ARDEN CONSULTING ENGINEERS, PLLC

January 21, 2013

Mr. Chuck Hatcher
Westchester Modular Homes, Inc.
30 Reagans Mill Road
Wingdale, NY 12594

Re: Reagan's Mill Drive Site Plan & Subdivision
Town of Dover, N.Y.

Revised Flood Plain Mapping and SWPPP

Dear Mr. Hatcher:

We have reviewed the datum difference between the assumed site vertical datum and NAVD88 as well as the most recent floodplain mapping provided by the project surveyor, Terry Bergendorff Collins Land Surveying, 52 Starr Ridge Road, Brewster, New York 10509.

The difference between the assumed vertical datum and NAVD88 is -164.185 feet. This difference was established by using the known NAVD88 floor elevation of the adjacent Westchester Modular Homes Factory. Review of the FEMA FIRM Map #36027C0441E that is attached, depicts a 100-year flood elevation of 339.0 near the intersection of Reagans Mill Road and the Ten Mile River. Adjusting for the difference in datum elevation yields a 100-year flood elevation of 503.185, which is lower than the previous established flood elevation of 507.0.

With the establishment of these new elevations, minor grading modifications have been made to lower the elevations of proposed structures and associated parking for Lot #1 and Lot #2. As a result of these modifications, no fill or structures associated with the proposed project encroach into 100-year floodplain or floodway.

The minor site plan changes have been incorporated in to the SWPPP last revised January 21, 2013. The volume and shape of the stormwater facilities have not been significantly altered as shown on the planset last revised January 21, 2013, which results in minor changes in pre and post development stormwater flow rates.

Please do not hesitate to contact us if you have any further questions or concerns.

Sincerely,

Arden Consulting Engineers, PLLC

Michael A. Morgante, P.E.

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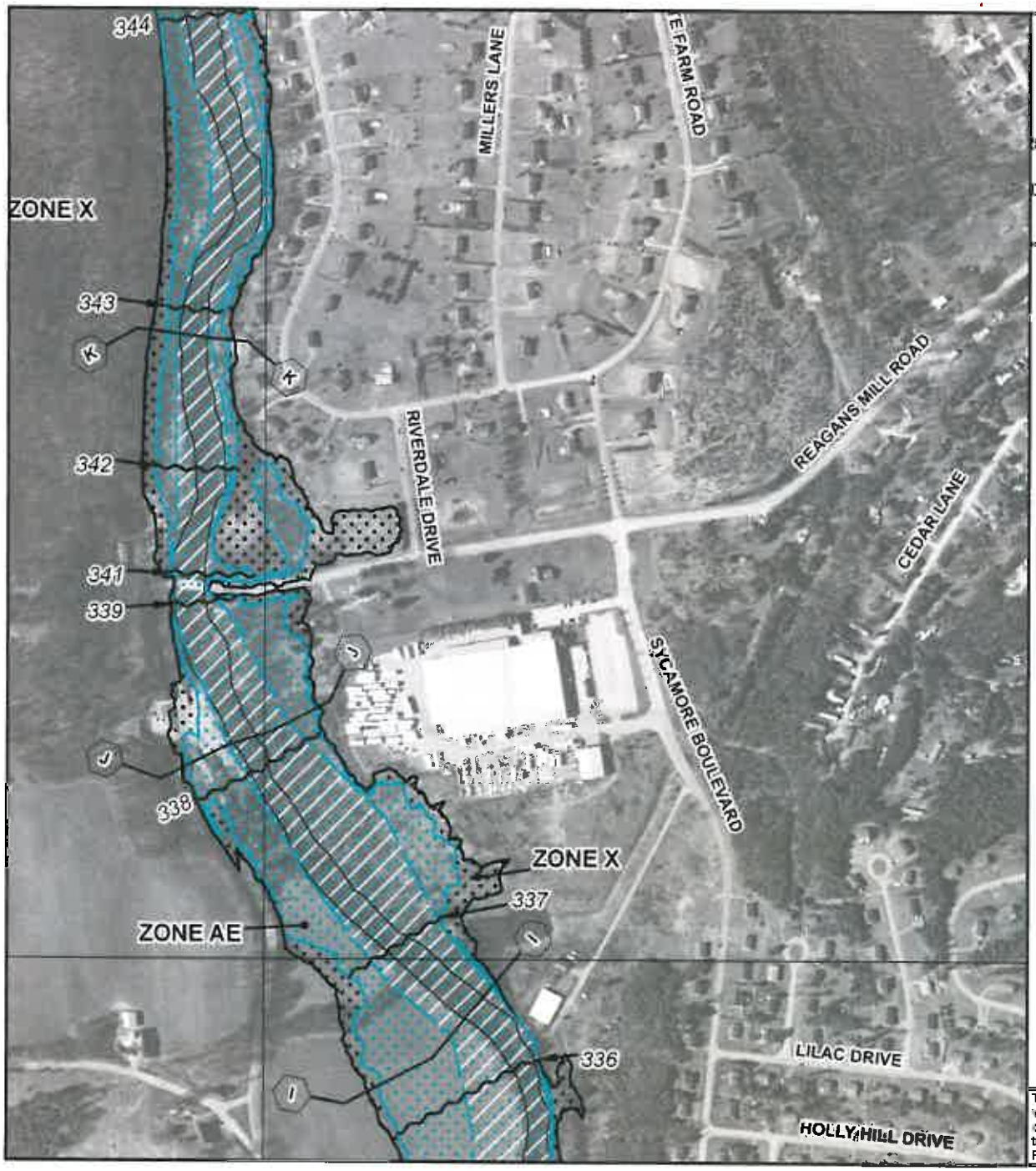
P.O. Box 340 ♦ Monroe, N.Y. ♦ 10949
Tel: 845-782-8114 ♦ Fax: 845-238-3527 ♦ Email: mam@ardenconsulting.net



MAP SCALE 1" = 500'

50 0 500 1000

FEET

METER

NFIP

PANEL 0441E

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

for DUTCHESS COUNTY, NEW YORK
(ALL JURISDICTIONS)

CONTAINS:

COMMUNITY	NUMBER
DOVER, TOWN OF	361335

PANEL 441 OF 602
MAP SUFFIX: E
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community

MAP NUMBER
36027C0441E

EFFECTIVE DATE
MAY 2, 2012

Federal Emergency Management Agency

ATTACHMENTS

APPENDIX A - PRE & POST DEVELOPMENT STORMWATER MAP
APPENDIX B – STORMWATER CALCULATIONS AND HYDROLOGIC MODEL
APPENDIX C – REVISED FLOOD PLAIN MAPPING & SWPPP

1. INTRODUCTION

1.1. Project Description

The site is located off of Reagans Mill Road in the Town of Dover, Dutchess County, New York. The general land use in the nearby vicinity of the project site is the CO Zoning District. The Westchester Modular Hoes, Inc. factory and residential houses are located in the nearby vicinity.

There is a knoll on the site that abuts the Westchester Modular Homes factory site from which a gently sloping topography descends in both the eastern and western directions of the site. Topography on the site reflects the local surrounding topography, and the Ten Mile River is located nearby to the west of the subject parcel.

The soils on the property were identified using the soil classifications of the USDA Soil Conservation Service (SCS), Soil Survey of Dutchess County, New York. This watershed is underlain primarily by one (3) soil types, the Copake (CuB) series which consists of deep, well-drained soil, the Pawling (Pg) series which consists of deep moderately well drained soil, and the Wayland (Wy) series which consists of poorly drained soils. The soil boundaries and designations are shown on the attached Pre & Post Development Drainage Analysis Maps in Appendix A.

The 4-lot subdivision and site plan will consist of the construction of townhouse dwellings on approximate 1-acre lots to be served by sewer and water, and four individual driveways that access Reagans Mill Road. Approximately 3.1 acres of soil disturbance will occur, and under the requirements of the current SPDES General Permit for Stormwater Discharges from Construction Activity GP-0-10-001, a Stormwater Pollution Prevention Plan (SWPPP) is required. Rain gardens, infiltration basins, and associated piping have been implemented in this SWPPP in order to meet the requirements of GP-0-10-001.

1.2. Existing Drainage Patterns

Generally, the pre-development site conditions are best described as open grassed areas and impervious surfaces associated with the existing road (Reagans Mill Road) and on-site structures.

There are two Watersheds on the subject parcel. Watershed #1 is 1.82 acres, and drains to the western portion of the site denoted as Stormwater Design Point #1 (SDP1) where it ultimately enters the Ten Mile River. Watershed #2 is 2.5 acres and drains to the southeastern portion of site denoted as Stormwater Design Point 2 (SDP2). Here the runoff enters an existing drainage system that conveys the flow to a large stormwater detention facility located on the Westchester Modular Homes Factory site. These conditions are shown on the attached Pre-Development Stormwater Map.

1.3. Proposed Drainage Patterns

Runoff from the site will continue to drain towards the SDP1 & SDP2 points shown the pre-development condition. In the post-development condition, Watershed #1 is 2.02 acres and

Watershed #2 is 2.28 acres. Impervious surface associated with proposed driveways and dwellings is located within these Watersheds. The stormwater design points and watersheds are shown on the attached Post Development Stormwater Map.

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 GP-0-10-001. This will be achieved by the installation of rain gardens and an infiltration facility.

2.2. Stormwater Quantity

The drainage report has been prepared to analyze the impact of stormwater runoff at the major discharge points SDP1 & SDP2) 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 Terry Bergendorf Collins. Map entitled "Survey of Property Prepared for Westchester Modular Homes" dated January 18, 2012.
- 4-Lot Subdivision & Site Plan prepared by Anthony S. Pisarri, P.E., P.C. last revised June 10, 2012.
- The site soil information from Dutchess County Soil Conservation Service.

The TR-55 method was used to determine the pre-development and post-development runoff rates at the design points identified on the property.

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 in
100 year storm = 7 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 (SDP2) where runoff leaves the site.

Table 1
Pre-development Runoff

Storm Frequency	SDP1 (cfs)	SDP2 (cfs)
10 year	2.78	4.45
100 year	5.44	8.30

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 (SDP2) are shown in Table 2 below.

Table 2
Post-development Runoff

Storm Frequency	SDP1 (cfs)	SDP2 (cfs)
10 year	1.45	1.63
100 year	5.16	6.71

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

Table 3
Pre- vs. Post-Development Runoff

Storm Frequency	Runoff (Pre) SDP1	Runoff (Post) SDP1	Runoff (Pre) SDP2	Runoff (Post) SDP2
10 year	2.78	1.45	4.45	1.63
100 year	5.44	5.16	8.30	6.71

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 (GP-0-10-01).

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, August 2010). 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 SMP's 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 project would result in an increase in the loadings of various chemical constituents to the receiving waters, potentially impairing the quality of those waters within the watersheds. 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)	Min RRv (cf)
1	2,425	3,900	467
2	2,271	3,760	501

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 typically 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.

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 utilize rain gardens, sedimentation basins and a bioretention facility 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 this Watershed #2 will drain into. Furthermore, the majority of the site runoff will be treated by means of subsurface filtration and storage prior to discharge, so a moderation of runoff temperatures is expected before the site flow reaches any water bodies. Based on this information, no special consideration was given to further 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. Use of rain gardens and infiltration basins will serve to remove pollutants and attenuate stormwater runoff. The rain gardens and infiltration basins will utilize elements such as a grass buffer strip, sedimentation basins, ponding areas, planting soils and vegetative plantings to remove pollutants and reduce 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.

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 (August 2010).

4.1. Infiltration

4.1.1. Feasibility

Required Elements

To be suitable for infiltration, underlying soils shall have an infiltration rate (fc) of at least 0.5 inches per hour, as initially determined from NRCS soil textural classification, and subsequently confirmed by field geotechnical tests (see SWDM Appendix D). The minimum geotechnical testing is one test hole per 5000 sf, with a minimum of two borings per facility (taken within the proposed limits of the facility). Initial soil testing indicates an acceptable infiltration rate can be achieved for this project.

Soils shall also have a clay content of less than 20% and a silt/clay content of less than 40%. Please refer to the latest DEC soil testing requirements found on the website http://www.dec.ny.gov/chemical/8694.html#Frequently FAQ #32. It appears that soil infiltration testing using a casing, and deep soil test pits is all that is required. The final testing will be completed once the hydrologic model and the SWPPPP content have been accepted.

Infiltration practices cannot be located on areas with natural slopes greater than 15%. The slope for this project where infiltration basins are located is less than 15%.

Infiltration practices cannot be located in fill soils, except the top quarter of an infiltration trench or dry well. The infiltration facilities are located in native soils. The infiltration facility has been designed with outlet control structures and/or a rip-rap lined spillway to regulate flows from the 10-year and 100-year storm events.

To protect groundwater from possible contamination, runoff from designated hotspot land uses or activities must not be directed to a formal infiltration facility. In cases where this goal is impossible (e.g., where the storm drain system leads to a large recharge facility designed for flood control), redundant pretreatment must be provided by applying two of the practices listed in Table 5.1 in series, both of which are sized to treat the entire WQv. This criteria does not apply for this project.

The bottom of the infiltration facility shall be separated by at least three feet vertically from the seasonally high water table or bedrock layer, as documented by on-site soil testing. (Four feet in sole source aquifers). The average separation to bedrock is greater than 3-feet and this project is not located in a sole source aquifer.

Infiltration facilities shall be located at least 100 feet horizontally from any water supply well.

Infiltration practices shall not be placed in locations that cause water problems to downgradient properties. Infiltration trenches and basins shall be setback 25 feet

downgradient from structures and septic systems. Dry wells shall be separated a minimum of 10 feet from structures. All of these criteria have been met in the design.

Design Guidance
The maximum contributing area to infiltration basins or trenches should generally be less than five acres. The infiltration basin can theoretically receive runoff from larger areas, provided that the soil is highly permeable (i.e., greater than 5.0 inches per hour). (See SWDM Appendix L for erosive velocities of grass and soil). Each watershed is less than 5 acres.

The maximum drainage area to dry wells should generally be smaller than one acre, and should include rooftop runoff only. This is not applicable in this design.

4.1.2. Conveyance

Required Elements
The overland flow path of surface runoff exceeding the capacity of the infiltration system shall be evaluated to preclude erosive concentrated flow during the overbank events. If computed flow velocities exceed erosive velocities (3.5 to 5.0 fps), an overflow channel shall be provided to a stabilized watercourse. The project has been designed such that there is a spillway for the 10 and 100 year storm.

All infiltration systems shall be designed to fully de-water the entire WQv within 48 hours after the storm event. Based on the preliminary soils testing the infiltration basin will de-water within 24-hours.

If runoff is delivered by a storm drain pipe or along the main conveyance system, the infiltration practice must be designed as an off-line practice (see SWDM Appendix K for a detail), except when used as a regional flood control practice. This facility is designed as an on-line practice.

Design Guidance
For infiltration basins and trenches, adequate stormwater outfalls should be provided for the overflow associated with the 10-year design storm event (non-erosive velocities on the down-slope). The infiltration basin spillway on Lot 1 drains towards the Ten Mile River and has been provided rip-rap protection. The infiltration basin spillway on Lot 3 & 4 drains towards the drainage system associated with the Westchester Modular Homes Factory site and has been provided with rip-rap protection.

For dry wells, all flows that exceed the capacity of the dry well should be passed through the surcharge pipe. This is not applicable to this design.

4.1.3. Pretreatment

Required Elements
A minimum pretreatment volume of 25% of the WQv must be provided prior to entry to an infiltration facility, and can be provided in the form of a sedimentation basin, sump pit, grass channel, plunge pool or other measure. A grass filter strip has been provided for pretreatment.

Calculations for infiltration basin sizing are found in Appendix B.

If the fc for the underlying soils is greater than 2.00 inches per hour, a minimum pretreatment volume of 50% of the WQv must be provided.

If the fc for the underlying soils is greater than 5.00 inches per hour, 100% of the WQv shall be pretreated prior to entry into an infiltration facility. 100% pretreatment has been provided for this project.

Exit velocities from pretreatment chambers shall be non-erosive (3.5 to 5.0 fps) during the two-year design storm.

Infiltration basins or trenches can have redundant methods to ensure the long-term integrity of the infiltration rate. The following techniques are pretreatment options for infiltration practices:

Grass channel (Maximum velocity of 1 fps for water quality flow. See the Fact Sheet on page 5-10 for more detailed design information.). Not applicable.

Grass filter strip (minimum 20 feet and only if sheet flow is established and maintained). This has been implemented as a redundant technique for lots 1 & 2.

Bottom sand layer (for I-1). Not applicable.

Upper sand layer (for I-1; 6" minimum with filter fabric at sand/gravel interface). Not applicable.

Use of washed bank run gravel as aggregate. Not applicable.

Alternatively, a pre-treatment settling chamber may be provided and sized to capture the pretreatment volume. Use the method prescribed in section 6.4.3 (i.e., the Camp-Hazen equation) to size the chamber.

A Plunge Pool is not applicable.

An underground trap with a permanent pool between the downspout and the dry well (I-3). Not applicable.

Design Guidance

The sides of infiltration trenches and dry wells should be lined with an acceptable filter fabric that prevents soil piping. Not applicable.

In infiltration trench designs, incorporate a fine gravel or sand layer above the coarse gravel treatment reservoir to serve as a filter layer. Not applicable.

4.1.4. Treatment

Required Elements
Infiltration practices shall be designed to exfiltrate the entire WQv through the floor of each practice (sides are not considered in sizing). This has been designed accordingly, see Appendix B for calculations.

The construction sequence and specifications for each infiltration practice shall be precisely followed in accordance with this SWPPP report.

Experience has shown that the longevity of infiltration practices is strongly influenced by the care taken during construction

Calculate the surface area of infiltration trenches as:
See Appendix B for treatment calculations.

Design Guidance
Infiltration practices are best used in conjunction with other practices, and downstream detention is often needed to meet the Cpv and Qp sizing criteria. This facility will provide Cpv and Qp.

A porosity value (Vv/Vt) of 0.4 can be used to design stone reservoirs for infiltration practices. The bottom of the stone reservoir should be completely flat so that infiltrated runoff will be able to infiltrate through the entire surface. Not applicable.

4.1.5. Landscaping

Required Elements
Upstream construction shall be completed and stabilized before connection to a downstream infiltration facility. A dense and vigorous vegetative cover shall be established over the contributing pervious drainage areas before runoff can be accepted into the facility.

Infiltration trenches shall not be constructed until all of the contributing drainage area has been completely stabilized.

Design Guidance
Mow upland and adjacent areas, and seed bare areas.

4.1.6. Maintenance

Required Elements
Infiltration practices shall never serve as a sediment control device during site construction phase. In addition, the Erosion and Sediment Control plan for the site shall clearly indicate how sediment will be prevented from entering an infiltration facility. Normally, the use of diversion berms around the perimeter of the infiltration practice, along with immediate vegetative stabilization and/or mulching can achieve this goal. In this case, the sedimentation basin located upstream of the infiltration basin shall be used as a sediment trap during construction.

An observation well shall be installed in every infiltration trench and dry well, consisting of an anchored six- inch diameter perforated PVC pipe with a lockable cap installed flush with the ground surface. This is not applicable here.

Direct access shall be provided to infiltration practices for maintenance and rehabilitation. If a stone reservoir or perforated pipe is used to temporarily store runoff prior to infiltration, the practice shall not be covered by an impermeable surface. An easement will be provided for Town access related to operation and maintenance issues.

Design Guidance
OSHA trench safety standards should be consulted if the infiltration trench will be excavated more than five feet. This is not applicable.

Infiltration designs should include dewatering methods in the event of failure. Dewatering can be accomplished with underdrain pipe systems that accommodate drawdown. An underdrain with cleanouts and a valve were not provided for this project due to topographic constraints and the inability to daylight underdrains.

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 construction of the potential 29-lot subdivision. After completion of the project and acceptance of drainage facilities by The Town of New Paltz, the Town will be responsible for maintenance of the drainage facilities within the created drainage district. 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 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).

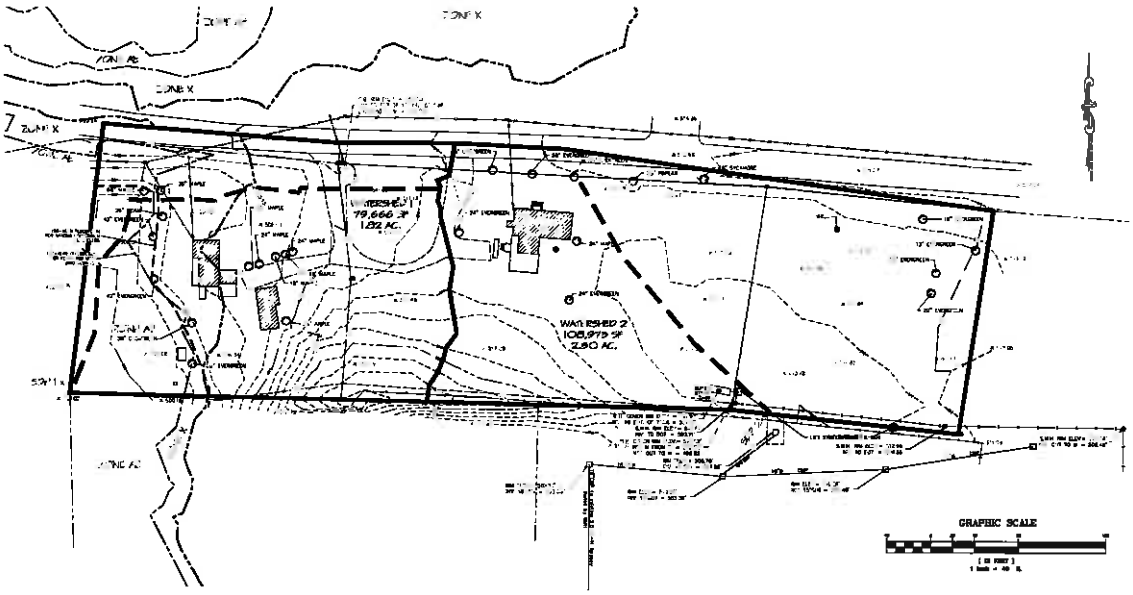
7. SUMMARY

7.1. General

Drainage from the proposed impervious surfaces will be collected primarily by the bioretention trench and partly by the rain gardens. 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 rain gardens and bioretention 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 2-lot subdivision has also been designed to minimize the extent of proposed grading and wetland 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.

