COLLEGE PARK ELEMENTARY SCHOOL
5001 Oriole Drive

CITY OF WILMINGTON, NEW HANOVER COUNTY, NC

STORMWATER - EROSION CONTROL NARRATIVE

Prepared for:

New Hanover County Board of Education
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Wilmington, NC 28412

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Project #15185.PE

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Final SW Calcs
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RAC

COLLEGE PARK ELEMENTARY SCHOOL
5001 Oriole Drive

CITY OF WILMINGTON, NEW HANOVER, NORTH CAROLINA
Project #15185.PE

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DESIGN NARRATIVE

This narrative describes the measures taken and design choices made on the College Park Elementary School project that qualify it as an Exceptionally Designed Project according to Article 10 of the City of Wilmington Land Development Code. The purpose of this Code is to encourage Low Impact Development (LID) and to encourage progressive and environmentally sensitive design on Land Development projects within the City of Wilmington. In order to qualify as an Exceptionally Designed Project, it is necessary to demonstrate that the proposed meets the baseline criteria and exceptional design criteria to obtain credits as detailed in Article 10. This project satisfies the criteria for an Exceptionally Designed Project in the following manner.

BASELINE CRITERIA (SECTION 18-543)

(a) Site Assessment

> A detailed natural resource inventory and assessment shall be prepared before the conceptual site design is developed to identify and prioritize the natural resources requiring management through project planning. The inventory shall identify high-quality natural areas as part of the site analysis and shall be used to incorporate site sensitivity into the design.

A detailed natural resource inventory and Low Impact Development (LID) Site Assessment has been prepared as part of the conceptual site design to determine the high-quality natural resources present on the site. The conservation of these high-quality resources is a primary concern in the design of this project. Since the site vegetative cover ranges from open fields to mature wooded areas, this project has made every effort to site buildings, roadways and parking areas within the existing footprints to preserve as many regulated or significant trees as possible. Based on a site assessment in December 2015 by the New Hanover County Schools (NHCS) environmental consultant, there are no wetlands on the subject site. The site is currently on the US Army Corp of Engineers (USACOE) schedule to verify and we will provide documentation of the USACOE approval upon receipt.

The proposed development will require approvals from NCDEQ Land Quality Section for Sediment &Erosion Control and the City of Wilmington for stormwater quality and peak flow attenuation compliance. The project drains to Bradley Creek and is classified as SC; HQW (18-87-24-4-(1)). Based on the classification, the proposed project is required to treat the first 1.5 inches of rainfall on the site and provide peak flow attenuation of the 25-year, 24-hour storm event through the use of approved Best Management Practices (BMP). As the site falls within the Watershed Resource Protection area as shown in the Coastal Area Management Act (CAMA) Land Classification Map, impervious surface area for the development is limited to twenty-five (25) percent of the total buildable area. Beyond the impervious area restrictions, no other environmental development restrictions are present on the project site. "This project is seeking an impervious percentage "bonus" through the use of the Exceptionally Designed Project criteria.

The Site Assessment involved professionals in the environmental and civil engineering fields in order to adequately address all aspects of the design to the City Manager. It is our belief that the proposed development is configured in a manner that will cause minimal disturbance to the natural resources that exist on the site during the construction period, and would cause little or no negative impact on these resources in the future.

Since this site was developed in the 1960's, there are currently no stormwater management or attenuation on the site. The proposed redevelopment of the site would maintain most of the existing vegetation along the northern and western property lines as well as a grove of trees located at the southeast corner of the site. The existing impervious cover of the site is 21.6% and the proposed impervious area is 35.7%. Due to the sites existing condition, containing two drainage areas that runoff to separate storm culverts that cross under Oriole Drive and ultimately connect, we are proposing stormwater BMP's that will mimic this existing condition and meet pre/post attenuation requirements at each culvert for the 2 through 25 year storms. In order to meet the pre/post attenuation and provide a TSS removal rate equal to or greater than 97%, a combination of LID and conventional techniques is being proposed. This will be a direct improvement to water quality and flood control in the immediate area.

(b) Development Plans

> A conceptual site development plan drawn to scale must be submitted to the development services department that demonstrates to the satisfaction of the City Manager that all the requirements of this section are met.

A Site Plan has been developed with input from City staff that demonstrates that all requirements of Sec. 18-543 have been met. The LID Site Assessment map serves to demonstrate that a full evaluation of the environmental impacts of the project have been taken into account. The Site Plan technically and visually illustrates the development potential for the project site and demonstrates that the project includes innovative design initiatives that will protect the natural resources on the property.

The project utilizes innovative and sustainable design techniques in order to ensure that the environment will be protected as a result of the development. The proposed buildings were placed as to minimize the number of trees removed and roadways and sidewalks were placed to avoid regulated and significant trees to the maximum extent practicable. Existing vegetation within the property streetyard and interior landscape courtyards will be preserved and supplemental plantings will be provided to increase the diversity and quantity of trees and shrubs in these areas. In addition, the project will provide a pedestrian sidewalk along Oriole Drive across the property frontage with multiple connection points to the school site to further connect the school with the adjacent residents.

(c) Low Impact Development Techniques

The project shall manage stormwater onsite through Low Impact Development (LID) techniques.

The proposed development will utilize LID design criteria for stormwater management to the maximum extent practicable, while still meeting the City's quality and peak flow attenuation requirements. Although the project is not constrained by the type of BMPs that can be used for storm water management, the project will provide a stormwater collection system that directs runoff from impervious surfaces to each of the wet detention/infiltration basins which will direct runoff back into the soils. Some aspects of the stormwater management plan will utilize conventional wet detention ponds to provide peak flow attenuation, but most of the stormwater runoff will be treated using infiltration basins. The following elements of LID design are satisfied:

a. Small scale techniques to manage precipitation as close as possible to where it hits the ground will be utilized throughout the project. The proposed project is 35% impervious cover; therefore, 65% of the site is wooded or grassed to further increase infiltration of stormwater runoff where it hits the ground.

b. Strategic placement of linked lot-level controls that are customized to address specific pollutant load and stormwater timing, flow rate, and volume. Since we are trying to work within the existing footprint of the current school facility and maximize the natural wooded areas, the proposed project is utilizing two (2) wet detention/infiltration basins that will attenuate the 2yr, 10yr, and 25yr storm as well as infiltrate 2.5 times the first 1.5-inches for water quality or 3.75 inches. Therefore, in terms of water quality, we are achieving 98.5% TSS removal.

c. Use of devices that allow infiltrating rainfall water to groundwater and evaporating rain water back to the atmosphere (raingardens, cisterns, dry wells, filter strips, etc.) to reduce runoff volume. This project will use two (2) wet detention/infiltration basins to allow storm water to infiltrate rather than being discharged from the site. Also note that the site as it currently exists, has no stormwater measures.

d. Site fingerprinting (minimal disturbance techniques) to minimize the extent of clearing and grading, thereby minimizing the hydrologic impacts. Site fingerprinting includes restricting ground disturbance by identifying the smallest possible area for disturbance and clearly delineating it on the site. With Site fingerprinting, land cover impacts are reduced through minimal disturbance techniques that include the following:

    i. Reduce paving and compaction of highly permeable soils to preserve absorptive capacity. As shown on the LID Site Assessment map, the project area is predominantly "A" and "B" type soils that are moderately well drained. This project will minimize the disturbance to pervious areas through the use of

construction and tree protection fencing to preserve the permeability of these soils.

