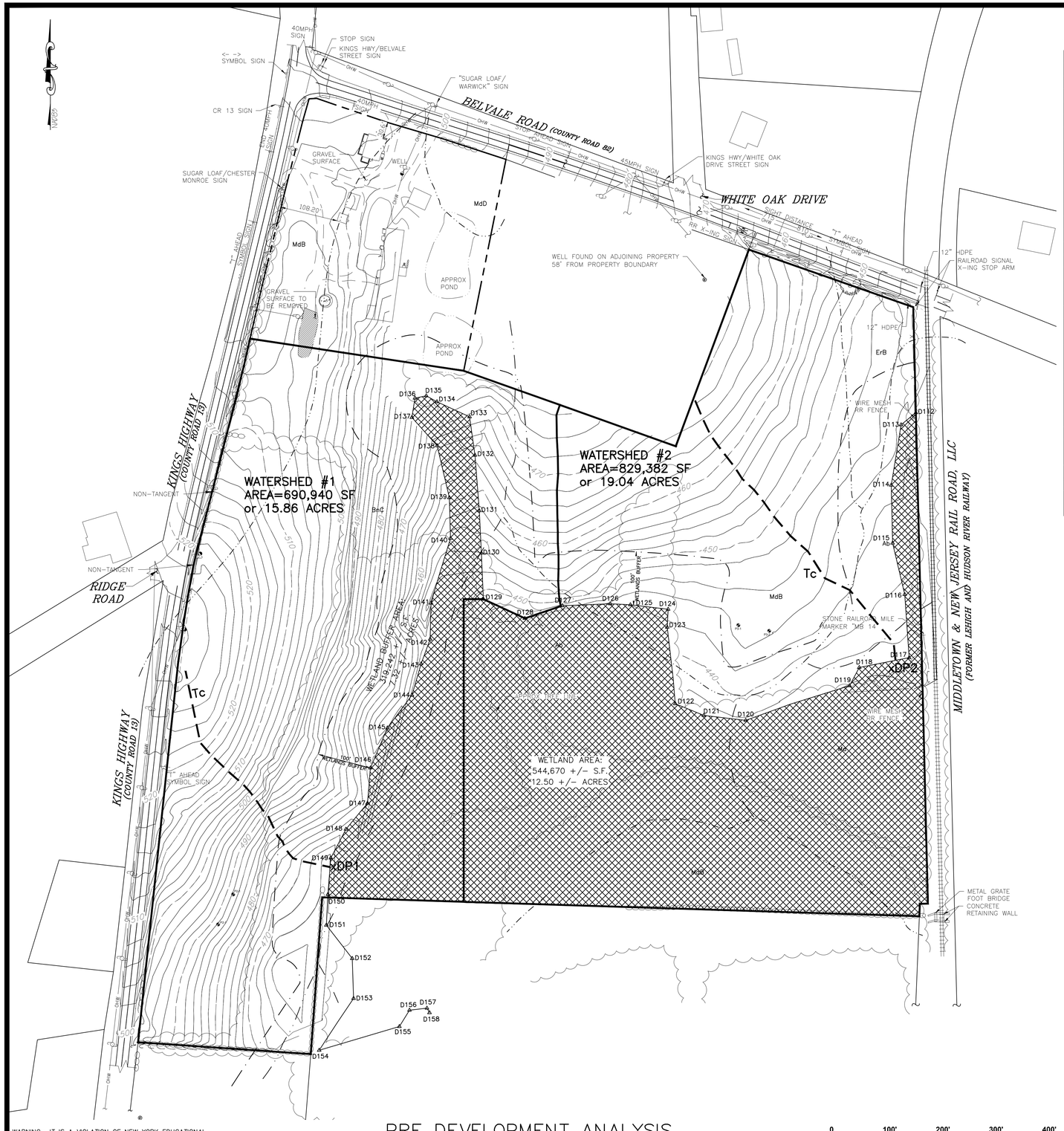
Regulatory Requirements	
% Total Suspended Solids Removal (ex. 80%)	% Total Phosphorus Removal (ex. 50%)
Project Stage ☐Conceptual Design ☐Preliminary Design ☐Final Design ☐Other	
Other Site Specific Sizing Criteria	

Thank you for supplying the required information! You're almost done!
We will also need:

- √ Plan(s) View
- √ Profile(s)

MKTG0013A#

Please email this form and any drawings to **Engineering@BaySaver.com**
Phone 800-BAYSAVER (800.229.7283) Fax 301.829.3747



LEGEND:

	EXISTING BUILDING
	EXISTING EASEMENT
	EXISTING WATER EDGE
	EXISTING WETLANDS BUFFER
	EXISTING EDGE OF PAVEMENT
	EXISTING YELLOW LINE
	EXISTING WHITE LINE
OHW	EXISTING OVERHEAD WIRE
X	EXISTING WIRE MESH FENCE
	EXISTING SOIL DELINEATOR
	EXISTING PROPERTY LINE
	EXISTING ADJACENT PROPERTY LINE
	EXISTING POND LINE
	EXISTING STONE WALL
	EXISTING DRAINAGE LINE
130	EXISTING MAJOR CONTOUR
118	EXISTING MINOR CONTOUR
	EXISTING WETLAND
	STEEL BRIDGE
	EXISTING GUY
	RAIL ROAD TRUCK
	GRAVEL SURFACE TO BE REMOVED
P3-1	PERCOLATION TEST
	EXISTING WELL
	EXISTING LIGHT POLE
	EXSITING IRON PIPE MARKER
	EXISTING IRON ROD MARKER
	EXISTING RAILROAD SIGNAL X-ING STOP ARM
	EXISTING SIGN
	RR X-ING SIGN
	TREE
	EXISTING TREELINE
	CONCRETE SURFACE

PRE DEVELOPMENT ANALYSIS

SCALE: 1"=100'

0 100' 200' 300' 400'
SCALE: 1"=100'

Dig Safely. New York
Call811
before you dig

REVISION	BY	DATE	DESCRIPTION

THIS SHEET IS NOT VALID WITHOUT ALL OF THE SHEETS THAT COMPRISE THE SET

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TEL: (845) 782-8114
WWW.ARDENCONSULTING.NET

STATE OF NEW YORK · MICHAEL A. MORGANTE · 078577 · LICENSED PROFESSIONAL ENGINEER

MICHAEL A. MORGANTE, P.E.
LIC. NO. 78577

SUBDIVISION & SITE PLAN FOR
1251 KINGS HIGHWAY LLC
1251 KINGS HWY
CHESTER, NY 10918

PRE DEVELOPMENT ANALYSIS

JOB#:	18-029
SCALE:	AS NOTED
DATE:	02/25/19
DRAWN:	MM
CHECKED:	MM
SHEET NO.	01 of 02

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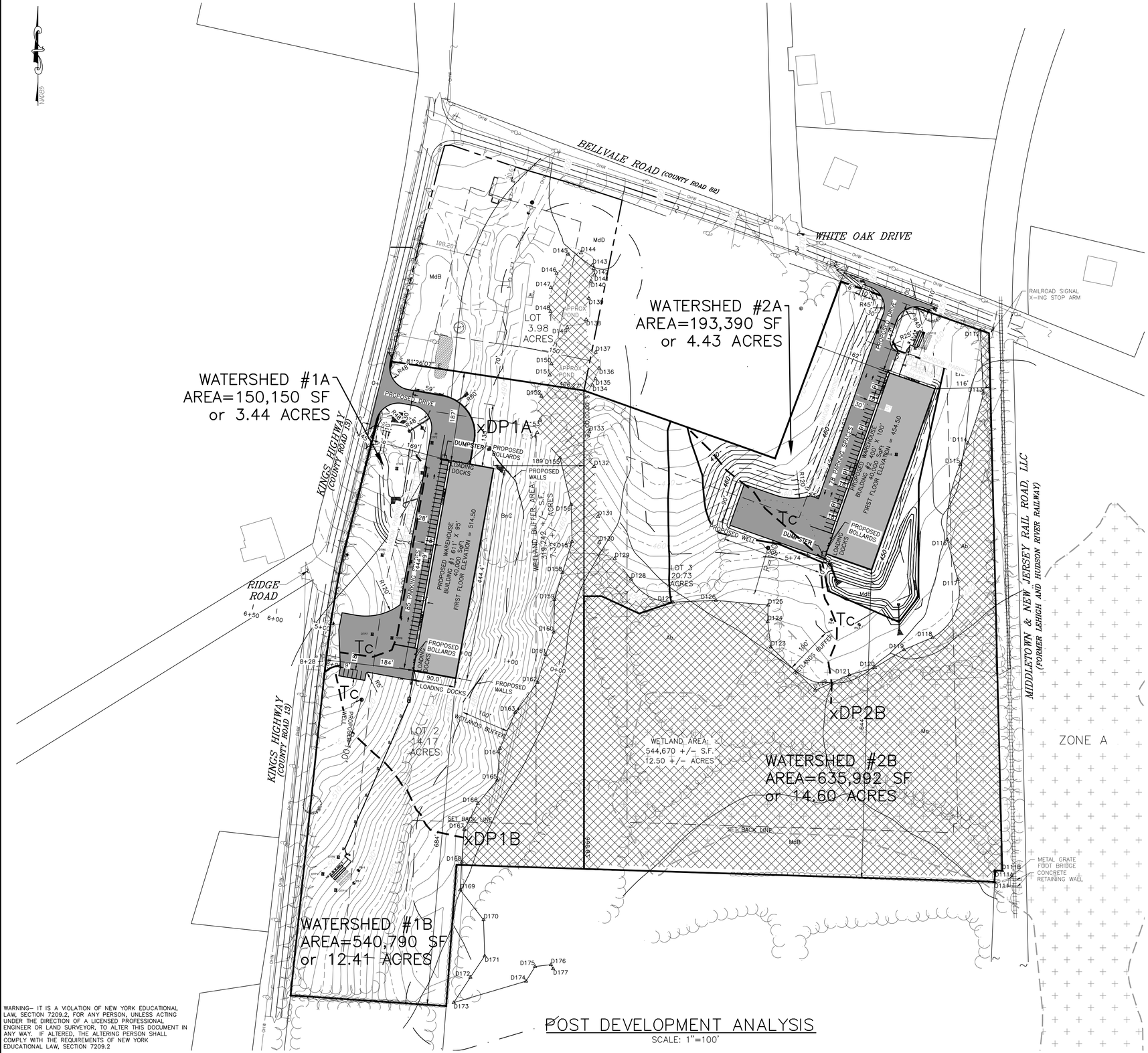

POST DEVELOPMENT ANALYSIS

SCALE: 1"=100'

LEGEND:

	EXISTING BUILDING
	EXISTING WATER EDGE
	EXISTING WETLANDS BUFFER
	EXISTING EDGE OF PAVEMENT
	EXISTING YELLOW LINE
	EXISTING WHITE LINE
OHW	EXISTING OVERHEAD WIRE
	EXISTING PROPERTY LINE
	EXISTING ADJACENT PROPERTY LINE
	EXISTING STONE WALL
130	EXISTING MAJOR CONTOUR
	EXISTING MINOR CONTOUR
	EXISTING DRAINAGE LINE
D149 D150	EXISTING WETLAND
	EXISTING GUY
	GRAVEL SURFACE TO BE REMOVED
	EXISTING RAILROAD SIGNAL X-ING STOP ARM
P3-1	PERCOLATION TEST
	EXISTING WELL
	EXISTING LIGHT POLE
	EXSITING IRON PIPE MARKER
	EXISTING IRON ROD MARKER
	EXISTING SIGN
	PROPOSED WELL
	PROPOSED BUILDING
	PROPOSED EDGE OF PAVEMENT
510	PROPOSED MAJOR CONTOUR
	PROPOSED MINOR CONTOUR
+510.5	PROPOSED SPOT GRADE
	PROPOSED DRAINAGE CATCHBASIN
	PROPOSED DRAINAGE PIPE
	PROPOSED RIPRAP
	PROPOSED PROPERTY LINE

Dig Safely. New York Call811 before you dig

0 40' 80 120 160
SCALE: 1"=40'

REVISION	BY	DATE	DESCRIPTION
1	MM	4/24/20	REVISIONS PER 4/10/20 OCDPW COMMENT LETTER

THIS SHEET IS NOT VALID WITHOUT ALL OF THE SHEETS THAT COMPRISE THE SET

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MICHAEL A. MORGANTE, P.E.
LIC. NO. 78577

SUBDIVISION & SITE PLAN FOR
1251 KINGS HIGHWAY LLC
1251 KINGS HWY
CHESTER, NY 10918

POST DEVELOPMENT ANALYSIS

JOB#: 18-029
SCALE: AS NOTED
DATE: 02/25/19
DRAWN: MM
CHECKED: MM
SHEET NO. 02 of 02

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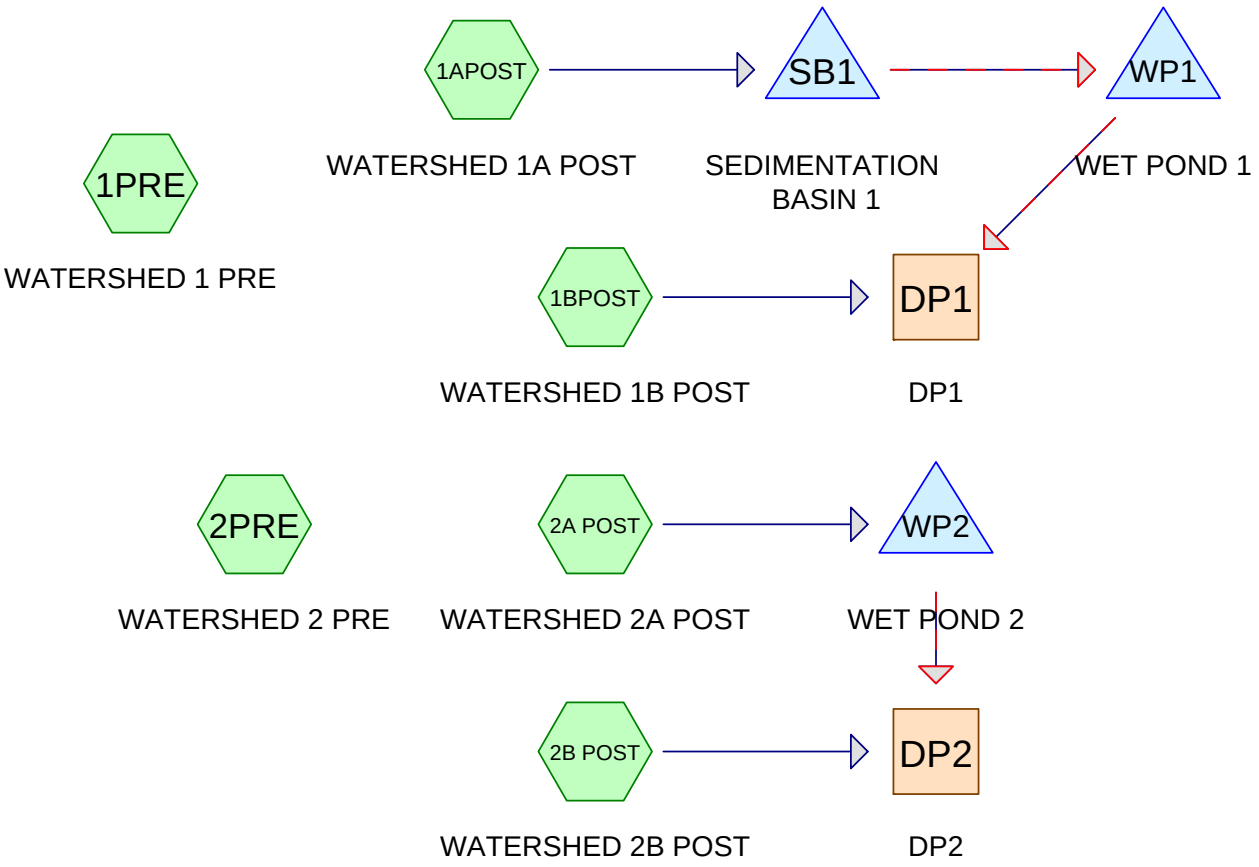
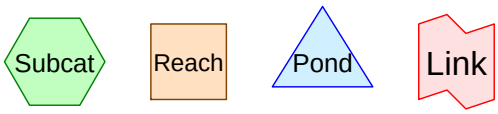




Routing Diagram for HYDROCAD 1-29-20
Prepared by {enter your company name here}, Printed 2/16/2020
HydroCAD® 10.00-25 s/n 04164 © 2019 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
19.050	74	>75% Grass cover, Good, HSG C (1APOST, 1BPOST, 2A POST, 2B POST, 2PRE)
4.247	98	Paved parking, HSG C (1APOST, 2A POST)
8.587	82	Row crops, SR + CR, Good, HSG C (1PRE)
25.034	98	Water Surface, HSG C (1BPOST, 1PRE, 2B POST, 2PRE)
12.889	70	Woods, Good, HSG C (1BPOST, 1PRE, 2PRE)
69.808	**84**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
69.808	HSG C	1APOST, 1BPOST, 1PRE, 2A POST, 2B POST, 2PRE
0.000	HSG D	
0.000	Other	
69.808		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	19.050	0.000	0.000	19.050	>75% Grass cover, Good	1APOST, 1BPOST, 2A POST, 2B POST, 2PRE
0.000	0.000	4.247	0.000	0.000	4.247	Paved parking	1APOST, 2A POST
0.000	0.000	8.587	0.000	0.000	8.587	Row crops, SR + CR, Good	1PRE
0.000	0.000	25.034	0.000	0.000	25.034	Water Surface	1BPOST, 1PRE, 2B POST, 2PRE
0.000	0.000	12.889	0.000	0.000	12.889	Woods, Good	1BPOST, 1PRE, 2PRE
0.000	**0.000**	**69.808**	**0.000**	**0.000**	**69.808**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	WP1	507.00	496.00	460.0	0.0239	0.012	15.0	0.0	0.0
2	WP2	442.50	441.60	180.0	0.0050	0.012	18.0	0.0	0.0

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1A POST: WATERSHED 1A Runoff Area=150,150 sf 59.94% Impervious Runoff Depth>1.55"
Flow Length=560' Tc=6.0 min CN=88 Runoff=6.28 cfs 0.446 af

Subcatchment 1B POST: WATERSHED 1B Runoff Area=540,790 sf 20.94% Impervious Runoff Depth>0.92"
Flow Length=490' Tc=10.3 min CN=78 Runoff=11.03 cfs 0.950 af

Subcatchment 1PRE: WATERSHED 1 PRE Runoff Area=690,940 sf 16.39% Impervious Runoff Depth>1.08"
Flow Length=490' Tc=12.4 min CN=81 Runoff=16.03 cfs 1.433 af

Subcatchment 2A POST: WATERSHED Runoff Area=193,390 sf 49.12% Impervious Runoff Depth>1.41"
Flow Length=395' Tc=7.4 min CN=86 Runoff=6.98 cfs 0.520 af

Subcatchment 2B POST: WATERSHED Runoff Area=635,992 sf 67.64% Impervious Runoff Depth>1.71"
Flow Length=300' Tc=10.8 min CN=90 Runoff=24.86 cfs 2.077 af

Subcatchment 2PRE: WATERSHED 2 PRE Runoff Area=829,559 sf 52.29% Impervious Runoff Depth>1.40"
Flow Length=630' Tc=12.6 min CN=86 Runoff=25.37 cfs 2.230 af

Reach DP1: DP1 Inflow=11.03 cfs 1.198 af
Outflow=11.03 cfs 1.198 af

Reach DP2: DP2 Inflow=24.86 cfs 2.253 af
Outflow=24.86 cfs 2.253 af

Pond SB1: SEDIMENTATION BASIN 1 Peak Elev=509.32' Storage=1,029 cf Inflow=6.28 cfs 0.446 af
Outflow=6.47 cfs 0.422 af

Pond WP1: WET POND 1 Peak Elev=508.32' Storage=8,311 cf Inflow=6.47 cfs 0.422 af
Primary=1.94 cfs 0.248 af Secondary=0.00 cfs 0.000 af Outflow=1.94 cfs 0.248 af

Pond WP2: WET POND 2 Peak Elev=443.55' Storage=15,892 cf Inflow=6.98 cfs 0.520 af
Primary=0.36 cfs 0.176 af Secondary=0.00 cfs 0.000 af Outflow=0.36 cfs 0.176 af

Total Runoff Area = 69.808 ac Runoff Volume = 7.656 af Average Runoff Depth = 1.32"
58.05% Pervious = 40.526 ac 41.95% Impervious = 29.281 ac

Summary for Subcatchment 1APOST: WATERSHED 1A POST

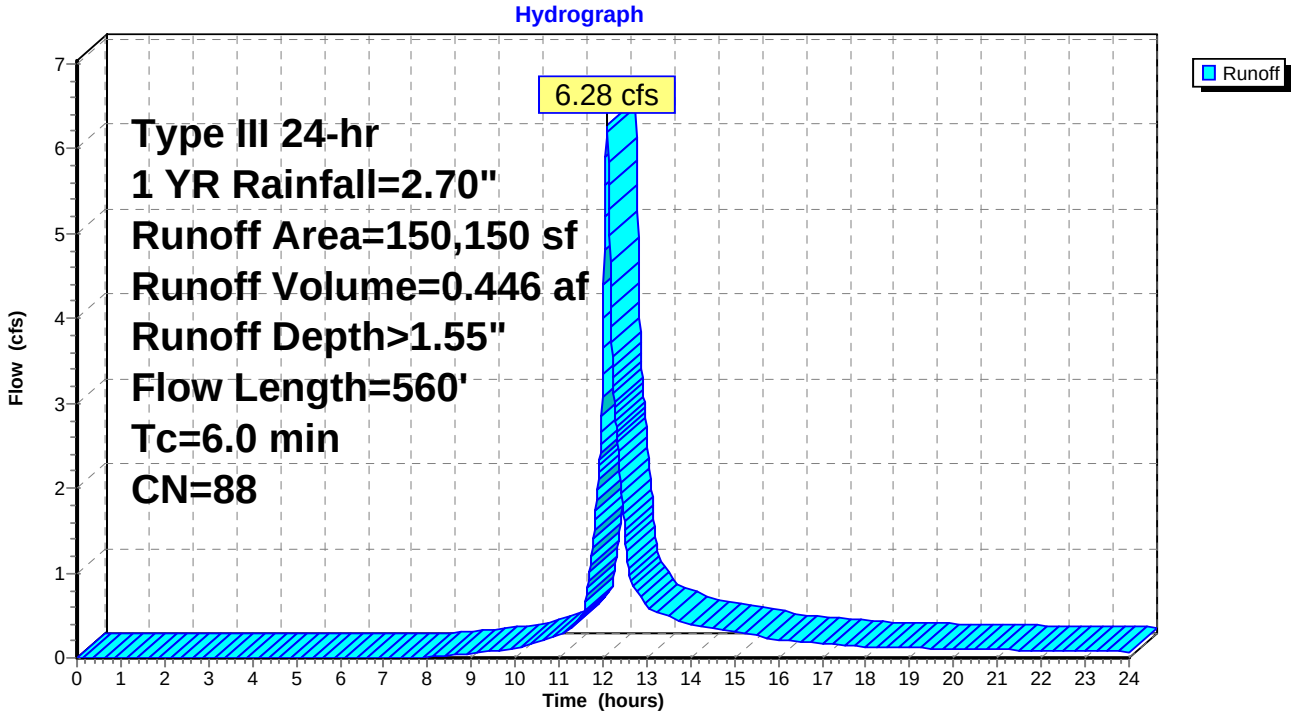
Runoff = 6.28 cfs @ 12.09 hrs, Volume= 0.446 af, Depth> 1.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 1 YR Rainfall=2.70"