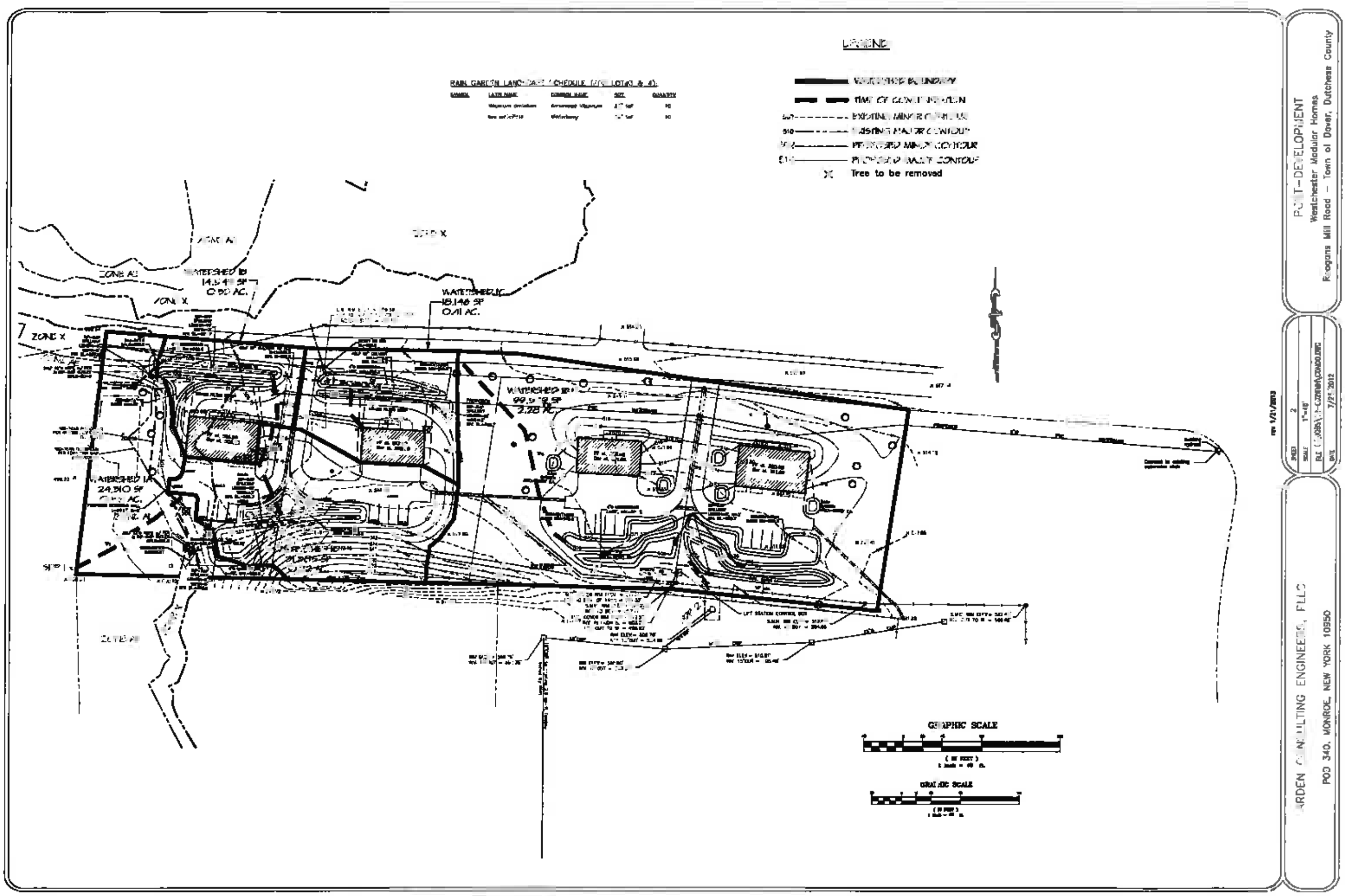
APPENDIX A

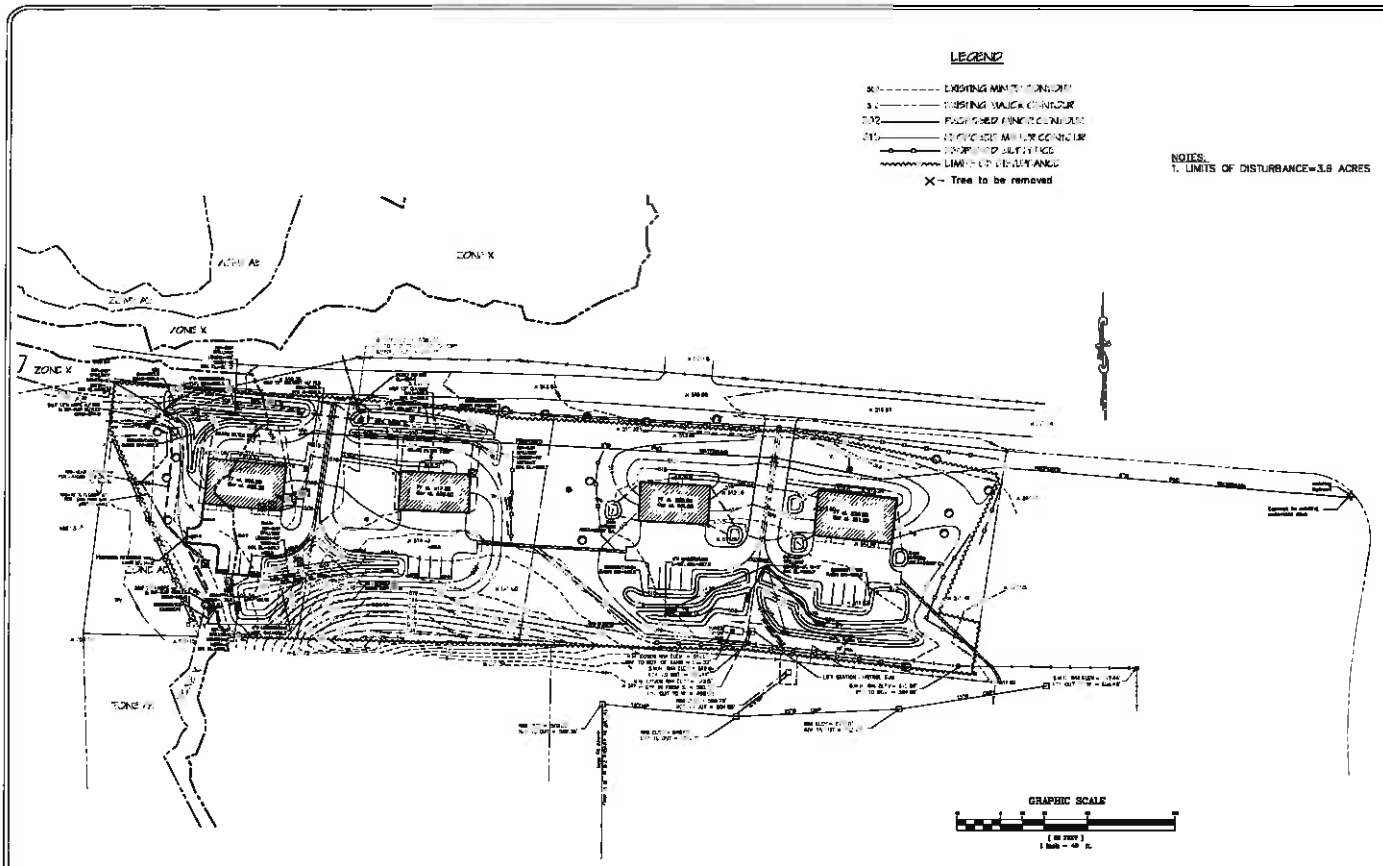


PRE-DEVELOPMENT
Westchester Modular Homes
Reagans Mill Road – Town of Dover, Dutchess County

SHEET 1
SCALE 1"=50'
FILE C:\2021\12-DOVER\DWG\DWG
DATE 1/13/2022

ARDEN CONSULTING ENGINEERS, PLLC
POB 340, MONROE, NEW YORK 10950


POST-DEVELOPMENT
Westchester Modular Homes
Reagans Mill Road — Town of Dover, Dutchess County
POB 340, MONROE, NEW YORK 10950
Tree to be removed
ZONE X
WATERSHED 1C
18,146 SF
0.41 AC.
GRAPHIC SCALE



E&SC-PLAN
Wes-chester Modular Homes
Response Hill Road – Town of Dover, Dutchess County

AMEEN CONSULTING ENGINEERS, PLLC
POB 340, MONROE, NEW YORK 10950

APPENDIX B

REQUIRED STORAGE VOLUME CALCULATIONS

Based on the requirements of the New York State Stormwater Management Design Manual (NYSMDM) (August 2010), this section of the report presents calculations to size the stormwater management practices for the Proposed 4-Lot Subdivision & Site Plan for WMH.

Calculations

1. Water Quality Storage Volume (WQ_v): this is the volume of stormwater that requires treatment in order to prevent the increase of onsite or downstream offsite pollutant levels. WQ_v is in ac-ft, **WQv2** is in cubic feet, Rv is the runoff volume in ac-ft, A is the area in acres, P90 is the 90% rainfall event number, and I is the impervious cover in percent.

WATERSHED #1

$P90 := 1.2$ inches

$I := 26.0$ %

$Rv := 0.05 + 0.009 \cdot I$

$A := 1.96$ acres

$Rv = 0.284$ ac – ft

$$WQv := \frac{(P90 \cdot Rv \cdot A)}{12}$$

$\boxed{WQv = 0.056}$ ac – ft OR $WQv2 := WQv \cdot 43560$ $\boxed{WQv2 = 2424.724}$ ft^3

WATERSHED #2

$P90 := 1.2$ inches

$I := 19$ %

$Rv := 0.05 + 0.009 \cdot I$

$A := 2.36$ acres

$Rv = 0.221$ ac – ft

$$WQv := \frac{(P90 \cdot Rv \cdot A)}{12}$$

$\boxed{WQv = 0.052}$ ac – ft OR $WQv2 := WQv \cdot 43560$ $\boxed{WQv2 = 2271.915}$ ft^3

Rain Garden Sizing for Lot #4

Rooftop Area=3,000 SF - Use one Rain Garden per 1,000 SF

Step 1: Calculate water quality volume using the following equation:

$P90 := 1.1$ inches

$I := 100$ %

$Rv := 0.05 + 0.009 \cdot I$

$A := 1000$ SF

$Rv = 0.95$ ac – ft

$$WQv := \frac{(P90 \cdot Rv \cdot A)}{12}$$

$\boxed{WQv = 87.083}$ CF

Step 2: Solve for drainage layer and soil media storage volume:

$Arg := 200$ SF [Rain Garden Surface Area]

$Dsm := 1.0$ ft [Depth of soil media]

$Ddl := 0.5$ ft [Depth of drainage layer]

$Psm := 0.20$ [Porosity of soil media]

$Pdl := 0.40$ [Porosity of drainage layer]

$Vsm := Arg \cdot Dsm \cdot Psm$

$Vsm = 40$ CF [Volume of soil media]

$Vdl := Arg \cdot Ddl \cdot Pdl$

$Vdl = 40$ [Volume of drainage layer]

$Dp := 0.5$ ft [6" Depth of ponding area]

$Vsm + Vdl + (Dp \cdot Arg) = 180$ CF > $WQv := 87$ CF

Rain Garden Sizing for Lot #3

Rooftop Area=2,200 SF - Use 1 Rain Garden per 1,000 SF

Step 1: Calculate water quality volume using the following equation:

$P90 := 1.1$ inches

$I := 100$ %

$Rv := 0.05 + 0.009 \cdot I$

$A := 1000$ SF

$Rv = 0.95$ ac – ft

$$WQv := \frac{(P90 \cdot Rv \cdot A)}{12}$$

$\boxed{WQv = 87.083}$ CF

Step 2: Solve for drainage layer and soil media storage volume:

Arg := 200 SF [Rain Garden Surface Area]

Dsm := 1.0 ft [Depth of soil media]

Ddl := 0.5 ft [Depth of drainage layer]

Psm := 0.20 [Porosity of soil media]

Pdl := 0.40 [Porosity of drainage layer]

Vsm := Arg·Dsm·Psm

Vsm = 40 CF [Volume of soil media]

Vdl := Arg·Ddl·Pdl

Vdl = 40 [Volume of drainage layer]

Dp := 0.5 ft [6" Depth of ponding area]

Vsm + Vdl + (Dp·Arg) = 180 CF > WQv := 87 CF

Watershed #1 Infiltration Basin Calculations

Wqv := 2425 CF

Wqv = 2425 CF

25% Wqv=265 CF

Sedimentation Basin Area Sizing for Infiltration:

As := (0.066)·Wqv

As = 160.05 SF [Sedimentation Basin Area For I<75%]

Total Sedimentation Basin Area Provided = 6,200 SF
2,925 CF of Pretreatment Volume > 100% Pretreatment Requirement

Infiltration Basin Sizing

Vw := 2425 CF

db := 2.0 Ft

$$A := \frac{Vw}{db}$$

A = 1212. SF Required

A := 2121 SF Provided

Cpv Calculation

Tc=7.2 mins OR approx. 0.1 hrs

CN := 70

Ia := 0.857 from TR55

P := 2.8 in 1 yr storm per NYSDEC SWM August 2010

$\frac{Ia}{P} = 0.306$

$qu := 600 \ \frac{csm}{min}$

qo/qi=0.04

$\frac{Vs}{Vr} := 0.55$

Runoff Volume for 1 year storm for Watershed 1 from HydroCad= 4,237 CF

$Vs := 0.55 \cdot 4237$

$Vs = 2330.35$ CF

This volume is stored and recharged within the infiltration basins. Adding the storage volumes below the outlet devices yields 4,562 CF.

Watershed #2 Infiltration Basin Calculations

$Wqv := 2272 - 435$ CF

$Wqv = 1837$ CF

25% Wqv=459 CF

Sedimentation Basin Area Sizing for Infiltration:

$As := (0.066) \cdot Wqv$

$As = 121.242$ SF [Sedimentation Basin Area For I<75%]

Total Sedimentation Basin Area Provided = 6,543 SF
3,514 CF of Pretreatment Volume > 100% Pretreatment Requirement

Infiltration Basin Sizing

$Vw := 1837$ CF

$db := 2.0$ Ft

$A := \frac{Vw}{db}$

$A = 918.5$ SF Required

$A := 1814$ SF Provided

Cpv Calculation

Tc=11 mins OR approx. 0.18 hrs

$CN := 72$

$Ia := 0.817$ from TR55

$P := 2.8$ in 1 yr storm per NYSDEC SWM August 2010

$\frac{Ia}{P} = 0.292$

$qu := 450 \ \frac{csm}{min}$

qo/qi=0.04

$\frac{Vs}{Vr} := 0.55$

Runoff Volume for 1 year storm for Watershed 2 from HydroCad= 6,009 CF

$Vs := 0.55 \cdot 6009$

$Vs = 3304.95 \ CF$

This volume is stored and recharged within the infiltration basin below elevation 509.2 from the HydroCad stage-storage graph.

RRv Calculations

Watershed 1:

Required WQv=2425 CF

HSG B = 0.40

$P := 1.2$ inches

$I := 100$

$S := 0.3$

$Aic := 16369 \ SF$

Minimum RRv Calculation

$$RRv := \frac{[P \cdot (0.05 + 0.009 \cdot I) \cdot (S \cdot Aic)]}{12}$$

$RRv = 466.516 \ CF$

Infiltration RRv Capacity = 90% x 3850 CF [SWDM Table 3.5]

Provided RRv = 3,900 CF > Req WQv=1990 CF

Watershed 2:

Required WQv=2271 CF

Average HSG = 0.36

$P := 1.2$ inches

$I := 100$

$S := 0.3$

$Aic := 17570 \ SF$

Minimum RRv Calculation

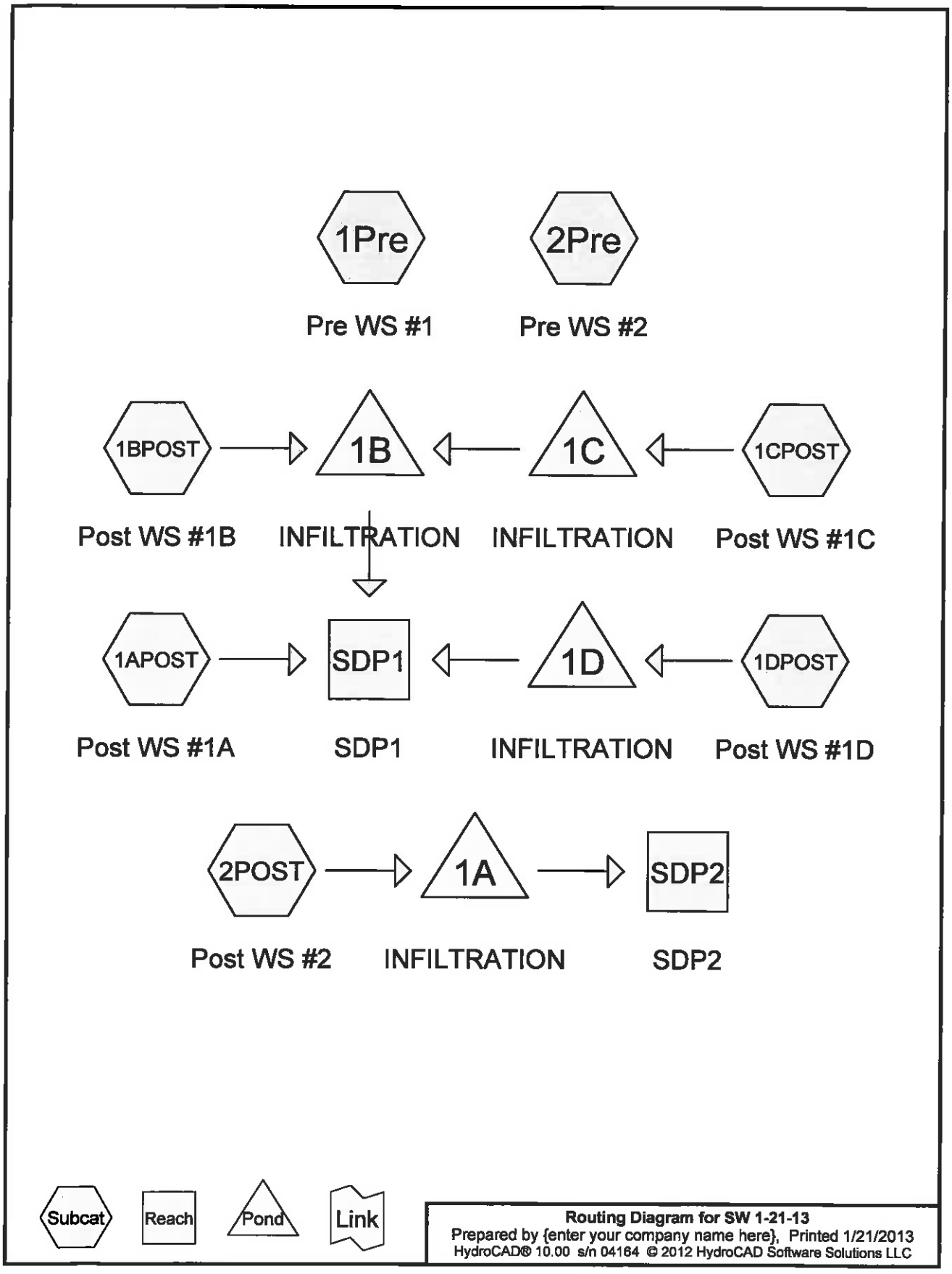
$$RRv := \frac{[P \cdot (0.05 + 0.009 \cdot I) \cdot (S \cdot Aic)]}{12}$$

RRv = 500.745 CF

Rain Garden Provided Wqv=435 CF

Infiltration RRv Capacity = 90% x 3700 CF [SWDM Table 3.5]

Provided RRv = 3,760 CF > Req WQv=2271 CF



Routing Diagram for SW 1-21-13
Prepared by {enter your company name here}, Printed 1/21/2013
HydroCAD® 10.00 s/n 04164 © 2012 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
241,006	61	>75% Grass cover, Good, HSG B (1APOST, 1BPOST, 1CPOST, 1DPOST, 1Pre, 2POST, 2Pre)
76,305	74	>75% Grass cover, Good, HSG C (2POST, 2Pre)
6,450	96	Gravel surface, HSG B (1Pre, 2Pre)
17,570	98	Paved parking, HSG B (2POST)
9,446	89	Paved roads w/open ditches, 50% imp, HSG B (1Pre, 2POST, 2Pre)
23,620	98	Unconnected pavement, HSG B (1BPOST, 1CPOST, 1DPOST, 2Pre)
2,205	98	Unconnected roofs, HSG B (1Pre)
376,602	**69**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
300,297	HSG B	1APOST, 1BPOST, 1CPOST, 1DPOST, 1Pre, 2POST, 2Pre
76,305	HSG C	2POST, 2Pre
0	HSG D	
0	Other	
376,602		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
0	241,006	76,305	0	0	317,311	>75% Grass cover, Good
0	6,450	0	0	0	6,450	Gravel surface
0	17,570	0	0	0	17,570	Paved parking
0	9,446	0	0	0	9,446	Paved roads w/open ditches, 50% imp
0	23,620	0	0	0	23,620	Unconnected pavement
0	2,205	0	0	0	2,205	Unconnected roofs
0	**300,297**	**76,305**	**0**	**0**	**376,602**	**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	1B	505.50	504.00	28.0	0.0536	0.012	12.0	0.0	0.0
2	1C	509.00	508.90	40.0	0.0025	0.012	12.0	0.0	0.0
3	1D	502.00	501.80	35.0	0.0057	0.012	12.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1APOST: Post WS #1A Runoff Area=24,310 sf 0.00% Impervious Runoff Depth=1.37"
Flow Length=130' Tc=5.7 min CN=61 Runoff=0.82 cfs 2,774 cf

Subcatchment1BPOST: Post WS #1B Runoff Area=14,543 sf 40.71% Impervious Runoff Depth=2.54"
Flow Length=50' Slope=0.1100 '/' Tc=2.5 min CN=76 Runoff=1.13 cfs 3,073 cf

Subcatchment1CPOST: Post WS #1C Runoff Area=18,146 sf 28.11% Impervious Runoff Depth=1.73"
Flow Length=50' Slope=0.1100 '/' Tc=2.5 min UI Adjusted CN=66 Runoff=0.92 cfs 2,613 cf