ii. Minimizing the size of construction easements and material storage areas, and siting stockpiles within the development envelope during the construction phase of a project. Site disturbance will be limited to the areas of hardscape construction with minimal construction access for safety and constructability issues.

iii. Delineating and flagging the smallest site disturbance area possible to minimize soil compaction on the site and restricting temporary storage of construction equipment in these areas. This project will minimize the disturbance through the use of construction and tree protection fencing to preserve the permeability of these soils.

iv. Siting building layout and clearing and grading practices to avoid removal of existing trees of all sizes where possible. The project will be designed to place buildings and hardscape on open space areas where practicable. Areas of vegetation within the development will be preserved through the use of tree protection fencing.

v. Minimizing imperviousness of site by reducing the total area of paved surfaces. The project is parked below the median parking requirement and is only 35% impervious at full buildout.

vi. Disconnecting as much impervious area as possible by breaking it up with pervious surfaces (grass filter strips in parking lots, raingardens, swales, etc.) to increase opportunities for infiltration and reduce water runoff flow. Due to the minimal increase in impervious surface from the current school to the proposed school and due to a tight school budget, we are not proposing any pervious pavement. Due to the increase in impervious surface we are required to obtain 20 LID points and we are conservatively proposing 30 points.

vii. Maintaining existing topography and associated drainage divides to encourage dispersed flow paths. The project will utilize natural drainage divides and follow the natural slope of the land to minimize the concentration of flow and protect the water quality of the receiving stream.

Measures, we believe the design qualifies for points, based on table 2 in Section 18.544. This point calculation is shown in the attached spreadsheet. The following is a breakdown of the areas of exceptional design as described in the text of Section 18.544:

a. Wetland Function: No-claim made

b. Shoreline/Riparian/Wetland Buffers: No claim made.

c. Impervious Surfaces: No claim made.

d. Porous Pavement: No claim made.

e. Flood Zone Storage Capacity: No claim made.

f. Constructed Wetlands: No claim made.

g. Stormwater Controls: Reduce total pollutant load leaving the site and minimize changes in overall site hydrology by use of LID techniques, or a combination of LID and conventional techniques. This project proposes to provide 98.5% TSS removal with the use of a wet detention basin in series with an infiltration basin.

h. Undeveloped Open Space: No claim made.

i. Greenways: No claim-made:

j. Habitat: No claim made.

k. Shared Facilities/Utilities: No claim made.

l. Resource Enhancement: No claim made.

m. Xeriscaping: No claim made.

PROPOSED IMPROVEMENTS/EROSION CONTROL

The applicant is proposing to build a new elementary school along with associated parking, installing utility services and a stormwater management system. It is proposed that all runoff resulting from impervious surfaces will be collected by a storm drainage system and then be conveyed to a wet detention pond where storm water quality requirements will be met. The pond has been designed to meet NCDEQ requirements for treatment of the first 1.5-inches of runoff, which includes a wet pond that releases the 1.5-inches of runoff through a low flow orifice within 2-5 days. The retention requirements for the 1.5-inch rainfall runoff were calculated using the Simple Method and the 90% TSS removal requirements.

Storm water from greater storm events will be allowed to exit the wet detention pond by means of a riser barrel outlet structure and a secondary spillway during emergency situations. The wet detention pond will also be used to provide peak discharge control to at or below pre-developed peak discharge in the 2, 10, and 25-yr design storm. The wet pond was calculated utilizing SCS TR-20 hydrograph routing through the HydroCAD software application.

PRE vs. POST RUNOFF SUMMARY: (Pond #1 and #2 Combined)

Pre-Dev:	**Total Post-Dev:**
Q2 = 0.87 cfs	**<Q2 = 0.50 cfs**
Q10 = 8.65 cfs	**<Q10 = 5.25 cfs**
Q25 = 13.78 cfs	**<Q25 = 12.12 cfs**

Wet Pond #1 (DA#1)

Pond Routing Peak Elev:
WSEL2 = 38.68'
WSEL10 = 39.35'
WSEL25 = 39.48' < 39.75' (Emer. Spwy)
WSEL50 = 39.60'
WSEL100 = 39.84' < 40.50' (Top of Pond)
Top of Pond = 40.50' (6" Freeboard-50-yr storm)

Wet Pond #2 (DA#2)

Pond Routing Peak Elev:
WSEL2 = 33.64'
WSEL10 = 34.26'
WSEL25 = 34.50' < 35.00 (Emer. Spwy)
WSEL50 = 34.78'
WSEL100 = 35.12' < ' (Top of Pond)
Top of Pond = 36.00' (6" Freeboard-50-yr storm)

Wet Pond #1

Principal Outlet Blocked - Emergency Spillway Active Only
WSEL50 = 39.96' < 40.50' (Top of Pond)
Q50 = 5.16 cfs

Wet Pond #2

Principal Outlet Blocked - Emergency Spillway Active Only
WSEL50 = 35.19' < 36.0' (Top of Pond)
Q50 = 6.46 cfs

During construction, sediment will be controlled by temporary silt fence, temporary inlet protection, diversion ditches, and temporary construction entrances. The storm water pond will serve as a temporary sediment basin during construction.

MAINTENANCE

Contractors shall be responsible for periodic inspection and maintenance of all indicated erosion control devices in accordance with the plans and specifications. In addition, inspection and any necessary maintenance will be required immediately following any significant storm event. Sediment will need to be removed from behind silt fencing as described on the Erosion Control Plan. Vegetative cover will be fertilized and reapplied as necessary to promote a vigorous stand.

EROSION AND SEDIMENTATION CONTROL SPECIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENT

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

A. Contractor shall take every reasonable precaution throughout construction to prevent the erosion of soil and the sedimentation of streams, lakes, reservoirs, other water impoundments, ground surfaces, or other property as required by State and Local regulations.

B. Contractor shall, upon suspension or completion of land-disturbing activities, provide protection covering for disturbed areas. Permanent vegetation shall be established at the earliest practicable time. Temporary and permanent erosion control measures shall be coordinated to assure economical, effective, and continuous erosion and sediment control throughout the construction and post construction period.

1.3 RELATED SECTIONS

A. Related Sections – The following Sections contain requirements that relate to this Section:
   1. 02-00-00 – Existing Underground Utilities
   2. 00-70-00 – Special Conditions for this Contract
   3. 01-30-00 – Shop Drawings, Project Data & Samples
   4. 31-23-33.1 – Earthwork, Excavation Trenching, and Backfilling
   5. 31-10-00 – Site Clearing
   6. 32-92-19 – Seeding General Areas

1.4 REGULATORY REQUIREMENTS

A. Contractor shall be responsible for prevention of damage to properties outside the construction limits from siltation due to construction of the project. The Contractor will assume all responsibilities to the affected property owners for correction of damages that may occur. Erosion control measures shall be performed by the Contractor, conforming to the requirements of, and in accordance with plans approved by applicable state and local agencies and as per the erosion control portion of the construction drawings and these specifications. The Contractor shall not allow mud and debris to accumulate in the streets. Should the Contractor pump water from trenches during construction, appropriate siltation preventative measures shall be taken prior to discharge of pumped water into any storm drain or stream.