Area (sf)	CN	Description
90,000	98	Paved parking, HSG C
60,150	74	>75% Grass cover, Good, HSG C
150,150	88	Weighted Average
60,150		40.06% Pervious Area
90,000		59.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	100	0.0900	2.53		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 3.25"
2.7	460	0.0200	2.87		**Shallow Concentrated Flow, Shallow Flow to SW Basin** Paved Kv= 20.3 fps
3.4	560	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1APOST: WATERSHED 1A POST



Summary for Subcatchment 1BPOST: WATERSHED 1B POST

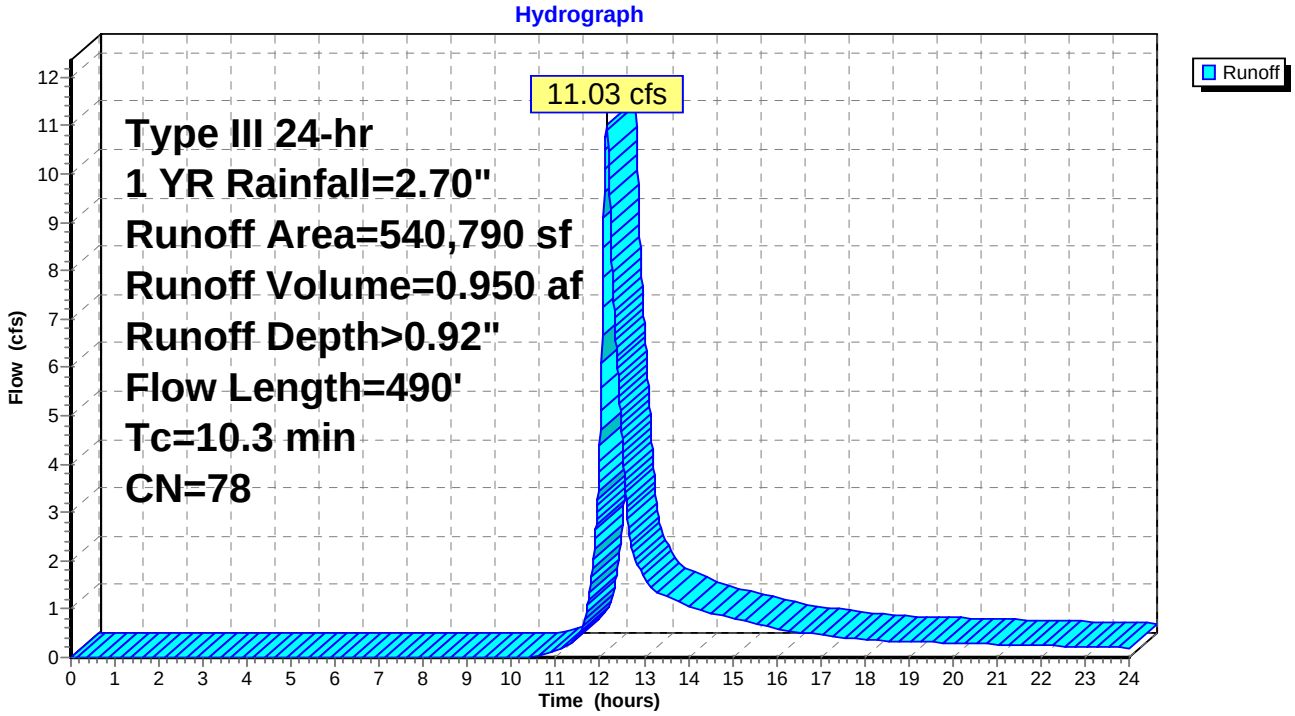
Runoff = 11.03 cfs @ 12.15 hrs, Volume= 0.950 af, Depth> 0.92"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 1 YR Rainfall=2.70"

Area (sf)	CN	Description
113,266	98	Water Surface, HSG C
277,724	74	>75% Grass cover, Good, HSG C
149,800	70	Woods, Good, HSG C
540,790	78	Weighted Average
427,524		79.06% Pervious Area
113,266		20.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	100	0.0400	0.23		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.25"
1.3	205	0.1500	2.71		**Shallow Concentrated Flow, Shallow Flow to Woods** Short Grass Pasture Kv= 7.0 fps
1.6	185	0.1400	1.87		**Shallow Concentrated Flow, Shallow Flow Woods to Wetland** Woodland Kv= 5.0 fps
10.3	490	Total			

Subcatchment 1BPOST: WATERSHED 1B POST



Summary for Subcatchment 1PRE: WATERSHED 1 PRE

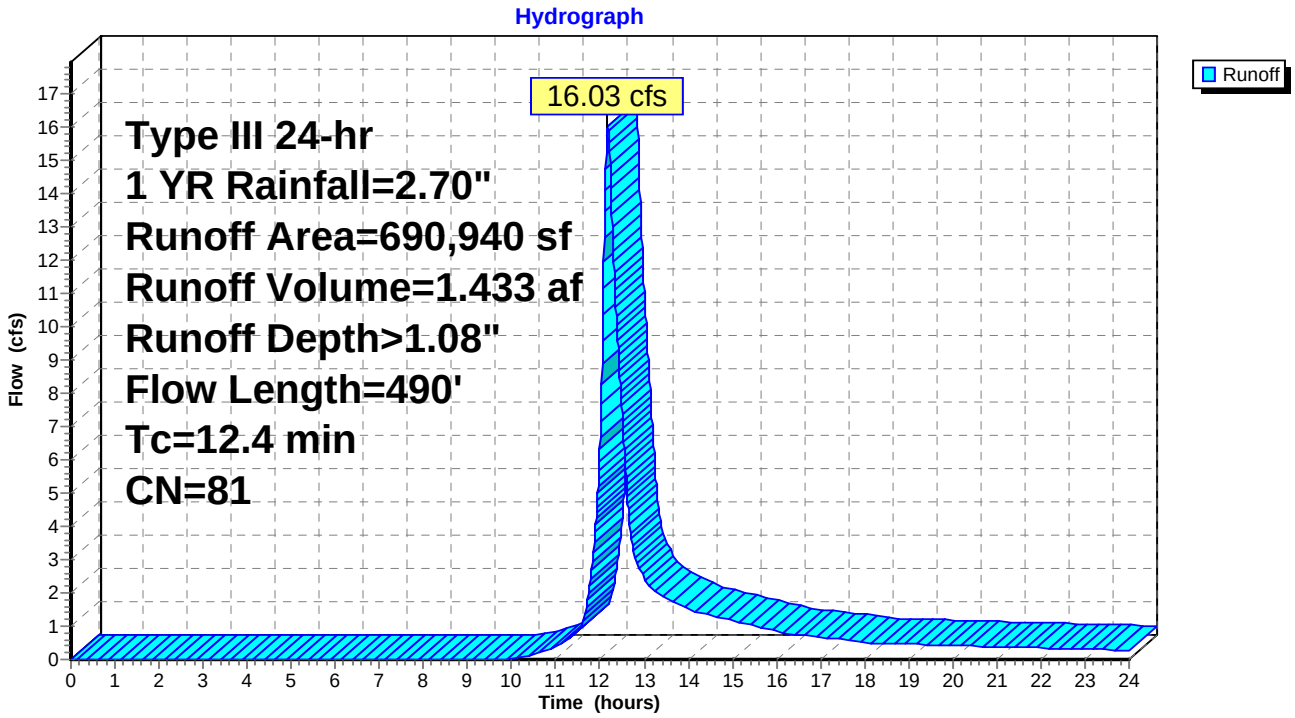
Runoff = 16.03 cfs @ 12.18 hrs, Volume= 1.433 af, Depth> 1.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 1 YR Rainfall=2.70"

Area (sf)	CN	Description
113,266	98	Water Surface, HSG C
374,041	82	Row crops, SR + CR, Good, HSG C
203,633	70	Woods, Good, HSG C
690,940	81	Weighted Average
577,674		83.61% Pervious Area
113,266		16.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	100	0.0400	0.20		**Sheet Flow, Sheet Flow** Cultivated: Residue>20% n= 0.170 P2= 3.25"
1.0	205	0.1500	3.49		**Shallow Concentrated Flow, Shallow Flow to Woods** Cultivated Straight Rows Kv= 9.0 fps
3.3	185	0.1400	0.94		**Shallow Concentrated Flow, Shallow Flow Woods to Wetland** Forest w/Heavy Litter Kv= 2.5 fps
12.4	490	Total			

Subcatchment 1PRE: WATERSHED 1 PRE



Summary for Subcatchment 2A POST: WATERSHED 2A POST

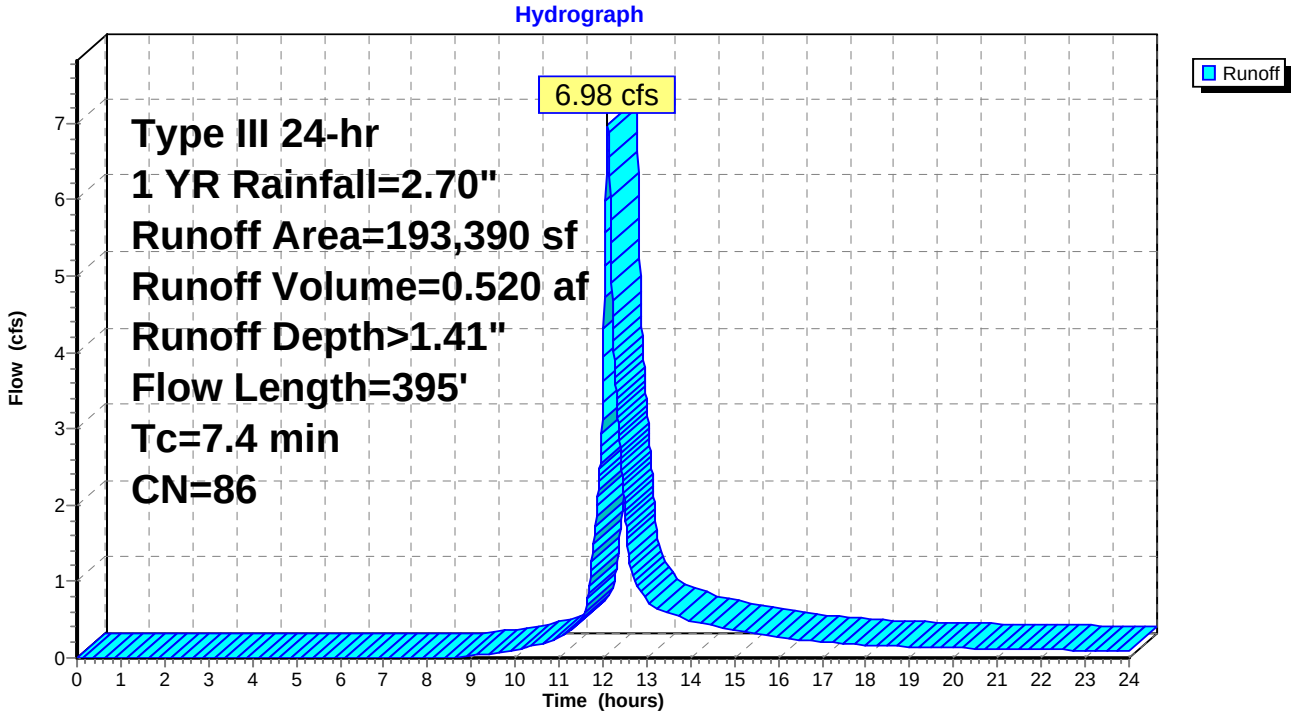
Runoff = 6.98 cfs @ 12.11 hrs, Volume= 0.520 af, Depth> 1.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 1 YR Rainfall=2.70"

Area (sf)	CN	Description
98,390	74	>75% Grass cover, Good, HSG C
95,000	98	Paved parking, HSG C
193,390	86	Weighted Average
98,390		50.88% Pervious Area
95,000		49.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	100	0.0800	0.30		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.25"
0.4	60	0.1500	2.71		**Shallow Concentrated Flow, Shallow Flow to Pavement** Short Grass Pasture Kv= 7.0 fps
1.4	235	0.0200	2.87		**Shallow Concentrated Flow, Shallow Flow Pavement to Catchba** Paved Kv= 20.3 fps
7.4	395	Total			

Subcatchment 2A POST: WATERSHED 2A POST



Summary for Subcatchment 2B POST: WATERSHED 2B POST

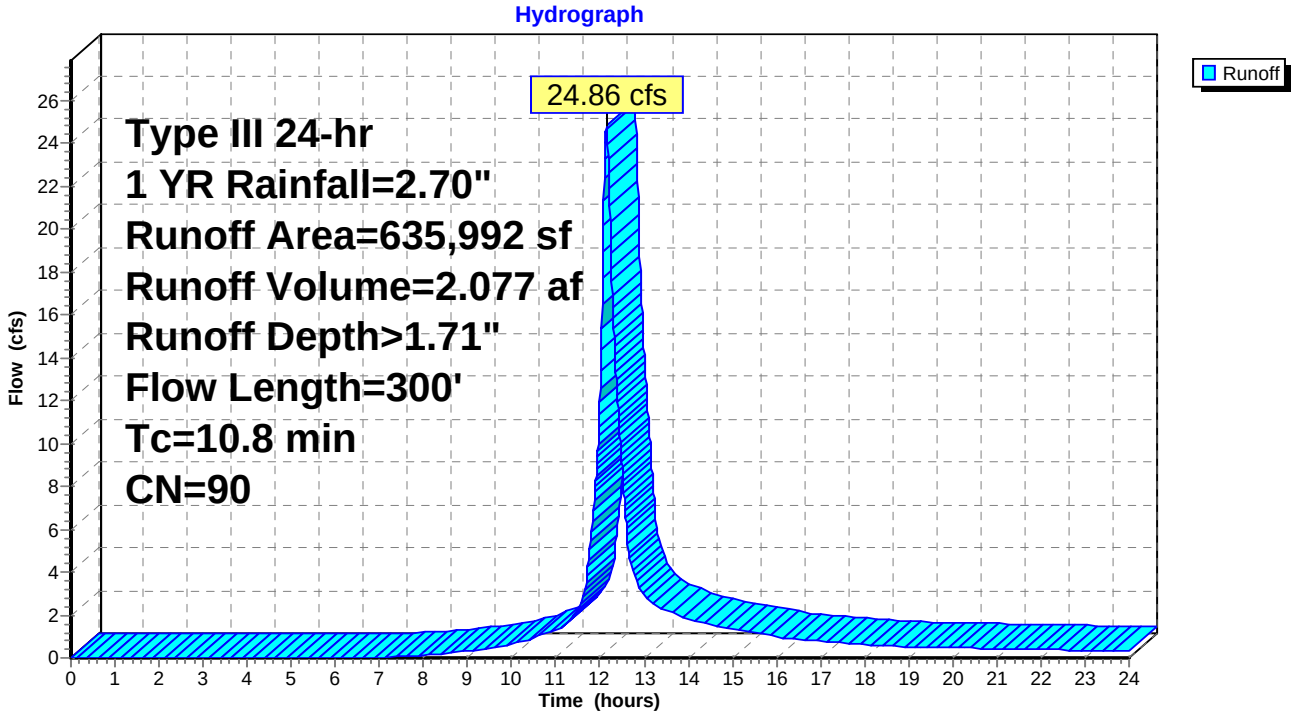
Runoff = 24.86 cfs @ 12.15 hrs, Volume= 2.077 af, Depth> 1.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 1 YR Rainfall=2.70"

Area (sf)	CN	Description
205,792	74	>75% Grass cover, Good, HSG C
430,200	98	Water Surface, HSG C
635,992	90	Weighted Average
205,792		32.36% Pervious Area
430,200		67.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	100	0.0250	0.19		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.25"
1.9	200	0.0650	1.78		**Shallow Concentrated Flow, Shallow Flow to Wetland** Short Grass Pasture Kv= 7.0 fps
10.8	300	Total			

Subcatchment 2B POST: WATERSHED 2B POST



Summary for Subcatchment 2PRE: WATERSHED 2 PRE

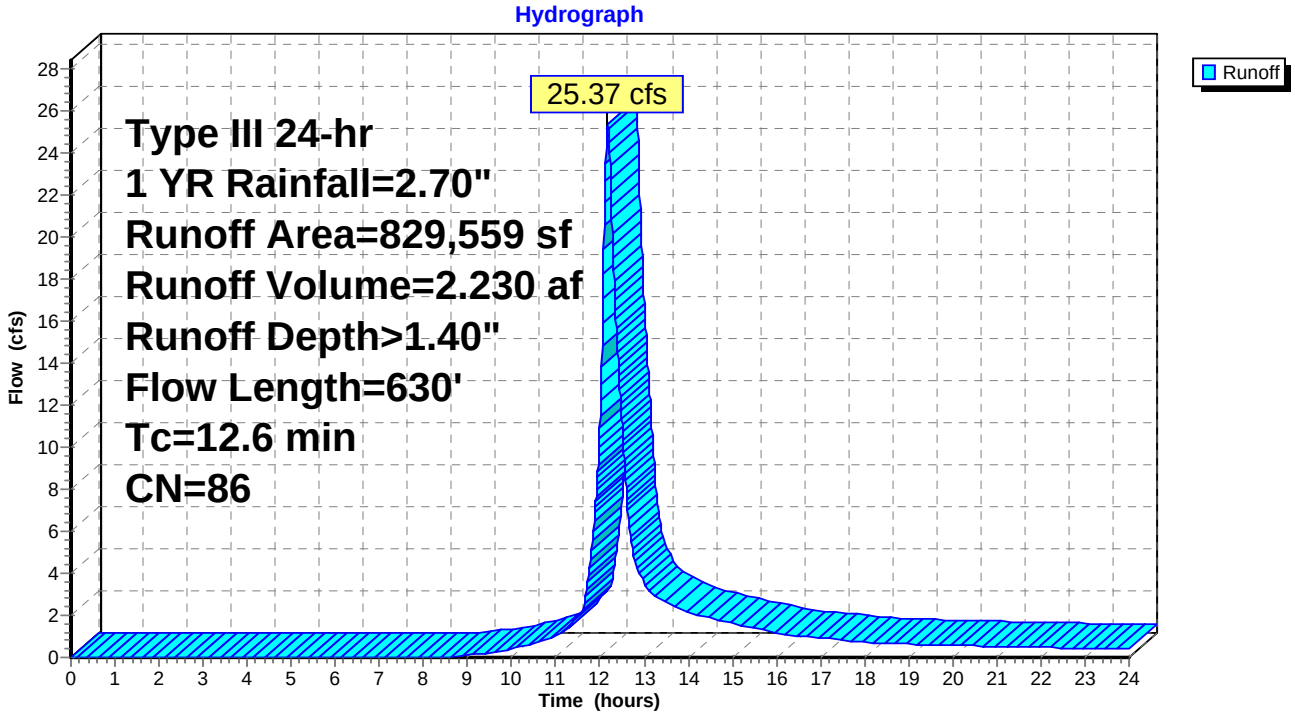
Runoff = 25.37 cfs @ 12.17 hrs, Volume= 2.230 af, Depth> 1.40"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 1 YR Rainfall=2.70"

Area (sf)	CN	Description
187,773	74	>75% Grass cover, Good, HSG C
433,755	98	Water Surface, HSG C
208,031	70	Woods, Good, HSG C
829,559	86	Weighted Average
395,804		47.71% Pervious Area
433,755		52.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	100	0.0600	0.27		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.25"
6.3	530	0.0400	1.40		**Shallow Concentrated Flow, Shallow Flow to Wetland** Short Grass Pasture Kv= 7.0 fps
12.6	630	Total			

Subcatchment 2PRE: WATERSHED 2 PRE

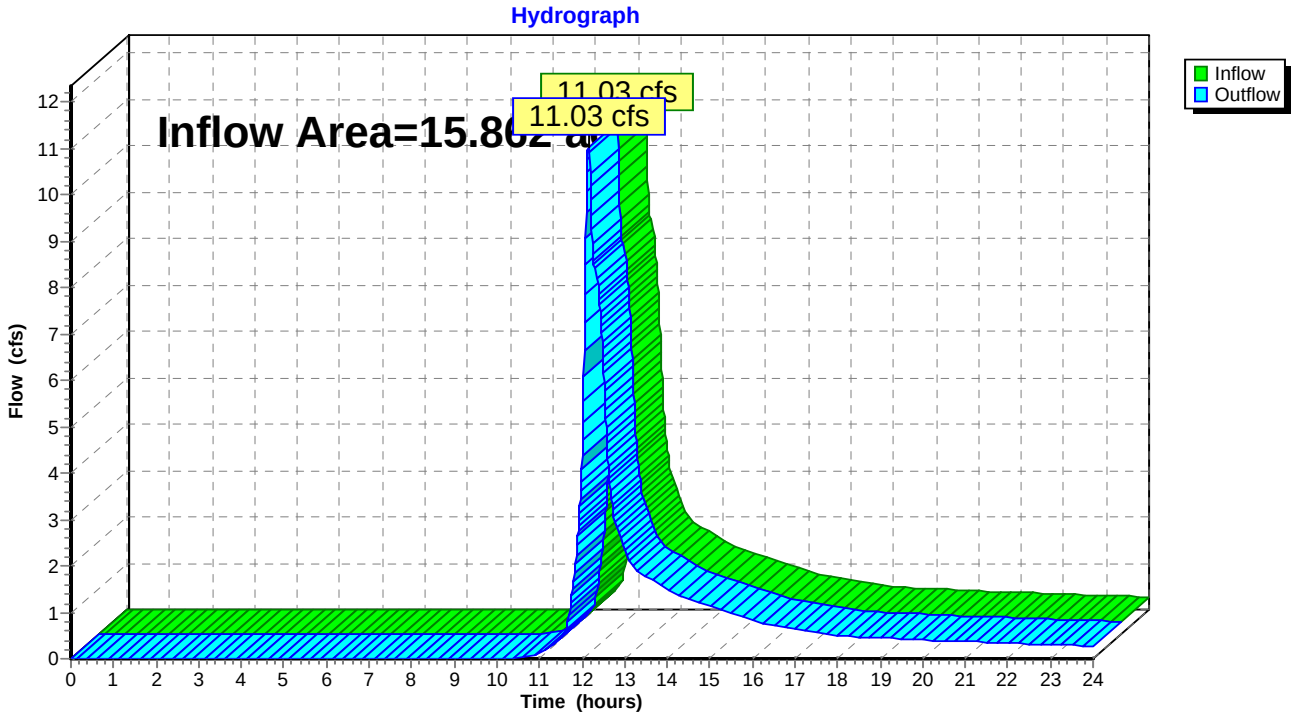


Summary for Reach DP1: DP1

Inflow Area = 15.862 ac, 29.42% Impervious, Inflow Depth > 0.91" for 1 YR event
Inflow = 11.03 cfs @ 12.15 hrs, Volume= 1.198 af
Outflow = 11.03 cfs @ 12.15 hrs, Volume= 1.198 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP1: DP1