Subcatchment1DPOST: Post WS #1D Runoff Area=31,385 sf 31.86% Impervious Runoff Depth=2.28"
Flow Length=110' Tc=7.2 min CN=73 Runoff=1.83 cfs 5,964 cf

Subcatchment1Pre: Pre WS #1 Runoff Area=79,666 sf 6.44% Impervious Runoff Depth=1.65"
Flow Length=451' Tc=11.7 min UI Adjusted CN=65 Runoff=2.78 cfs 10,977 cf

Subcatchment2POST: Post WS #2 Runoff Area=99,579 sf 18.55% Impervious Runoff Depth=2.20"
Flow Length=231' Slope=0.0200 '/' Tc=11.0 min CN=72 Runoff=4.93 cfs 18,238 cf

Subcatchment2Pre: Pre WS #2 Runoff Area=108,973 sf 3.21% Impervious Runoff Depth=1.88"
Flow Length=261' Slope=0.0200 '/' Tc=11.5 min CN=68 Runoff=4.45 cfs 17,069 cf

Reach SDP1: SDP1 Inflow=1.45 cfs 9,679 cf
Outflow=1.45 cfs 9,679 cf

Reach SDP2: SDP2 Inflow=1.63 cfs 2,327 cf
Outflow=1.63 cfs 2,327 cf

Pond 1A: INFILTRATION Peak Elev=509.80' Storage=6,521 cf Inflow=4.93 cfs 18,238 cf
Discarded=0.60 cfs 15,910 cf Primary=1.63 cfs 2,327 cf Outflow=2.23 cfs 18,237 cf

Pond 1B: INFILTRATION Peak Elev=507.67' Storage=1,518 cf Inflow=1.13 cfs 4,061 cf
Discarded=0.00 cfs 0 cf Primary=0.21 cfs 2,694 cf Secondary=0.00 cfs 0 cf Outflow=0.21 cfs 2,694 cf

Pond 1C: INFILTRATION Peak Elev=509.13' Storage=1,857 cf Inflow=0.92 cfs 2,613 cf
Discarded=0.00 cfs 0 cf Primary=0.04 cfs 988 cf Outflow=0.04 cfs 988 cf

Pond 1D: INFILTRATION Peak Elev=504.81' Storage=2,019 cf Inflow=1.83 cfs 5,964 cf
Discarded=0.00 cfs 0 cf Primary=0.98 cfs 4,211 cf Secondary=0.00 cfs 0 cf Outflow=0.98 cfs 4,211 cf

Total Runoff Area = 376,602 sf Runoff Volume = 60,708 cf Average Runoff Depth = 1.93"
87.22% Pervious = 328,484 sf 12.78% Impervious = 48,118 sf

Summary for Subcatchment 1APOST: Post WS #1A

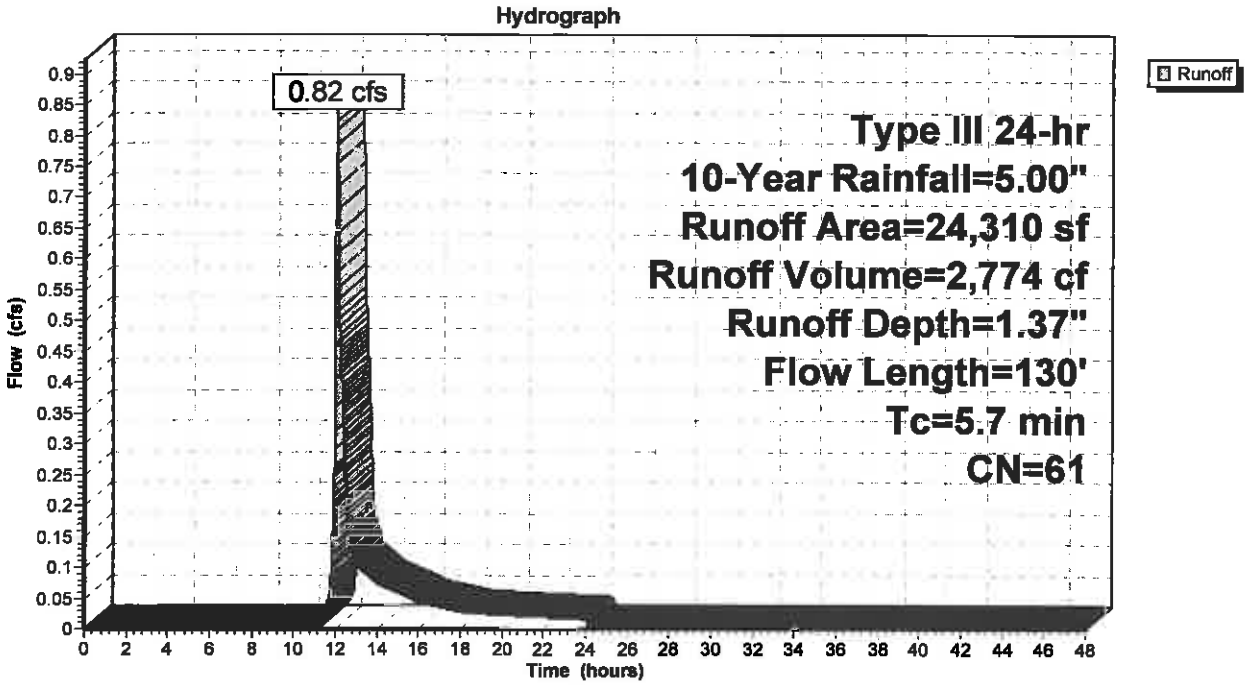
Runoff = 0.82 cfs @ 12.09 hrs, Volume= 2,774 cf, Depth= 1.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=5.00"

Area (sf)	CN	Description
24,310	61	>75% Grass cover, Good, HSG B
24,310		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	100	0.0800	0.33		**Sheet Flow, SHEET FLOW** Grass: Short n= 0.150 P2= 4.00"
0.7	30	0.0100	0.70		**Shallow Concentrated Flow, SHALLOW FLOW TO SDP1** Short Grass Pasture Kv= 7.0 fps
5.7	130	Total			

Subcatchment 1APOST: Post WS #1A



Summary for Subcatchment 1BPOST: Post WS #1B

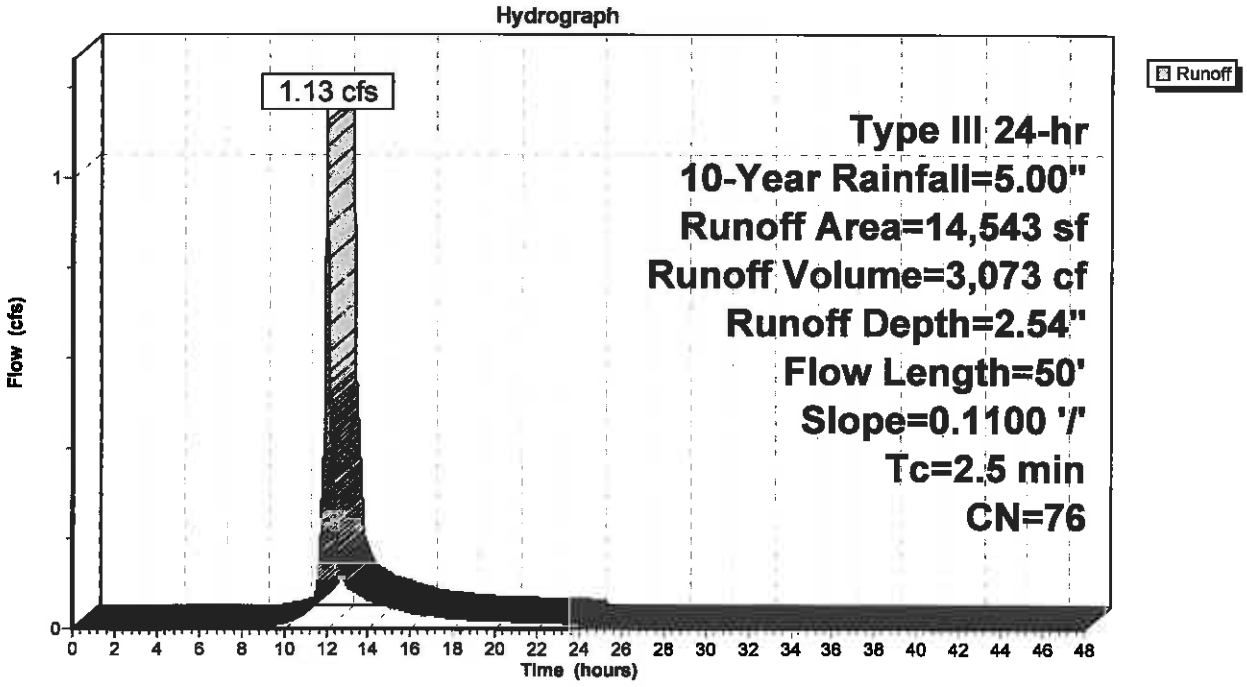
Runoff = 1.13 cfs @ 12.04 hrs, Volume= 3,073 cf, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=5.00"

Area (sf)	CN	Description
5,920	98	Unconnected pavement, HSG B
8,623	61	>75% Grass cover, Good, HSG B
14,543	76	Weighted Average
8,623		59.29% Pervious Area
5,920		40.71% Impervious Area
5,920		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	50	0.1100	0.33		**Sheet Flow, SHEET FLOW** Grass: Short n= 0.150 P2= 4.00"

Subcatchment 1BPOST: Post WS #1B



Summary for Subcatchment 1CPOST: Post WS #1C

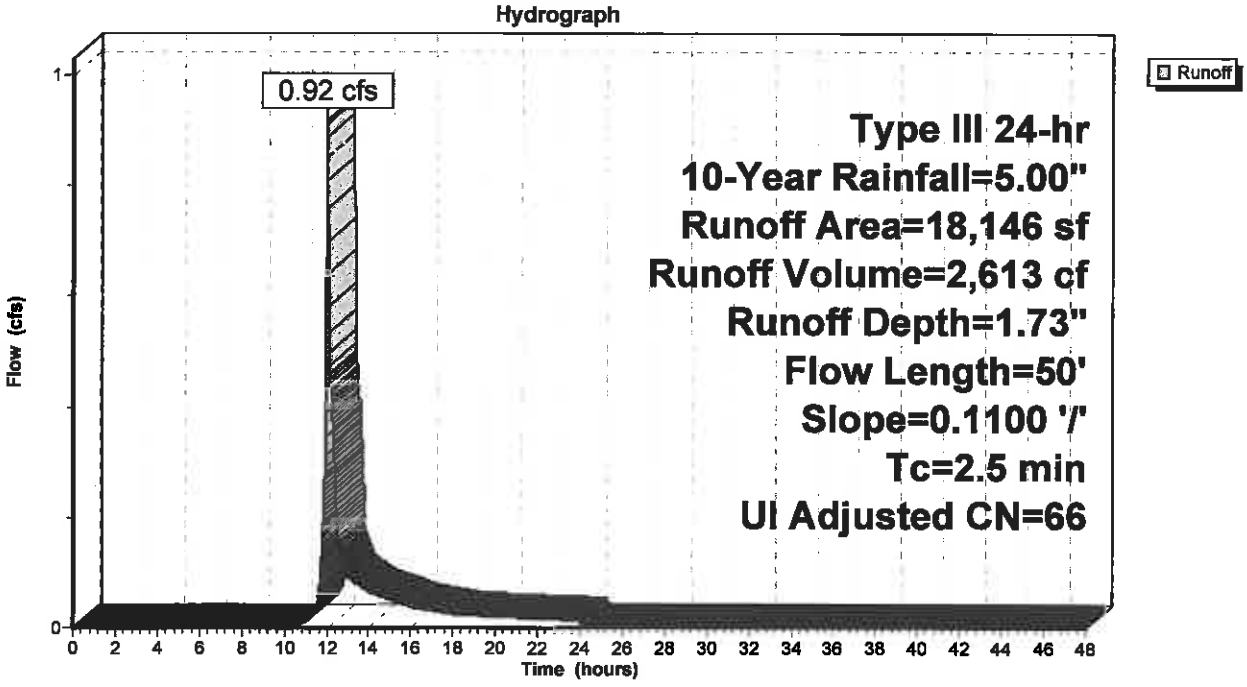
Runoff = 0.92 cfs @ 12.04 hrs, Volume= 2,613 cf, Depth= 1.73"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=5.00"

Area (sf)	CN	Description
5,100	98	Unconnected pavement, HSG B
13,046	61	>75% Grass cover, Good, HSG B
18,146	71	Weighted Average, UI Adjusted CN = 66
13,046		71.89% Pervious Area
5,100		28.11% Impervious Area
5,100		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	50	0.1100	0.33		**Sheet Flow, SHEET FLOW** Grass: Short n= 0.150 P2= 4.00"

Subcatchment 1CPOST: Post WS #1C



Summary for Subcatchment 1DPOST: Post WS #1D

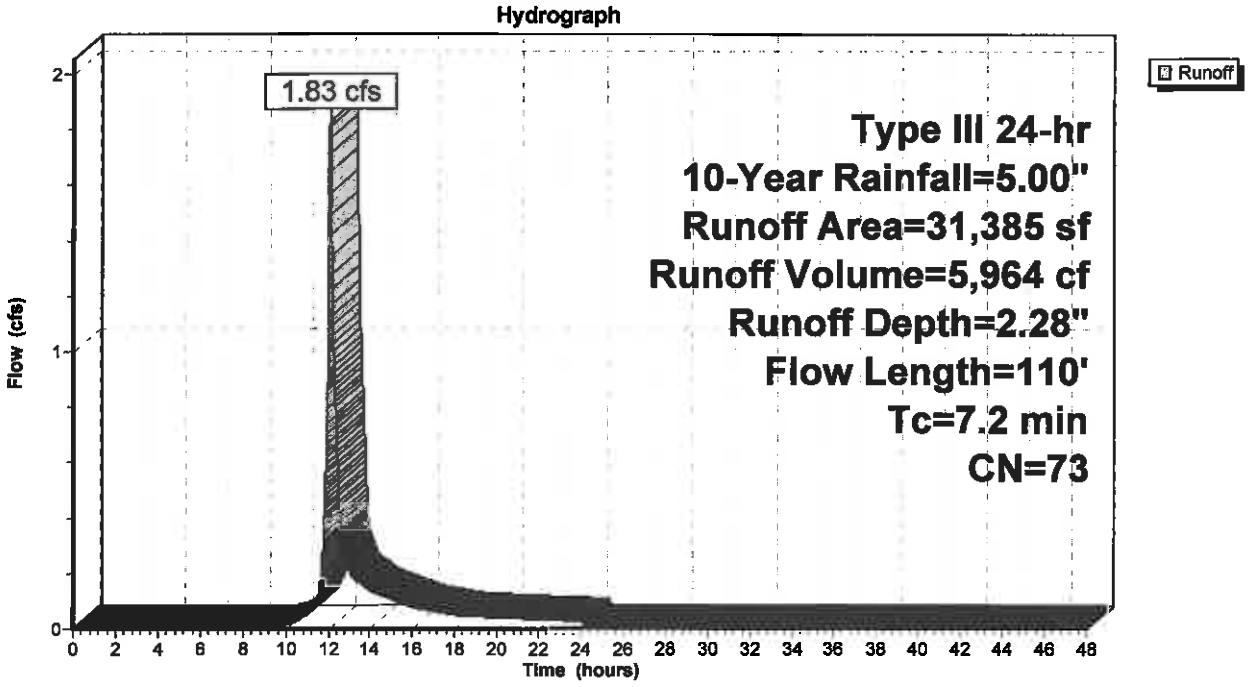
Runoff = 1.83 cfs @ 12.11 hrs, Volume= 5,964 cf, Depth= 2.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=5.00"

Area (sf)	CN	Description
10,000	98	Unconnected pavement, HSG B
21,385	61	>75% Grass cover, Good, HSG B
31,385	73	Weighted Average
21,385		68.14% Pervious Area
10,000		31.86% Impervious Area
10,000		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	65	0.0600	0.27		**Sheet Flow, SHEET FLOW GRASS** Grass: Short n= 0.150 P2= 4.00"
0.3	20	0.0200	1.11		**Sheet Flow, SHEET FLOW PAVEMENT** Smooth surfaces n= 0.011 P2= 4.00"
2.9	25	0.0200	0.14		**Sheet Flow, GRASS FILTER STRIP** Grass: Short n= 0.150 P2= 4.00"
7.2	110	Total			

Subcatchment 1DPOST: Post WS #1D



Summary for Subcatchment 1Pre: Pre WS #1

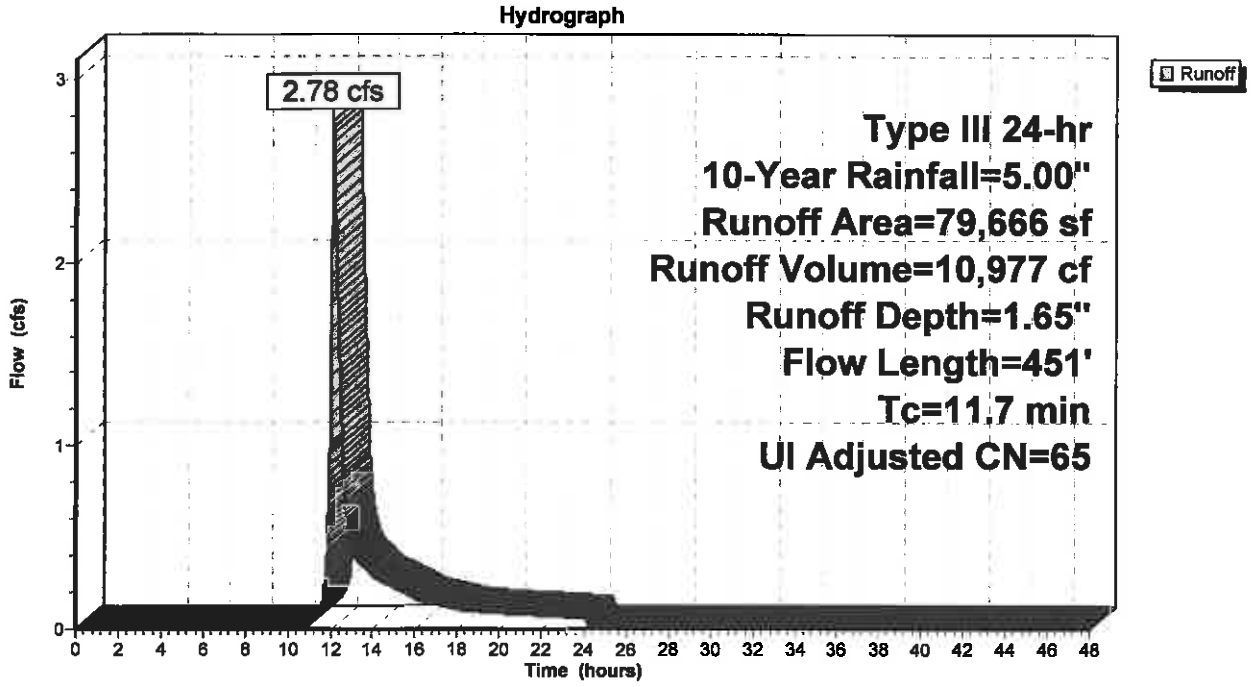
Runoff = 2.78 cfs @ 12.17 hrs, Volume= 10,977 cf, Depth= 1.65"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=5.00"

Area (sf)	CN	Description
4,100	96	Gravel surface, HSG B
2,205	98	Unconnected roofs, HSG B
5,846	89	Paved roads w/open ditches, 50% imp, HSG B
67,515	61	>75% Grass cover, Good, HSG B
79,666	66	Weighted Average, UI Adjusted CN = 65
74,538		93.56% Pervious Area
5,128		6.44% Impervious Area
2,205		43.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	100	0.0250	0.21		**Sheet Flow, SHEET FLOW** Grass: Short n= 0.150 P2= 4.00"
3.7	351	0.0500	1.57		**Shallow Concentrated Flow, SHALLOW FLOW TO SDP1** Short Grass Pasture Kv= 7.0 fps
11.7	451	Total			

Subcatchment 1Pre: Pre WS #1



Summary for Subcatchment 2POST: Post WS #2

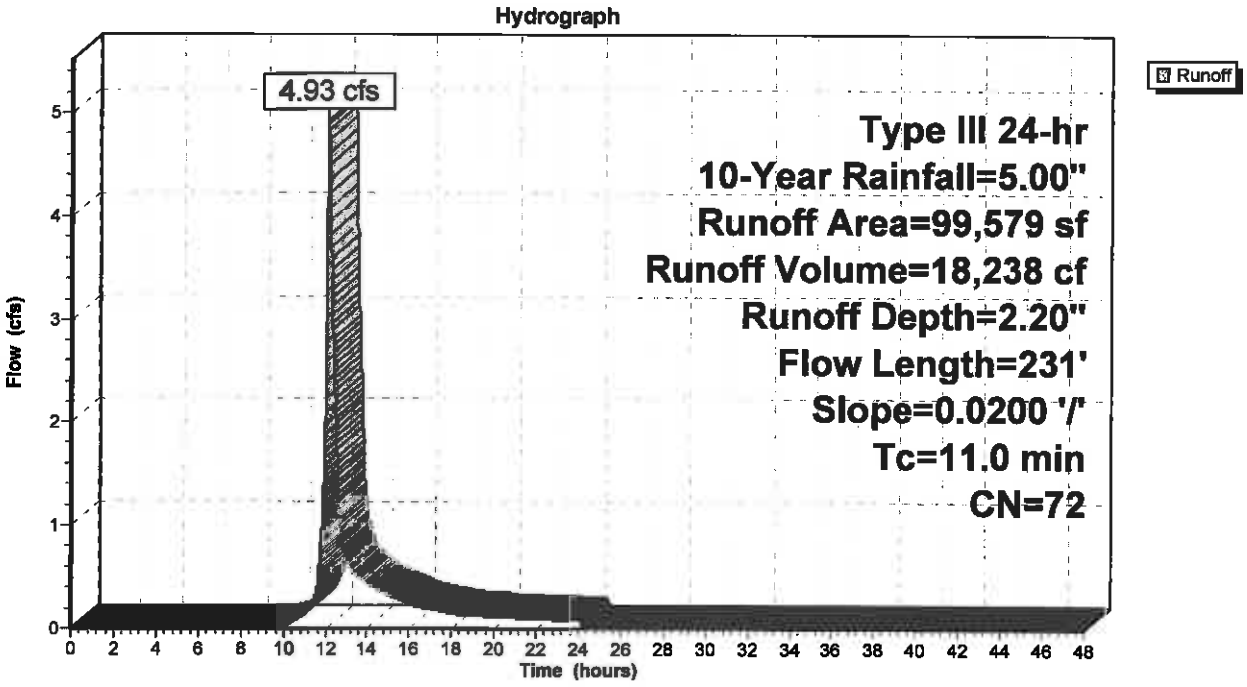
Runoff = 4.93 cfs @ 12.16 hrs, Volume= 18,238 cf, Depth= 2.20"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=5.00"