PART 2 - PRODUCTS

2.1 Open mesh biodegradable mulching cloth.

2.2 Fertilizer shall be 10-10-10 grade or equivalent.

2.3 Lime shall be dolomitic agricultural ground 1 limestone containing not less than 10 percent magnesium oxide.

2.4 Phosphate shall be 20 percent super phosphate or equivalent.

2.5 Provide grass seed mixture as shown on the plans.

2.6 Silt fence shall consist of non-biodegradable filter fabric (Trevira, Mirafi, etc.) wired to galvanized wire mesh fencing and supported by wood or metal posts.

2.7 NCDOT Class B stone for erosion control.

PART 3 - EXECUTION

3.1 CLEARING

A. Clearing and grubbing shall be scheduled and performed in such a manner that subsequent grading operation and erosion control practices can follow immediately thereafter. Excavation, borrow, and embankment operations will be conducted such that continuous operation. All construction areas not otherwise protected shall be planted with permanent vegetative cover within 15 working days after completion of active construction. All slopes shall be planted within 21 calendar days after completion of such activity.

3.2 STABILIZING

A. The angle for graded slopes and fills shall be no greater than the angle that can be retained by vegetative cover or other adequate erosion control devices or structures. All disturbed areas not to be paved and left exposed will, within 21 calendar days of completion of any phase of grading, be planted or otherwise provided with either temporary or permanent ground cover, devices, or structures sufficient to restrain erosion. All slopes steeper than 3:1 shall be planted or otherwise provided with either temporary or permanent ground cover, devices, or structures sufficient to restrain erosion within 21 calendar days.

3.3 REGULATORY REQUIREMENTS

A. Whenever land disturbing activity is undertaken on a tract, a ground cover sufficient to restrain erosion must be planted or otherwise provided within 15 calendar days on that portion of the tract upon which further active construction is to being undertaken.

B. If any earthwork is to be suspended for any reason whatsoever for longer than 15 calendar days, the areas involved shall be seeded with vegetative cover or otherwise protected against excessive erosion during the suspension period. Suspension of work in any area of operation does not relieve the Contractor of the responsibility for the control of erosion in that area.

PART 4 - CONSTRUCTION PHASE

4.1 PRACTICES

A. Avoid dumping soil or sediment into any streambed or watercourse. Backfill for stream crossings shall be placed dry and compacted to minimize siltation of the watercourse, where applicable.

B. Maintain an undisturbed vegetative buffer where possible between a natural watercourse and trenching and grading operations.

C. Avoid equipment crossings of streams, creeks, and ditches where practicable.

PART 5 - SEDIMENT CONTROL FEATURES

5.1 GENERAL

A. All devices (silt fences, retention areas, etc.), for sediment control shall be constructed at the locations indicated prior to beginning excavation on the site. All devices shall be properly maintained in place until a structure or paving makes the device unnecessary or until directed to permanently remove the device.

5.2 DESIGN APPLICATIONS

A. Mulch shall be used for temporary stabilization of areas subject to excessive erosion, and for protection of seed beds after planting where required.
   1. Jute, mesh, etc. should be installed as per manufacturer's instructions.

B. Silt fences shall be used at the base of slopes and in drainage swales to restrict movement of sediment from the site. Straw bales may be required for reinforcement.

C. Riprap shall be used at the proposed outfall pipes as indicated on plans.

D. Establish vegetative cover on all unpaved areas disturbed by the work.
   1. Preparation of Seedbed. Areas to be seeded shall be scarified a depth of 6 inches until a firm, well-pulverized, uniform seedbed is prepared. Lime, phosphorous, and fertilizer shall be applied during the scarification process in accordance with the following rates.
      a. Lime – 2 ton per acre
      b. Nitrogen – 100 pounds per acre
      c. P_2O_5 – 200 pounds per acre
   2. Seeding. Disturbed areas along roads and ditches shall be permanently seeded with 10-20 pounds per acre of centipede during the period from March through September. Seeding performed during the period from April to August shall be temporarily seeded with 40 pounds per acre of German Millet. The permanent vegetative cover will be over seeded at the earliest possible time as specified above.
   3. Mulch all areas immediately after seeding. Mulch shall be applied and anchored as specified hereinbefore.

5.3 MAINTENANCE

A. The Contractor shall be responsible for maintaining all temporary and permanent erosion control measures in functioning order. Temporary structures shall be maintained until such time as vegetation is firmly established and grassed areas shall be maintained until completion of the project. Areas which fail to show a suitable stand of grass or which are damaged by erosion shall be immediately repaired.