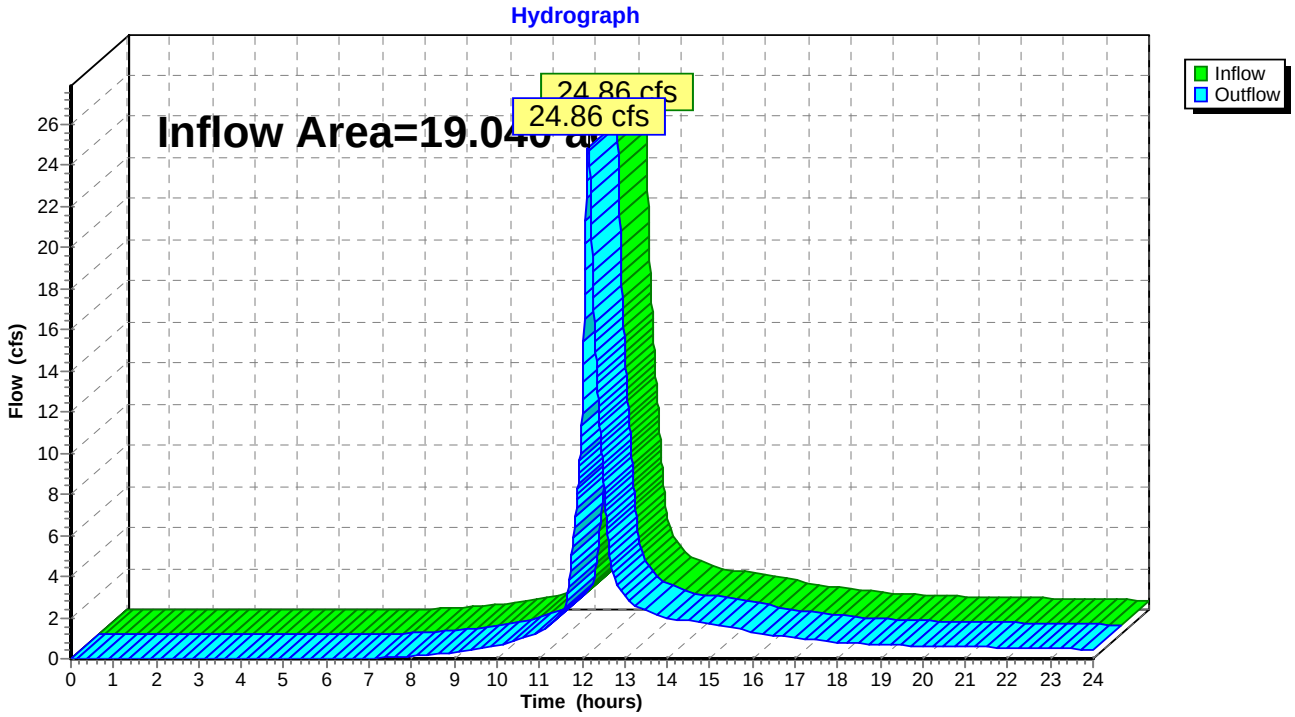


Summary for Reach DP2: DP2

Inflow Area = 19.040 ac, 63.32% Impervious, Inflow Depth > 1.42" for 1 YR event
Inflow = 24.86 cfs @ 12.15 hrs, Volume= 2.253 af
Outflow = 24.86 cfs @ 12.15 hrs, Volume= 2.253 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP2: DP2



Summary for Pond SB1: SEDIMENTATION BASIN 1

Inflow Area = 3.447 ac, 59.94% Impervious, Inflow Depth > 1.55" for 1 YR event
Inflow = 6.28 cfs @ 12.09 hrs, Volume= 0.446 af
Outflow = 6.47 cfs @ 12.08 hrs, Volume= 0.422 af, Atten= 0%, Lag= 0.0 min
Primary = 6.47 cfs @ 12.08 hrs, Volume= 0.422 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 509.32' @ 12.08 hrs Surf.Area= 1,062 sf Storage= 1,029 cf
Flood Elev= 509.25' Surf.Area= 1,062 sf Storage= 1,029 cf

Plug-Flow detention time= 40.8 min calculated for 0.422 af (95% of inflow)
Center-of-Mass det. time= 12.2 min (833.7 - 821.5)

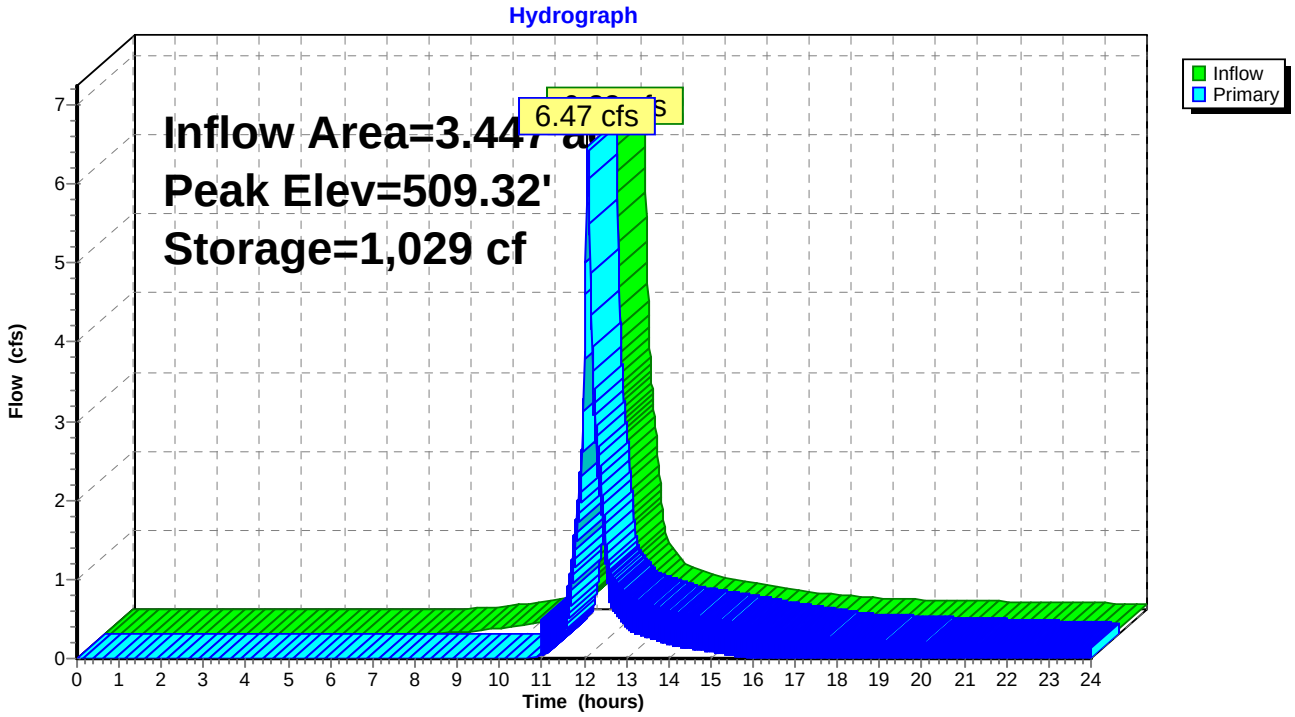
Volume	Invert	Avail.Storage	Storage Description
#1	507.00'	1,029 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
507.00	388	81.0	0	0	388
508.00	777	109.0	571	571	822
508.50	1,062	127.0	458	1,029	1,165

Device	Routing	Invert	Outlet Devices
#1	Primary	509.00'	**15.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=6.43 cfs @ 12.08 hrs HW=509.31' TW=507.78' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 6.43 cfs @ 1.36 fps)

Pond SB1: SEDIMENTATION BASIN 1



Summary for Pond WP1: WET POND 1

Inflow Area = 3.447 ac, 59.94% Impervious, Inflow Depth > 1.47" for 1 YR event
Inflow = 6.47 cfs @ 12.08 hrs, Volume= 0.422 af
Outflow = 1.94 cfs @ 12.43 hrs, Volume= 0.248 af, Atten= 70%, Lag= 20.7 min
Primary = 1.94 cfs @ 12.43 hrs, Volume= 0.248 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 508.32' @ 12.43 hrs Surf.Area= 7,038 sf Storage= 8,311 cf
Flood Elev= 509.25' Surf.Area= 8,718 sf Storage= 15,449 cf

Plug-Flow detention time= 196.1 min calculated for 0.248 af (59% of inflow)
Center-of-Mass det. time= 88.8 min (922.5 - 833.7)

Volume	Invert	Avail.Storage	Storage Description
#1	507.00'	23,107 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

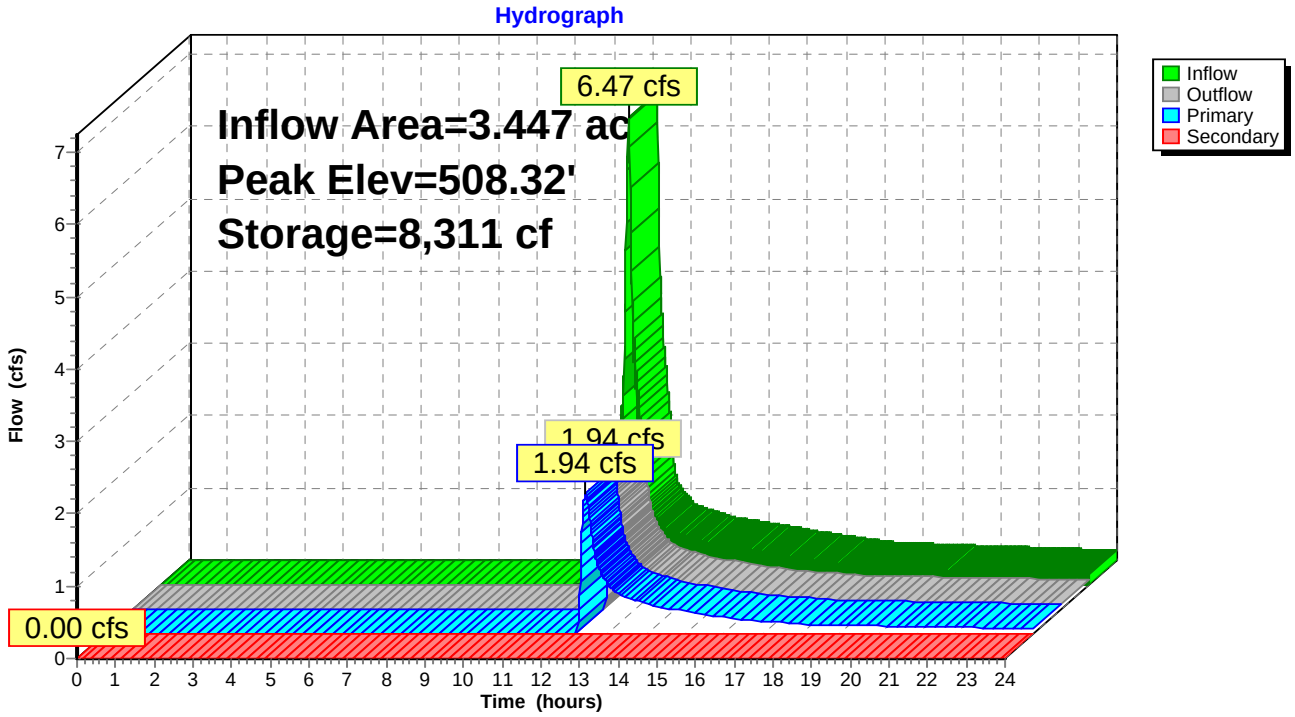
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
507.00	5,600	360.0	0	0	5,600
508.00	6,700	370.0	6,142	6,142	6,286
509.00	7,800	380.0	7,243	13,385	6,991
510.00	11,780	540.0	9,722	23,107	18,714

Device	Routing	Invert	Outlet Devices
#1	Primary	507.00'	**15.0" Round Culvert** L= 460.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 507.00' / 496.00' S= 0.0239 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#2	Device 1	508.20'	**Custom Weir/Orifice X 3.00, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 Width (feet) 5.00 5.00
#3	Device 1	509.20'	**60.0" x 60.0" Horiz. Orifice/Grate** C= 0.600 in 72.0" x 72.0" Grate (69% open area) Limited to weir flow at low heads
#4	Secondary	509.25'	**15.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=1.94 cfs @ 12.43 hrs HW=508.32' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Passes 1.94 cfs of 4.91 cfs potential flow)
  ├─**2=Custom Weir/Orifice** (Weir Controls 1.94 cfs @ 1.11 fps)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=507.00' TW=0.00' (Dynamic Tailwater)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond WP1: WET POND 1



Summary for Pond WP2: WET POND 2

Inflow Area = 4.440 ac, 49.12% Impervious, Inflow Depth > 1.41" for 1 YR event
Inflow = 6.98 cfs @ 12.11 hrs, Volume= 0.520 af
Outflow = 0.36 cfs @ 15.13 hrs, Volume= 0.176 af, Atten= 95%, Lag= 181.3 min
Primary = 0.36 cfs @ 15.13 hrs, Volume= 0.176 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 443.55' @ 15.13 hrs Surf.Area= 9,296 sf Storage= 15,892 cf
Flood Elev= 446.00' Surf.Area= 14,315 sf Storage= 44,478 cf

Plug-Flow detention time= 365.2 min calculated for 0.176 af (34% of inflow)
Center-of-Mass det. time= 238.1 min (1,068.6 - 830.5)

Volume	Invert	Avail.Storage	Storage Description
#1	441.50'	44,478 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

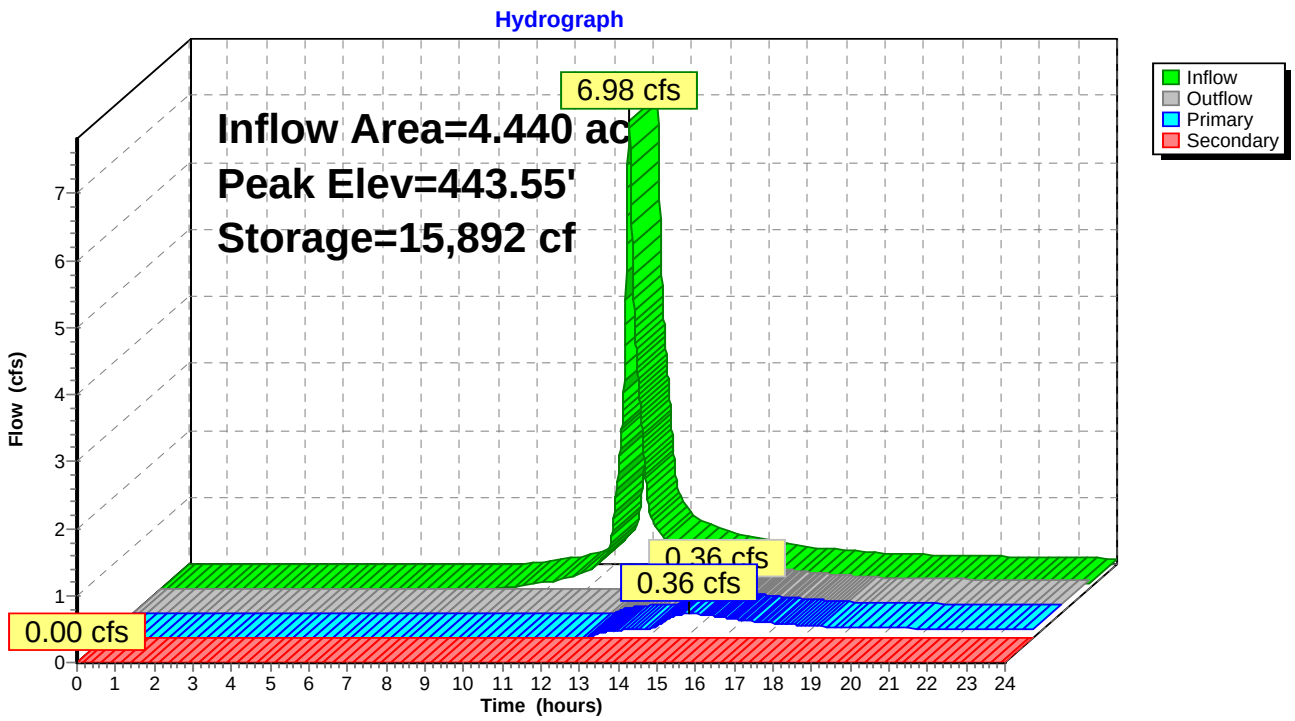
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
441.50	6,320	601.0	0	0	6,320
444.00	10,030	660.0	20,260	20,260	12,447
446.00	14,315	725.0	24,218	44,478	19,743

Device	Routing	Invert	Outlet Devices
#1	Primary	442.50'	**18.0" Round Culvert** L= 180.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 442.50' / 441.60' S= 0.0050 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Primary	443.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	443.50'	**Custom Weir/Orifice X 4.00, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 2.00 Width (feet) 1.50 1.50
#4	Device 1	445.50'	**30.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 in 42.0" x 60.0" Grate (57% open area) Limited to weir flow at low heads
#5	Secondary	445.50'	**15.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=0.36 cfs @ 15.13 hrs HW=443.55' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Passes 0.21 cfs of 3.96 cfs potential flow)
  - **3=Custom Weir/Orifice** (Weir Controls 0.21 cfs @ 0.72 fps)
  - **4=Orifice/Grate** (Controls 0.00 cfs)
- **2=Orifice/Grate** (Orifice Controls 0.15 cfs @ 3.13 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=441.50' TW=0.00' (Dynamic Tailwater)
- **5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond WP2: WET POND 2



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1A POST: WATERSHED 1A Runoff Area=150,150 sf 59.94% Impervious Runoff Depth>3.67"
Flow Length=560' Tc=6.0 min CN=88 Runoff=14.48 cfs 1.053 af

Subcatchment 1B POST: WATERSHED 1B Runoff Area=540,790 sf 20.94% Impervious Runoff Depth>2.71"
Flow Length=490' Tc=10.3 min CN=78 Runoff=34.17 cfs 2.800 af

Subcatchment 1PRE: WATERSHED 1 PRE Runoff Area=690,940 sf 16.39% Impervious Runoff Depth>2.98"
Flow Length=490' Tc=12.4 min CN=81 Runoff=45.10 cfs 3.937 af

Subcatchment 2A POST: WATERSHED Runoff Area=193,390 sf 49.12% Impervious Runoff Depth>3.46"
Flow Length=395' Tc=7.4 min CN=86 Runoff=16.96 cfs 1.281 af

Subcatchment 2B POST: WATERSHED Runoff Area=635,992 sf 67.64% Impervious Runoff Depth>3.87"
Flow Length=300' Tc=10.8 min CN=90 Runoff=54.71 cfs 4.708 af

Subcatchment 2PRE: WATERSHED 2 PRE Runoff Area=829,559 sf 52.29% Impervious Runoff Depth>3.46"
Flow Length=630' Tc=12.6 min CN=86 Runoff=61.87 cfs 5.490 af

Reach DP1: DP1 Inflow=40.90 cfs 3.653 af
Outflow=40.90 cfs 3.653 af

Reach DP2: DP2 Inflow=61.84 cfs 5.631 af
Outflow=61.84 cfs 5.631 af

Pond SB1: SEDIMENTATION BASIN 1 Peak Elev=509.52' Storage=1,029 cf Inflow=14.48 cfs 1.053 af
Outflow=14.63 cfs 1.029 af

Pond WP1: WET POND 1 Peak Elev=509.02' Storage=13,519 cf Inflow=14.63 cfs 1.029 af
Primary=6.97 cfs 0.854 af Secondary=0.00 cfs 0.000 af Outflow=6.97 cfs 0.854 af

Pond WP2: WET POND 2 Peak Elev=444.20' Storage=22,288 cf Inflow=16.96 cfs 1.281 af
Primary=7.96 cfs 0.923 af Secondary=0.00 cfs 0.000 af Outflow=7.96 cfs 0.923 af

Total Runoff Area = 69.808 ac Runoff Volume = 19.268 af Average Runoff Depth = 3.31"
58.05% Pervious = 40.526 ac 41.95% Impervious = 29.281 ac

Summary for Subcatchment 1APOST: WATERSHED 1A POST

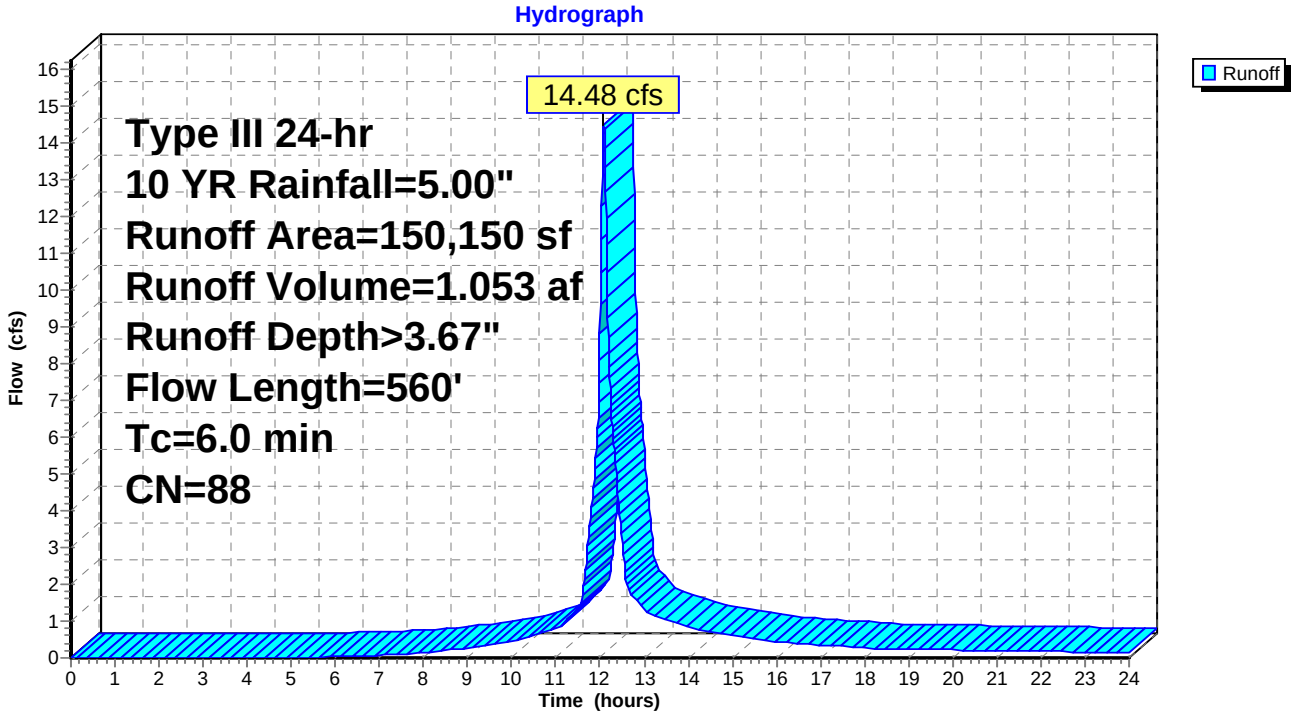
Runoff = 14.48 cfs @ 12.09 hrs, Volume= 1.053 af, Depth> 3.67"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=5.00"