Area (sf)	CN	Description
17,570	98	Paved parking, HSG B
1,800	89	Paved roads w/open ditches, 50% imp, HSG B
31,785	74	>75% Grass cover, Good, HSG C
48,424	61	>75% Grass cover, Good, HSG B
99,579	72	Weighted Average
81,109		81.45% Pervious Area
18,470		18.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	100	0.0200	0.19		**Sheet Flow, SHEET FLOW** Grass: Short n= 0.150 P2= 4.00"
2.2	131	0.0200	0.99		**Shallow Concentrated Flow, SHALLOW FLOW TO I-BASIN** Short Grass Pasture Kv= 7.0 fps
11.0	231	Total			

Subcatchment 2POST: Post WS #2



Summary for Subcatchment 2Pre: Pre WS #2

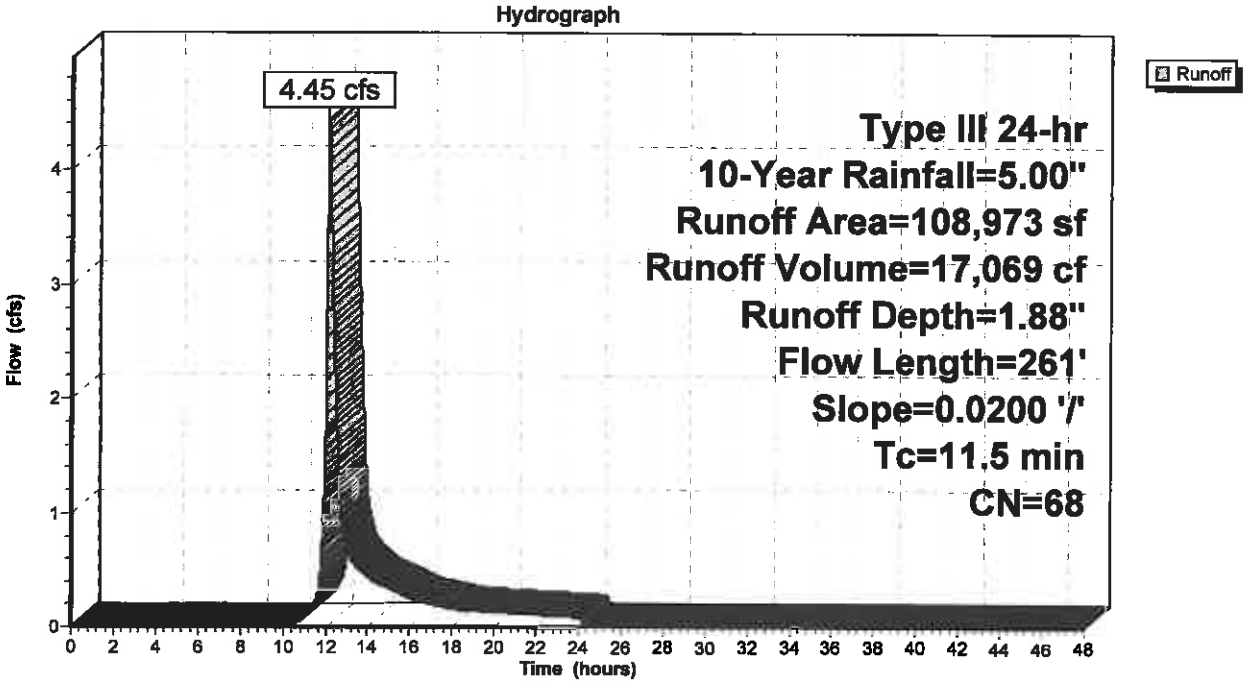
Runoff = 4.45 cfs @ 12.17 hrs, Volume= 17,069 cf, Depth= 1.88"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=5.00"

Area (sf)	CN	Description
2,350	96	Gravel surface, HSG B
2,600	98	Unconnected pavement, HSG B
44,520	74	>75% Grass cover, Good, HSG C
57,703	61	>75% Grass cover, Good, HSG B
1,800	89	Paved roads w/open ditches, 50% imp, HSG B
108,973	68	Weighted Average
105,473		96.79% Pervious Area
3,500		3.21% Impervious Area
2,600		74.29% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	100	0.0200	0.19		**Sheet Flow, SHEET FLOW** Grass: Short n= 0.150 P2= 4.00"
2.7	161	0.0200	0.99		**Shallow Concentrated Flow, SHALLOW FLOW** Short Grass Pasture Kv= 7.0 fps
11.5	261	Total			

Subcatchment 2Pre: Pre WS #2

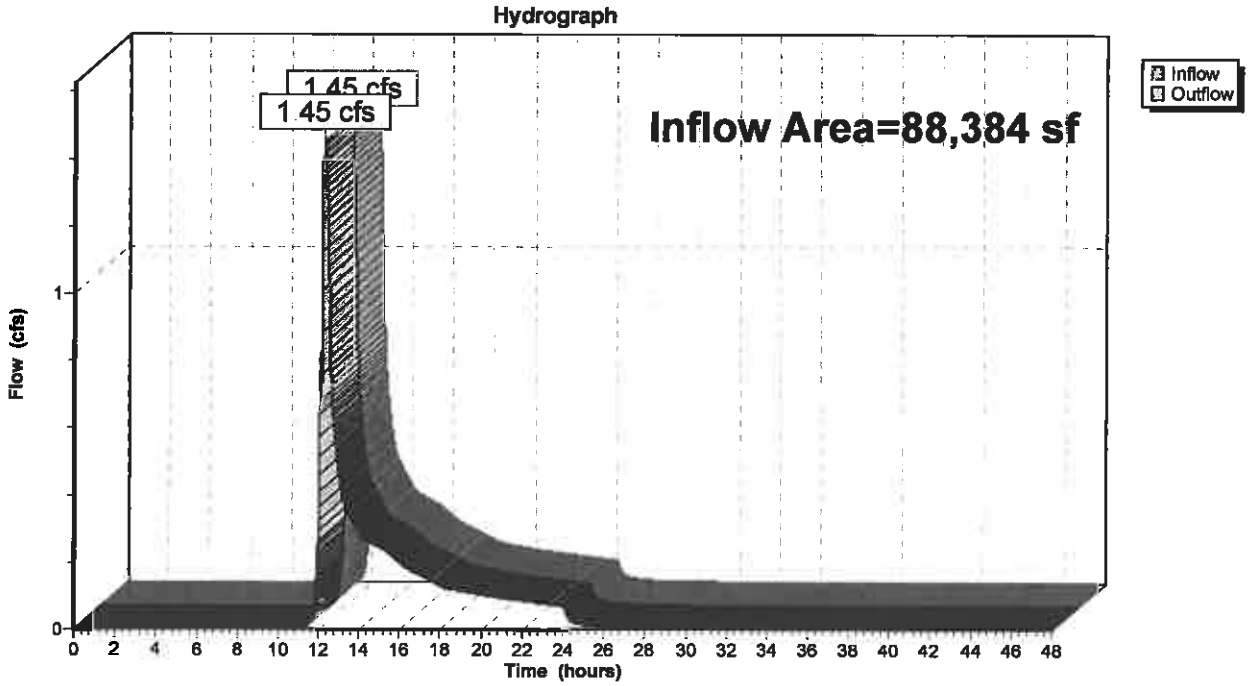


Summary for Reach SDP1: SDP1

Inflow Area = 88,384 sf, 23.78% Impervious, Inflow Depth > 1.31" for 10-Year event
Inflow = 1.45 cfs @ 12.29 hrs, Volume= 9,679 cf
Outflow = 1.45 cfs @ 12.29 hrs, Volume= 9,679 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach SDP1: SDP1

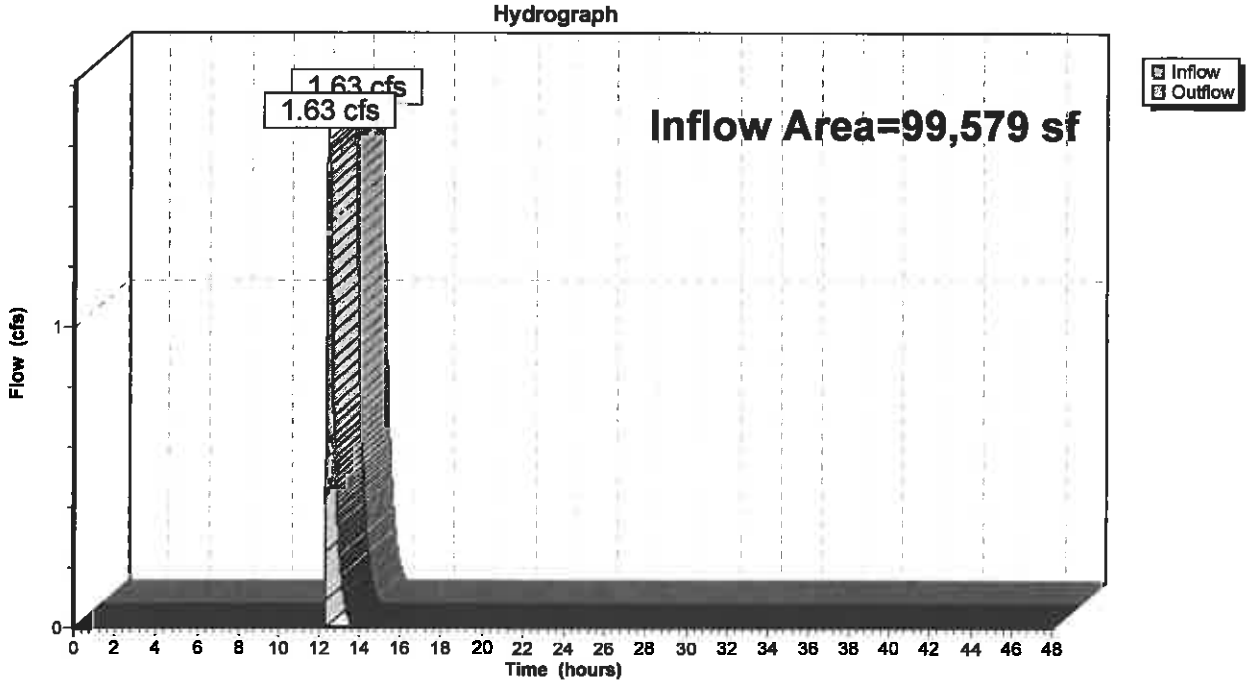


Summary for Reach SDP2: SDP2

Inflow Area = 99,579 sf, 18.55% Impervious, Inflow Depth = 0.28" for 10-Year event
Inflow = 1.63 cfs @ 12.46 hrs, Volume= 2,327 cf
Outflow = 1.63 cfs @ 12.46 hrs, Volume= 2,327 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach SDP2: SDP2



Summary for Pond 1A: INFILTRATION

Inflow Area = 99,579 sf, 18.55% Impervious, Inflow Depth = 2.20" for 10-Year event
Inflow = 4.93 cfs @ 12.16 hrs, Volume= 18,238 cf
Outflow = 2.23 cfs @ 12.46 hrs, Volume= 18,237 cf, Atten= 55%, Lag= 18.2 min
Discarded = 0.60 cfs @ 12.46 hrs, Volume= 15,910 cf
Primary = 1.63 cfs @ 12.46 hrs, Volume= 2,327 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 509.80' @ 12.46 hrs Surf.Area= 6,674 sf Storage= 6,521 cf
Flood Elev= 510.00' Surf.Area= 7,670 sf Storage= 7,963 cf

Plug-Flow detention time= 167.6 min calculated for 18,234 cf (100% of inflow)
Center-of-Mass det. time= 167.8 min (1,015.0 - 847.2)

Volume	Invert	Avail.Storage	Storage Description
#1	508.00'	7,963 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

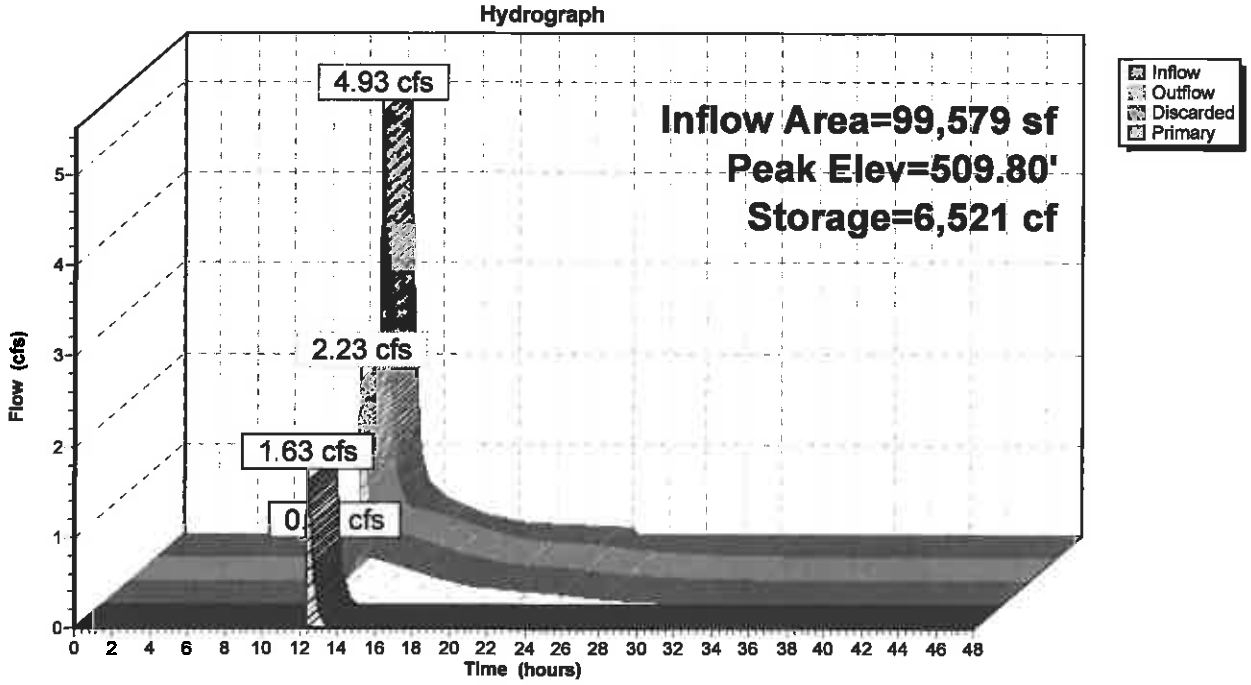
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
508.00	1,814	535.0	0	0	1,814
509.00	3,405	678.0	2,568	2,568	15,631
510.00	7,670	967.0	5,395	7,963	53,471

Device	Routing	Invert	Outlet Devices
#1	Primary	509.70'	**10.0' long x 1.5' breadth Broad-Crested Rectangular Weir X 2.00** 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 Coef. (English) 2.62 2.64 2.64 2.68 2.75 2.86 2.92 3.07 3.07 3.03 3.28 3.32
#2	Discarded	508.00'	**5.000 in/hr Exfiltration over Surface area from 508.00' - 510.00'** Conductivity to Groundwater Elevation = 500.00' Excluded Surface area = 1,814 sf

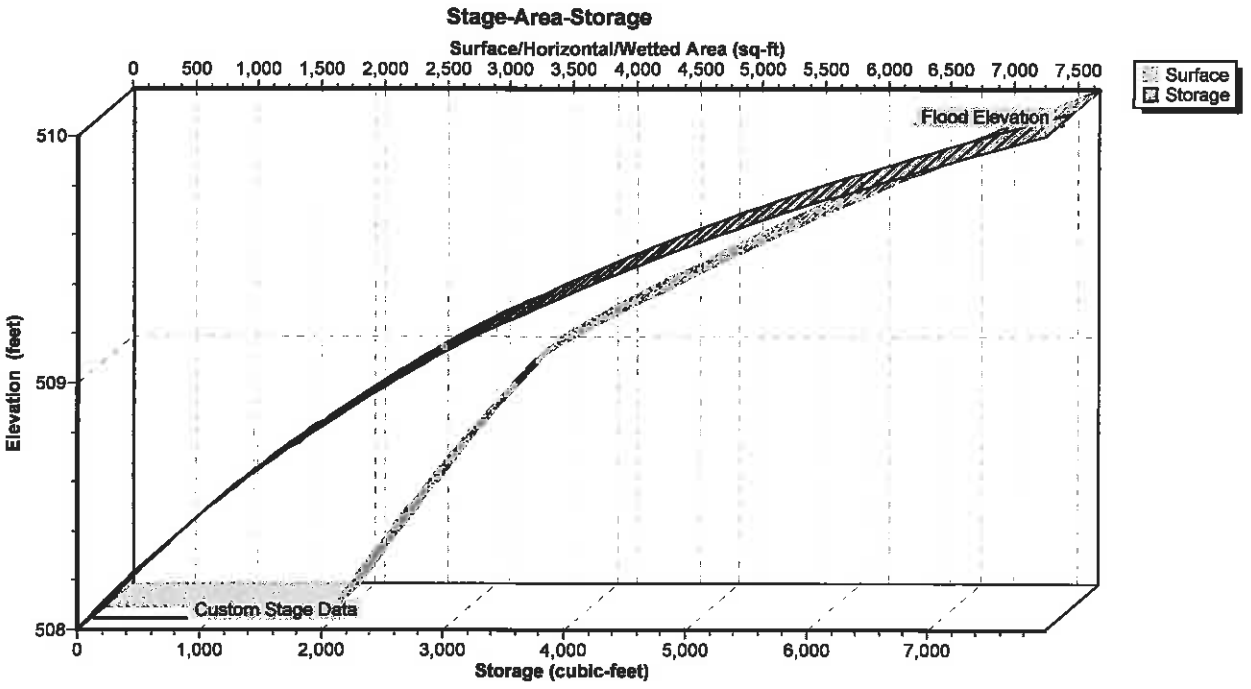
Discarded OutFlow Max=0.60 cfs @ 12.46 hrs HW=509.80' (Free Discharge)
↑**2=Exfiltration** (Controls 0.60 cfs)

Primary OutFlow Max=1.63 cfs @ 12.46 hrs HW=509.80' TW=0.00' (Dynamic Tailwater)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 1.63 cfs @ 0.82 fps)

Pond 1A: INFILTRATION



Pond 1A: INFILTRATION



Summary for Pond 1B: INFILTRATION

Inflow Area = 32,689 sf, 33.71% Impervious, Inflow Depth > 1.49" for 10-Year event
Inflow = 1.13 cfs @ 12.04 hrs, Volume= 4,061 cf
Outflow = 0.21 cfs @ 12.48 hrs, Volume= 2,694 cf, Atten= 81%, Lag= 26.3 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.21 cfs @ 12.48 hrs, Volume= 2,694 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 507.67' @ 12.48 hrs Surf.Area= 2,172 sf Storage= 1,518 cf
Flood Elev= 508.00' Surf.Area= 3,369 sf Storage= 2,413 cf

Plug-Flow detention time= 277.2 min calculated for 2,694 cf (66% of inflow)
Center-of-Mass det. time= 124.8 min (1,042.9 - 918.1)

Volume	Invert	Avail.Storage	Storage Description
#1	506.00'	2,413 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)
506.00	830	340.0	0	0	830
507.00	525	275.0	672	672	4,026
508.00	3,369	601.0	1,741	2,413	26,756

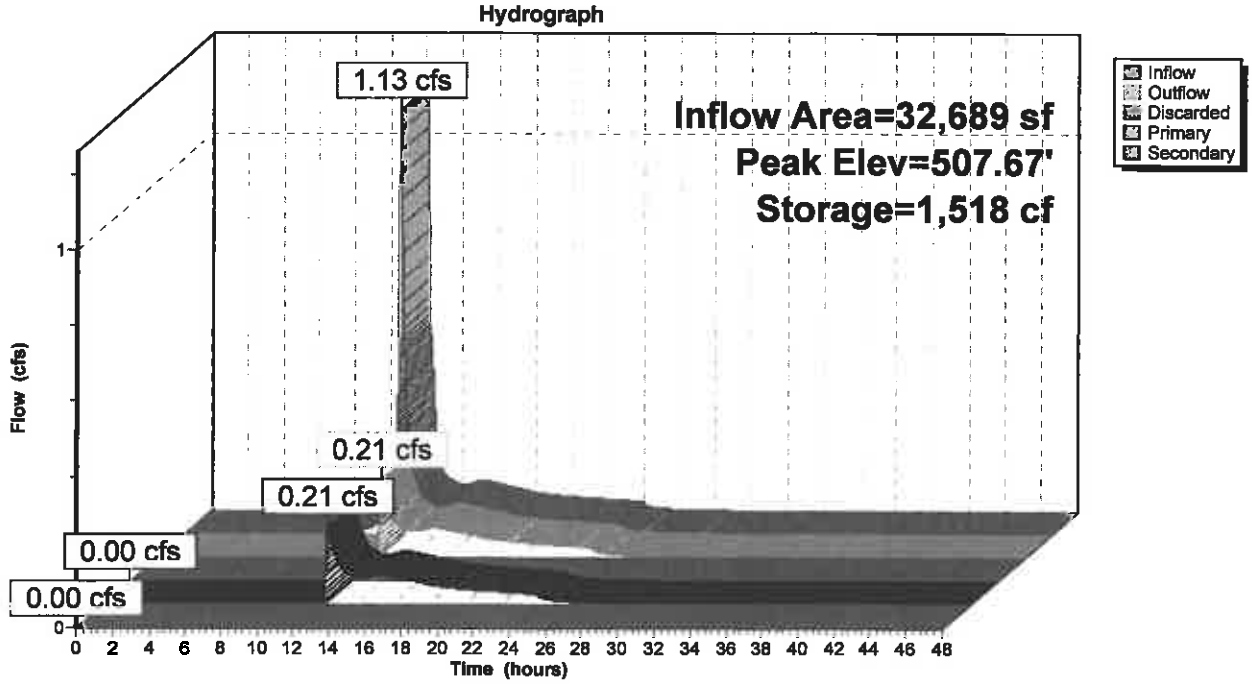
Device	Routing	Invert	Outlet Devices
#1	Discarded	506.00'	**5.000 in/hr Exfiltration over Surface area from 496.80' - 499.50'** Conductivity to Groundwater Elevation = 485.00' Excluded Surface area = 0 sf
#2	Device 3	507.60'	**12.0" Horiz. Orifice/Grate** C= 0.600 in 30.0" x 30.0" Grate Limited to weir flow at low heads
#3	Primary	505.50'	**12.0" Round Culvert** L= 28.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 505.50' / 504.00' S= 0.0536 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#4	Secondary	507.80'	**8.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=506.00' (Free Discharge)
└**1=Exfiltration** (Controls 0.00 cfs)