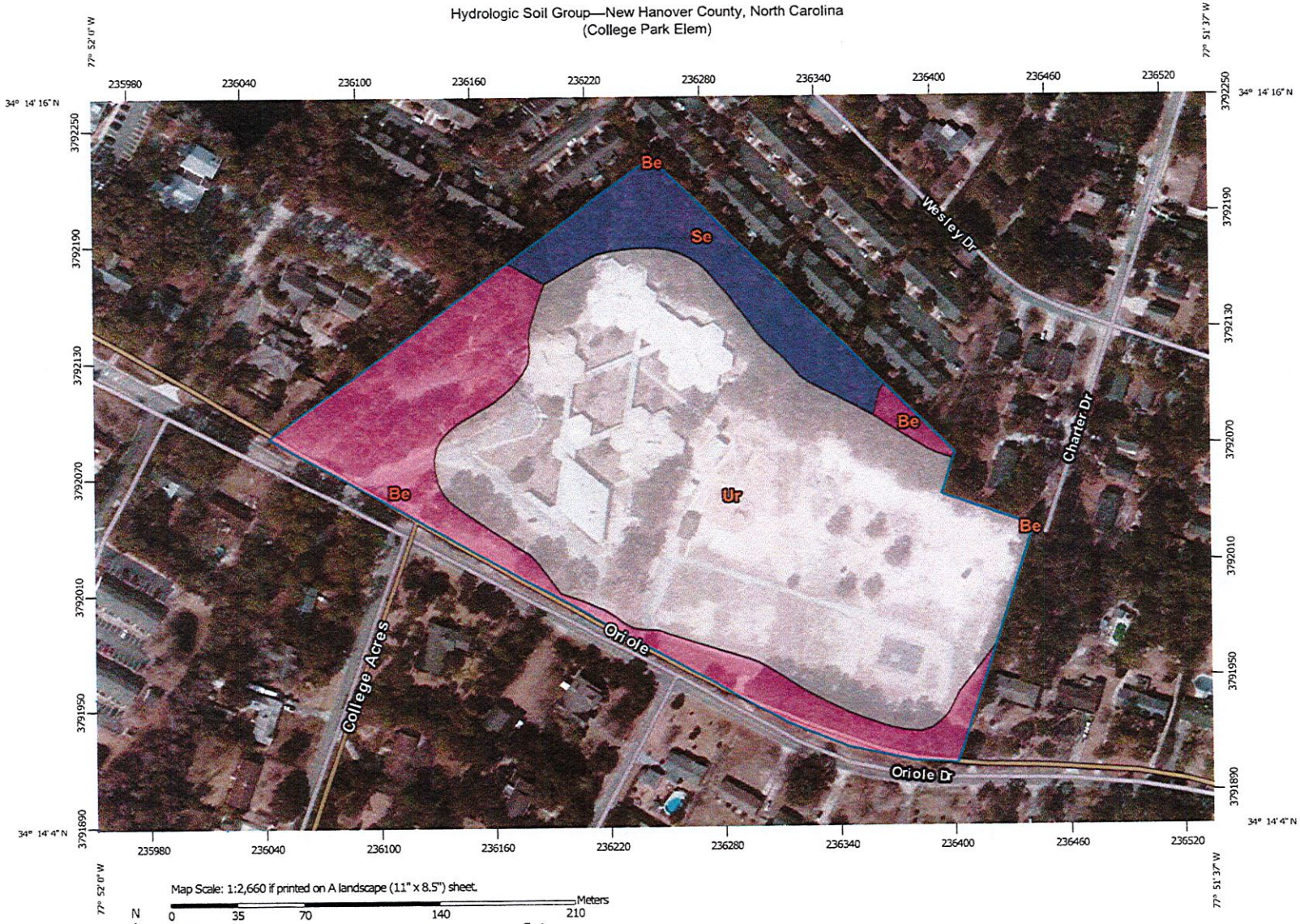
5.4 REMOVAL OF SEDIMENT CONTROL DEVICES

A. Near completion of the project, when directed by the Owner's agent, the Contractor shall dismantle and remove the temporary devices used for sediment control during construction. All erosion control devices in seeded areas shall be left in place until the grass is established. Seed areas around devices and mulch after removing or filling temporary control devices.

END OF SECTION

NEW HANOVER COUNTY SOILS MAP

Hydrologic Soil Group—New Hanover County, North Carolina
(College Park Elem)



Map Scale: 1:2,660 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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: http://websoilsurvey.nrcs.usda.gov
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: New Hanover County, North Carolina
Survey Area Data: Version 16, Sep 29, 2015

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

Date(s) aerial images were photographed: Data not available.

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — New Hanover County, North Carolina (NC129)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Be	Baymeade fine sand, 1 to 6 percent slopes	A	3.2	21.0%
Se	Seagate fine sand	B	1.5	9.7%
Ur	Urban land		10.7	69.3%
Totals for Area of Interest			15.4	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

S&ME

August 25, 2015

New Hanover County Schools
6410 Carolina Beach Road
Wilmington, NC 28412

Attention: Ms. Paula Zabkar

Reference: **Seasonal High Water Table (SHWT) Evaluation**
College Park Elementary School
Wilmington, NC
S&ME Project No. 4305-15-171

Dear Ms. Zabkar:

S&ME, Inc. (S&ME) is pleased to provide this report for SHWT evaluation services at the above-referenced site. S&ME was requested by you to perform these services in preparation for the replacement of this school. S&ME has conducted these services in general accordance with S&ME Proposal 13-1500396 dated July 24, 2015.

❖ Project Background

S&ME was contacted by you via email on July 21 and 22, 2015 at which time you requested that we provide geotechnical services, including SHWT evaluations for the proposed replacement of the College Park Elementary School. A copy of a conceptual site plan prepared by Paramounte Engineering and a boring location plan prepared by New Hanover County Schools dated April 7, 2015 was provided to us for preparation of our proposal. Please note that this report covers only the SHWT evaluation. The findings of the geotechnical exploration will be provided under a separate report.

Review of the Web Soil Survey indicates that the test locations are in area mapped within the Urban soil series which does not have a standard description due to the developed/altered nature of the soils.

❖ Findings

The SHWT evaluations were performed on August 14 and 18, 2015 by advancing one hand auger boring at seven test locations (SHWT-1 through SHWT-7) predetermined by New Hanover County Schools personnel as shown on the attached SHWT Evaluation Map (**Figure 1**). The hand auger borings were advanced to depths ranging from approximately 48 to 96 inches below the existing ground surface. Soils were evaluated by a Licensed Soil Scientist for evidence of SHWT influence. This evaluation involved looking at the actual moisture content in the soil and observing the matrix and mottle colors.

Depending on the soil texture, the soil color will indicate processes that are driven by SHWT fluctuations such as iron reduction and oxidation and organic matter staining.

In addition, S&ME recorded the observed water table (OWT) level below existing ground surface at each indicated hand auger boring location if applicable. The OWT was measured as the static water level in each of the temporary hand auger boring locations. It should be noted that the static water level/OWT measured in the auger holes is a measurement of the water table at that moment and does not represent an average water level or the highest point at which the water table may rise to. Furthermore, it is expected that groundwater elevations in the study area will likely be influenced by factors such as precipitation and proximity to surface water discharge/recharge features.

See **Table 1** below for the SHWT depths at the test locations and the attached **Figure 1** for the approximate test locations.

Table 1

TEST LOCATION	GROUND SURFACE ELEVATION[1] (feet above mean sea level)	SEASONAL HIGH WATER TABLE DEPTH (inches below ground surface)	SEASONAL HIGH WATER TABLE ELEVATIONS (feet above sea level)	OBSERVED WATER TABLE DEPTH (inches below ground surface)
SHWT-1	33.5 feet	35 inches	30.6 feet	> 96 inches
SHWT-2	33.2 feet	15 inches	32.0 feet	> 48 inches
SHWT-3	36.3 feet	40 inches	33.0 feet	> 67 inches
SHWT-4	37.8 feet	26 inches	35.6 feet	> 48 inches
SHWT-5	41.3 feet	48 inches	37.3 feet	> 72 inches
SHWT-6	41.4 feet	62 inches	36.2 feet	> 96 inches
SHWT-7	36.5 feet	40 inches	33.2 feet	> 48 inches

Note: [1] ground surface elevations were provided by New Hanover County personnel and measured by WK Dickson personnel

Surface and near surface soils at the test locations were observed to consist mostly of fine sand with loamy sand and cemented soil pieces and clayey lenses observed as well. Deeper soil horizons consisted mostly of fine sand to sandy loam with one occurrence of sandy clay loam. The SHWT depths ranged from 15 inches below the ground surface at SHWT-2 to 62 inches below the ground surface at SHWT-6.

A hand auger boring profile sheet, which provides a description of the observed soil horizons and the determined SHWT, has also been included with this report.

❖ Discussion

The conceptual site plan shows a potential stormwater best management practice (BMP) in the southeast corner of the site, which corresponds to the location of SHWT-1. The potential type of BMP was not specified on the conceptual site plan. Based on the soil profile for SHWT-1, this location could be suitable for wet detention, bio-retention, infiltration or dry detention (and possibly others). The NC Department of Natural Resources (NCDENR) BMP Manual specifies that infiltration systems not be constructed in fill material, which was identified at SHWT-1; however, it has been our experience that older, naturalized fill areas have been approved for infiltration systems if the soils satisfy the other design parameters for

infiltration systems. Other locations would be suitable for these BMPs as well with exception to SHWT-2 where infiltration would most likely not be suitable due to the SHWT being less than two feet below the existing ground surface. Please note that soil infiltration testing or hydraulic conductivity testing was not performed at the site and may be required for infiltration or bio-retention systems.

❖ Closing

S&ME appreciates the opportunity to provide SHWT evaluation services for this project. If you have any questions, or would like to further discuss our findings or additional stormwater suitability evaluations, please contact me at 910-799-9945 or pmasten@smeinc.com.