Area (sf)	CN	Description
90,000	98	Paved parking, HSG C
60,150	74	>75% Grass cover, Good, HSG C
150,150	88	Weighted Average
60,150		40.06% Pervious Area
90,000		59.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	100	0.0900	2.53		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 3.25"
2.7	460	0.0200	2.87		**Shallow Concentrated Flow, Shallow Flow to SW Basin** Paved Kv= 20.3 fps
3.4	560	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1APOST: WATERSHED 1A POST



Summary for Subcatchment 1BPOST: WATERSHED 1B POST

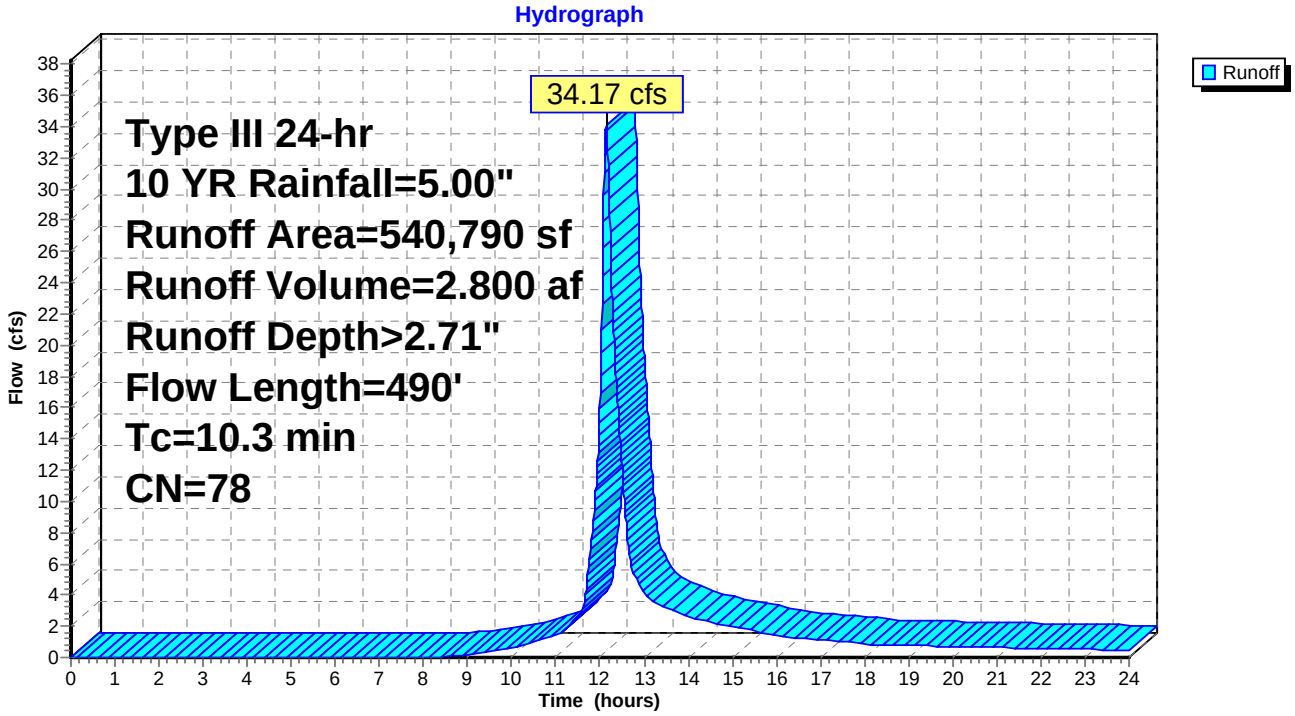
Runoff = 34.17 cfs @ 12.14 hrs, Volume= 2.800 af, Depth> 2.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=5.00"

Area (sf)	CN	Description
113,266	98	Water Surface, HSG C
277,724	74	>75% Grass cover, Good, HSG C
149,800	70	Woods, Good, HSG C
540,790	78	Weighted Average
427,524		79.06% Pervious Area
113,266		20.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	100	0.0400	0.23		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.25"
1.3	205	0.1500	2.71		**Shallow Concentrated Flow, Shallow Flow to Woods** Short Grass Pasture Kv= 7.0 fps
1.6	185	0.1400	1.87		**Shallow Concentrated Flow, Shallow Flow Woods to Wetland** Woodland Kv= 5.0 fps
10.3	490	Total			

Subcatchment 1BPOST: WATERSHED 1B POST



Summary for Subcatchment 1PRE: WATERSHED 1 PRE

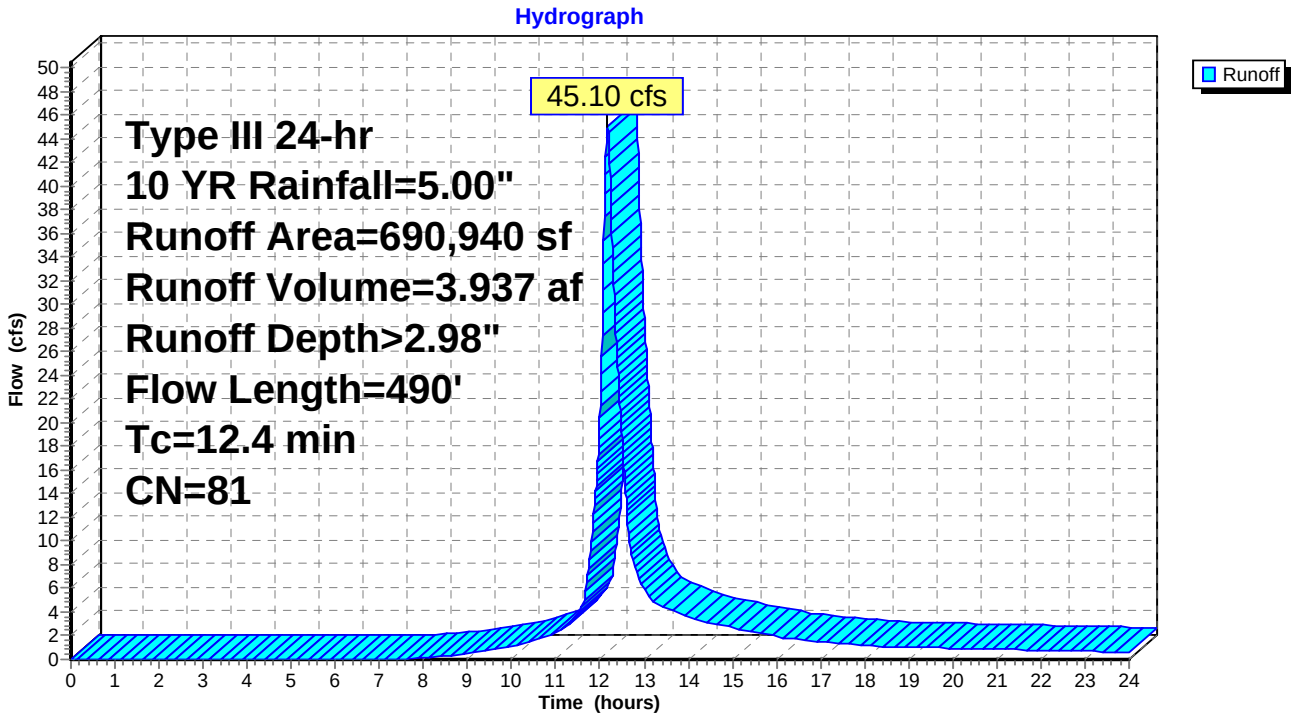
Runoff = 45.10 cfs @ 12.17 hrs, Volume= 3.937 af, Depth> 2.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=5.00"

Area (sf)	CN	Description
113,266	98	Water Surface, HSG C
374,041	82	Row crops, SR + CR, Good, HSG C
203,633	70	Woods, Good, HSG C
690,940	81	Weighted Average
577,674		83.61% Pervious Area
113,266		16.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	100	0.0400	0.20		**Sheet Flow, Sheet Flow** Cultivated: Residue>20% n= 0.170 P2= 3.25"
1.0	205	0.1500	3.49		**Shallow Concentrated Flow, Shallow Flow to Woods** Cultivated Straight Rows Kv= 9.0 fps
3.3	185	0.1400	0.94		**Shallow Concentrated Flow, Shallow Flow Woods to Wetland** Forest w/Heavy Litter Kv= 2.5 fps
12.4	490	Total			

Subcatchment 1PRE: WATERSHED 1 PRE



Summary for Subcatchment 2A POST: WATERSHED 2A POST

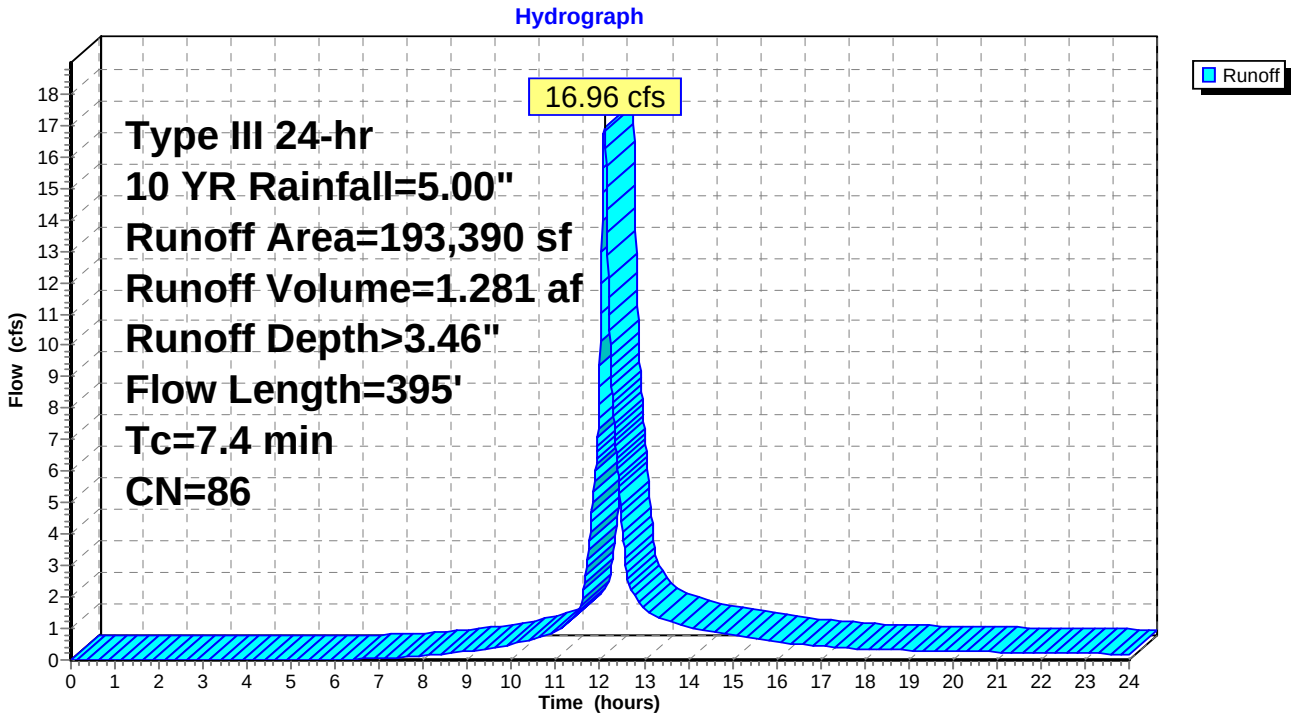
Runoff = 16.96 cfs @ 12.10 hrs, Volume= 1.281 af, Depth> 3.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=5.00"

Area (sf)	CN	Description
98,390	74	>75% Grass cover, Good, HSG C
95,000	98	Paved parking, HSG C
193,390	86	Weighted Average
98,390		50.88% Pervious Area
95,000		49.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	100	0.0800	0.30		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.25"
0.4	60	0.1500	2.71		**Shallow Concentrated Flow, Shallow Flow to Pavement** Short Grass Pasture Kv= 7.0 fps
1.4	235	0.0200	2.87		**Shallow Concentrated Flow, Shallow Flow Pavement to Catchba** Paved Kv= 20.3 fps
7.4	395	Total			

Subcatchment 2A POST: WATERSHED 2A POST



Summary for Subcatchment 2B POST: WATERSHED 2B POST

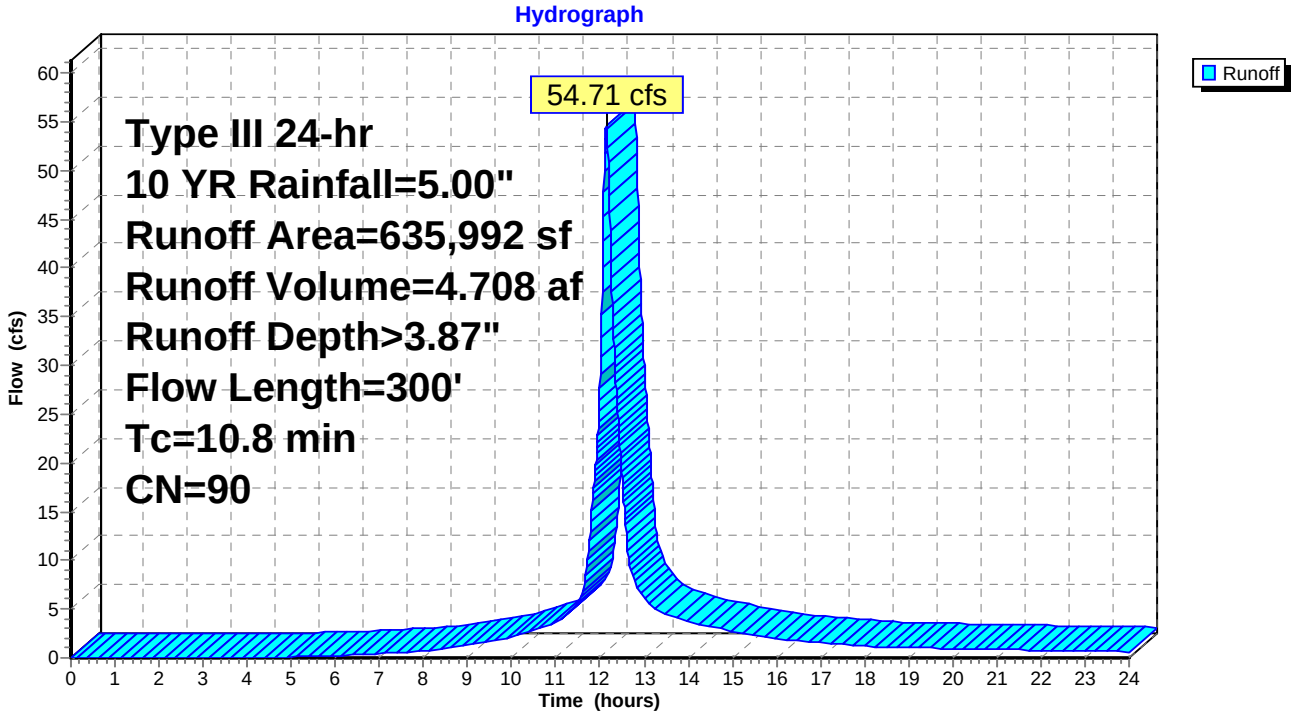
Runoff = 54.71 cfs @ 12.15 hrs, Volume= 4.708 af, Depth> 3.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=5.00"

Area (sf)	CN	Description
205,792	74	>75% Grass cover, Good, HSG C
430,200	98	Water Surface, HSG C
635,992	90	Weighted Average
205,792		32.36% Pervious Area
430,200		67.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	100	0.0250	0.19		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.25"
1.9	200	0.0650	1.78		**Shallow Concentrated Flow, Shallow Flow to Wetland** Short Grass Pasture Kv= 7.0 fps
10.8	300	Total			

Subcatchment 2B POST: WATERSHED 2B POST



Summary for Subcatchment 2PRE: WATERSHED 2 PRE

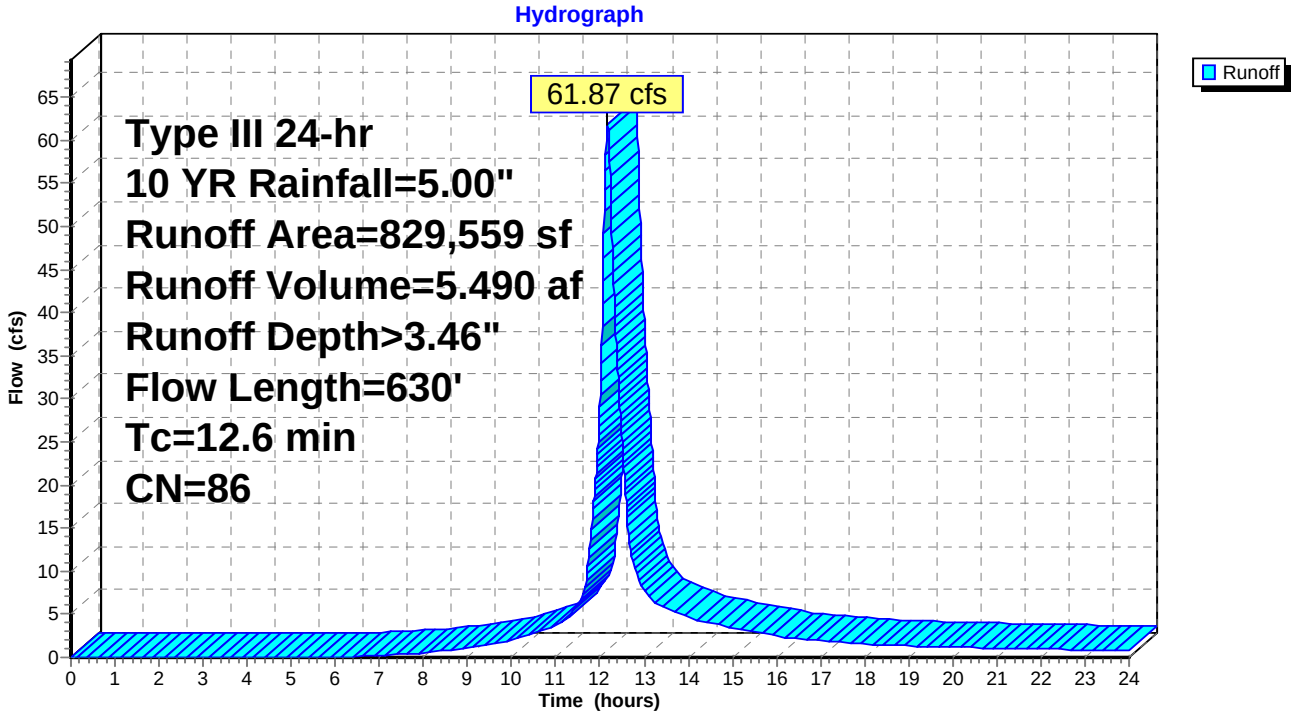
Runoff = 61.87 cfs @ 12.17 hrs, Volume= 5.490 af, Depth> 3.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 YR Rainfall=5.00"

Area (sf)	CN	Description
187,773	74	>75% Grass cover, Good, HSG C
433,755	98	Water Surface, HSG C
208,031	70	Woods, Good, HSG C
829,559	86	Weighted Average
395,804		47.71% Pervious Area
433,755		52.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	100	0.0600	0.27		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.25"
6.3	530	0.0400	1.40		**Shallow Concentrated Flow, Shallow Flow to Wetland** Short Grass Pasture Kv= 7.0 fps
12.6	630	Total			

Subcatchment 2PRE: WATERSHED 2 PRE

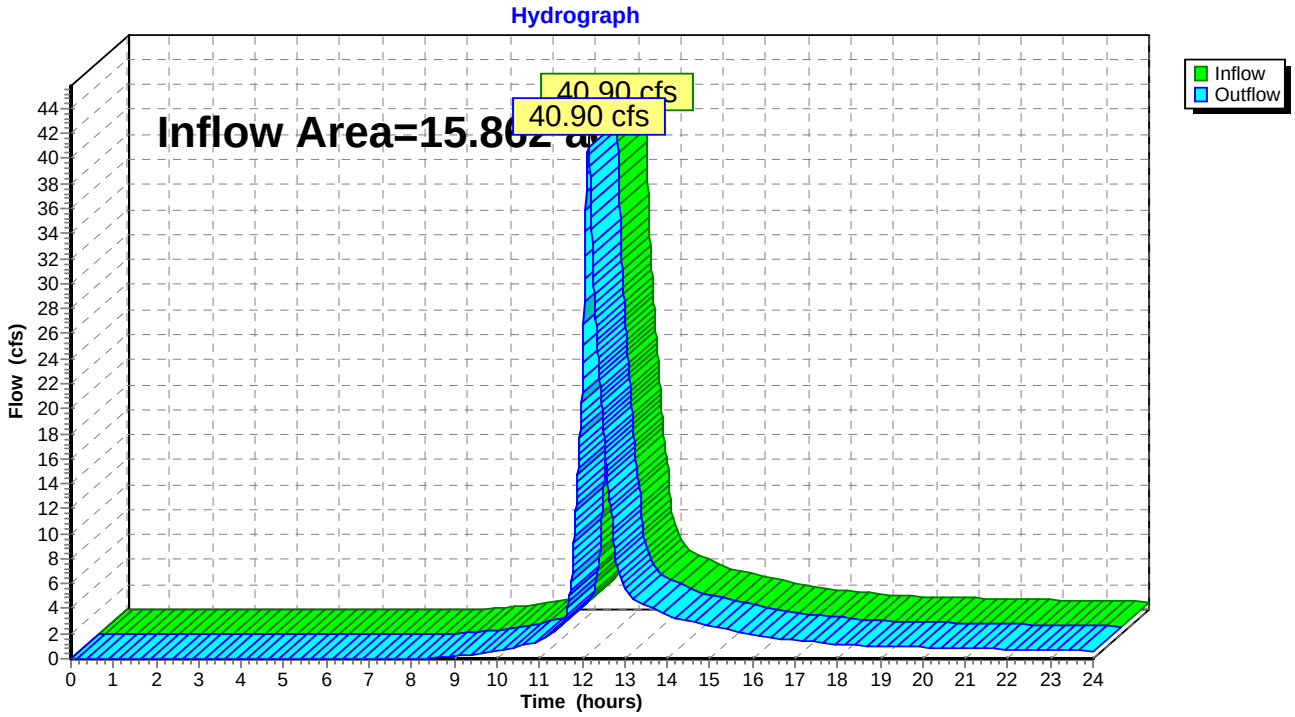


Summary for Reach DP1: DP1

Inflow Area = 15.862 ac, 29.42% Impervious, Inflow Depth > 2.76" for 10 YR event
Inflow = 40.90 cfs @ 12.15 hrs, Volume= 3.653 af
Outflow = 40.90 cfs @ 12.15 hrs, Volume= 3.653 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP1: DP1