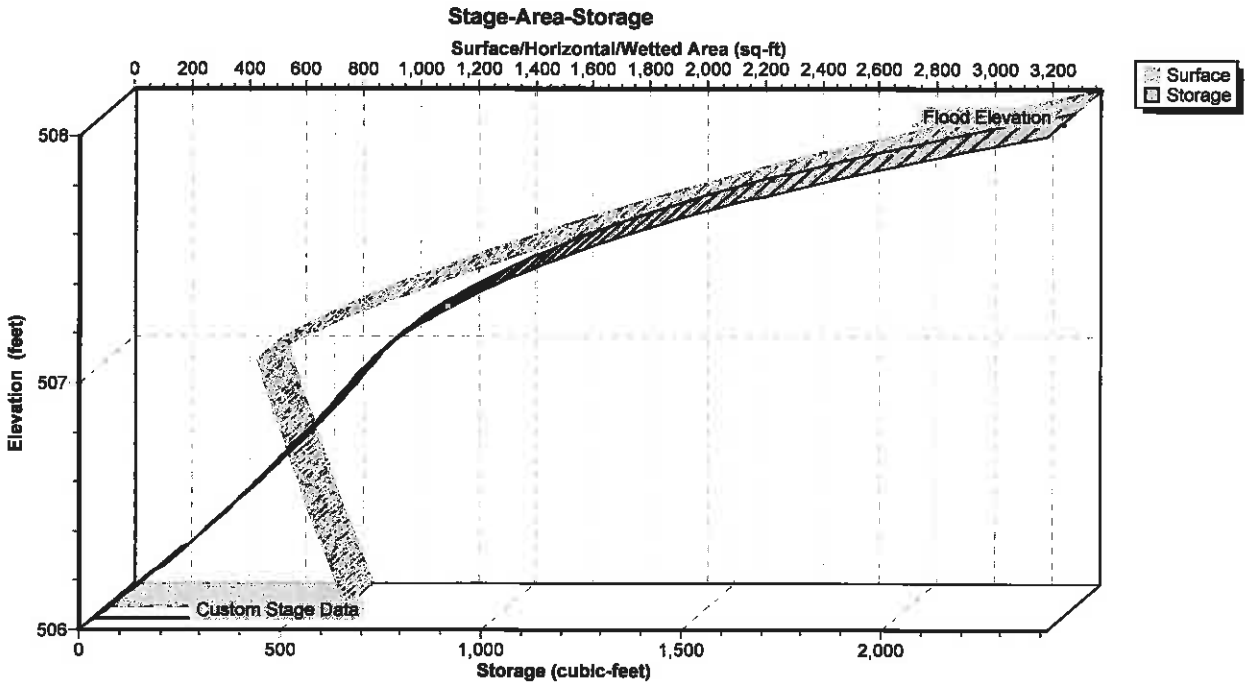
Primary OutFlow Max=0.21 cfs @ 12.48 hrs HW=507.67' TW=0.00' (Dynamic Tailwater)
└**3=Culvert** (Passes 0.21 cfs of 4.89 cfs potential flow)
└**2=Orifice/Grate** (Weir Controls 0.21 cfs @ 0.89 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=506.00' (Free Discharge)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1B: INFILTRATION



Pond 1B: INFILTRATION



Summary for Pond 1C: INFILTRATION

Inflow Area = 18,146 sf, 28.11% Impervious, Inflow Depth = 1.73" for 10-Year event
Inflow = 0.92 cfs @ 12.04 hrs, Volume= 2,613 cf
Outflow = 0.04 cfs @ 15.90 hrs, Volume= 988 cf, Atten= 96%, Lag= 231.6 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.04 cfs @ 15.90 hrs, Volume= 988 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 509.13' @ 15.90 hrs Surf.Area= 2,089 sf Storage= 1,857 cf
Flood Elev= 510.00' Surf.Area= 2,891 sf Storage= 4,026 cf

Plug-Flow detention time= 475.9 min calculated for 988 cf (38% of inflow)
Center-of-Mass det. time= 339.9 min (1,194.8 - 854.9)

Volume	Invert	Avail.Storage	Storage Description
#1	508.00'	4,026 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

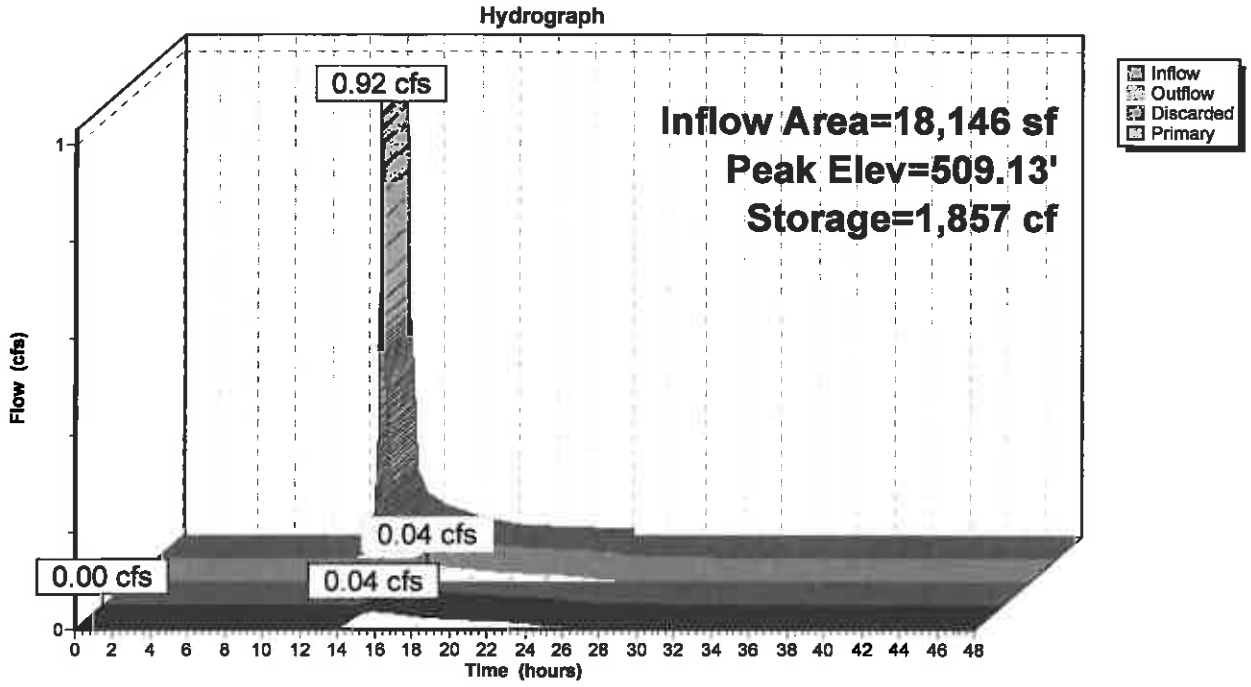
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
508.00	1,248	537.0	0	0	1,248
510.00	2,891	583.0	4,026	4,026	5,498

Device	Routing	Invert	Outlet Devices
#1	Discarded	508.00'	**5.000 in/hr Exfiltration over Surface area from 496.80' - 499.50'** Conductivity to Groundwater Elevation = 485.00' Excluded Surface area = 0 sf
#2	Primary	509.00'	**12.0" Round Culvert** L= 40.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 509.00' / 508.90' S= 0.0025 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

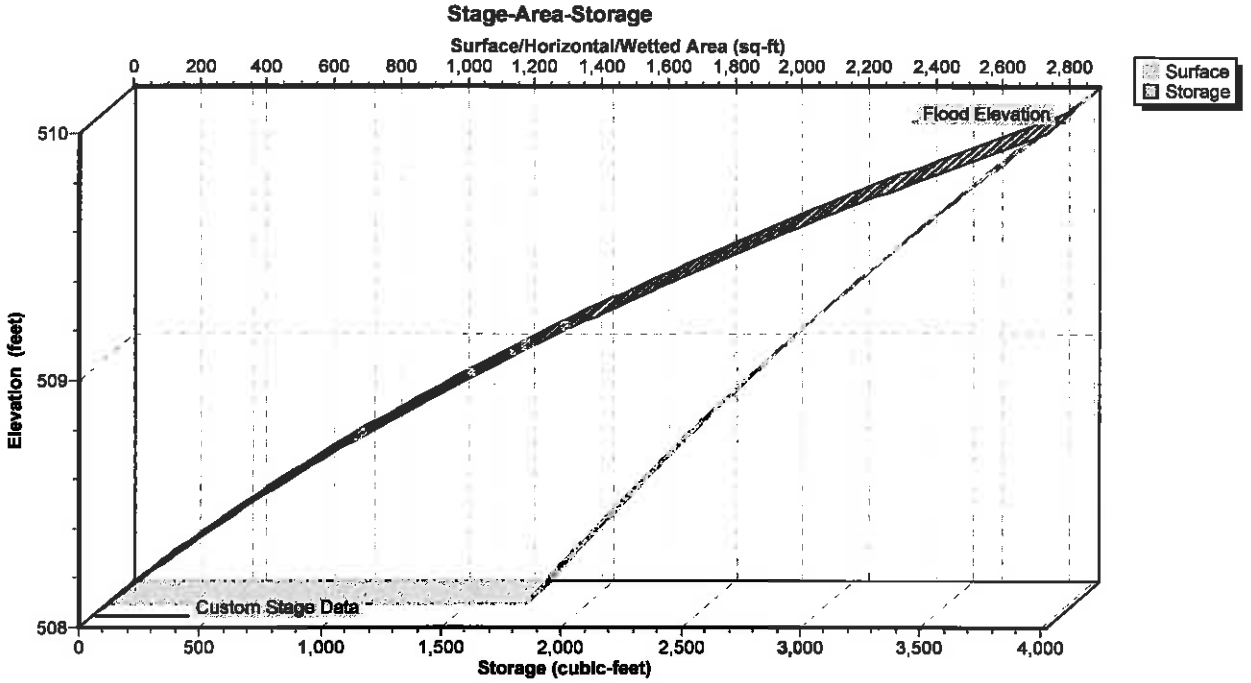
Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=508.00' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.04 cfs @ 15.90 hrs HW=509.13' TW=507.64' (Dynamic Tailwater)
↑—**2=Culvert** (Barrel Controls 0.04 cfs @ 0.99 fps)

Pond 1C: INFILTRATION



Pond 1C: INFILTRATION



Summary for Pond 1D: INFILTRATION

Inflow Area = 31,385 sf, 31.86% Impervious, Inflow Depth = 2.28" for 10-Year event
Inflow = 1.83 cfs @ 12.11 hrs, Volume= 5,964 cf
Outflow = 0.98 cfs @ 12.28 hrs, Volume= 4,211 cf, Atten= 46%, Lag= 10.2 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.98 cfs @ 12.28 hrs, Volume= 4,211 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 504.81' @ 12.28 hrs Surf.Area= 1,312 sf Storage= 2,019 cf
Flood Elev= 509.00' Surf.Area= 3,600 sf Storage= 11,915 cf

Plug-Flow detention time= 162.5 min calculated for 4,211 cf (71% of inflow)
Center-of-Mass det. time= 64.0 min (905.1 - 841.1)

Volume	Invert	Avail.Storage	Storage Description
#1	503.00'	11,915 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)
503.00	1,175	275.0	0	0	1,175
504.00	1,000	217.0	1,086	1,086	3,459
509.00	3,600	604.0	10,829	11,915	28,826

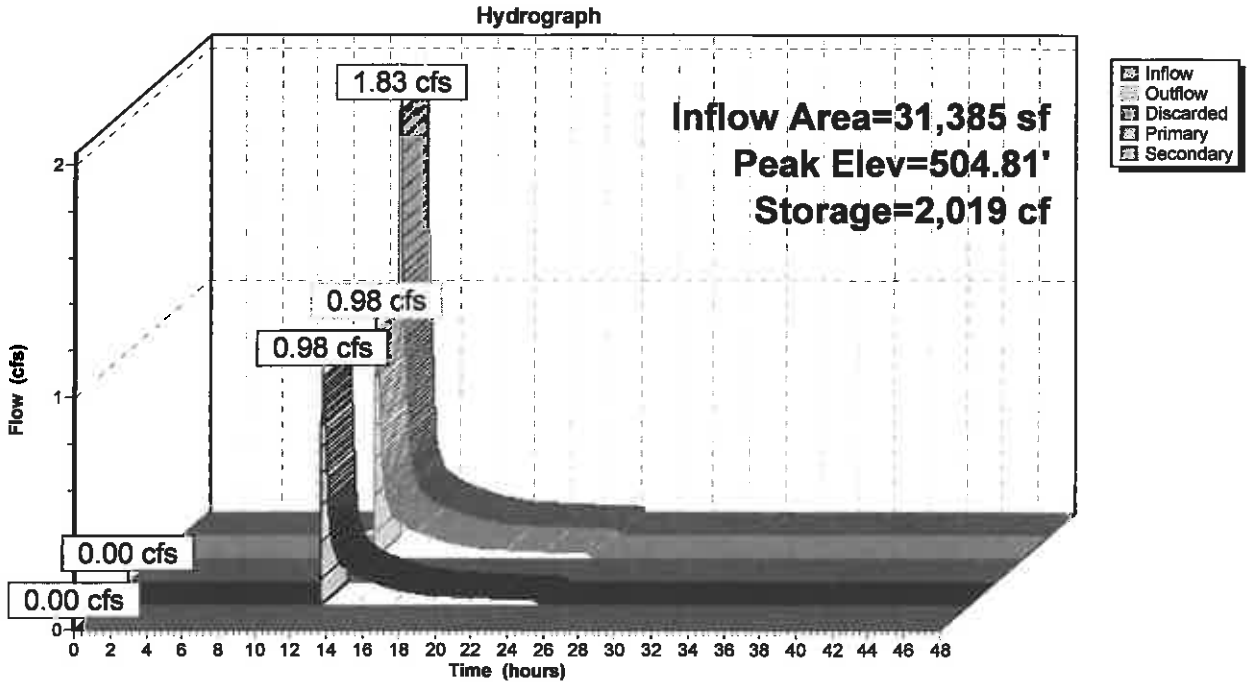
Device	Routing	Invert	Outlet Devices
#1	Discarded	508.00'	**5.000 in/hr Exfiltration over Surface area from 508.00' - 510.00'** Conductivity to Groundwater Elevation = 500.00' Excluded Surface area = 2,951 sf
#2	Device 3	504.60'	**12.0" Horiz. Orifice/Grate** C= 0.600 in 30.0" x 30.0" Grate Limited to weir flow at low heads
#3	Primary	502.00'	**12.0" Round Culvert** L= 35.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 502.00' / 501.80' S= 0.0057 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#4	Secondary	505.80'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=503.00' (Free Discharge)
└**1=Exfiltration** (Controls 0.00 cfs)

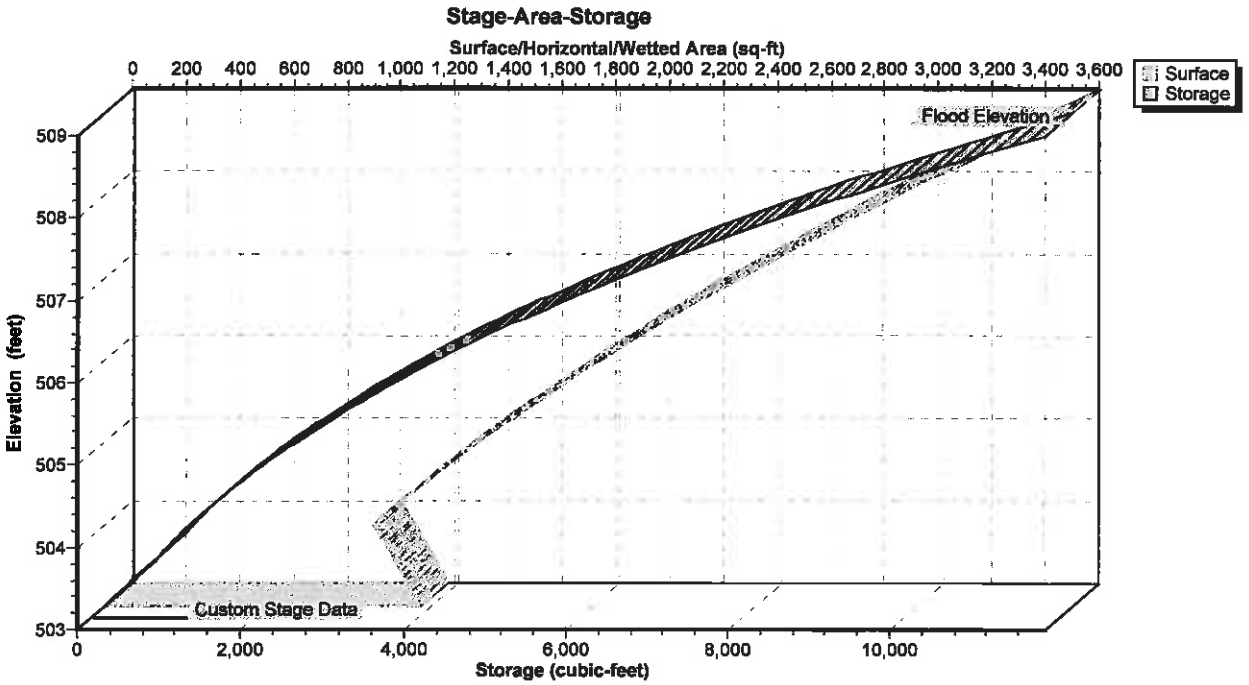
Primary OutFlow Max=0.98 cfs @ 12.28 hrs HW=504.81' TW=0.00' (Dynamic Tailwater)
└**3=Culvert** (Passes 0.98 cfs of 5.72 cfs potential flow)
└**2=Orifice/Grate** (Weir Controls 0.98 cfs @ 1.50 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=503.00' (Free Discharge)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1D: INFILTRATION



Pond 1D: INFILTRATION



Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1APOST: Post WS #1A Runoff Area=24,310 sf 0.00% Impervious Runoff Depth=2.70"
Flow Length=130' Tc=5.7 min CN=61 Runoff=1.74 cfs 5,474 cf

Subcatchment1BPOST: Post WS #1B Runoff Area=14,543 sf 40.71% Impervious Runoff Depth=4.26"
Flow Length=50' Slope=0.1100 '/' Tc=2.5 min CN=76 Runoff=1.89 cfs 5,160 cf

Subcatchment1CPOST: Post WS #1C Runoff Area=18,146 sf 28.11% Impervious Runoff Depth=3.20"
Flow Length=50' Slope=0.1100 '/' Tc=2.5 min UI Adjusted CN=66 Runoff=1.77 cfs 4,846 cf

Subcatchment1DPOST: Post WS #1D Runoff Area=31,385 sf 31.86% Impervious Runoff Depth=3.94"
Flow Length=110' Tc=7.2 min CN=73 Runoff=3.19 cfs 10,292 cf

Subcatchment1Pre: Pre WS #1 Runoff Area=79,666 sf 6.44% Impervious Runoff Depth=3.10"
Flow Length=451' Tc=11.7 min UI Adjusted CN=65 Runoff=5.44 cfs 20,597 cf

Subcatchment2POST: Post WS #2 Runoff Area=99,579 sf 18.55% Impervious Runoff Depth=3.83"
Flow Length=231' Slope=0.0200 '/' Tc=11.0 min CN=72 Runoff=8.69 cfs 31,774 cf

Subcatchment2Pre: Pre WS #2 Runoff Area=108,973 sf 3.21% Impervious Runoff Depth=3.41"
Flow Length=261' Slope=0.0200 '/' Tc=11.5 min CN=68 Runoff=8.30 cfs 30,968 cf

Reach SDP1: SDP1 Inflow=5.16 cfs 21,020 cf
Outflow=5.16 cfs 21,020 cf

Reach SDP2: SDP2 Inflow=6.71 cfs 11,359 cf
Outflow=6.71 cfs 11,359 cf

Pond 1A: INFILTRATION Peak Elev=509.95' Storage=7,614 cf Inflow=8.69 cfs 31,774 cf
Discarded=0.70 cfs 20,414 cf Primary=6.71 cfs 11,359 cf Outflow=7.41 cfs 31,773 cf

Pond 1B: INFILTRATION Peak Elev=507.81' Storage=1,848 cf Inflow=1.89 cfs 8,380 cf
Discarded=0.00 cfs 0 cf Primary=1.00 cfs 7,008 cf Secondary=0.03 cfs 6 cf Outflow=1.03 cfs 7,014 cf

Pond 1C: INFILTRATION Peak Elev=509.32' Storage=2,291 cf Inflow=1.77 cfs 4,846 cf
Discarded=0.00 cfs 0 cf Primary=0.26 cfs 3,221 cf Outflow=0.26 cfs 3,221 cf

Pond 1D: INFILTRATION Peak Elev=505.08' Storage=2,393 cf Inflow=3.19 cfs 10,292 cf
Discarded=0.00 cfs 0 cf Primary=2.63 cfs 8,539 cf Secondary=0.00 cfs 0 cf Outflow=2.63 cfs 8,539 cf

Total Runoff Area = 376,602 sf Runoff Volume = 109,111 cf Average Runoff Depth = 3.48"
87.22% Pervious = 328,484 sf 12.78% Impervious = 48,118 sf