Sincerely,

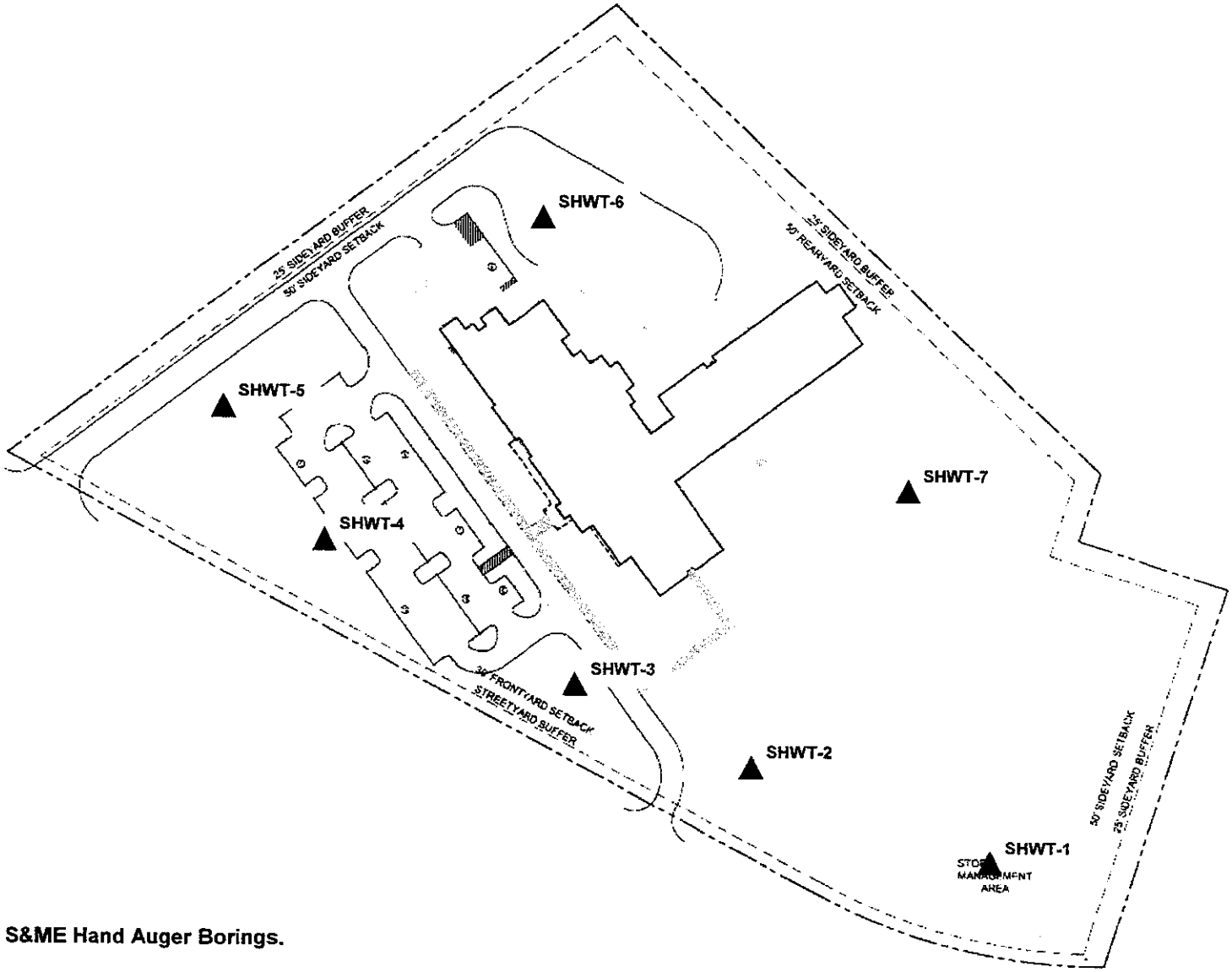
S&ME, Inc.

Paul Masten, L.S.S.
Licensed Soil Scientist
NC LSS No. 1329

Walter Cole, L.S.S.
Project Manager
NC LSS No. 1267

Enclosed: Figure 1: SHWT Evaluation Map
Attachment 1: Soil Profile Descriptions

Figure 1: – SHWT Evaluation Map



LEGEND

▲ **Proposed S&ME Hand Auger Borings.**

REFERENCE: UNTITLED, UNDATED SITE PLAN
PREPARED BY PARAMOUNTE ENGINEERING.

NORTH

SCALE: NTS	
CHECKED BY: WDC	
PREPARED BY: PAM	
DATE: 8/19/2015	

S&ME

SEASONAL HIGH WATER TABLE EVALUATIONS
COLLEGE PARK ES REPLACEMENT
WILMINGTON, NORTH CAROLINA

S&ME PROJECT NUMBER: 1306-15-028

FIGURE NUMBER

1

USGS MAP

USGS science for a changing world

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

WRIGHTSVILLE BEACH QUADRANGLE

NORTH CAROLINA NEW HANOVER CO
7.5-MINUTE SERIES (TOPOGRAPHIC)

Produced by the United States Geological Survey

Topography compiled by photogrammetric methods from aerial photographs taken 1969. Planimetry derived from imagery taken 1997 and other sources. Surveys updated current as of 1970

Selected hydrographic data compiled from NOS Charts 833 (1970). This information is not intended for navigational purposes

North American Datum of 1983 (NAD 83). Projection and 1 000 meter grid: Universal Transverse Mercator, zone 18. 10 000 meter ticks: North Carolina Coordinate System of 1983

North American Datum of 1927 (NAD 27) is shown by dashed corner ticks. The values of the shift between NAD 83 and NAD 27 for 7.5-minute intersections are obtainable from National Geodetic Survey, NADCON software

Grey tint indicates areas in which only landmark buildings are shown

SCALE 1:24 000

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS

FOR SALE BY U.S. GEOLOGICAL SURVEY, P.O. BOX 25286, DENVER, COLORADO 80225

ROAD CLASSIFICATION

WRIGHTSVILLE BEACH, NC
1997

STREAM CLASSIFICATION

.0311 CAPE FEAR RIVER BASIN

Name of Stream	Description	Class	Class Date	Index No.
Wrightsville Recreational Area (including Lees Cut, Motts Channel and portions of Banks (Channel))	In any waters within a line beginning at a point on the mainland along the Intracoastal Waterway 1400 feet north of the U.S. Hwy. 74-76 bridge extending directly across the waterway to the northern edge of Lees Cut, thence along the northern edge of Lees Cut to the end of the Cut, crossing the Cut in a northeasterly direction to a point on Wrightsville Beach 1900 feet northeast of the U.S. Hwy. 74 bridge, thence along the western shoreline of Wrightsville Beach to a point 4000 feet southwest of the U.S. Hwy. 76 bridge, thence in a northwesterly direction across Banks Channel and mud flats to a point on the eastern side of the Intracoastal Waterway across from the southern edge of Bradley Creek, thence along the eastern side of the waterway to a point 1750 feet northeast of Channel Marker #128, thence directly across the waterway in a easterly direction to Money Point and along the western edge of the Intracoastal Waterway in a northeasterly direction to the point of beginning.	SB:#	10/01/87	18-87-24
Lees Cut	Entire Cut	SB:#	10/01/87	18-87-24-1
Motts Channel	Entire Channel	SB:#	10/01/87	18-87-24-2
Banks Channel	Entire channel south of the Wrightsville Recreational Area	SA;HQW	10/01/87	18-87-24-3
Bradley Creek	From source to U.S. Hwys. 17, 74 & 76 bridge	SC;HQW:#	08/01/90	18-87-24-4-(1)
Bradley Creek	From U.S. Hwys. 17, 74 & 76 bridge to Intracoastal Waterway	SC:#	10/01/87	18-87-24-4-(2)

DEED

effect, and this instrument is in no way to be construed as affecting or impairing its efficacy in respect of the foreclosure of any other property described in said deed of trust, or of any other terms and conditions of the said deed of trust.