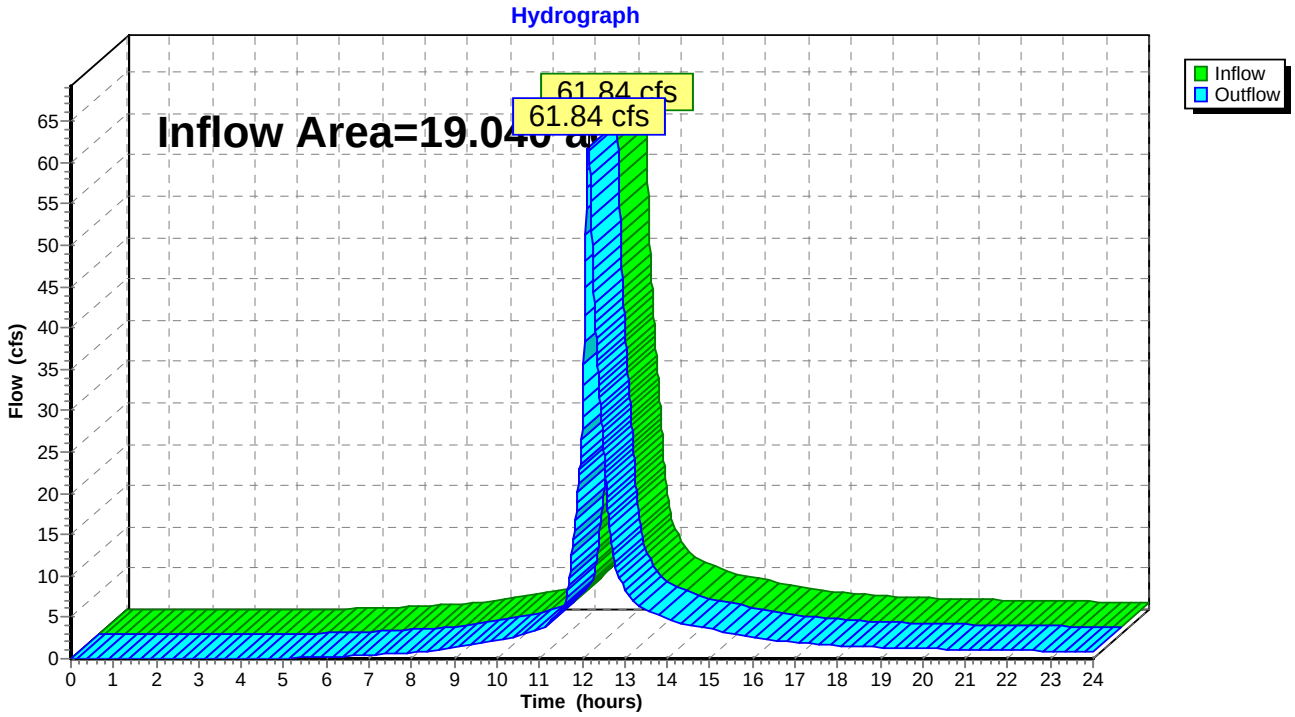


Summary for Reach DP2: DP2

Inflow Area = 19.040 ac, 63.32% Impervious, Inflow Depth > 3.55" for 10 YR event
Inflow = 61.84 cfs @ 12.15 hrs, Volume= 5.631 af
Outflow = 61.84 cfs @ 12.15 hrs, Volume= 5.631 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP2: DP2



Summary for Pond SB1: SEDIMENTATION BASIN 1

Inflow Area = 3.447 ac, 59.94% Impervious, Inflow Depth > 3.67" for 10 YR event
Inflow = 14.48 cfs @ 12.09 hrs, Volume= 1.053 af
Outflow = 14.63 cfs @ 12.08 hrs, Volume= 1.029 af, Atten= 0%, Lag= 0.0 min
Primary = 14.63 cfs @ 12.08 hrs, Volume= 1.029 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 509.52' @ 12.08 hrs Surf.Area= 1,062 sf Storage= 1,029 cf
Flood Elev= 509.25' Surf.Area= 1,062 sf Storage= 1,029 cf

Plug-Flow detention time= 21.2 min calculated for 1.029 af (98% of inflow)
Center-of-Mass det. time= 7.9 min (805.1 - 797.3)

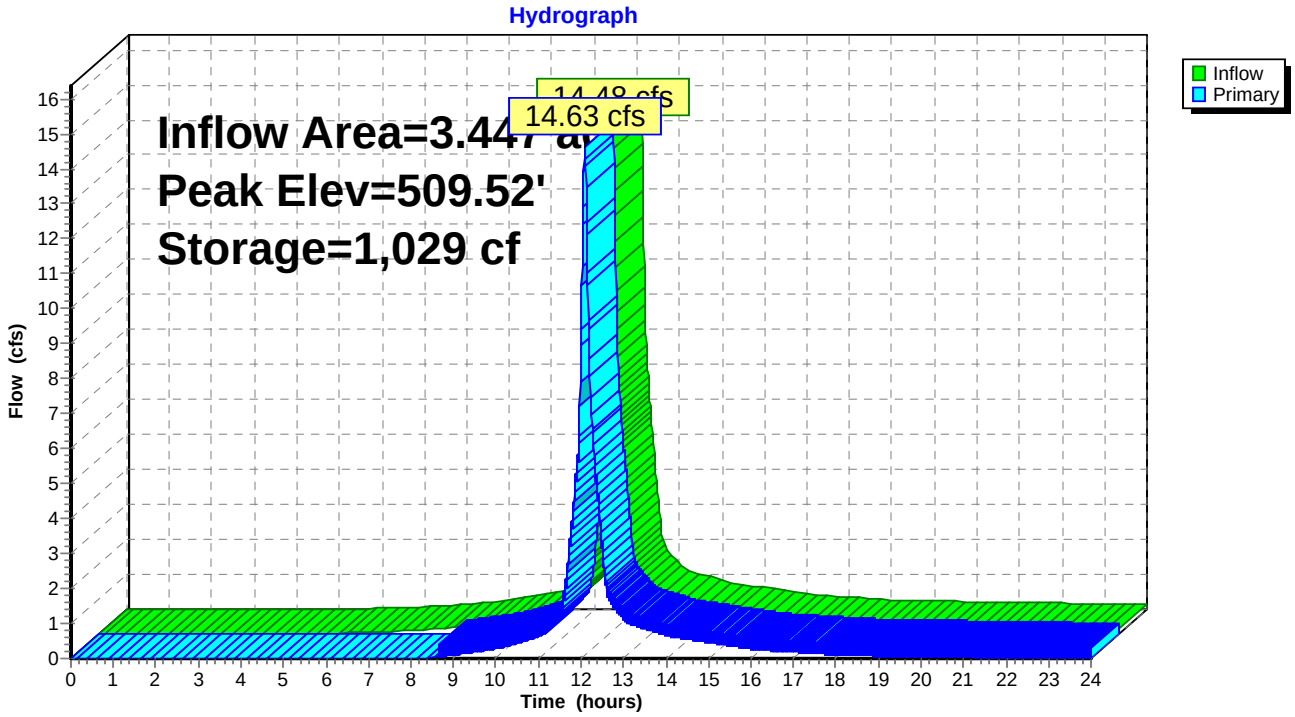
Volume	Invert	Avail.Storage	Storage Description
#1	507.00'	1,029 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
507.00	388	81.0	0	0	388
508.00	777	109.0	571	571	822
508.50	1,062	127.0	458	1,029	1,165

Device	Routing	Invert	Outlet Devices
#1	Primary	509.00'	**15.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=14.57 cfs @ 12.08 hrs HW=509.52' TW=508.72' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Weir Controls 14.57 cfs @ 1.88 fps)

Pond SB1: SEDIMENTATION BASIN 1



Summary for Pond WP1: WET POND 1

Inflow Area = 3.447 ac, 59.94% Impervious, Inflow Depth > 3.58" for 10 YR event
Inflow = 14.63 cfs @ 12.08 hrs, Volume= 1.029 af
Outflow = 6.97 cfs @ 12.24 hrs, Volume= 0.854 af, Atten= 52%, Lag= 9.8 min
Primary = 6.97 cfs @ 12.24 hrs, Volume= 0.854 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 509.02' @ 12.24 hrs Surf.Area= 7,861 sf Storage= 13,519 cf
Flood Elev= 509.25' Surf.Area= 8,718 sf Storage= 15,449 cf

Plug-Flow detention time= 108.3 min calculated for 0.854 af (83% of inflow)
Center-of-Mass det. time= 40.4 min (845.5 - 805.1)

Volume	Invert	Avail.Storage	Storage Description
#1	507.00'	23,107 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

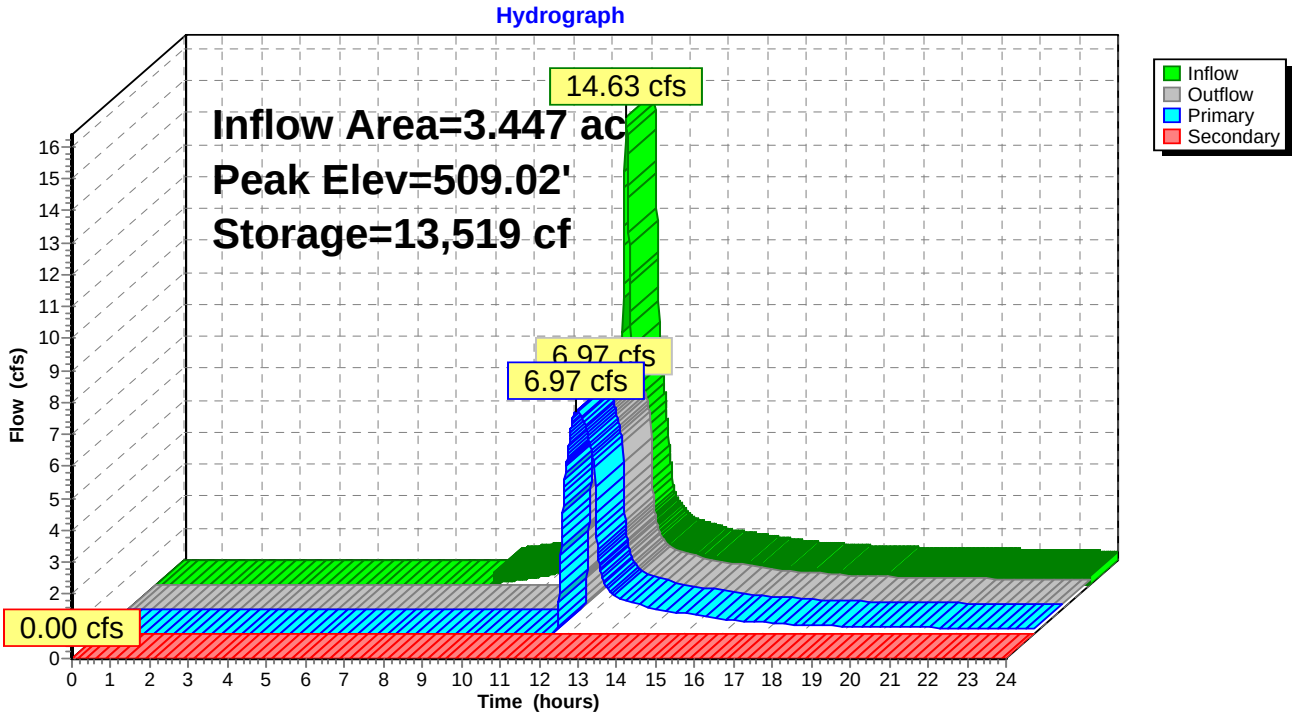
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
507.00	5,600	360.0	0	0	5,600
508.00	6,700	370.0	6,142	6,142	6,286
509.00	7,800	380.0	7,243	13,385	6,991
510.00	11,780	540.0	9,722	23,107	18,714

Device	Routing	Invert	Outlet Devices
#1	Primary	507.00'	**15.0" Round Culvert** L= 460.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 507.00' / 496.00' S= 0.0239 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#2	Device 1	508.20'	**Custom Weir/Orifice X 3.00, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 Width (feet) 5.00 5.00
#3	Device 1	509.20'	**60.0" x 60.0" Horiz. Orifice/Grate** C= 0.600 in 72.0" x 72.0" Grate (69% open area) Limited to weir flow at low heads
#4	Secondary	509.25'	**15.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=6.97 cfs @ 12.24 hrs HW=509.02' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 6.97 cfs @ 5.68 fps)
  ├─**2=Custom Weir/Orifice** (Passes 6.97 cfs of 36.28 cfs potential flow)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=507.00' TW=0.00' (Dynamic Tailwater)
└─**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond WP1: WET POND 1



Summary for Pond WP2: WET POND 2

Inflow Area = 4.440 ac, 49.12% Impervious, Inflow Depth > 3.46" for 10 YR event
Inflow = 16.96 cfs @ 12.10 hrs, Volume= 1.281 af
Outflow = 7.96 cfs @ 12.30 hrs, Volume= 0.923 af, Atten= 53%, Lag= 11.8 min
Primary = 7.96 cfs @ 12.30 hrs, Volume= 0.923 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 444.20' @ 12.30 hrs Surf.Area= 10,421 sf Storage= 22,288 cf
Flood Elev= 446.00' Surf.Area= 14,315 sf Storage= 44,478 cf

Plug-Flow detention time= 157.3 min calculated for 0.923 af (72% of inflow)
Center-of-Mass det. time= 67.7 min (872.6 - 804.9)

Volume	Invert	Avail.Storage	Storage Description
#1	441.50'	44,478 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

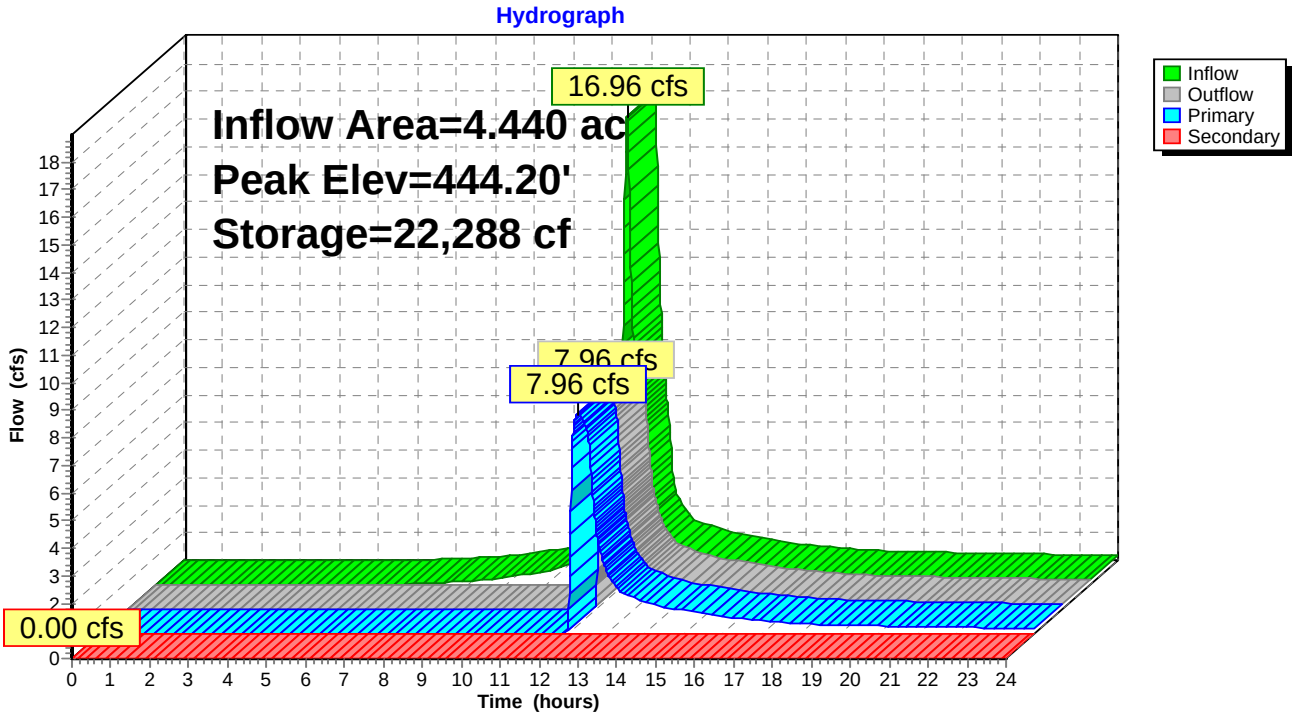
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
441.50	6,320	601.0	0	0	6,320
444.00	10,030	660.0	20,260	20,260	12,447
446.00	14,315	725.0	24,218	44,478	19,743

Device	Routing	Invert	Outlet Devices
#1	Primary	442.50'	**18.0" Round Culvert** L= 180.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 442.50' / 441.60' S= 0.0050 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Primary	443.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	443.50'	**Custom Weir/Orifice X 4.00, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 2.00 Width (feet) 1.50 1.50
#4	Device 1	445.50'	**30.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 in 42.0" x 60.0" Grate (57% open area) Limited to weir flow at low heads
#5	Secondary	445.50'	**15.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=7.96 cfs @ 12.30 hrs HW=444.20' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Barrel Controls 7.71 cfs @ 4.82 fps)
  - **3=Custom Weir/Orifice** (Passes 7.71 cfs of 11.47 cfs potential flow)
  - **4=Orifice/Grate** (Controls 0.00 cfs)
- **2=Orifice/Grate** (Orifice Controls 0.24 cfs @ 4.99 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=441.50' TW=0.00' (Dynamic Tailwater)
- **5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond WP2: WET POND 2



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1A POST: WATERSHED 1A Runoff Area=150,150 sf 59.94% Impervious Runoff Depth>7.05"
Flow Length=560' Tc=6.0 min CN=88 Runoff=26.92 cfs 2.025 af

Subcatchment 1B POST: WATERSHED 1B Runoff Area=540,790 sf 20.94% Impervious Runoff Depth>5.84"
Flow Length=490' Tc=10.3 min CN=78 Runoff=72.97 cfs 6.047 af

Subcatchment 1PRE: WATERSHED 1 PRE Runoff Area=690,940 sf 16.39% Impervious Runoff Depth>6.20"
Flow Length=490' Tc=12.4 min CN=81 Runoff=92.16 cfs 8.198 af

Subcatchment 2A POST: WATERSHED Runoff Area=193,390 sf 49.12% Impervious Runoff Depth>6.81"
Flow Length=395' Tc=7.4 min CN=86 Runoff=32.31 cfs 2.519 af

Subcatchment 2B POST: WATERSHED Runoff Area=635,992 sf 67.64% Impervious Runoff Depth>7.29"
Flow Length=300' Tc=10.8 min CN=90 Runoff=99.54 cfs 8.865 af

Subcatchment 2PRE: WATERSHED 2 PRE Runoff Area=829,559 sf 52.29% Impervious Runoff Depth>6.80"
Flow Length=630' Tc=12.6 min CN=86 Runoff=118.12 cfs 10.797 af

Reach DP1: DP1 Inflow=91.43 cfs 7.871 af
Outflow=91.43 cfs 7.871 af

Reach DP2: DP2 Inflow=109.68 cfs 11.021 af
Outflow=109.68 cfs 11.021 af

Pond SB1: SEDIMENTATION BASIN 1 Peak Elev=509.88' Storage=1,029 cf Inflow=26.92 cfs 2.025 af
Outflow=27.06 cfs 2.002 af

Pond WP1: WET POND 1 Peak Elev=509.67' Storage=19,494 cf Inflow=27.06 cfs 2.002 af
Primary=8.46 cfs 1.625 af Secondary=10.45 cfs 0.200 af Outflow=18.91 cfs 1.825 af

Pond WP2: WET POND 2 Peak Elev=445.59' Storage=38,829 cf Inflow=32.31 cfs 2.519 af
Primary=11.16 cfs 2.142 af Secondary=0.98 cfs 0.013 af Outflow=12.14 cfs 2.155 af

Total Runoff Area = 69.808 ac Runoff Volume = 38.452 af Average Runoff Depth = 6.61"
58.05% Pervious = 40.526 ac 41.95% Impervious = 29.281 ac

Summary for Subcatchment 1APOST: WATERSHED 1A POST

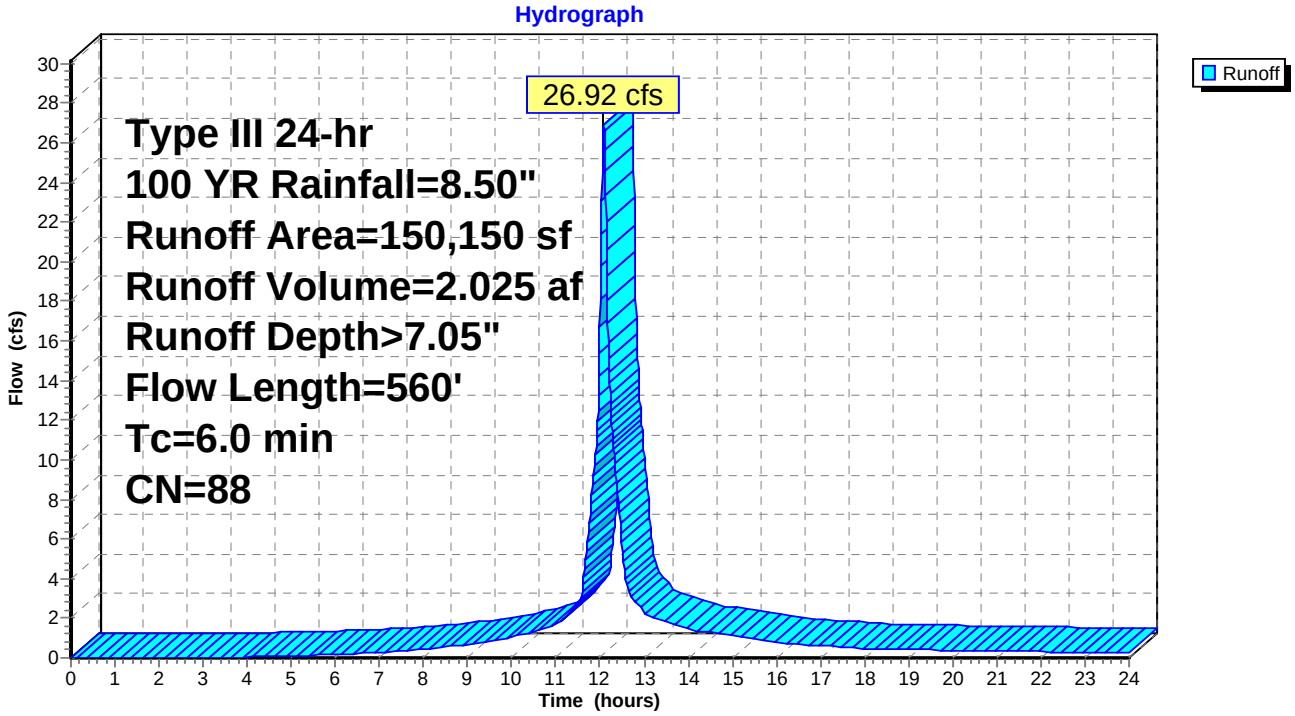
Runoff = 26.92 cfs @ 12.08 hrs, Volume= 2.025 af, Depth> 7.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=8.50"

Area (sf)	CN	Description
90,000	98	Paved parking, HSG C
60,150	74	>75% Grass cover, Good, HSG C
150,150	88	Weighted Average
60,150		40.06% Pervious Area
90,000		59.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	100	0.0900	2.53		**Sheet Flow, Sheet Flow** Smooth surfaces n= 0.011 P2= 3.25"
2.7	460	0.0200	2.87		**Shallow Concentrated Flow, Shallow Flow to SW Basin** Paved Kv= 20.3 fps
3.4	560	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1APOST: WATERSHED 1A POST