Summary for Subcatchment 1APOST: Post WS #1A

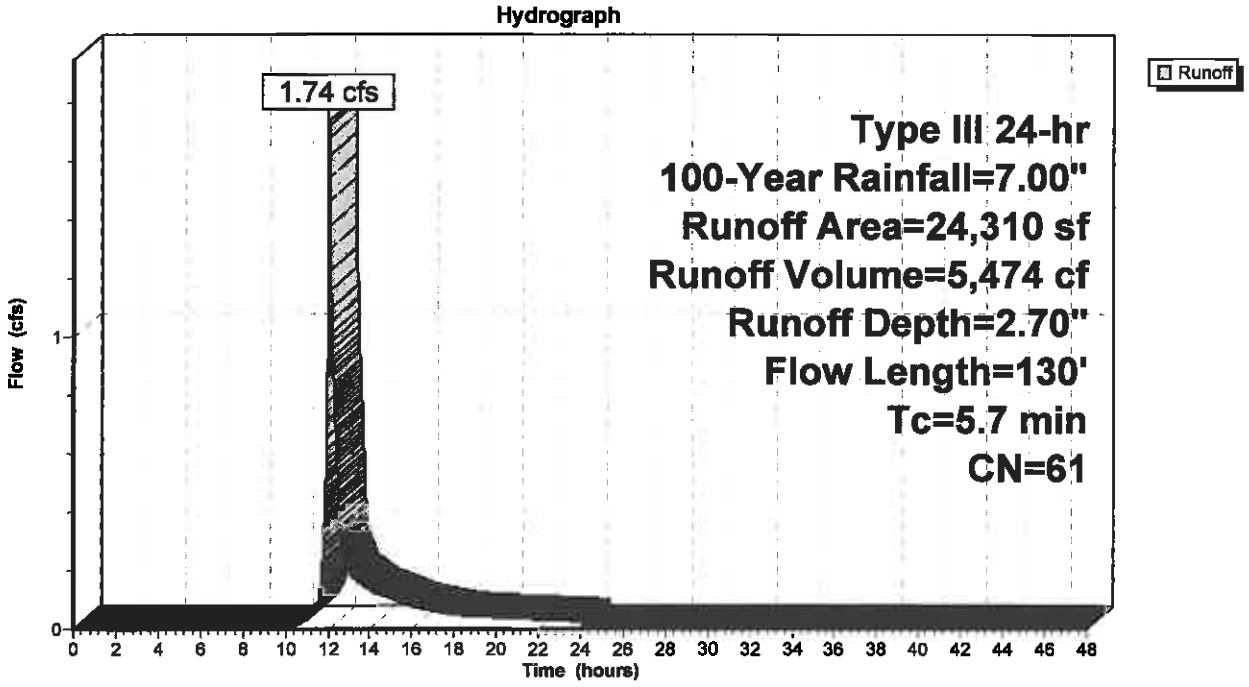
Runoff = 1.74 cfs @ 12.09 hrs, Volume= 5,474 cf, Depth= 2.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (sf)	CN	Description
24,310	61	>75% Grass cover, Good, HSG B
24,310		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	100	0.0800	0.33		**Sheet Flow, SHEET FLOW** Grass: Short n= 0.150 P2= 4.00"
0.7	30	0.0100	0.70		**Shallow Concentrated Flow, SHALLOW FLOW TO SDP1** Short Grass Pasture Kv= 7.0 fps
5.7	130	Total			

Subcatchment 1APOST: Post WS #1A



Summary for Subcatchment 1BPOST: Post WS #1B

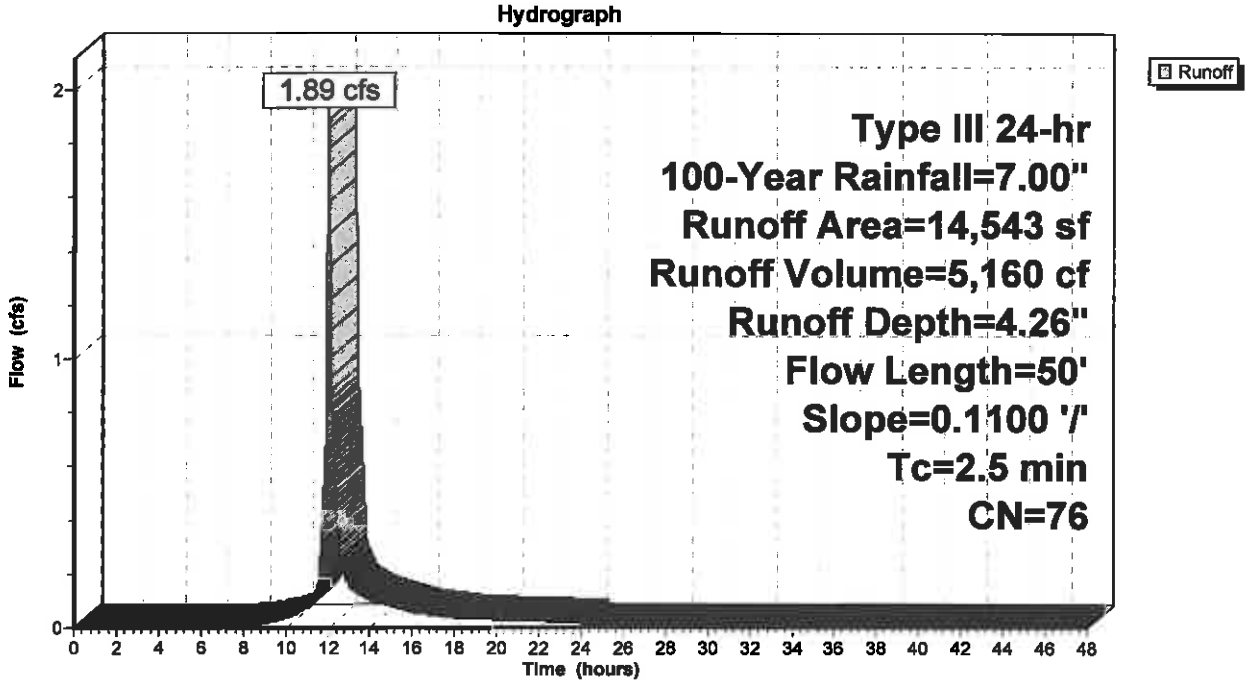
Runoff = 1.89 cfs @ 12.04 hrs, Volume= 5,160 cf, Depth= 4.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (sf)	CN	Description
5,920	98	Unconnected pavement, HSG B
8,623	61	>75% Grass cover, Good, HSG B
14,543	76	Weighted Average
8,623		59.29% Pervious Area
5,920		40.71% Impervious Area
5,920		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	50	0.1100	0.33		**Sheet Flow, SHEET FLOW** Grass: Short n= 0.150 P2= 4.00"

Subcatchment 1BPOST: Post WS #1B



Summary for Subcatchment 1CPOST: Post WS #1C

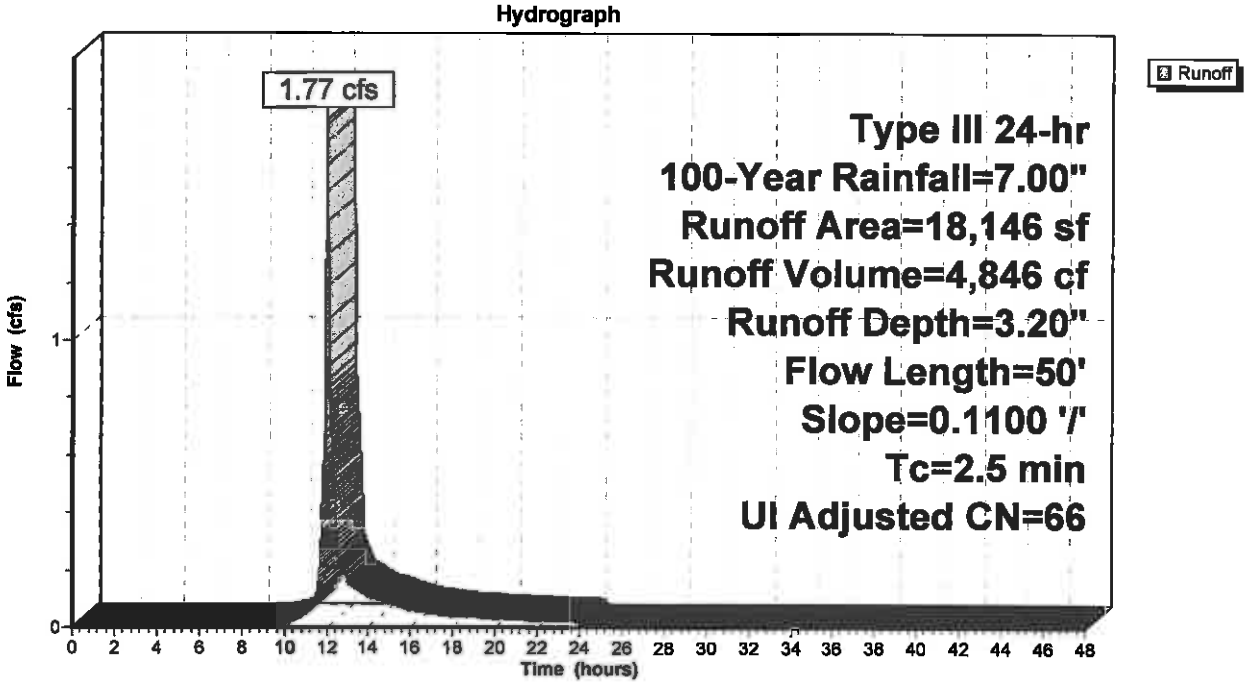
Runoff = 1.77 cfs @ 12.04 hrs, Volume= 4,846 cf, Depth= 3.20"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (sf)	CN	Description
5,100	98	Unconnected pavement, HSG B
13,046	61	>75% Grass cover, Good, HSG B
18,146	71	Weighted Average, UI Adjusted CN = 66
13,046		71.89% Pervious Area
5,100		28.11% Impervious Area
5,100		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.5	50	0.1100	0.33		**Sheet Flow, SHEET FLOW** Grass: Short n= 0.150 P2= 4.00"

Subcatchment 1CPOST: Post WS #1C



Summary for Subcatchment 1DPOST: Post WS #1D

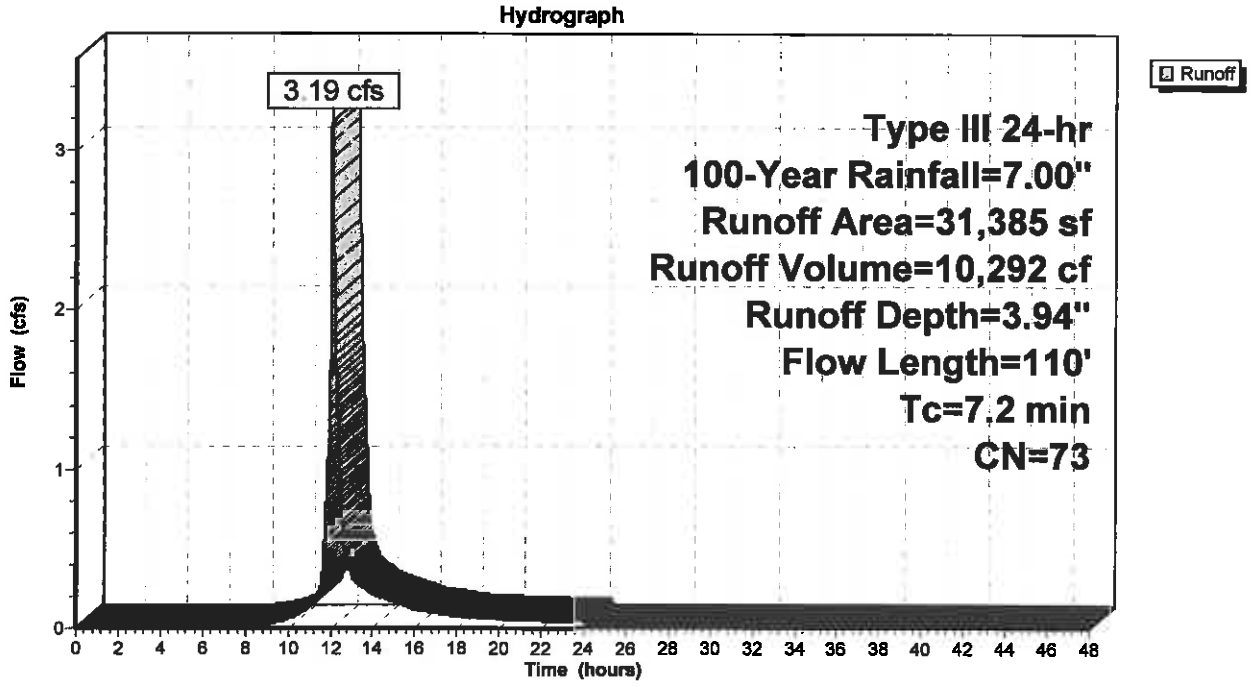
Runoff = 3.19 cfs @ 12.10 hrs, Volume= 10,292 cf, Depth= 3.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (sf)	CN	Description
10,000	98	Unconnected pavement, HSG B
21,385	61	>75% Grass cover, Good, HSG B
31,385	73	Weighted Average
21,385		68.14% Pervious Area
10,000		31.86% Impervious Area
10,000		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	65	0.0600	0.27		**Sheet Flow, SHEET FLOW GRASS** Grass: Short n= 0.150 P2= 4.00"
0.3	20	0.0200	1.11		**Sheet Flow, SHEET FLOW PAVEMENT** Smooth surfaces n= 0.011 P2= 4.00"
2.9	25	0.0200	0.14		**Sheet Flow, GRASS FILTER STRIP** Grass: Short n= 0.150 P2= 4.00"
7.2	110	Total			

Subcatchment 1DPOST: Post WS #1D



Summary for Subcatchment 1Pre: Pre WS #1

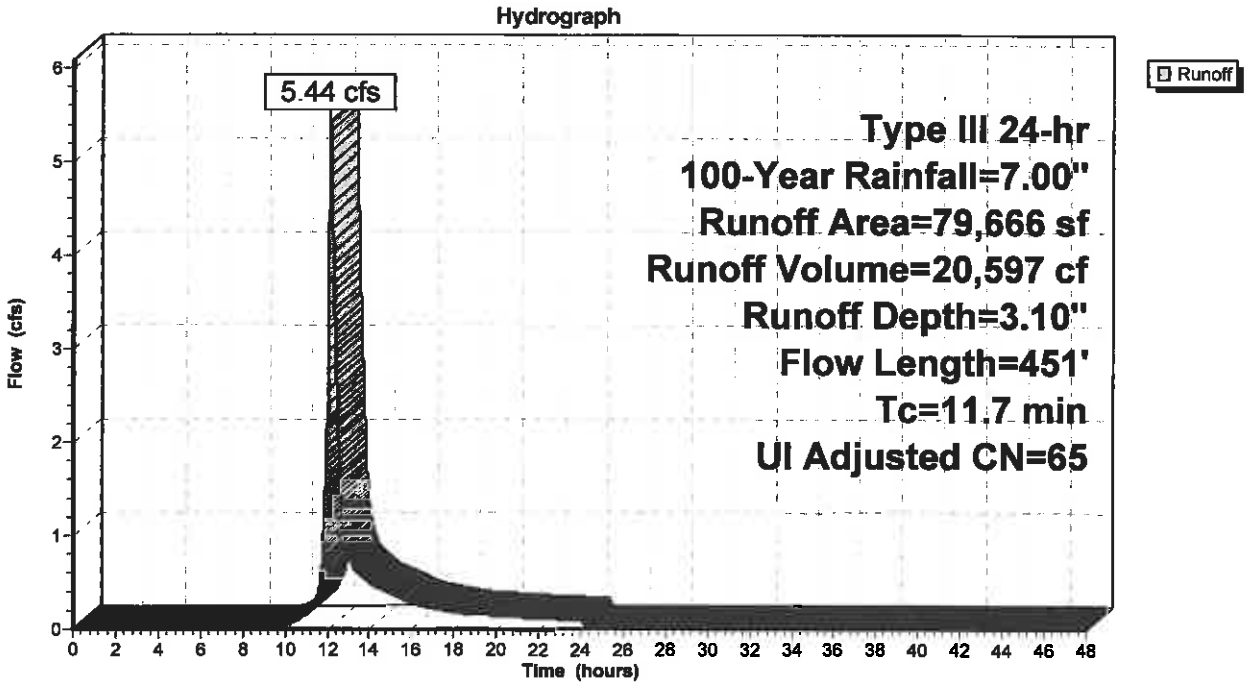
Runoff = 5.44 cfs @ 12.17 hrs, Volume= 20,597 cf, Depth= 3.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (sf)	CN	Description
4,100	96	Gravel surface, HSG B
2,205	98	Unconnected roofs, HSG B
5,846	89	Paved roads w/open ditches, 50% imp, HSG B
67,515	61	>75% Grass cover, Good, HSG B
79,666	66	Weighted Average, UI Adjusted CN = 65
74,538		93.56% Pervious Area
5,128		6.44% Impervious Area
2,205		43.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	100	0.0250	0.21		**Sheet Flow, SHEET FLOW** Grass: Short n= 0.150 P2= 4.00"
3.7	351	0.0500	1.57		**Shallow Concentrated Flow, SHALLOW FLOW TO SDP1** Short Grass Pasture Kv= 7.0 fps
11.7	451	Total			

Subcatchment 1Pre: Pre WS #1



Summary for Subcatchment 2POST: Post WS #2

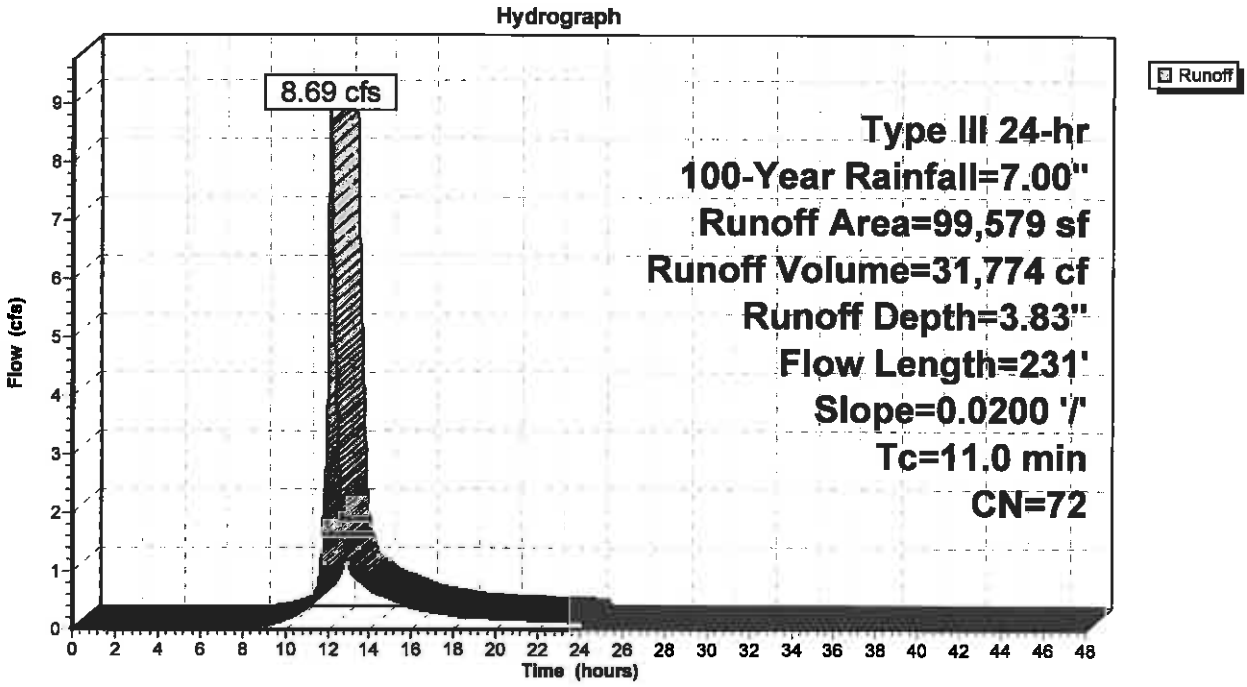
Runoff = 8.69 cfs @ 12.15 hrs, Volume= 31,774 cf, Depth= 3.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (sf)	CN	Description
17,570	98	Paved parking, HSG B
1,800	89	Paved roads w/open ditches, 50% imp, HSG B
31,785	74	>75% Grass cover, Good, HSG C
48,424	61	>75% Grass cover, Good, HSG B
99,579	72	Weighted Average
81,109		81.45% Pervious Area
18,470		18.55% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	100	0.0200	0.19		**Sheet Flow, SHEET FLOW** Grass: Short n= 0.150 P2= 4.00"
2.2	131	0.0200	0.99		**Shallow Concentrated Flow, SHALLOW FLOW TO I-BASIN** Short Grass Pasture Kv= 7.0 fps
11.0	231	Total			

Subcatchment 2POST: Post WS #2



Summary for Subcatchment 2Pre: Pre WS #2

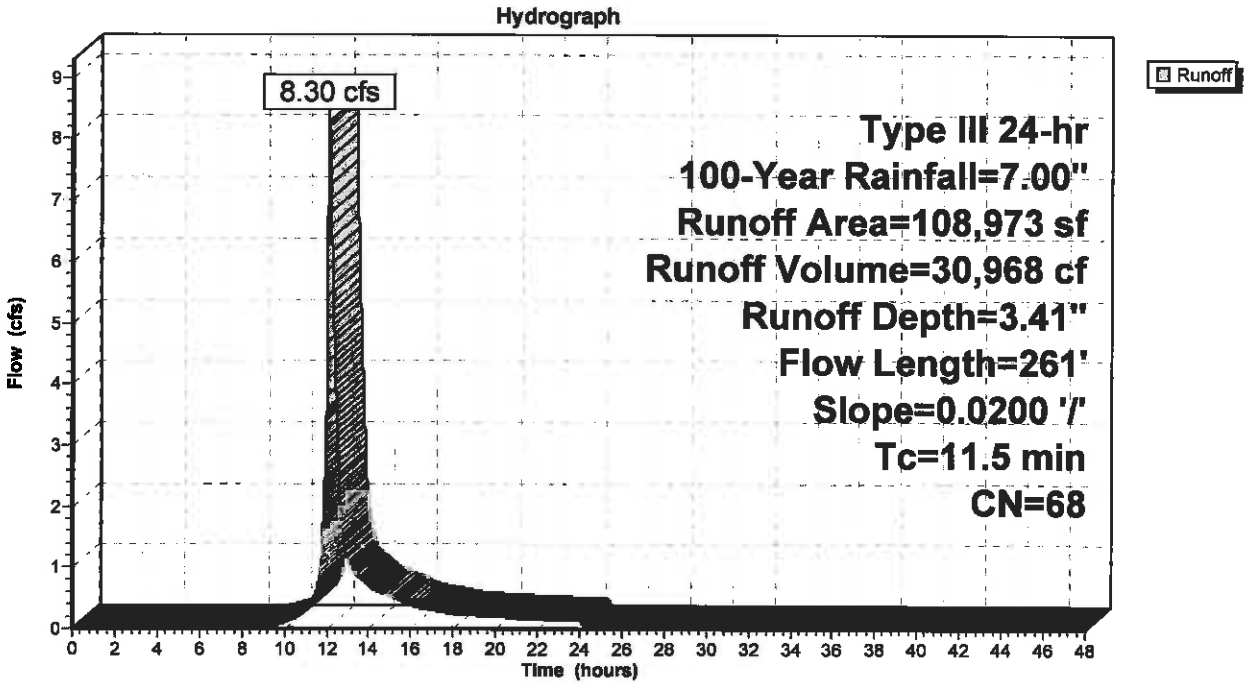
Runoff = 8.30 cfs @ 12.16 hrs, Volume= 30,968 cf, Depth= 3.41"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (sf)	CN	Description
2,350	96	Gravel surface, HSG B
2,600	98	Unconnected pavement, HSG B
44,520	74	>75% Grass cover, Good, HSG C
57,703	61	>75% Grass cover, Good, HSG B
1,800	89	Paved roads w/open ditches, 50% imp, HSG B
108,973	68	Weighted Average
105,473		96.79% Pervious Area
3,500		3.21% Impervious Area
2,600		74.29% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.8	100	0.0200	0.19		**Sheet Flow, SHEET FLOW** Grass: Short n= 0.150 P2= 4.00"
2.7	161	0.0200	0.99		**Shallow Concentrated Flow, SHALLOW FLOW** Short Grass Pasture Kv= 7.0 fps
11.5	261	Total			