IN TESTIMONY WHEREOF, the said Elizabeth W. Hammond, and David H. Scott, Trustee, have signed their names and affixed their seals, and the said Citizens Savings & Loan Association has caused this instrument to be signed in its name by its Executive Vice-President, attested by its Assistant Secretary and its corporate seal affixed thereto, by authority of its Board of Directors, all the day and year first above written.

U. S. Doc. Stamps $2.20.

Elizabeth W. Hammond (SEAL)

Corporate Seal

David H. Scott, Trustee (SEAL)

Attest:

CITIZENS SAVINGS & LOAN ASSOCIATION

Katharine A. Alexander
Assistant Secretary

By U. L. Spence, Jr.
Executive Vice-President

STATE OF NORTH CAROLINA
COUNTY OF NEW HANOVER

Personally appeared before me, Linda H. Burke, a Notary Public in and for the State and County aforesaid, Elizabeth W. Hammond and acknowledged the due execution of the foregoing and annexed instrument.
Witness my hand and notarial seal this the 18th day of February, 1965.

Notarial Seal
My Commission Expires: 12-5-66

Linda H. Burke
Notary Public

STATE OF NORTH CAROLINA
COUNTY OF NEW HANOVER

Personally appeared before me, Linda H. Burke, a Notary Public in and for the State and County aforesaid, David H. Scott, Trustee, and acknowledged the due execution of the foregoing and annexed instrument.
Witness my hand and notarial seal this the 18th day of February, 1965.

Notarial Seal
My Commission Expires: 12-5-66

Linda H. Burke
Notary Public

STATE OF NORTH CAROLINA
COUNTY OF NEW HANOVER

I, Linda H. Burke, a Notary Public of Notary Public of New Hanover County, N. C., certify that Katharine A. Alexander personally appeared before me this day and acknowledged that she is Assistant Secretary of the Citizens Savings and Loan Association, a corporation, and that, by authority duly given and as the act of the corporation, the foregoing and annexed instrument was signed in its name by its Executive Vice-President, sealed with its corporate seal, and attested by herself as its Assistant Secretary.
Witness my hand and notarial seal this the 19th day of February, 1965.

Notarial Seal
My Commission Expires: 12-5-66.

Linda H. Burke
Notary Public

STATE OF NORTH CAROLINA
NEW HANOVER COUNTY

The Foregoing Certificates of Linda H. Burke Notary Public of New Hanover County, are adjudged to be correct. Let the instrument with the Certificate be recorded. Drawn by David H. Scott. This the 19th day of Feb., 1965.

Vernell DeVane
Asst. Clerk Superior Court

Received and Recorded, February 19, 1965
at 11:00 A. M., and Verified

Paul B. Blanchard
Register of Deeds

NEW HANOVER COUNTY BOARD OF EDUCATION :
TO :
RALFORD G. TRASK ET UX ET AL :
BOUNDARY DEED :

STATE OF NORTH CAROLINA
COUNTY OF NEW HANOVER

BOUNDARY DEED

THIS INDENTURE, Made this 9 day of February, 1965, by and between the New Hanover County Board of Education, a body corporate of New Hanover County, North Carolina, party of the first part; and Ralford G. Trask and wife, Mabel Dunn Trask, of New Hanover County, North Carolina, and Long Leaf Acres, Inc., a North Carolina corporation, of New Hanover County, North Carolina, parties of the second part;

WITNESSETH: THAT WHEREAS, by deed dated January 22, 1964, and duly recorded on January 23, 1964, in Book 722 at page 337 of the New Hanover County Registry, from Ralford G. Trask and wife, Mabel Dunn Trask, and by deed dated January 22, 1964, and duly recorded on January 23, 1964, in Book 726 at page 527 of the New Hanover County Registry, from Long Leaf Acres, Inc. the party of the first part was conveyed a certain tract of land upon which is located the College Park Elementary School, together with a right of way leading from said school to North Carolina Highway #132, reference being made to said deeds and to a map showing the property and right of way, recorded in Map Book 8 at page 39 of the New Hanover County Registry for a more particular description of the tracts therein conveyed; and

WHEREAS, subsequently a road was actually constructed over the right of way as shown by map recorded in Map Book 8 at page 78 of the New Hanover County Registry, rather than as shown by map recorded in Map Book 8 at page 39 of said Registry; and

WHEREAS, some question has arisen as to the boundary between the party of the first part and the parties of the second part, and their rights in the right of way as described in said deeds and Map Book 8 at page 39, and as said right of way is actually located; and

WHEREAS, the parties hereto desire to definitely establish a boundary between them, and establish the right of way solely as actually located and shown by map recorded in Map Book 8 at page 78 of said Registry;

NOW, THEREFORE, the said parties of the first and second parts in consideration of the premises and the sum of One ($1.00) Dollar each to the other in hand paid, the receipt of which is hereby acknowledged, do hereby covenant and agree as follows:

(1) That the party of the first part has given, granted, bargained and sold, aliened and conveyed, released, and forever quitclaimed, and by these presents does hereby bargain and sell, alien and convey, release and forever quitclaim unto Ralford G. Trask and wife, Mabel Dunn Trask, all of its right, title, and interest in and to that tract of land situated, lying, and being in Harnett Township, County of New Hanover, State of North Carolina, bounded and described as follows, to-wit:

All that tract of land lying South of the Northern line of Oriole Drive as shown by map recorded in Map Book 8 at page 78 of the New Hanover County Registry, and conveyed to the New Hanover County Board of Education by deeds recorded in Books 722 at page 337 and 726 at page 527 of the New Hanover County Registry, together with all easements described in said deeds, reference being made to said map and deeds for a more particular and detailed description of the property herein described.

TO HAVE AND TO HOLD the above granted and described premises together with all and singular the rights, privileges, easements, tenements and appurtenances thereunto belonging or in anywise appertaining unto the said Ralford G. Trask and wife, Mabel Dunn Trask, their heirs and assigns, in fee simple forever.

(2) That the parties of the second part have given, granted, bargained and sold, aliened and conveyed, released, and forever quitclaimed, and by these presents do hereby bargain and sell, alien and convey, release, and forever quitclaim unto the party of the first part all of their right, title, and interest in and to that tract of land situated, lying and being in Harnett Township, County of New Hanover, State of North Carolina, bounded and described as follows, to-wit:

All of that tract of land now owned by the parties of the second part lying within the boundaries of that property described as "Board of Education Tract", lying North of the Northern line of Oriole Drive, as show by map recorded in Map Book 8 at page 78 of the New Hanover County Registry, together with an easement or right of way for ingress and egress over Oriole Drive as the same is shown on the map aforesaid, reference being hereby made for a more particular and detailed description of the tract and right of way herein conveyed.