Summary for Subcatchment 1BPOST: WATERSHED 1B POST

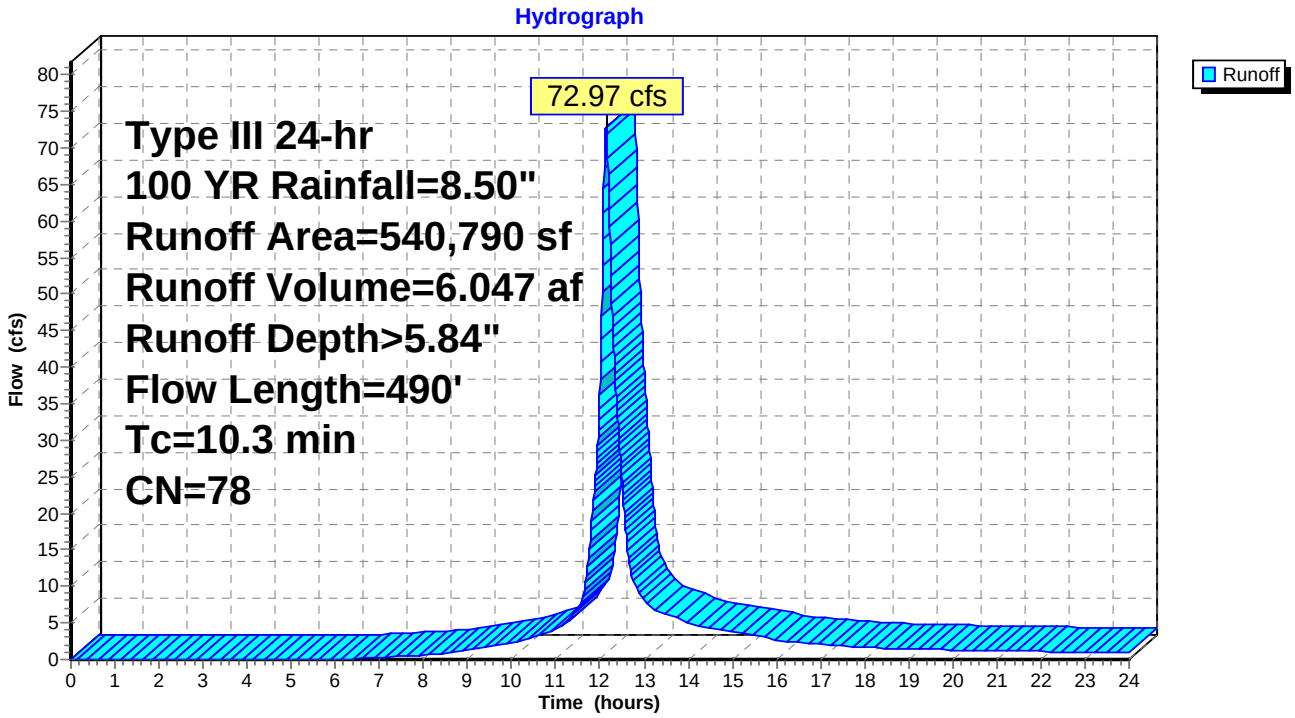
Runoff = 72.97 cfs @ 12.14 hrs, Volume= 6.047 af, Depth> 5.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=8.50"

Area (sf)	CN	Description
113,266	98	Water Surface, HSG C
277,724	74	>75% Grass cover, Good, HSG C
149,800	70	Woods, Good, HSG C
540,790	78	Weighted Average
427,524		79.06% Pervious Area
113,266		20.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	100	0.0400	0.23		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.25"
1.3	205	0.1500	2.71		**Shallow Concentrated Flow, Shallow Flow to Woods** Short Grass Pasture Kv= 7.0 fps
1.6	185	0.1400	1.87		**Shallow Concentrated Flow, Shallow Flow Woods to Wetland** Woodland Kv= 5.0 fps
10.3	490	Total			

Subcatchment 1BPOST: WATERSHED 1B POST



Summary for Subcatchment 1PRE: WATERSHED 1 PRE

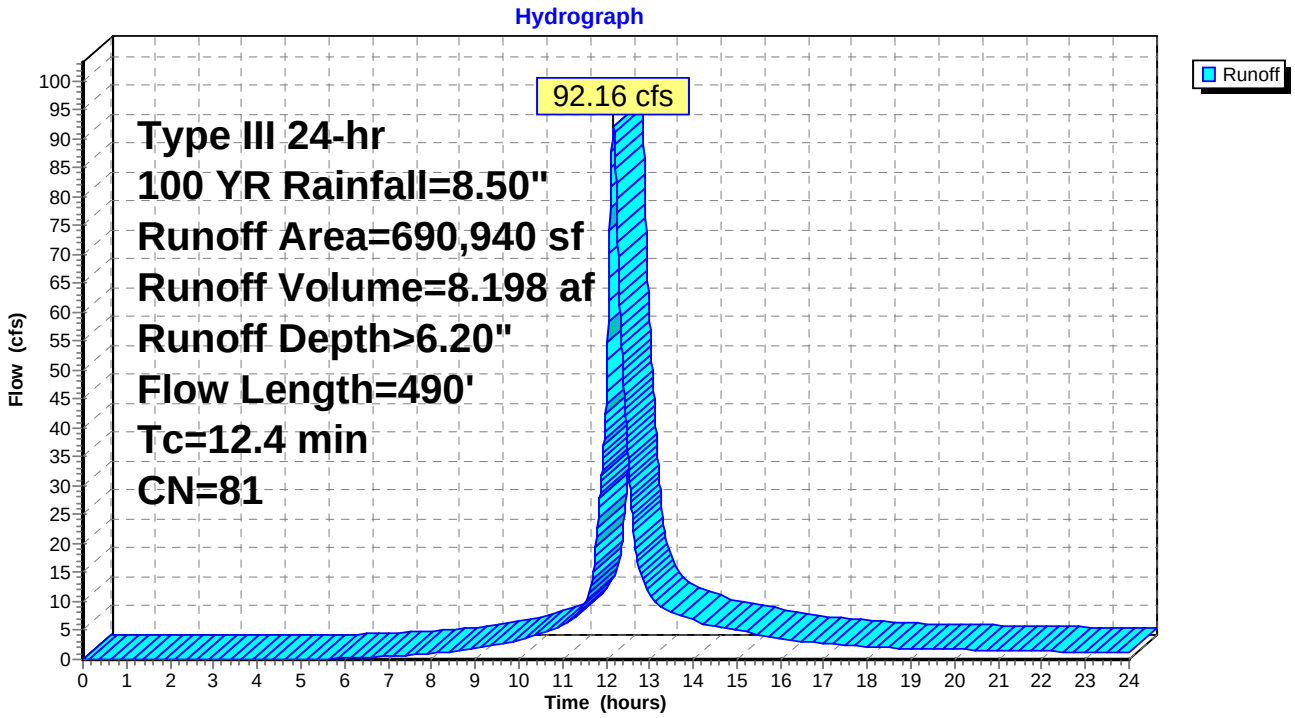
Runoff = 92.16 cfs @ 12.17 hrs, Volume= 8.198 af, Depth> 6.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=8.50"

Area (sf)	CN	Description
113,266	98	Water Surface, HSG C
374,041	82	Row crops, SR + CR, Good, HSG C
203,633	70	Woods, Good, HSG C
690,940	81	Weighted Average
577,674		83.61% Pervious Area
113,266		16.39% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	100	0.0400	0.20		**Sheet Flow, Sheet Flow** Cultivated: Residue>20% n= 0.170 P2= 3.25"
1.0	205	0.1500	3.49		**Shallow Concentrated Flow, Shallow Flow to Woods** Cultivated Straight Rows Kv= 9.0 fps
3.3	185	0.1400	0.94		**Shallow Concentrated Flow, Shallow Flow Woods to Wetland** Forest w/Heavy Litter Kv= 2.5 fps
12.4	490	Total			

Subcatchment 1PRE: WATERSHED 1 PRE



Summary for Subcatchment 2A POST: WATERSHED 2A POST

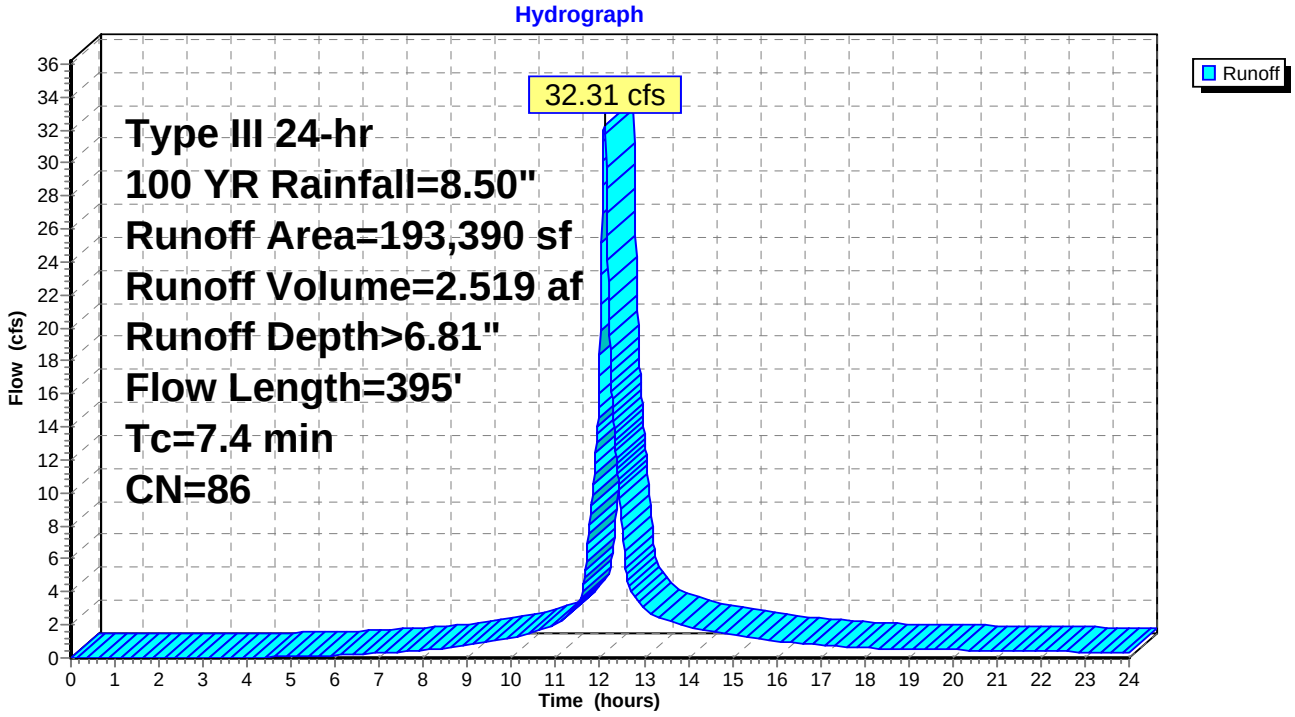
Runoff = 32.31 cfs @ 12.10 hrs, Volume= 2.519 af, Depth> 6.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=8.50"

Area (sf)	CN	Description
98,390	74	>75% Grass cover, Good, HSG C
95,000	98	Paved parking, HSG C
193,390	86	Weighted Average
98,390		50.88% Pervious Area
95,000		49.12% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.6	100	0.0800	0.30		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.25"
0.4	60	0.1500	2.71		**Shallow Concentrated Flow, Shallow Flow to Pavement** Short Grass Pasture Kv= 7.0 fps
1.4	235	0.0200	2.87		**Shallow Concentrated Flow, Shallow Flow Pavement to Catchba** Paved Kv= 20.3 fps
7.4	395	Total			

Subcatchment 2A POST: WATERSHED 2A POST



Summary for Subcatchment 2B POST: WATERSHED 2B POST

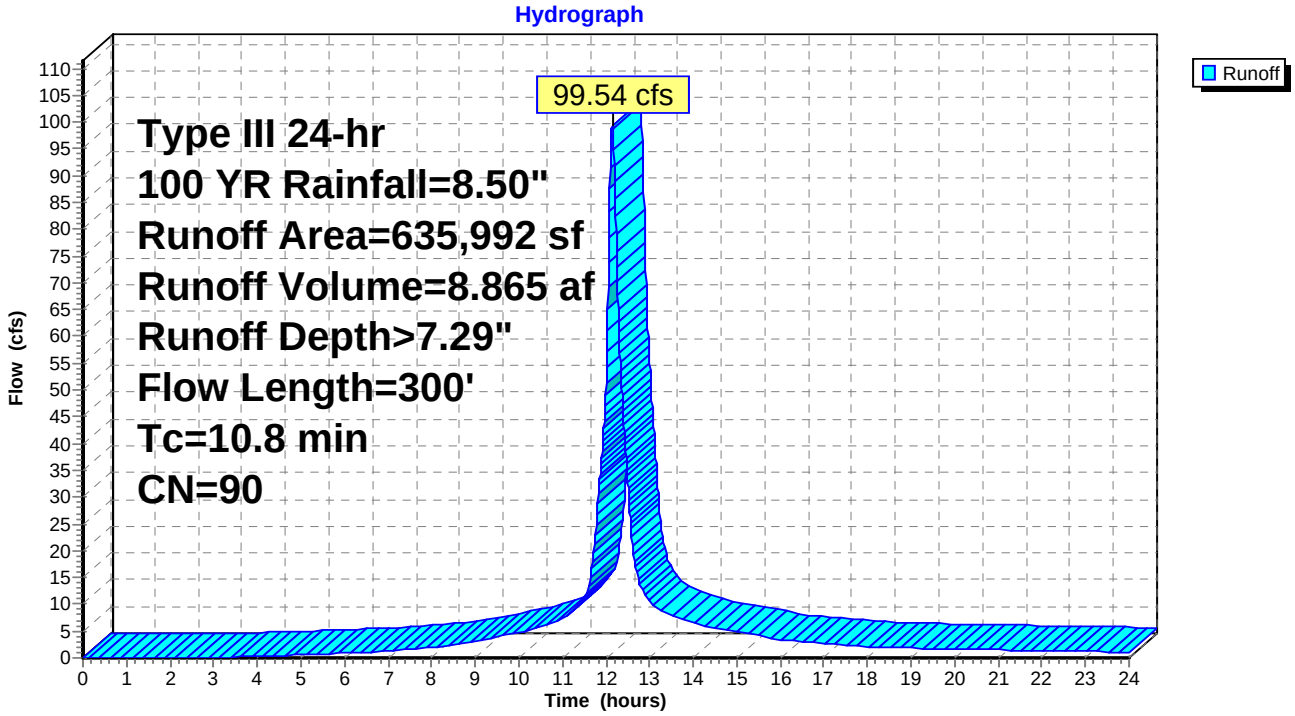
Runoff = 99.54 cfs @ 12.14 hrs, Volume= 8.865 af, Depth> 7.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=8.50"

Area (sf)	CN	Description
205,792	74	>75% Grass cover, Good, HSG C
430,200	98	Water Surface, HSG C
635,992	90	Weighted Average
205,792		32.36% Pervious Area
430,200		67.64% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.9	100	0.0250	0.19		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.25"
1.9	200	0.0650	1.78		**Shallow Concentrated Flow, Shallow Flow to Wetland** Short Grass Pasture Kv= 7.0 fps
10.8	300	Total			

Subcatchment 2B POST: WATERSHED 2B POST



Summary for Subcatchment 2PRE: WATERSHED 2 PRE

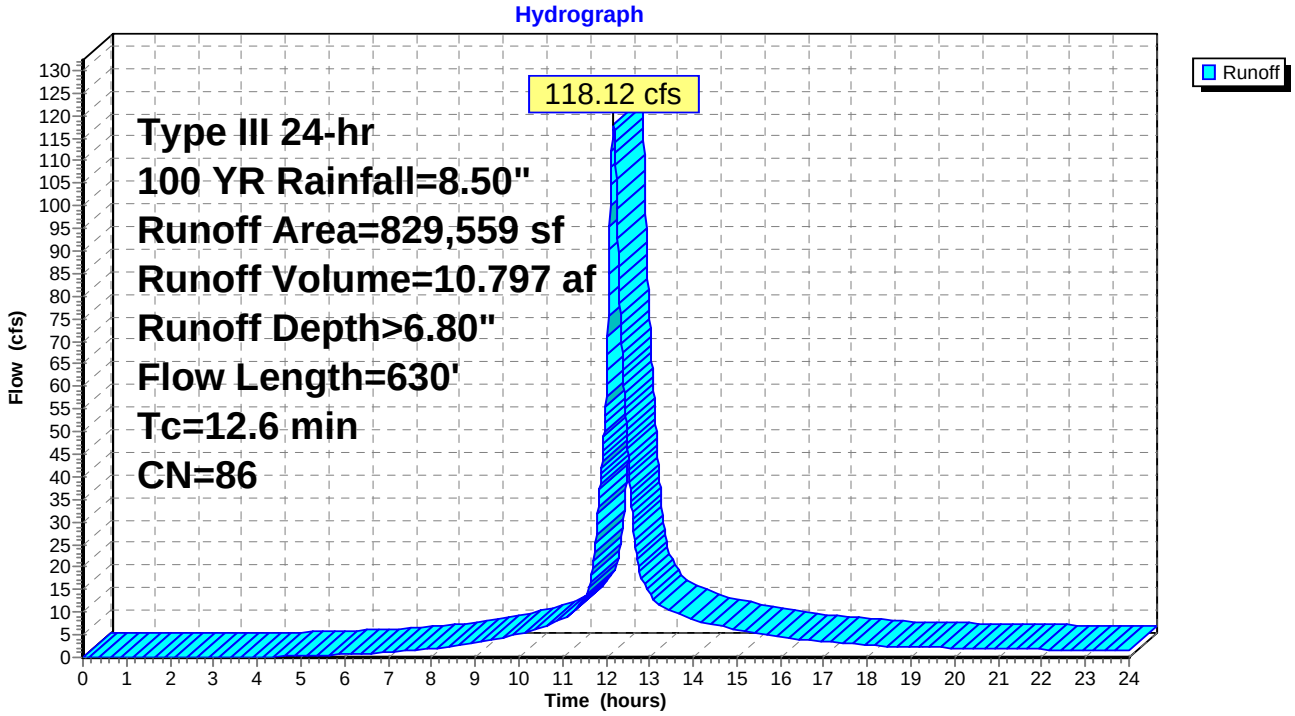
Runoff = 118.12 cfs @ 12.17 hrs, Volume= 10.797 af, Depth> 6.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 YR Rainfall=8.50"

Area (sf)	CN	Description
187,773	74	>75% Grass cover, Good, HSG C
433,755	98	Water Surface, HSG C
208,031	70	Woods, Good, HSG C
829,559	86	Weighted Average
395,804		47.71% Pervious Area
433,755		52.29% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	100	0.0600	0.27		**Sheet Flow, Sheet Flow** Grass: Short n= 0.150 P2= 3.25"
6.3	530	0.0400	1.40		**Shallow Concentrated Flow, Shallow Flow to Wetland** Short Grass Pasture Kv= 7.0 fps
12.6	630	Total			

Subcatchment 2PRE: WATERSHED 2 PRE

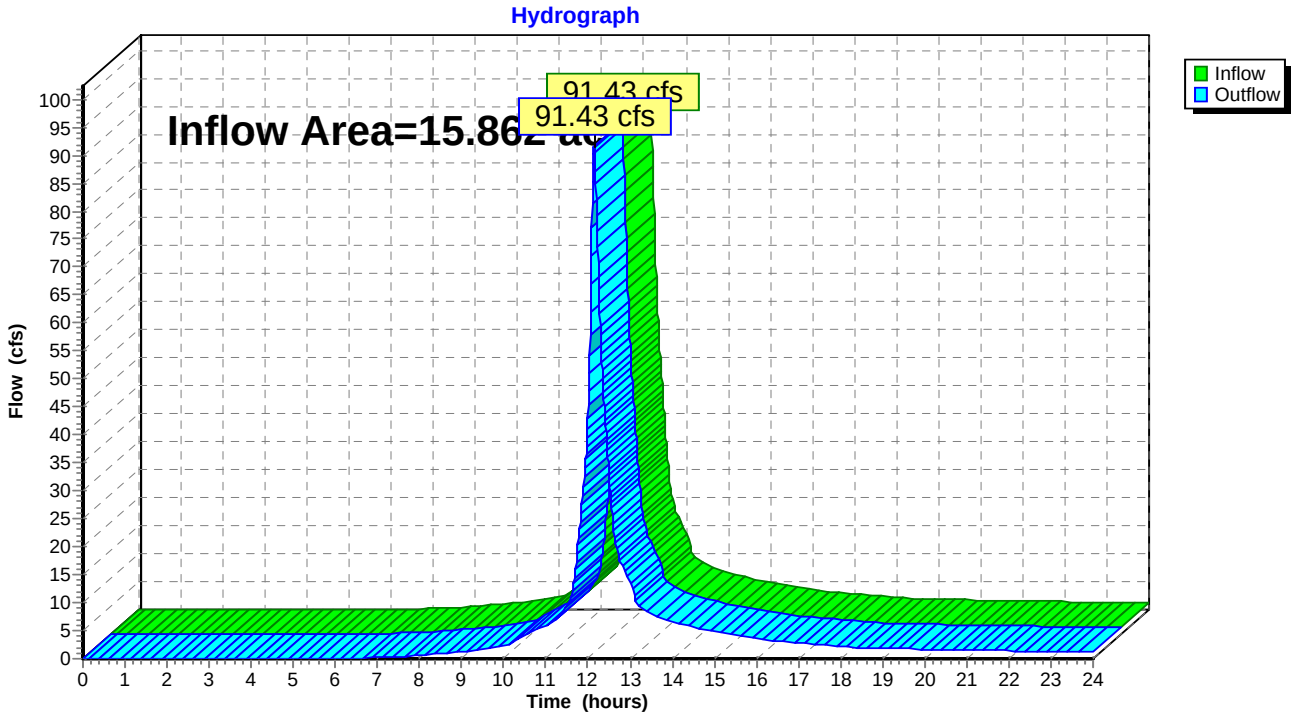


Summary for Reach DP1: DP1

Inflow Area = 15.862 ac, 29.42% Impervious, Inflow Depth > 5.95" for 100 YR event
Inflow = 91.43 cfs @ 12.15 hrs, Volume= 7.871 af
Outflow = 91.43 cfs @ 12.15 hrs, Volume= 7.871 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP1: DP1