Subcatchment 2Pre: Pre WS #2

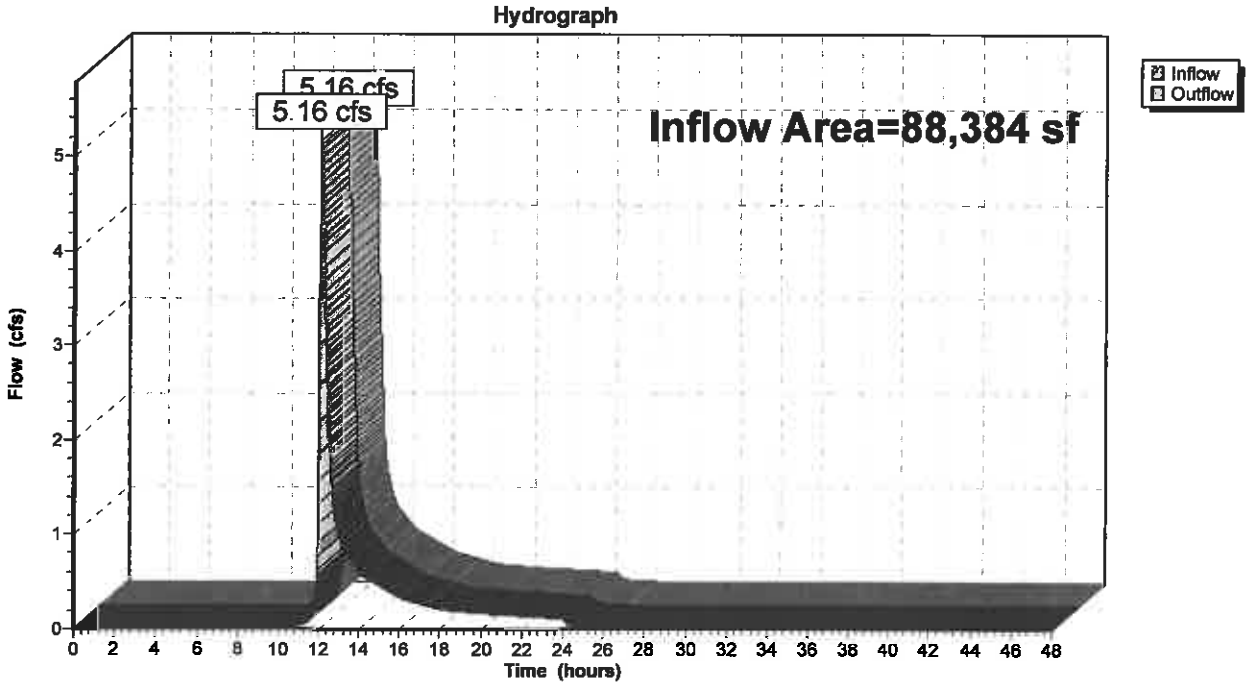


Summary for Reach SDP1: SDP1

Inflow Area = 88,384 sf, 23.78% Impervious, Inflow Depth = 2.85" for 100-Year event
Inflow = 5.16 cfs @ 12.12 hrs, Volume= 21,020 cf
Outflow = 5.16 cfs @ 12.12 hrs, Volume= 21,020 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach SDP1: SDP1

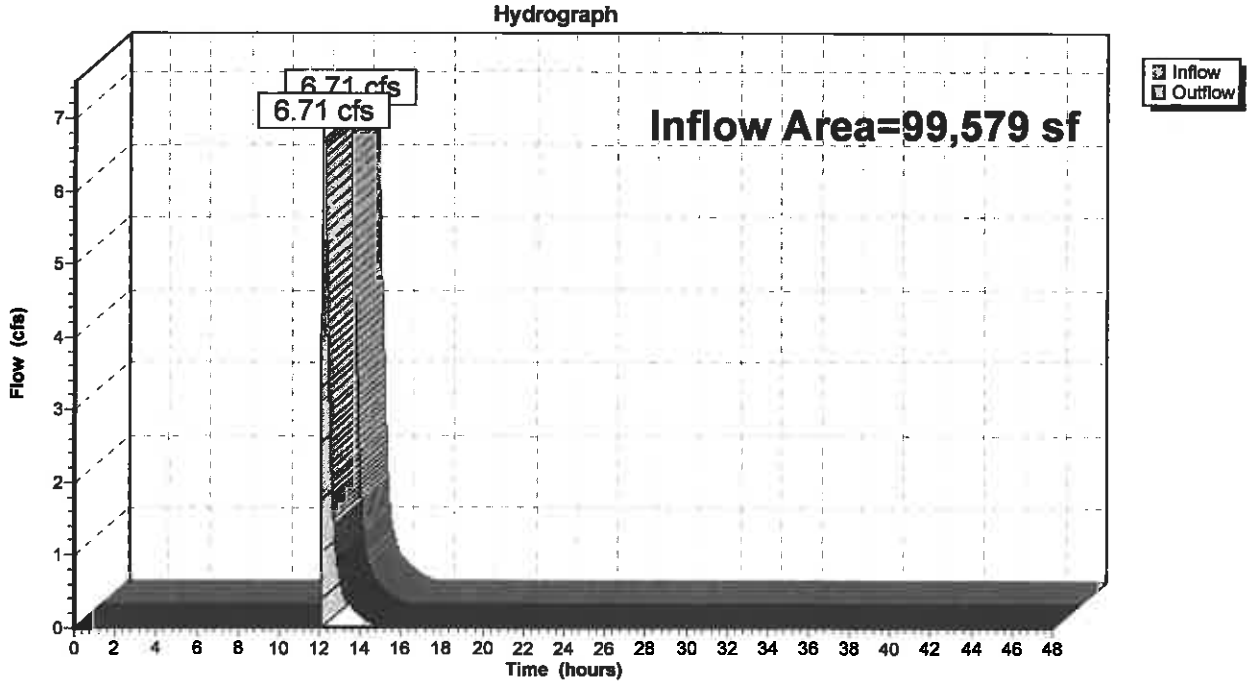


Summary for Reach SDP2: SDP2

Inflow Area = 99,579 sf, 18.55% Impervious, Inflow Depth = 1.37" for 100-Year event
Inflow = 6.71 cfs @ 12.23 hrs, Volume= 11,359 cf
Outflow = 6.71 cfs @ 12.23 hrs, Volume= 11,359 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Reach SDP2: SDP2



Summary for Pond 1A: INFILTRATION

Inflow Area = 99,579 sf, 18.55% Impervious, Inflow Depth = 3.83" for 100-Year event
Inflow = 8.69 cfs @ 12.15 hrs, Volume= 31,774 cf
Outflow = 7.41 cfs @ 12.23 hrs, Volume= 31,773 cf, Atten= 15%, Lag= 4.2 min
Discarded = 0.70 cfs @ 12.23 hrs, Volume= 20,414 cf
Primary = 6.71 cfs @ 12.23 hrs, Volume= 11,359 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 509.95' @ 12.23 hrs Surf.Area= 7,435 sf Storage= 7,614 cf
Flood Elev= 510.00' Surf.Area= 7,670 sf Storage= 7,963 cf

Plug-Flow detention time= 121.8 min calculated for 31,766 cf (100% of inflow)
Center-of-Mass det. time= 122.0 min (953.1 - 831.1)

Volume	Invert	Avail.Storage	Storage Description
#1	508.00'	7,963 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

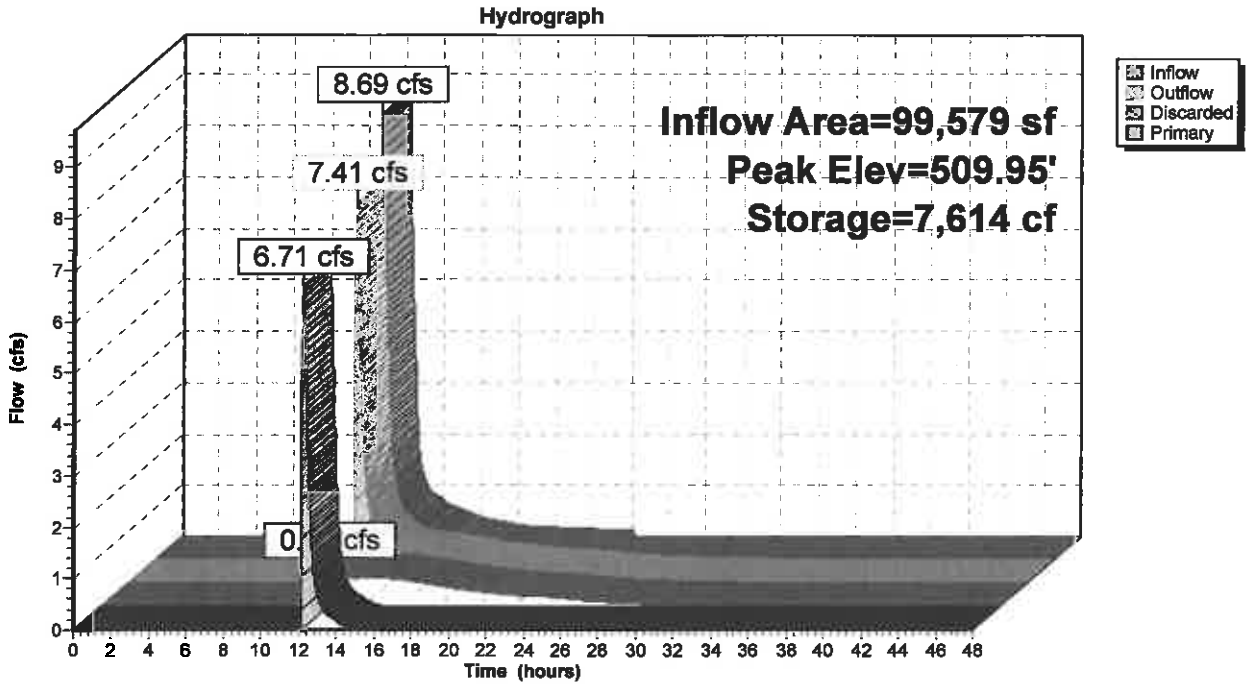
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
508.00	1,814	535.0	0	0	1,814
509.00	3,405	678.0	2,568	2,568	15,631
510.00	7,670	967.0	5,395	7,963	53,471

Device	Routing	Invert	Outlet Devices
#1	Primary	509.70'	**10.0' long x 1.5' breadth Broad-Crested Rectangular Weir X 2.00** 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 Coef. (English) 2.62 2.64 2.64 2.68 2.75 2.86 2.92 3.07 3.07 3.03 3.28 3.32
#2	Discarded	508.00'	**5.000 in/hr Exfiltration over Surface area from 508.00' - 510.00'** Conductivity to Groundwater Elevation = 500.00' Excluded Surface area = 1,814 sf

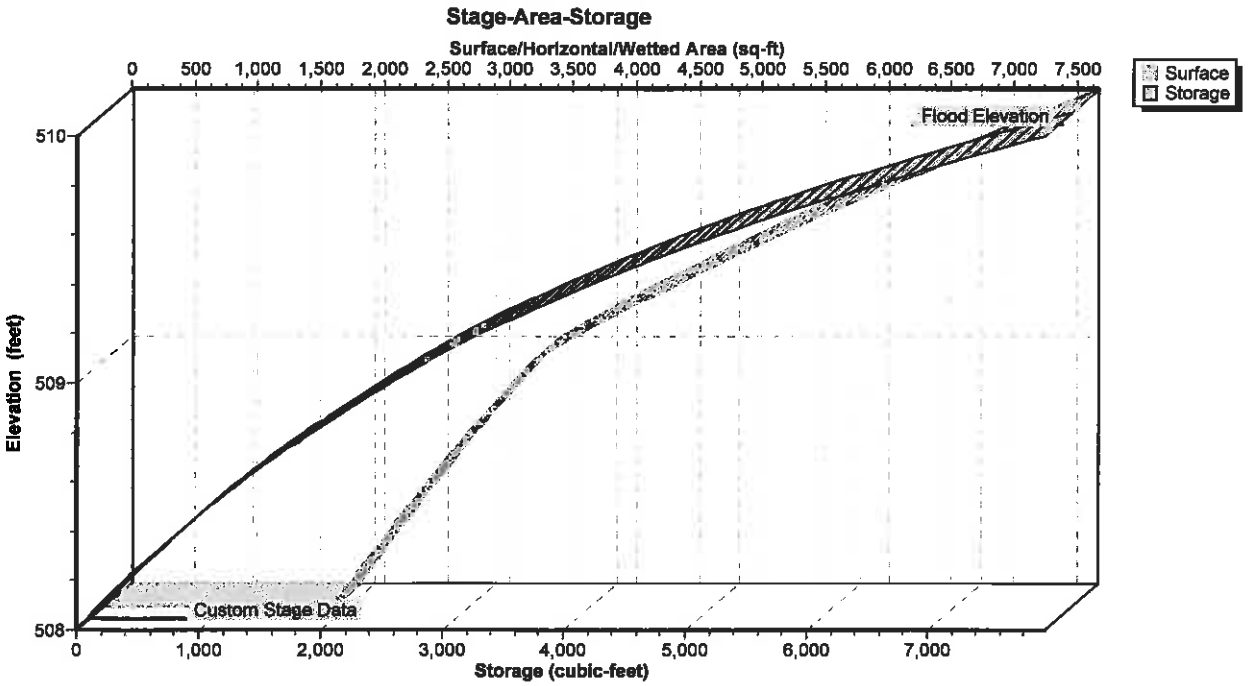
Discarded OutFlow Max=0.70 cfs @ 12.23 hrs HW=509.95' (Free Discharge)
↑—**2=Exfiltration** (Controls 0.70 cfs)

Primary OutFlow Max=6.70 cfs @ 12.23 hrs HW=509.95' TW=0.00' (Dynamic Tailwater)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 6.70 cfs @ 1.32 fps)

Pond 1A: INFILTRATION



Pond 1A: INFILTRATION



Summary for Pond 1B: INFILTRATION

Inflow Area = 32,689 sf, 33.71% Impervious, Inflow Depth > 3.08" for 100-Year event
Inflow = 1.89 cfs @ 12.04 hrs, Volume= 8,380 cf
Outflow = 1.03 cfs @ 12.13 hrs, Volume= 7,014 cf, Atten= 46%, Lag= 5.4 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 1.00 cfs @ 12.13 hrs, Volume= 7,008 cf
Secondary = 0.03 cfs @ 12.13 hrs, Volume= 6 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 507.81' @ 12.13 hrs Surf.Area= 2,645 sf Storage= 1,848 cf
Flood Elev= 508.00' Surf.Area= 3,369 sf Storage= 2,413 cf

Plug-Flow detention time= 134.9 min calculated for 7,014 cf (84% of inflow)
Center-of-Mass det. time= 52.2 min (931.6 - 879.4)

Volume	Invert	Avail.Storage	Storage Description
#1	506.00'	2,413 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)
506.00	830	340.0	0	0	830
507.00	525	275.0	672	672	4,026
508.00	3,369	601.0	1,741	2,413	26,756

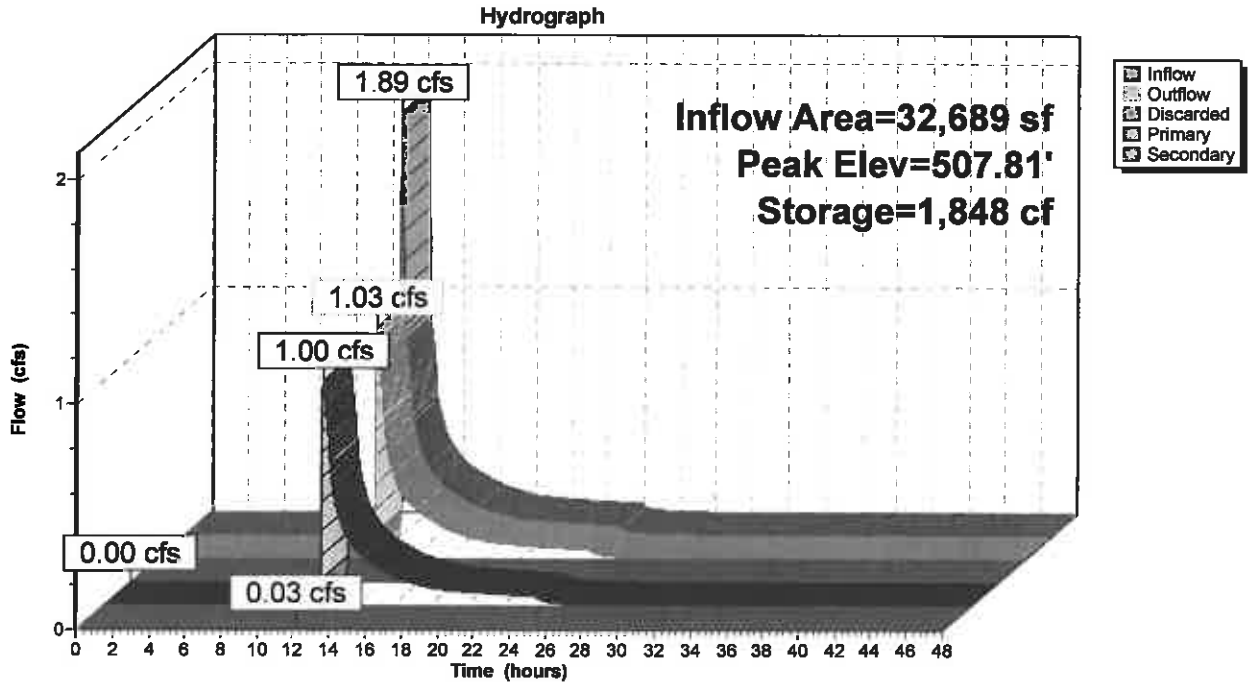
Device	Routing	Invert	Outlet Devices
#1	Discarded	506.00'	**5.000 in/hr Exfiltration over Surface area from 496.80' - 499.50'** Conductivity to Groundwater Elevation = 485.00' Excluded Surface area = 0 sf
#2	Device 3	507.60'	**12.0" Horiz. Orifice/Grate** C= 0.600 in 30.0" x 30.0" Grate Limited to weir flow at low heads
#3	Primary	505.50'	**12.0" Round Culvert** L= 28.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 505.50' / 504.00' S= 0.0536 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#4	Secondary	507.80'	**8.0' long x 1.0' 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 Coef. (English) 2.69 2.72 2.75 2.85 2.98 3.08 3.20 3.28 3.31 3.30 3.31 3.32

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=506.00' (Free Discharge)
└**1=Exfiltration** (Controls 0.00 cfs)

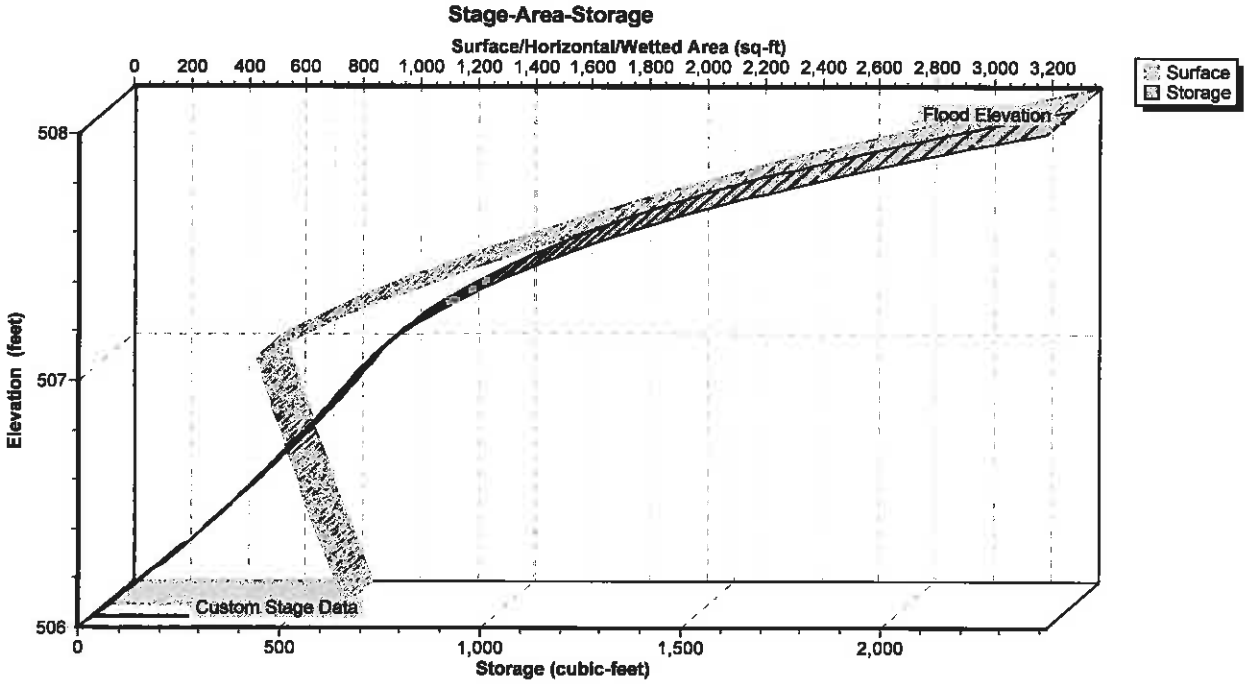
Primary OutFlow Max=1.00 cfs @ 12.13 hrs HW=507.81' TW=0.00' (Dynamic Tailwater)
└**3=Culvert** (Passes 1.00 cfs of 5.09 cfs potential flow)
└**2=Orifice/Grate** (Weir Controls 1.00 cfs @ 1.50 fps)