TO HAVE AND TO HOLD the above granted and described premises together with all and singular the rights, privileges, easements, tenements and appurtenances thereunto belonging or in anywise appertaining unto the said party of the first part, its successors and assigns, in fee simple forever.

IN TESTIMONY WHEREOF the New Hanover County Board of Education has caused this instrument to be signed by its Chairman and attested by its Secretary, with its corporate seal affixed; Ralford G. Trask and wife, Mabel Dunn Trask have hereunto set their hands and seals; and Long Leaf Acres, Inc. has caused this instrument to be signed by its President, attested by its Secretary, with its corporate seal affixed, all the day and year hereinabove first written.

Corporate Seal

Attest:
William H. Wagoner
William H. Wagoner, Secretary

NEW HANOVER COUNTY BOARD OF EDUCATION

By Emsley A. Laney
Emsley A. Laney, Chairman

Ralford G. Trask (SEAL)
Ralford G. Trask

Mabel Dunn Trask (SEAL)
Mabel Dunn Trask

Corporate Seal

Attest:

Mabel Dunn Trask
Mabel Dunn Trask, Secretary

LONG LEAF ACRES, INC.

By Ralford G. Trask,
Ralford G. Trask, President

STATE OF NORTH CAROLINA
COUNTY OF NEW HANOVER

This 9 day of February, 1965, personally appeared before me, Ione P. Whitehead, a Notary Public in and for the above named State and County, William H. Wagoner, who being by me duly sworn, says that he knows the common seal of the New Hanover County Board of Education, a public corporation, and is acquainted with Emsley A. Laney, who is the Chairman of said Board, and that he, the said William H. Wagoner is the secretary of said Board and saw the said Chairman sign the foregoing instrument, and saw the said common seal of said Board affixed to said instrument by the said Chairman, and that he, the said William H. Wagoner signed his name in attestation of the execution of said instrument in the presence of said Chairman of said Board.

Witness my hand and notarial seal, this 9 day of February, 1965.

Notarial Seal
My commission expires: Sept. 12, 1965.

Ione P. Whitehead
Notary Public

STATE OF NORTH CAROLINA
COUNTY OF NEW HANOVER

Personally appeared before me, Margaree E. Murray, a Notary Public in and for the County and State aforesaid, Ralford G. Trask and wife, Mabel Dunn Trask and acknowledged the due execution of the foregoing instrument for the uses and purposes therein expressed.

Witness my hand and notarial seal this 18 day of Feb., 1965.

Notarial Seal
My commission expires: 2/25/1965

Margaree E. Murray
Notary Public

STATE OF NORTH CAROLINA
COUNTY OF NEW HANOVER

This 18 day of Feb., 1965, personally appeared before me, Margaree E. Murray, a Notary Public in and for the above named State and County, Mabel Dunn Trask, who being by me duly sworn, says that she knows the common seal of

STORMWATER CALCULATIONS

College Park Elementary Wet Pond #1

NC DENR Retention Requirements

Objective: design a wet detention basin with the following characteristics: a permanent water pool depth between 3- and 6-feet, a surface area that meets TSS removal requirements (values set by NC DENR and included here), a forebay that is approximately 20% of the total pond volume, a temporary water pool sized to detain the initial 1.5 inch of rainfall runoff, an outlet device that drains the temporary water pool within 2-5 days, and a length-to-width ratio of approximately 3:1.

Step 1: *Determine the surface area required for 90% TSS removal*

Post-Development Conditions			
Total Drainage Area	3.644	ACRE	*Value from CAD*
Impervious Drainage Area	1.428	ACRE	*Value from CAD*
Impervious Cover	39.19%		*Impervious Cover=(Impervious Drainage Area)/(Total Drainage Area)*100%*
Elevation of Permanent Pool Surface	**37.50**	**FT**	*Value selected by designer*
Depth of Permanent Pool	**7.50**	**FT**	*Value selected by designer*
Elevation of Wet Detention Pond Bottom	30.0	FT	*(Bottom Elevation)=(Permanent Pool Surface Elevation)-(Depth of Permanent Pool)*
Approximate Pond Length	117	FT	*Value from CAD*
Approximate Pond Width	64	FT	*Value from CAD*
Length:Width Ratio	**1.8:1**		*Ratio=(Length)/(Width):1*
Required SA/DA Ratio for 90% TSS Removal	3.44		*Value from chart. Reference: "90% TSS Removal*
Required Permanent Pool Surface Area	**5,452**	**SF**	*Required Surface Area=(Required SA/DA Ratio)*(Total Drainage Area)*
Provided Permanent Pool Surface Area	**8,548**	**SF**	*Interpolated value from stage-storage calculations*

Step 2: *Determine the 1.5-inch runoff elevation within the wet detention pond.*

Runoff Coefficient, Rv	0.403	IN/IN	*Rv=0.05+0.009*(% Impervious)*
Required 1.5" Runoff Volume (Volume of Temporary Pool)	7,990	CF	*1.5" Runoff Volume=1.5 inch*Rv*1 foot/12 inch*(Total Drainage Area)*
Volume Below Permanent Pool	26,019	CF	*Value from stage-storage calculations (cumulative pond volume at permanent pool elevation)*
Total Volume to be Controlled	**34,009**	**CF**	*Total Volume to be Controlled=(Volume Below Permanent Pool)+(1.5" Runoff Volume)*
Storage Elevation at Required Volume	**38.19**	**FT**	*Value is interpolation based upon stage-storage values. See stage-storage calculations*

Step 3: *Calculate the required forebay volume (18-22% of total pond volume) and compare to the forebay volume provided.*

Total Pond Volume	26,019	CF	*Value from stage-storage calculations*
Required Total Forebay Volume	**4,683**	**CF**	*Forebay Volume=(Total Pond Volume)*18%*
Provided Total Forebay Volume	**5,044**	**CF**	*Value from stage-storage calculations*
Provided Forebay Volume:Total Pond Volume	**19.4%**		*(Provided Forebay Volume)/(Total Pond Volume)*100%*

Step 4: *Verify that time required to drawdown the 1.5-inch runoff volume is within 2 to 5 days.*

Diameter of Proposed Low-flow Orifice	1.75	IN	*Value chosen by designer*
Elevation of 1.5" Volume	38.19	FT	*Value chosen by designer*
Total Elevation Head Above Orifice	0.69	FT	*(Total Elevation Head Above Orifice)=(Weir Elevation)-(Elevation of Permanent Pool Surface)*
Average Elevation Head Above Orifice	0.23	FT	*(Average Elevation Head Above Orifice)=[(Storage Elevation at Required Volume)+(Elevation of Permanent Pool Surface)]/3-(Storage Elevation at Required Volume)*
Cd, Coefficient of Discharge	0.60		*Value chosen by designer*
Q, Flowrate Through Low-flow Orifice	0.04	CFS	*Q=Cd*(Pi)*[(Diameter of Orifice)*(1 ft/12 in)]^2/4*[2*32.2*(Averge Head)]^1/2*
Drawdown Time for 1.5-inch Runoff	**2.39**	**DAYS**	*(Drawdown Time)=(1.5" Runoff Volume)/Q*(1 day/86400 seconds)*