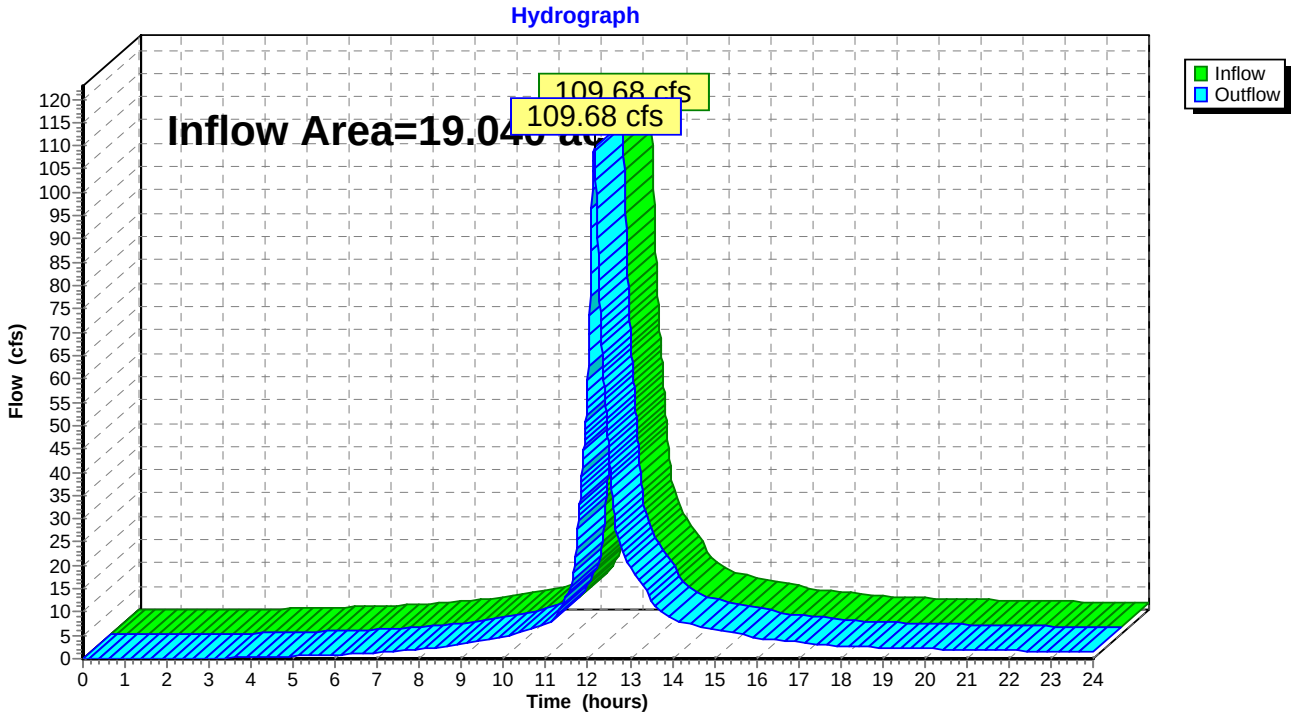


Summary for Reach DP2: DP2

Inflow Area = 19.040 ac, 63.32% Impervious, Inflow Depth > 6.95" for 100 YR event
Inflow = 109.68 cfs @ 12.15 hrs, Volume= 11.021 af
Outflow = 109.68 cfs @ 12.15 hrs, Volume= 11.021 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach DP2: DP2



Summary for Pond SB1: SEDIMENTATION BASIN 1

Inflow Area = 3.447 ac, 59.94% Impervious, Inflow Depth > 7.05" for 100 YR event
Inflow = 26.92 cfs @ 12.08 hrs, Volume= 2.025 af
Outflow = 27.06 cfs @ 12.08 hrs, Volume= 2.002 af, Atten= 0%, Lag= 0.0 min
Primary = 27.06 cfs @ 12.08 hrs, Volume= 2.002 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 509.88' @ 12.12 hrs Surf.Area= 1,062 sf Storage= 1,029 cf
Flood Elev= 509.25' Surf.Area= 1,062 sf Storage= 1,029 cf

Plug-Flow detention time= 12.8 min calculated for 2.002 af (99% of inflow)
Center-of-Mass det. time= 5.4 min (785.1 - 779.6)

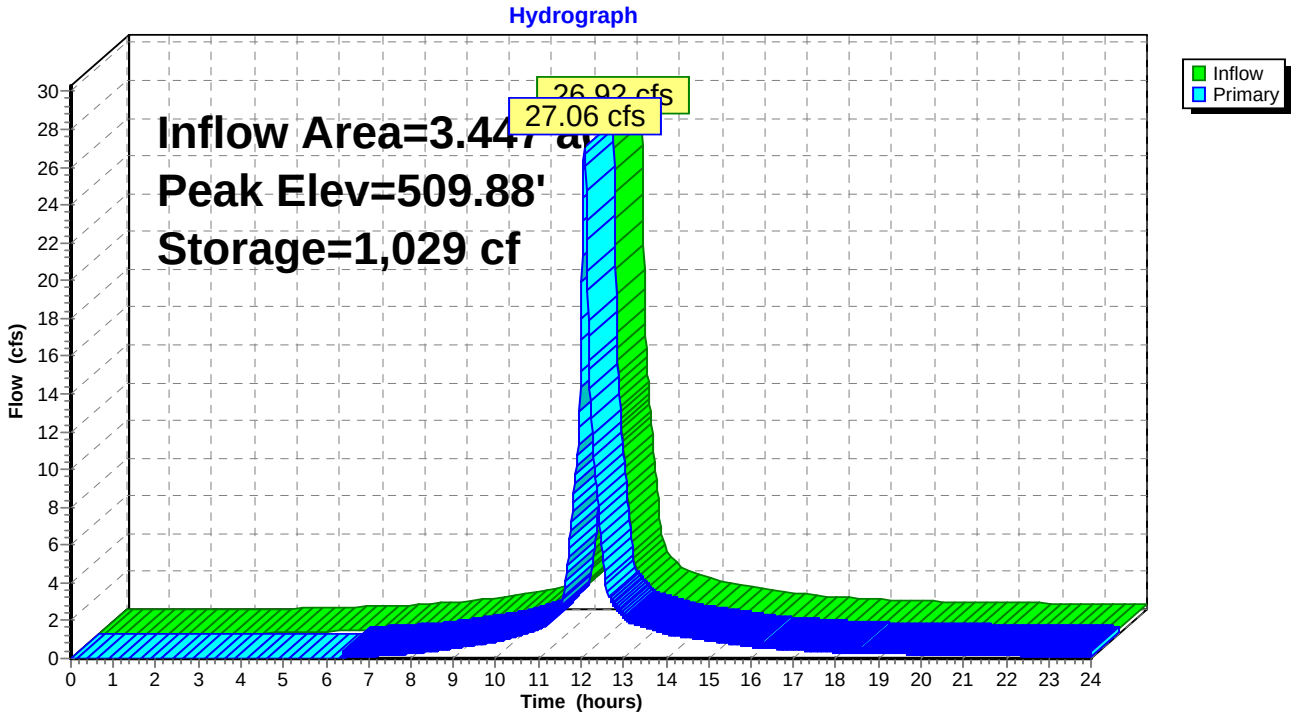
Volume	Invert	Avail.Storage	Storage Description
#1	507.00'	1,029 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
507.00	388	81.0	0	0	388
508.00	777	109.0	571	571	822
508.50	1,062	127.0	458	1,029	1,165

Device	Routing	Invert	Outlet Devices
#1	Primary	509.00'	**15.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=25.77 cfs @ 12.08 hrs HW=509.84' TW=509.45' (Dynamic Tailwater)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 25.77 cfs @ 2.04 fps)

Pond SB1: SEDIMENTATION BASIN 1



Summary for Pond WP1: WET POND 1

Inflow Area =	3.447 ac, 59.94% Impervious, Inflow Depth > 6.97" for 100 YR event				
Inflow =	27.06 cfs @	12.08 hrs,	Volume=	2.002 af	
Outflow =	18.91 cfs @	12.16 hrs,	Volume=	1.825 af,	Atten= 30%, Lag= 4.9 min
Primary =	8.46 cfs @	12.16 hrs,	Volume=	1.625 af	
Secondary =	10.45 cfs @	12.16 hrs,	Volume=	0.200 af	

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 509.67' @ 12.16 hrs Surf.Area= 10,392 sf Storage= 19,494 cf
Flood Elev= 509.25' Surf.Area= 8,718 sf Storage= 15,449 cf

Plug-Flow detention time= 77.1 min calculated for 1.824 af (91% of inflow)
Center-of-Mass det. time= 33.2 min (818.2 - 785.1)

Volume	Invert	Avail.Storage	Storage Description
#1	507.00'	23,107 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

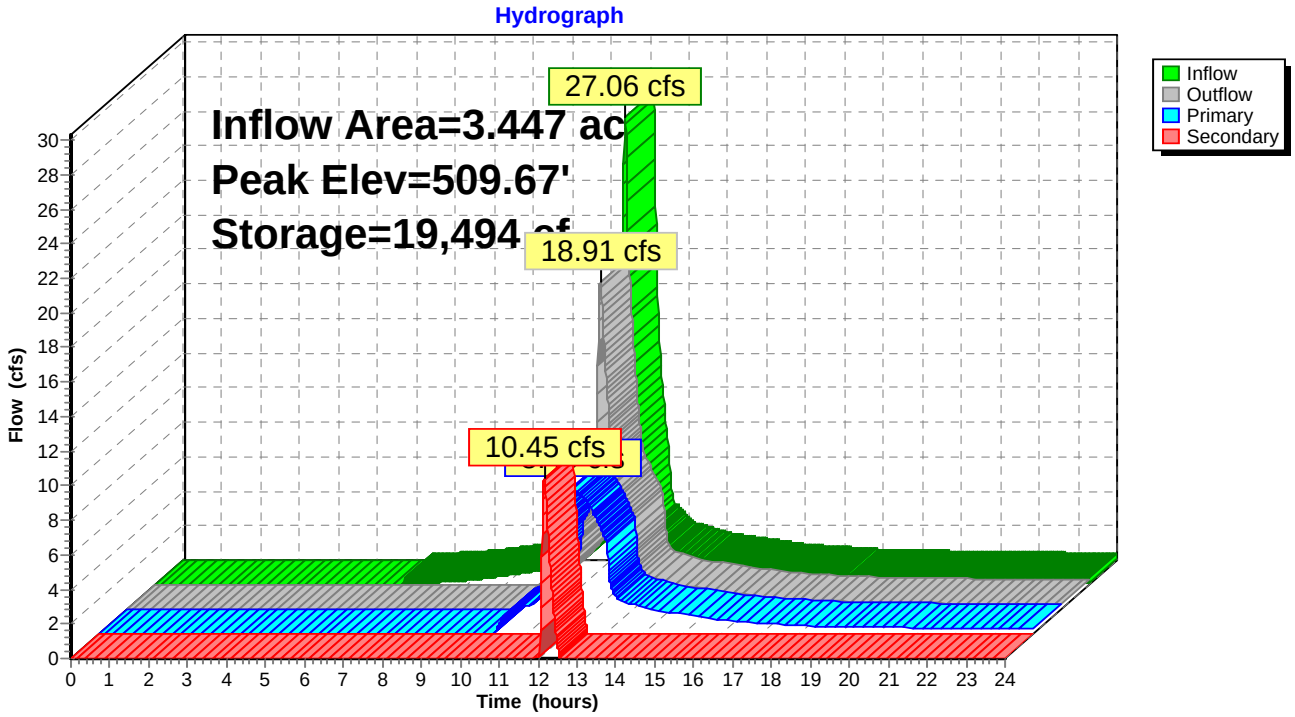
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
507.00	5,600	360.0	0	0	5,600
508.00	6,700	370.0	6,142	6,142	6,286
509.00	7,800	380.0	7,243	13,385	6,991
510.00	11,780	540.0	9,722	23,107	18,714

Device	Routing	Invert	Outlet Devices
#1	Primary	507.00'	**15.0" Round Culvert** L= 460.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 507.00' / 496.00' S= 0.0239 '/' Cc= 0.900 n= 0.012, Flow Area= 1.23 sf
#2	Device 1	508.20'	**Custom Weir/Orifice X 3.00, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 1.00 Width (feet) 5.00 5.00
#3	Device 1	509.20'	**60.0" x 60.0" Horiz. Orifice/Grate** C= 0.600 in 72.0" x 72.0" Grate (69% open area) Limited to weir flow at low heads
#4	Secondary	509.25'	**15.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=8.46 cfs @ 12.16 hrs HW=509.67' TW=0.00' (Dynamic Tailwater)
└─**1=Culvert** (Inlet Controls 8.46 cfs @ 6.89 fps)
  ├─**2=Custom Weir/Orifice** (Passes < 71.86 cfs potential flow)
  └─**3=Orifice/Grate** (Passes < 21.30 cfs potential flow)

Secondary OutFlow Max=10.43 cfs @ 12.16 hrs HW=509.67' TW=0.00' (Dynamic Tailwater)
└─**4=Broad-Crested Rectangular Weir** (Weir Controls 10.43 cfs @ 1.64 fps)

Pond WP1: WET POND 1



Summary for Pond WP2: WET POND 2

Inflow Area = 4.440 ac, 49.12% Impervious, Inflow Depth > 6.81" for 100 YR event
Inflow = 32.31 cfs @ 12.10 hrs, Volume= 2.519 af
Outflow = 12.14 cfs @ 12.37 hrs, Volume= 2.155 af, Atten= 62%, Lag= 16.0 min
Primary = 11.16 cfs @ 12.37 hrs, Volume= 2.142 af
Secondary = 0.98 cfs @ 12.37 hrs, Volume= 0.013 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Peak Elev= 445.59' @ 12.37 hrs Surf.Area= 13,379 sf Storage= 38,829 cf
Flood Elev= 446.00' Surf.Area= 14,315 sf Storage= 44,478 cf

Plug-Flow detention time= 117.4 min calculated for 2.154 af (86% of inflow)
Center-of-Mass det. time= 55.8 min (842.2 - 786.3)

Volume	Invert	Avail.Storage	Storage Description
#1	441.50'	44,478 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

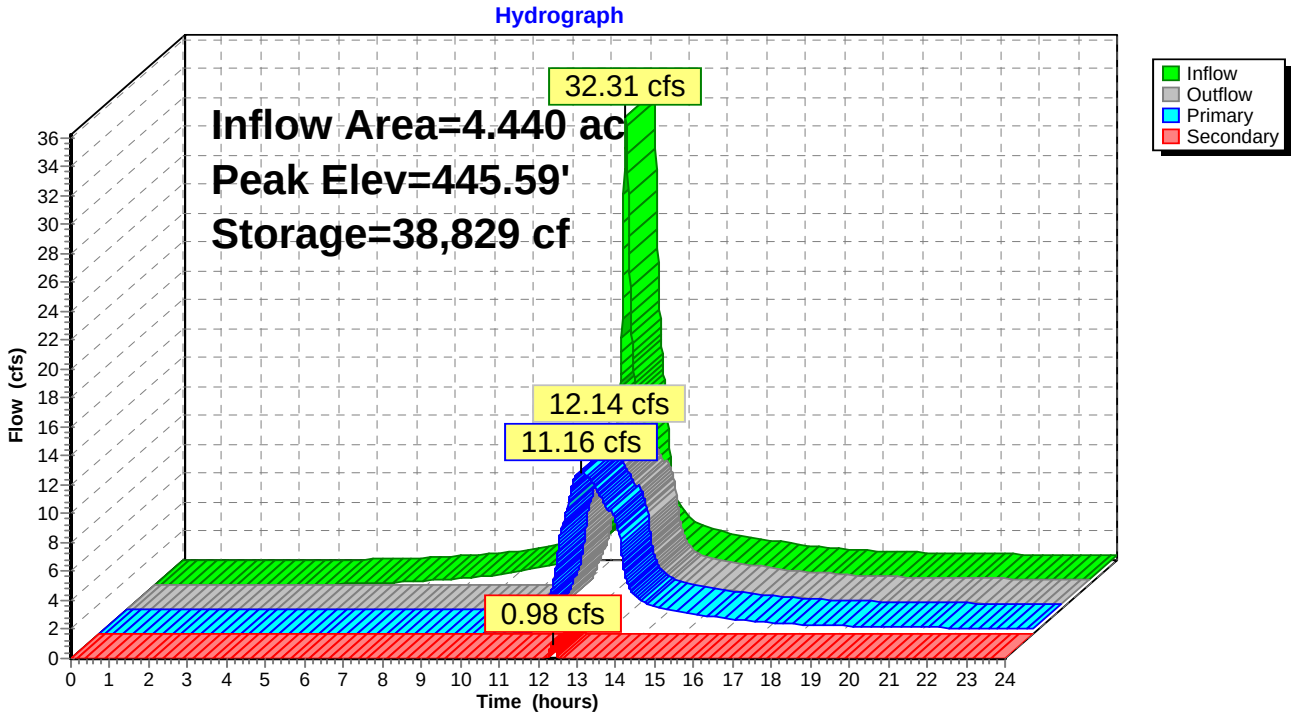
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
441.50	6,320	601.0	0	0	6,320
444.00	10,030	660.0	20,260	20,260	12,447
446.00	14,315	725.0	24,218	44,478	19,743

Device	Routing	Invert	Outlet Devices
#1	Primary	442.50'	**18.0" Round Culvert** L= 180.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 442.50' / 441.60' S= 0.0050 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Primary	443.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	443.50'	**Custom Weir/Orifice X 4.00, Cv= 2.62 (C= 3.28)** Head (feet) 0.00 2.00 Width (feet) 1.50 1.50
#4	Device 1	445.50'	**30.0" x 48.0" Horiz. Orifice/Grate** C= 0.600 in 42.0" x 60.0" Grate (57% open area) Limited to weir flow at low heads
#5	Secondary	445.50'	**15.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=11.16 cfs @ 12.37 hrs HW=445.59' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Barrel Controls 10.79 cfs @ 6.11 fps)
  - **3=Custom Weir/Orifice** (Passes < 58.91 cfs potential flow)
  - **4=Orifice/Grate** (Passes < 1.19 cfs potential flow)
- **2=Orifice/Grate** (Orifice Controls 0.37 cfs @ 7.56 fps)

Secondary OutFlow Max=0.98 cfs @ 12.37 hrs HW=445.59' TW=0.00' (Dynamic Tailwater)
- **5=Broad-Crested Rectangular Weir** (Weir Controls 0.98 cfs @ 0.71 fps)

Pond WP2: WET POND 2



APPENDIX C

ATTACHMENT 1

Construction Stormwater Compliance Inspection Report

Project Name and Location:	Date:	Page 1 of 2
	Permit # (if any): **NYR**	
Municipality: County:	Entry Time:	Exit Time:
On-site Representative(s) and contact information:	Weather Conditions:	
Name and Address of SPDES Permittee/Title/Phone/Fax Numbers: Contacted: Yes ☐ No ☐		

INSPECTION CHECKLIST

SPDES Authority

	Yes	No	N/A		Law, rule or permit citation
1.	☐	☐	☐	Is a copy of the NOI posted at the construction site for public viewing?	
2.	☐	☐	☐	Is an up-to-date copy of the signed SWPPP retained at the construction site?	
3.	☐	☐	☐	Is a copy of the SPDES General Permit retained at the construction site?	

SWPPP Content

	Yes	No	N/A		Law, rule or permit citation
4.	☐	☐	☐	Does the SWPPP describe and identify the erosion & sediment control measures to be employed?	
5.	☐	☐	☐	Does the SWPPP provide a maintenance schedule for the erosion & sediment control measures?	
6.	☐	☐	☐	Does the SWPPP describe and identify the post-construction SW control measures to be employed?	
7.	☐	☐	☐	Does the SWPPP identify the contractor(s) and subcontractor(s) responsible for each measure?	
8.	☐	☐	☐	Does the SWPPP include all the necessary 'CONTRACTOR CERTIFICATION' statements?	
9.	☐	☐	☐	Is the SWPPP signed/certified by the permittee?	

Recordkeeping

	Yes	No	N/A		Law, rule or permit citation
10.	☐	☐	☐	Are inspections performed as required by the permit (every 7 days and after ½" rain event)?	
11.	☐	☐	☐	Are the site inspections performed by a qualified professional?	
12.	☐	☐	☐	Are all required reports properly signed/certified?	
13.	☐	☐	☐	Does the SWPPP include copies of the monthly/quarterly written summaries of compliance status?	

Visual Observations

	Yes	No	N/A		Law, rule or permit citation
14.	☐	☐	☐	Are all erosion and sediment control measures installed/constructed?	
15.	☐	☐	☐	Are all erosion and sediment control measures maintained properly?	
16.	☐	☐	☐	Have all disturbances of 5 acres or more been approved prior to the disturbance?	
17.	☐	☐	☐	Are stabilization measures initiated in inactive areas?	
18.	☐	☐	☐	Are permanent stormwater control measures implemented?	
19.	☐	☐	☐	Was there a discharge into the receiving water on the day of inspection?	
20.	☐	☐	☐	Are receiving waters free of there evidence of turbidity, sedimentation, or oil ? (If no , complete Page 2)	

Overall Inspection Rating: ❑ Satisfactory ❑ Marginal ❑ Unsatisfactory	
Name/Agency of Lead Inspector:	**Signature of Lead Inspector:**
Names/Agencies of Other Inspectors:	

Water Quality Observations

Describe the discharge(s) [source(s), impact on receiving water(s), etc.] _____

_____

_____

_____

_____

Describe the quality of the receiving water(s) both upstream and downstream of the discharge_____

_____

_____

_____

_____

Describe any other water quality standards or permit violations _____

_____

_____

Additional Comments:_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

☐ Photographs attached

APPENDIX H

STATE POLLUTANT DISCHARGE ELIMINATION SYSTEM FOR CONSTRUCTION ACTIVITIES

CONSTRUCTION SITE LOG BOOK

Table of Contents

I. Pre-Construction Meeting Documents
   a. Preamble to Site Assessment and Inspections
   b. Operator's Certification
   c. Qualified Professional's Credentials & Certification
   d. Pre-Construction Site Assessment Checklist

II. Construction Duration Inspections
   a. Directions
   b. Modification to the SWPPP

III. Monthly Summary Reports

IV. Monitoring, Reporting, and Three-Month Status Reports
   a. Operator's Compliance Response Form

Properly completing forms such as those contained in Appendix H meet the inspection requirement of NYS-DEC SPDES GP for Construction Activities. Completed forms shall be kept on site at all times and made available to authorities upon request.

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 professional[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.

When construction starts, site inspections shall be conducted by the qualified professional at least every 7 calendar days and within 24 hours of the end of a storm event of 0.5 inches or greater (Construction Duration Inspections). 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. The Operator shall post at the site, in a publicly accessible location, a summary of the site inspection activities on a monthly basis (Monthly Summary Report).

The operator shall also prepare a written summary of compliance with this general permit at a minimum frequency of every three months (Operator's Compliance Response Form), while coverage exists. The summary should address the status of achieving each component of the SWPPP.

Prior to filing the Notice of Termination or the end of permit term, the Operator shall have a qualified professional perform a final site inspection. The qualified professional 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 "Qualified Professional means a person knowledgeable in the principles and practice of erosion and sediment controls, such as a Certified Professional in Erosion and Sediment Control (CPESC), soil scientist, licensed engineer or someone working under the direction and supervision of a licensed engineer (person must have experience in the principles and practices of erosion and sediment control).
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. Operators Certification

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

Name (please print): _____

Title _____ **Date:** _____

Address: _____

Phone: _____ **Email:** _____

Signature: _____

c. Qualified Professional's Credentials & Certification

"I hereby certify that I meet the criteria set forth in the General Permit to conduct site inspections for this project and that the appropriate erosion and sediment controls described in the SWPPP and as described in the following Pre-construction Site Assessment Checklist have been adequately installed or implemented, ensuring the overall preparedness of this site for the commencement of construction."

Name (please print): _____

Title _____ **Date:**_____

Address: _____

Phone: _____ **Email:** _____

Signature: _____

d. 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 Entrance

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. Perimeter 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.

SITE PLAN/SKETCH

_____	_____
Inspector (print name)	**Date of Inspection**
_____	_____
Qualified Professional (print name)	**Qualified Professional 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?
[ ] [ ] [ ] Is there residue from oil and floating substances, visible oil film, or globules or grease?
[ ] [ ] [ ] 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 and debris 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.

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.

2. Level 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

Runoff Control Practices (continued)

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. Stabilized Construction Entrance

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?

2. Silt Fence

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)

3. Storm Drain Inlet Protection (Use for Stone & Block; Filter Fabric; Curb; or, Excavated 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.