Secondary OutFlow Max=0.03 cfs @ 12.13 hrs HW=507.81' (Free Discharge)
└**4=Broad-Crested Rectangular Weir** (Weir Controls 0.03 cfs @ 0.29 fps)

Pond 1B: INFILTRATION



Pond 1B: INFILTRATION



Summary for Pond 1C: INFILTRATION

Inflow Area = 18,146 sf, 28.11% Impervious, Inflow Depth = 3.20" for 100-Year event
Inflow = 1.77 cfs @ 12.04 hrs, Volume= 4,846 cf
Outflow = 0.26 cfs @ 12.53 hrs, Volume= 3,221 cf, Atten= 85%, Lag= 29.1 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.26 cfs @ 12.53 hrs, Volume= 3,221 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 509.32' @ 12.53 hrs Surf.Area= 2,260 sf Storage= 2,291 cf
Flood Elev= 510.00' Surf.Area= 2,891 sf Storage= 4,026 cf

Plug-Flow detention time= 251.7 min calculated for 3,220 cf (66% of inflow)
Center-of-Mass det. time= 147.4 min (983.9 - 836.5)

Volume	Invert	Avail.Storage	Storage Description
#1	508.00'	4,026 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

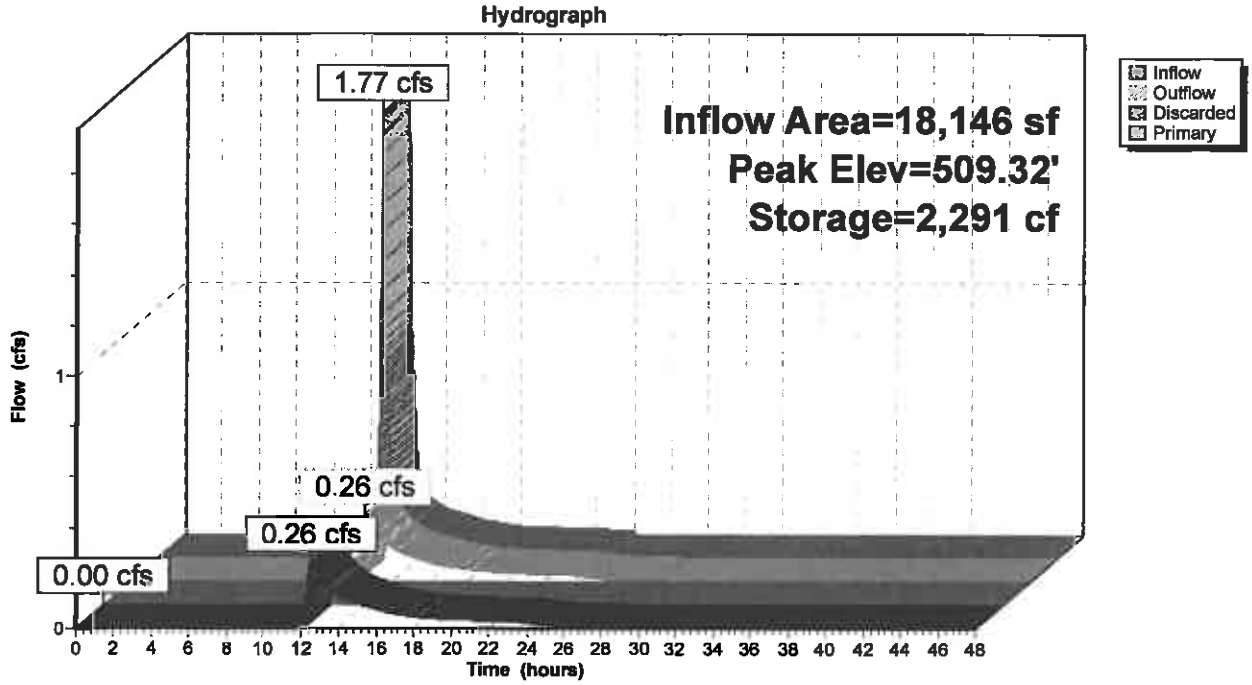
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
508.00	1,248	537.0	0	0	1,248
510.00	2,891	583.0	4,026	4,026	5,498

Device	Routing	Invert	Outlet Devices
#1	Discarded	508.00'	**5.000 in/hr Exfiltration over Surface area from 496.80' - 499.50'** Conductivity to Groundwater Elevation = 485.00' Excluded Surface area = 0 sf
#2	Primary	509.00'	**12.0" Round Culvert** L= 40.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 509.00' / 508.90' S= 0.0025 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf

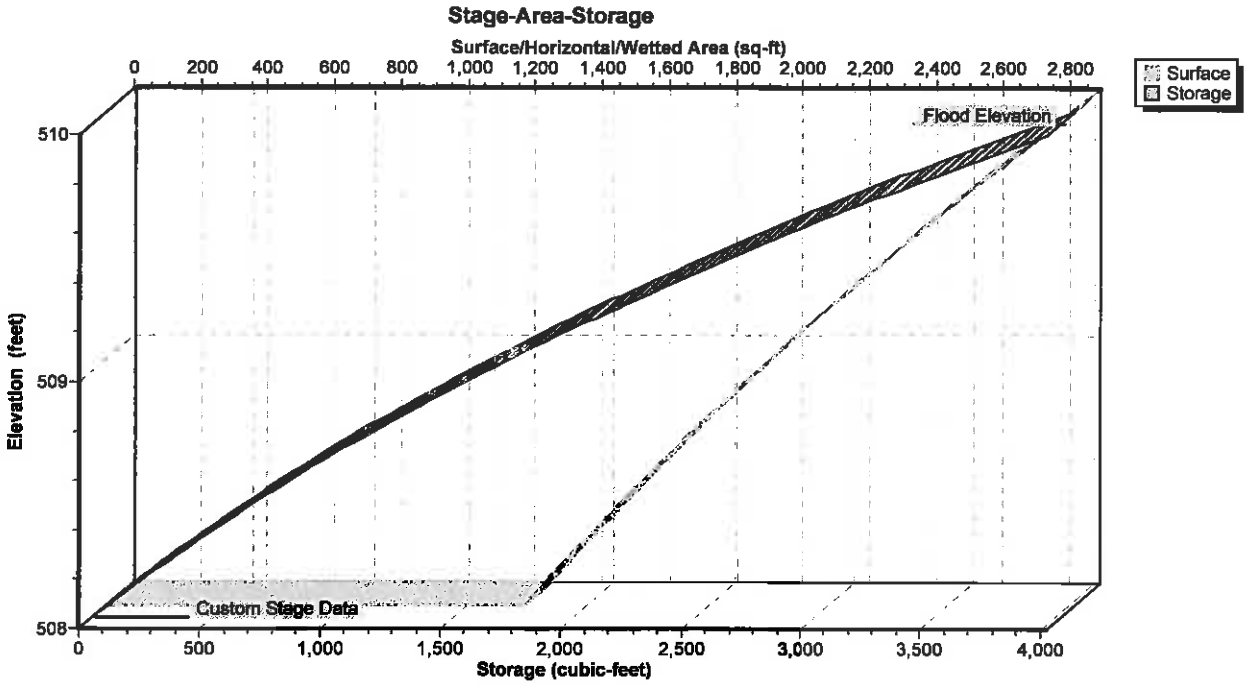
Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=508.00' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.26 cfs @ 12.53 hrs HW=509.32' TW=507.76' (Dynamic Tailwater)
↑—**2=Culvert** (Barrel Controls 0.26 cfs @ 1.76 fps)

Pond 1C: INFILTRATION



Pond 1C: INFILTRATION



Summary for Pond 1D: INFILTRATION

Inflow Area = 31,385 sf, 31.86% Impervious, Inflow Depth = 3.94" for 100-Year event
Inflow = 3.19 cfs @ 12.10 hrs, Volume= 10,292 cf
Outflow = 2.63 cfs @ 12.16 hrs, Volume= 8,539 cf, Atten= 18%, Lag= 3.6 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 2.63 cfs @ 12.16 hrs, Volume= 8,539 cf
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Peak Elev= 505.08' @ 12.16 hrs Surf.Area= 1,426 sf Storage= 2,393 cf
Flood Elev= 509.00' Surf.Area= 3,600 sf Storage= 11,915 cf

Plug-Flow detention time= 108.3 min calculated for 8,537 cf (83% of inflow)
Center-of-Mass det. time= 38.0 min (863.3 - 825.3)

Volume	Invert	Avail.Storage	Storage Description
#1	503.00'	11,915 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)
503.00	1,175	275.0	0	0	1,175
504.00	1,000	217.0	1,086	1,086	3,459
509.00	3,600	604.0	10,829	11,915	28,826

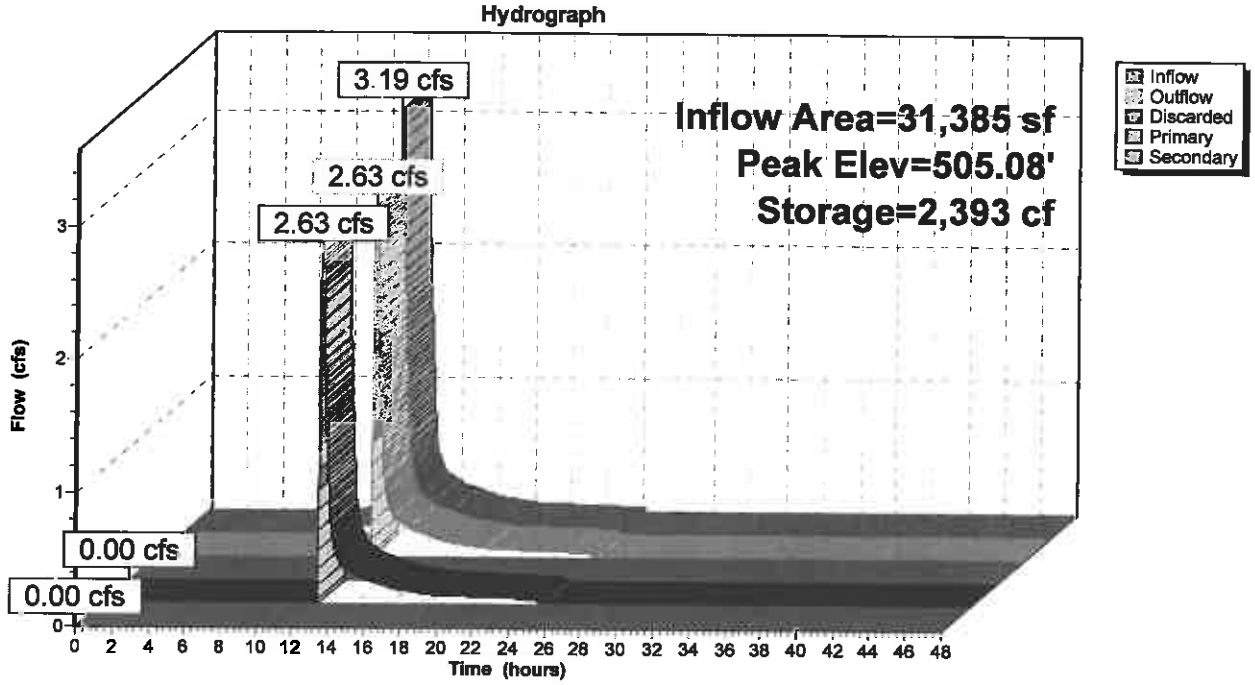
Device	Routing	Invert	Outlet Devices
#1	Discarded	508.00'	**5.000 in/hr Exfiltration over Surface area from 508.00' - 510.00'** Conductivity to Groundwater Elevation = 500.00' Excluded Surface area = 2,951 sf
#2	Device 3	504.60'	**12.0" Horiz. Orifice/Grate** C= 0.600 in 30.0" x 30.0" Grate Limited to weir flow at low heads
#3	Primary	502.00'	**12.0" Round Culvert** L= 35.0' CPP, end-section conforming to fill, Ke= 0.500 Inlet / Outlet Invert= 502.00' / 501.80' S= 0.0057 '/' Cc= 0.900 n= 0.012, Flow Area= 0.79 sf
#4	Secondary	505.80'	**5.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=503.00' (Free Discharge)
└**1=Exfiltration** (Controls 0.00 cfs)

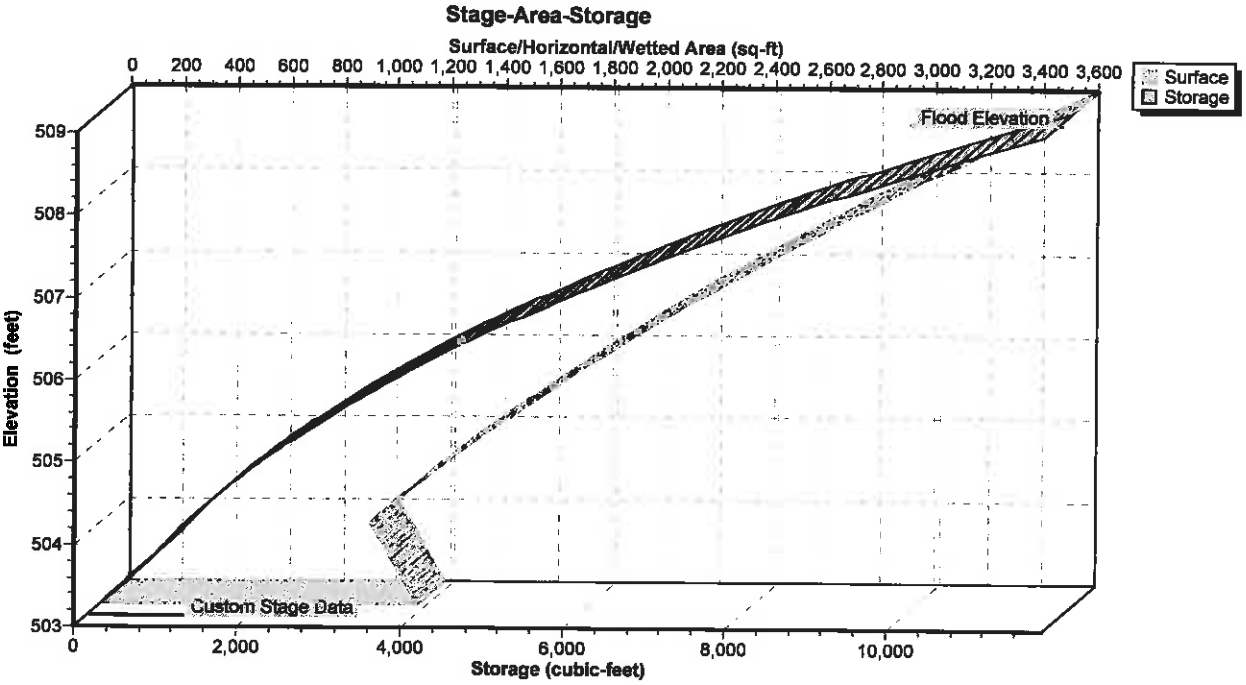
Primary OutFlow Max=2.63 cfs @ 12.16 hrs HW=505.08' TW=0.00' (Dynamic Tailwater)
└**3=Culvert** (Passes 2.63 cfs of 6.08 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 2.63 cfs @ 3.34 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=503.00' (Free Discharge)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 1D: INFILTRATION



Pond 1D: INFILTRATION



APPENDIX C

ARDEN CONSULTING ENGINEERS, PLLC

January 21, 2013

Mr. Chuck Hatcher
Westchester Modular Homes, Inc.
30 Reagans Mill Road
Wingdale, NY 12594

Re: Reagan's Mill Drive Site Plan & Subdivision
Town of Dover, N.Y.

Revised Flood Plain Mapping and SWPPP

Dear Mr. Hatcher:

We have reviewed the datum difference between the assumed site vertical datum and NAVD88 as well as the most recent floodplain mapping provided by the project surveyor, Terry Bergendorff Collins Land Surveying, 52 Starr Ridge Road, Brewster, New York 10509.

The difference between the assumed vertical datum and NAVD88 is -164.185 feet. This difference was established by using the known NAVD88 floor elevation of the adjacent Westchester Modular Homes Factory. Review of the FEMA FIRM Map #36027C0441E that is attached, depicts a 100-year flood elevation of 339.0 near the intersection of Reagans Mill Road and the Ten Mile River. Adjusting for the difference in datum elevation yields a 100-year flood elevation of 503.185, which is lower than the previous established flood elevation of 507.0.

With the establishment of these new elevations, minor grading modifications have been made to lower the elevations of proposed structures and associated parking for Lot #1 and Lot #2. As a result of these modifications, no fill or structures associated with the proposed project encroach into 100-year floodplain or floodway.

The minor site plan changes have been incorporated in to the SWPPP last revised January 21, 2013. The volume and shape of the stormwater facilities have not been significantly altered as shown on the planset last revised January 21, 2013, which results in minor changes in pre and post development stormwater flow rates.

Please do not hesitate to contact us if you have any further questions or concerns.

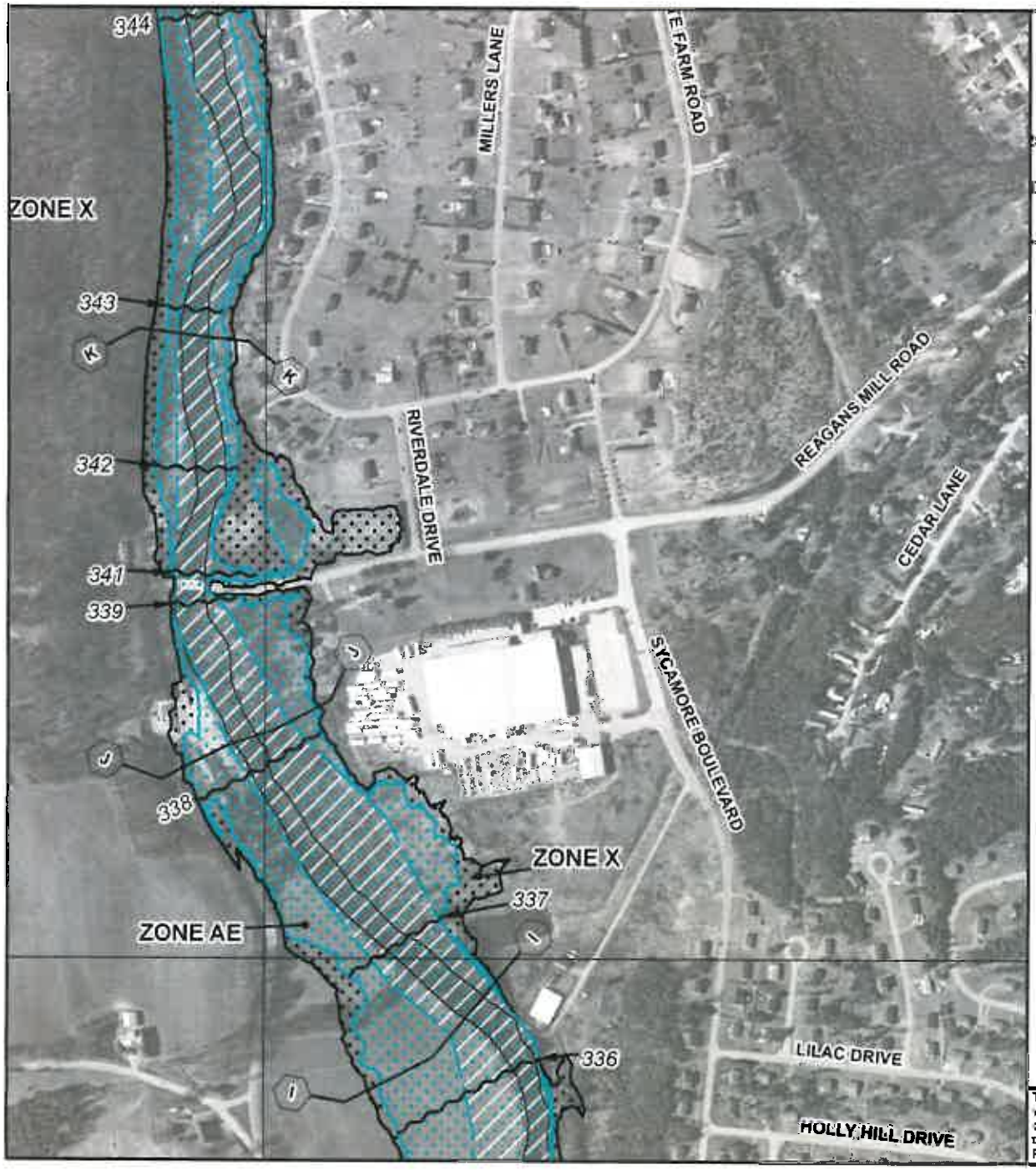
Sincerely,

Arden Consulting Engineers, PLLC

Michael A. Morgante, P.E.

C:\JOBS\12-002 WMH\Stormwater\SW Letter 1-21-13.doc

P.O. Box 340 ♦ Monroe, N.Y. ♦ 10949
Tel: 845-782-8114 ♦ Fax: 845-238-3527 ♦ Email: mam@ardenconsulting.net



MAP SCALE 1" = 500'

250 0 500 1000

FEET

METER

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0441E

FIRM

FLOOD INSURANCE RATE MAP

for DUTCHESS COUNTY, NEW YORK
(ALL JURISDICTIONS)

CONTAINS:

COMMUNITY	NUMBER
DOVER, TOWN OF	361335

PANEL 441 OF 602
MAP SUFFIX: E
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

Notice to User. The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
36027C0441E

EFFECTIVE DATE
MAY 2, 2012

Federal Emergency Management Agency