Sediment accumulation ___% of design capacity.

4. 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 accumulation is ___% of design capacity.

5. 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 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.
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:

III. Monthly Summary of Site Inspection Activities

Name of Permitted Facility:	**Today's Date:**	**Reporting Month:**
Location:	**Permit Identification #:**	
Name and Telephone Number of Site Inspector:		

Date of Inspection	Regular / Rainfall based Inspection	Name of Inspector	Items of Concern

Owner/Operator Certification:

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

Signature of Permittee or Duly Authorized Representative

Name of Permittee or Duly Authorized Representative Date

Duly authorized representatives must have written authorization, submitted to DEC, to sign any permit documents.

APPENDIX D

0644089821

NOTICE OF INTENT

New York State Department of Environmental Conservation
Division of Water
625 Broadway, 4th Floor
Albany, New York 12233-3505

NYR _____
(for DEC use only)

Stormwater Discharges Associated with Construction Activity Under State Pollutant Discharge Elimination System (SPDES) General Permit # GP-0-15-002

All sections must be completed unless otherwise noted. Failure to complete all items may result in this form being returned to you, thereby delaying your coverage under this General Permit. Applicants must read and understand the conditions of the permit and prepare a Stormwater Pollution Prevention Plan prior to submitting this NOI. Applicants are responsible for identifying and obtaining other DEC permits that may be required.

-IMPORTANT-
RETURN THIS FORM TO THE ADDRESS ABOVE
OWNER/OPERATOR MUST SIGN FORM

Owner/Operator Information

Owner/Operator (Company Name/Private Owner Name/Municipality Name)
1251 Kings Highway, LLC

Owner/Operator Contact Person Last Name (NOT CONSULTANT)
Ostreicher

Owner/Operator Contact Person First Name
Simon

Owner/Operator Mailing Address
435 Bellvale Rd

City
Chester

State
NY

Zip
10918 -

Phone (Owner/Operator)
845 537 4445

Fax (Owner/Operator)
- -

Email (Owner/Operator)
simon@tileclassic.com

FED TAX ID
- (not required for individuals)

Project Site Information

Project/Site Name
1251 Kings Highway Site Plan & Subd.

Street Address (NOT P.O. BOX)
1251 Kings Highway

Side of Street
○ **North** ○ **South** ● **East** ○ **West**

City/Town/Village (THAT ISSUES BUILDING PERMIT)
Town of Chester

State: NY
Zip: **10918**-
County: ORANGE
DEC Region: 3

Name of Nearest Cross Street
Bellvale Road

Distance to Nearest Cross Street (Feet)
0

Project In Relation to Cross Street
○ **North** ○ **South** ○ **East** ● **West**

Tax Map Numbers
Section-Block-Parcel
17-1-99.221

Tax Map Numbers

1. Provide the Geographic Coordinates for the project site in NYTM Units. To do this you **must** go to the NYSDEC Stormwater Interactive Map on the DEC website at:

www.dec.ny.gov/imsmaps/stormwater/viewer.htm

Zoom into your Project Location such that you can accurately click on the centroid of your site. Once you have located your project site, go to the tool boxes on the top and choose "i"(identify). Then click on the center of your site and a new window containing the X, Y coordinates in UTM will pop up. Transcribe these coordinates into the boxes below. For problems with the interactive map use the help function.

X Coordinates (Easting)
74283

Y Coordinates (Northing)
4113300 99

2. What is the nature of this construction project?

● **New Construction**

○ **Redevelopment with increase in impervious area**

○ **Redevelopment with no increase in impervious area**

3. Select the predominant land use for both pre and post development conditions.
SELECT ONLY ONE CHOICE FOR EACH

Pre-Development Existing Land Use

- ○ FOREST
- ● PASTURE/OPEN LAND
- ○ CULTIVATED LAND
- ○ SINGLE FAMILY HOME
- ○ SINGLE FAMILY SUBDIVISION
- ○ TOWN HOME RESIDENTIAL
- ○ MULTIFAMILY RESIDENTIAL
- ○ INSTITUTIONAL/SCHOOL
- ○ INDUSTRIAL
- ○ COMMERCIAL
- ○ ROAD/HIGHWAY
- ○ RECREATIONAL/SPORTS FIELD
- ○ BIKE PATH/TRAIL
- ○ LINEAR UTILITY
- ○ PARKING LOT
- ○ OTHER

Post-Development Future Land Use

- ○ SINGLE FAMILY HOME
- ○ SINGLE FAMILY SUBDIVISION — Number of Lots
- ○ TOWN HOME RESIDENTIAL
- ○ MULTIFAMILY RESIDENTIAL
- ○ INSTITUTIONAL/SCHOOL
- ○ INDUSTRIAL
- ● COMMERCIAL
- ○ MUNICIPAL
- ○ ROAD/HIGHWAY
- ○ RECREATIONAL/SPORTS FIELD
- ○ BIKE PATH/TRAIL
- ○ LINEAR UTILITY (water, sewer, gas, etc.)
- ○ PARKING LOT
- ○ CLEARING/GRADING ONLY
- ○ DEMOLITION, NO REDEVELOPMENT
- ○ WELL DRILLING ACTIVITY *(Oil, Gas, etc.)
- ○ OTHER

***Note**: for gas well drilling, non-high volume hydraulic fractured wells only

4. In accordance with the larger common plan of development or sale, enter the total project site area; the total area to be disturbed; existing impervious area to be disturbed (for redevelopment activities); and the future impervious area constructed within the disturbed area. (Round to the nearest tenth of an acre.)

Total Site Area	Total Area To Be Disturbed	Existing Impervious Area To Be Disturbed	Future Impervious Area Within Disturbed Area
38.398.9	10.170.7	0.00.0	4.24.2

5. Do you plan to disturb more than 5 acres of soil at any one time? ○ **Yes** ● **No**

6. Indicate the percentage of each Hydrologic Soil Group(HSG) at the site.

A	B	C	D
%	%	70%	30%

7. Is this a phased project? ○ **Yes** ● **No**

8. Enter the planned start and end dates of the disturbance activities.

Start Date 07/01/2019 - **End Date** 07/30/2020

9. Identify the nearest surface waterbody(ies) to which construction site runoff will discharge.

Name

NYSDEC WETLAND

9a. Type of waterbody identified in Question 9?

- ● Wetland / State Jurisdiction On Site (Answer 9b)
- ○ Wetland / State Jurisdiction Off Site
- ○ Wetland / Federal Jurisdiction On Site (Answer 9b)
- ○ Wetland / Federal Jurisdiction Off Site
- ○ Stream / Creek On Site
- ○ Stream / Creek Off Site
- ○ River On Site
- ○ River Off Site
- ○ Lake On Site
- ○ Lake Off Site
- ○ Other Type On Site
- ○ Other Type Off Site

9b. How was the wetland identified?

- ○ Regulatory Map
- ● Delineated by Consultant
- ○ Delineated by Army Corps of Engineers
- ○ Other (identify)

10. Has the surface waterbody(ies) in question 9 been identified as a 303(d) segment in Appendix E of GP-0-15-002? ○ **Yes** ● **No**

11. Is this project located in one of the Watersheds identified in Appendix C of GP-0-15-002? ○ **Yes** ● **No**

12. Is the project located in one of the watershed areas associated with AA and AA-S classified waters? ○ **Yes** ● **No**
If no, skip question 13.

13. Does this construction activity disturb land with no existing impervious cover and where the Soil Slope Phase is identified as an E or F on the USDA Soil Survey? ○ **Yes** ● **No**
If Yes, what is the acreage to be disturbed?

.

14. Will the project disturb soils within a State regulated wetland or the protected 100 foot adjacent area? ○ **Yes** ● **No**

15. Does the site runoff enter a separate storm sewer system (including roadside drains, swales, ditches, culverts, etc)? ○ **Yes** ● **No** ○ **Unknown**

16. What is the name of the municipality/entity that owns the separate storm sewer system?

17. Does any runoff from the site enter a sewer classified as a Combined Sewer? ○ **Yes** ● **No** ○ **Unknown**

18. Will future use of this site be an agricultural property as defined by the NYS Agriculture and Markets Law? ○ **Yes** ● **No**

19. Is this property owned by a state authority, state agency, federal government or local government? ○ **Yes** ● **No**

20. Is this a remediation project being done under a Department approved work plan? (i.e. CERCLA, RCRA, Voluntary Cleanup Agreement, etc.) ○ **Yes** ● **No**

21. Has the required Erosion and Sediment Control component of the SWPPP been developed in conformance with the current NYS Standards and Specifications for Erosion and Sediment Control (aka Blue Book)? ● **Yes** ○ **No**

22. Does this construction activity require the development of a SWPPP that includes the post-construction stormwater management practice component (i.e. Runoff Reduction, Water Quality and Quantity Control practices/techniques)? ● **Yes** ○ **No**
If No, skip questions 23 and 27-39.

23. Has the post-construction stormwater management practice component of the SWPPP been developed in conformance with the current NYS Stormwater Management Design Manual? ● **Yes** ○ **No**

24. The Stormwater Pollution Prevention Plan (SWPPP) was prepared by:

- ● **Professional Engineer (P.E.)**
- ○ **Soil and Water Conservation District (SWCD)**
- ○ **Registered Landscape Architect (R.L.A)**
- ○ **Certified Professional in Erosion and Sediment Control (CPESC)**
- ○ **Owner/Operator**
- ○ **Other**

SWPPP Preparer: ARDEN CONSULTING ENGINEERS

Contact Name (Last, Space, First): MORGANTE MICHAEL

Mailing Address: PO BOX 340

City: MONROE

State: NY Zip: 10950 -

Phone: 845 782 1414 Fax: - -

Email: MAM@ARDENCONSULTING.NET

SWPPP Preparer Certification

I hereby certify that the Stormwater Pollution Prevention Plan (SWPPP) for this project has been prepared in accordance with the terms and conditions of the GP-0-15-002. Furthermore, I understand that certifying false, incorrect or inaccurate information is a violation of this permit and the laws of the State of New York and could subject me to criminal, civil and/or administrative proceedings.

First Name: MICHAEL **MI**: A

Last Name: MORGANTE

Signature

Date: 02/14/2020

25. Has a construction sequence schedule for the planned management practices been prepared? ● Yes ○ No

26. Select **all** of the erosion and sediment control practices that will be employed on the project site:

Temporary Structural

- ○ Check Dams
- ○ Construction Road Stabilization
- ○ Dust Control
- ○ Earth Dike
- ○ Level Spreader
- ○ Perimeter Dike/Swale
- ○ Pipe Slope Drain
- ○ Portable Sediment Tank
- ○ Rock Dam
- ○ Sediment Basin
- ● Sediment Traps
- ● Silt Fence
- ● Stabilized Construction Entrance
- ○ Storm Drain Inlet Protection
- ○ Straw/Hay Bale Dike
- ○ Temporary Access Waterway Crossing
- ○ Temporary Stormdrain Diversion
- ○ Temporary Swale
- ○ Turbidity Curtain
- ○ Water bars

Biotechnical

- ○ Brush Matting
- ○ Wattling

Vegetative Measures

- ○ Brush Matting
- ○ Dune Stabilization
- ○ Grassed Waterway
- ● Mulching
- ○ Protecting Vegetation
- ○ Recreation Area Improvement
- ● Seeding
- ○ Sodding
- ○ Straw/Hay Bale Dike
- ○ Streambank Protection
- ○ Temporary Swale
- ○ Topsoiling
- ○ Vegetating Waterways

Permanent Structural

- ○ Debris Basin
- ○ Diversion
- ○ Grade Stabilization Structure
- ● Land Grading
- ○ Lined Waterway (Rock)
- ○ Paved Channel (Concrete)
- ○ Paved Flume
- ○ Retaining Wall
- ○ Riprap Slope Protection
- ○ Rock Outlet Protection
- ○ Streambank Protection

Other

Siltation Pond

Post-construction Stormwater Management Practice (SMP) Requirements

Important: Completion of Questions 27-39 is not required if response to Question 22 is No.

27. Identify all site planning practices that were used to prepare the final site plan/layout for the project.

- ● **Preservation of Undisturbed Areas**
- ○ **Preservation of Buffers**
- ○ **Reduction of Clearing and Grading**
- ○ **Locating Development in Less Sensitive Areas**
- ○ **Roadway Reduction**
- ○ **Sidewalk Reduction**
- ○ **Driveway Reduction**
- ○ **Cul-de-sac Reduction**
- ○ **Building Footprint Reduction**
- ○ **Parking Reduction**

27a. Indicate which of the following soil restoration criteria was used to address the requirements in Section 5.1.6("Soil Restoration") of the Design Manual (2010 version).

- ● All disturbed areas will be restored in accordance with the Soil Restoration requirements in Table 5.3 of the Design Manual (see page 5-22).
- ○ Compacted areas were considered as impervious cover when calculating the **WQv Required**, and the compacted areas were assigned a post-construction Hydrologic Soil Group (HSG) designation that is one level less permeable than existing conditions for the hydrology analysis.

28. Provide the total Water Quality Volume (WQv) required for this project (based on final site plan/layout).

Total WQv Required

.	4	4	.	4	4		**acre-feet**

29. Identify the RR techniques (Area Reduction), RR techniques(Volume Reduction) and Standard SMPs with RRv Capacity in Table 1 (See Page 9) that were used to reduce the Total WQv Required(#28).

Also, provide in Table 1 the total impervious area that contributes runoff to each technique/practice selected. For the Area Reduction Techniques, provide the total contributing area (includes pervious area) and, if applicable, the total impervious area that contributes runoff to the technique/practice.

Note: Redevelopment projects shall use Tables 1 and 2 to identify the SMPs used to treat and/or reduce the WQv required. If runoff reduction techniques will not be used to reduce the required WQv, skip to question 33a after identifying the SMPs.

Table 1 - Runoff Reduction (RR) Techniques and Standard Stormwater Management Practices (SMPs)

	Total Contributing Area (acres)		Total Contributing Impervious Area(acres)
RR Techniques (Area Reduction)			
● Conservation of Natural Areas (RR-1) ...	3 8 . 8 9	and/or	4 . 2 4 . 2
○ Sheetflow to Riparian Buffers/Filters Strips (RR-2)	.	and/or	.
○ Tree Planting/Tree Pit (RR-3)	.	and/or	.
○ Disconnection of Rooftop Runoff (RR-4)..	.	and/or	.
RR Techniques (Volume Reduction)			
○ Vegetated Swale (RR-5)			.
○ Rain Garden (RR-6)			.
○ Stormwater Planter (RR-7)			.
○ Rain Barrel/Cistern (RR-8)			.
○ Porous Pavement (RR-9)			.
○ Green Roof (RR-10)			.
Standard SMPs with RRv Capacity			
○ Infiltration Trench (I-1)			.
● Infiltration Basin (I-2)			3 . 4 3 4 . 4 4
○ Dry Well (I-3)			.
○ Underground Infiltration System (I-4)			.
○ Bioretention (F-5)			.
○ Dry Swale (O-1)			.
Standard SMPs			
○ Micropool Extended Detention (P-1)			.
○ Wet Pond (P-2)			.
○ Wet Extended Detention (P-3)			.
○ Multiple Pond System (P-4)			.
○ Pocket Pond (P-5)			.
○ Surface Sand Filter (F-1)			.
○ Underground Sand Filter (F-2)			.
○ Perimeter Sand Filter (F-3)			.
○ Organic Filter (F-4)			.
○ Shallow Wetland (W-1)			.
○ Extended Detention Wetland (W-2)			.
○ Pond/Wetland System (W-3)			.
○ Pocket Wetland (W-4)			.
○ Wet Swale (O-2)			.

Table 2 - Alternative SMPs (DO NOT INCLUDE PRACTICES BEING USED FOR PRETREATMENT ONLY)

Alternative SMP	Total Contributing Impervious Area(acres)
● Hydrodynamic	4.64.6
○ Wet Vault	
○ Media Filter	
○ Other	

Provide the name and manufacturer of the Alternative SMPs (i.e. proprietary practice(s)) being used for WQv treatment.

Name: Bayfilter

Manufacturer: ADS

Note: Redevelopment projects which do not use RR techniques, shall use questions 28, 29, 33 and 33a to provide SMPs used, total WQv required and total WQv provided for the project.

30. Indicate the Total RRv provided by the RR techniques (Area/Volume Reduction) and Standard SMPs with RRv capacity identified in question 29.

Total RRv provided

1.116.16 **acre-feet**

31. Is the Total RRv provided (#30) greater than or equal to the total WQv required (#28).

● **Yes** ○ **No**

If Yes, go to question 36.
If No, go to question 32.

32. Provide the Minimum RRv required based on HSG.
[Minimum RRv Required = (P)(0.95)(Ai)/12, Ai=(S)(Aic)]

Minimum RRv Required

0.102.12 **acre-feet**

32a. Is the Total RRv provided (#30) greater than or equal to the Minimum RRv Required (#32)?

● **Yes** ○ **No**

If Yes, go to question 33.
Note: Use the space provided in question #39 to summarize the specific site limitations and justification for not reducing 100% of WQv required (#28). A detailed evaluation of the specific site limitations and justification for not reducing 100% of the WQv required (#28) must also be included in the SWPPP.
If No, sizing criteria has not been met, so NOI can not be processed. SWPPP preparer must modify design to meet sizing criteria.

33. Identify the Standard SMPs in Table 1 and, if applicable, the Alternative SMPs in Table 2 that were used to treat the remaining total WQv(=Total WQv Required in 28 - Total RRv Provided in 30).

Also, provide in Table 1 and 2 the total impervious area that contributes runoff to each practice selected.

Note: Use Tables 1 and 2 to identify the SMPs used on Redevelopment projects.

33a. Indicate the Total WQv provided (i.e. WQv treated) by the SMPs identified in question #33 and Standard SMPs with RRv Capacity identified in question 29.

WQv Provided

1.116 **acre-feet**

Note: For the standard SMPs with RRv capacity, the WQv provided by each practice = the WQv calculated using the contributing drainage area to the practice - RRv provided by the practice. (See Table 3.5 in Design Manual)

34. Provide the sum of the Total RRv provided (#30) and the WQv provided (#33a). 2.232

35. Is the sum of the RRv provided (#30) and the WQv provided (#33a) greater than or equal to the total WQv required (#28)? ● **Yes** ○ **No**

If Yes, go to question 36.
If No, sizing criteria has not been met, so NOI can not be processed. SWPPP preparer must modify design to meet sizing criteria.

36. Provide the total Channel Protection Storage Volume (CPv) required and provided or select waiver (36a), if applicable.

CPv Required . **acre-feet**

CPv Provided . **acre-feet**

36a. The need to provide channel protection has been waived because:

○ Site discharges directly to tidal waters or a fifth order or larger stream.

● Reduction of the total CPv is achieved on site through runoff reduction techniques or infiltration systems.

37. Provide the Overbank Flood (Qp) and Extreme Flood (Qf) control criteria or select waiver (37a), if applicable.

Total Overbank Flood Control Criteria (Qp)

Pre-Development: 1066.97 **CFS**

Post-development: 1022.74 **CFS**

Total Extreme Flood Control Criteria (Qf)

Pre-Development: 2100.28 **CFS**

Post-development: 2011.11 **CFS**

37a. The need to meet the Qp and Qf criteria has been waived because:

- ○ Site discharges directly to tidal waters or a fifth order or larger stream.
- ○ Downstream analysis reveals that the Qp and Qf controls are not required

38. Has a long term Operation and Maintenance Plan for the post-construction stormwater management practice(s) been developed? ● **Yes** ○ **No**

If Yes, Identify the entity responsible for the long term Operation and Maintenance

PROPERTY OWNER

39. Use this space to summarize the specific site limitations and justification for not reducing 100% of WQv required(#28). (See question 32a) This space can also be used for other pertinent project information.

40. Identify other DEC permits, existing and new, that are required for this project/facility.

- ○ Air Pollution Control
- ○ Coastal Erosion
- ○ Hazardous Waste
- ○ Long Island Wells
- ○ Mined Land Reclamation
- ○ Solid Waste
- ○ Navigable Waters Protection / Article 15
- ○ Water Quality Certificate
- ○ Dam Safety
- ○ Water Supply
- ○ Freshwater Wetlands/Article 24
- ○ Tidal Wetlands
- ○ Wild, Scenic and Recreational Rivers
- ○ Stream Bed or Bank Protection / Article 15
- ○ Endangered or Threatened Species(Incidental Take Permit)
- ○ Individual SPDES
- ○ SPDES Multi-Sector GP N Y R
- ○ Other
- ○ None

41. Does this project require a US Army Corps of Engineers Wetland Permit? ○ **Yes** ● **No**
If Yes, Indicate Size of Impact. . Square Feet

42. Is this project subject to the requirements of a regulated, traditional land use control MS4? ○ **Yes** ● **No**
(If No, skip question 43)

43. Has the "MS4 SWPPP Acceptance" form been signed by the principal executive officer or ranking elected official and submitted along with this NOI? ○ **Yes** ● **No**

44. If this NOI is being submitted for the purpose of continuing or transferring coverage under a general permit for stormwater runoff from construction activities, please indicate the former SPDES number assigned. N Y R

Owner/Operator Certification

I have read or been advised of the permit conditions and believe that I understand them. I also understand that, under the terms of the permit, there may be reporting requirements. I hereby certify that this document and the corresponding documents were prepared under my direction or supervision. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. I further understand that coverage under the general permit will be identified in the acknowledgment that I will receive as a result of submitting this NOI and can be as long as sixty (60) business days as provided for in the general permit. I also understand that, by submitting this NOI, I am acknowledging that the SWPPP has been developed and will be implemented as the first element of construction, and agreeing to comply with all the terms and conditions of the general permit for which this NOI is being submitted.

Print First Name: Simon

MI:

Print Last Name: Ostreicher

Owner/Operator Signature:

Date: 02/14/2020

APPENDIX E

CONSTRUCTION WASTE MANAGEMENT & SPILL PREVENTION PLAN

At the commencement of construction, land clearing materials will be collected and stored on-site for reuse. Construction debris such as cardboard, concrete, metal, wood and similar garbage will be collected in dumpsters and disposed of properly. An open top container will be on site during construction. The contractor will be responsible for organizing and placing containers on site and timely removal/replacement when containers are filled to capacity.

On-site storage of fuel chemicals shall be equipped with a spill kit. The contractor must provide secondary containment for storing any hazardous chemicals on site.

All equipment stored on site shall be inspected daily by the contractor for any oil or lubricant spills or leaks. Any leaks shall be repaired immediately. In addition, all equipment must be closely inspected prior to working in any R.O.W.

The contractor shall clean all spills immediately and shall report all spills to the New York State Department of Environmental Conservation.

This plan will be displayed in the construction jobsite trailer at all times.

APPENDIX F

Contractor Certification Statement

Site Plan & Subdivision for 1251 Kings Highway _____ NYR_____ _____

Name of Construction Site DEC Permit ID Municipality (MS4)

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

Name _____ Title _____

Signature _____ Date _____

Company Name & Address _____ Phone_____

_____

Project Site Address 1251 Kings Highway, Chester, NY

Provisions Responsible for _____

_____

_____

Information on the Trained Certified Contractor or Subcontractor

_____ _____ _____

Name of Trained Employee Title of Trained Employee NYSDEC SWT#

A copy of this signed contractor certification statement must be maintained in the SWPPP on site.