Step 5: *Verify that time required to drawdown the provided temp pool volume is within 2 to 5 days.*

Diameter of Proposed Low-flow Orifice	1.75	IN	*Value chosen by designer*
Elevation of Outlet Structure	39.25	FT	*Value chosen by designer*
Total Elevation Head Above Orifice	1.75	FT	*(Total Elevation Head Above Orifice)=(Weir Elevation)-(Elevation of Permanent Pool Surface)*
Average Elevation Head Above Orifice	0.58	FT	*(Average Elevation Head Above Orifice)=[(Storage Elevation at Required Volume)+(Elevation of Permanent Pool Surface)]/3-(Storage Elevation at Required Volume)*
Cd, Coefficient of Discharge	0.60		*Value chosen by designer*
Q, Flowrate Through Low-flow Orifice	0.06	CFS	*Q=Cd*(Pi)*[(Diameter of Orifice)*(1 ft/12 in)]^2/4*[2*32.2*(Averge Head)]^1/2*
Drawdown Time for Provided Runoff	**4.02**	**DAYS**	*(Drawdown Time)=(Provided Runoff Volume)/Q*(1 day/86400 seconds)*

College Park Elementary Wet Pond

Stage-Storage Calculations for Proposed Wet Detention Pond

Stage/Storage Above Permanent Pool (Including Forebay)

Contour	Contour Area (SF)	Incremental Volume (CF)	Cumulative Volume, S (CF)	
37.50	**11,214**	0	0	**←Permanent Pool**
38.00	**11,830**	5,761	5,761	
39.00	**13,110**	12,470	18,231	
39.25	**13,442**	3,319	21,550	
40.00	**14,450**	10,460	32,010	
40.50	**15,135**	7,396	39,406	

Stage/Storage Total Pond (Including Forebay)

Contour	Contour Area (SF)	Incremental Volume (CF)	Cumulative Volume, S (CF)	
29.0		-	-	**←Sediment Storage**
30.0		0	0	**←Bottom Elev.**
31.0		943	943	
32.0	*SEE BELOW*	1,363	2,305	
33.0		1,855	4,160	
34.0		2,946	7,106	
35.0		3,854	10,960	
36.0		4,867	15,827	
36.5		2,857	18,684	
37.0		3,353	22,037	
37.5		3,983	26,019	**←Permanent Pool**

Main Pond

Contour	Contour Area (SF)	Incremental Volume (CF)	Cumulative Volume, S (CF)	
29.0	435	-	-	**←Sediment Storage**
30.0	750	0	0	**←Bottom Elev.**
31.0	1,135	943	943	
32.0	1,590	1,363	2,305	
33.0	2,120	1,855	4,160	
34.0	2,720	2,420	6,580	
35.0	3,390	3,055	9,635	
36.0	4,125	3,758	13,393	
36.5	4,520	2,161	15,554	
37.0	5,485	2,501	18,055	
37.5	6,195	2,920	20,975	**←Permanent Pool**

Forebay

Contour	Contour Area (SF)	Incremental Volume (CF)	Cumulative Volume, S (CF)	
30.0	-	-	-	
31.0	65	-	-	**←Sediment Storage**
32.0	197	-	-	
33.0	398	0	0	**←Bottom Elev.**
34.0	653	526	526	
35.0	945	799	1,325	
36.0	1,274	1,110	2,434	
36.5	1,510	696	3,130	
37.0	1,897	852	3,982	
37.5	2,353	1,063	5,044	**←Forebay Volume**

College Park Elementary Wet Pond #2

NC DENR Retention Requirements

Objective: design a wet detention basin with the following characteristics: a permanent water pool depth between 3- and 6-feet, a surface area that meets TSS removal requirements (values set by NC DENR and included here), a forebay that is approximately 20% of the total pond volume, a temporary water pool sized to detain the initial 1.5 inch of rainfall runoff, an outlet device that drains the temporary water pool within 2-5 days, and a length-to-width ratio of approximately 3:1.

Step 1: *Determine the surface area required for 90% TSS removal*

Post-Development Conditions			
Total Drainage Area	11.814	ACRE	*Value from CAD*
Impervious Drainage Area	4.072	ACRE	*Value from CAD*
Impervious Cover	34.47%		*Impervious Cover=(Impervious Drainage Area)/(Total Drainage Area)*100%*
Elevation of Permanent Pool Surface	**32.60**	**FT**	*Value selected by designer*
Depth of Permanent Pool	**5.60**	**FT**	*Value selected by designer*
Elevation of Wet Detention Pond Bottom	27.0	FT	*(Bottom Elevation)=(Permanent Pool Surface Elevation)-(Depth of Permanent Pool)*
Approximate Pond Length	226	FT	*Value from CAD*
Approximate Pond Width	95	FT	*Value from CAD*
Length:Width Ratio	**2.4:1**		*Ratio=(Length)/(Width):1*
Required SA/DA Ratio for 90% TSS Removal	3.45		*Value from chart. Reference: "90% TSS Removal*
Required Permanent Pool Surface Area	**17,739**	**SF**	*Required Surface Area=(Required SA/DA Ratio)*(Total Drainage Area)*
Provided Permanent Pool Surface Area	25,480 RC ~~25,895~~	**SF**	*Interpolated value from stage-storage calculations*

Step 2: *Determine the 1.5-inch runoff elevation within the wet detention pond.*

Runoff Coefficient, Rv	0.360	IN/IN	*Rv=0.05+0.009*(% Impervious)*
Required 1.5" Runoff Volume (Volume of Temporary Pool)	23,171	CF	*1.5" Runoff Volume=1.5 inch*Rv*1 foot/12 inch*(Total Drainage Area)*
Volume Below Permanent Pool	95,875	CF	*Value from stage-storage calculations (cumulative pond volume at permanent pool elevation)*
Total Volume to be Controlled	**119,046**	**CF**	*Total Volume to be Controlled=(Volume Below Permanent Pool)+(1.5" Runoff Volume)*
Storage Elevation at Required Volume	**33.14**	**FT**	*Value is interpolation based upon stage-storage values. See stage-storage calculations*

Step 3: *Calculate the required forebay volume (18-22% of total pond volume) and compare to the forebay volume provided.*

Total Pond Volume	95,875	CF	*Value from stage-storage calculations*
Required Total Forebay Volume	**17,257**	**CF**	*Forebay Volume=(Total Pond Volume)*18%*
Provided Total Forebay Volume	**18,380**	**CF**	*Value from stage-storage calculations*
Provided Forebay Volume:Total Pond Volume	**19.2%**		*(Provided Forebay Volume)/(Total Pond Volume)*100%*

Step 4: *Verify that time required to drawdown the 1.5-inch runoff volume is within 2 to 5 days.*

Diameter of Proposed Low-flow Orifice	3.25	IN	*Value chosen by designer*
Elevation of 1.5" Volume	33.14	FT	*Value chosen by designer*
Total Elevation Head Above Orifice	0.54	FT	*(Total Elevation Head Above Orifice)=(Weir Elevation)-(Elevation of Permanent Pool Surface)*
Average Elevation Head Above Orifice	0.18	FT	*(Average Elevation Head Above Orifice)=[(Storage Elevation at Required Volume)+(Elevation of Permanent Pool Surface)]/3-(Storage Elevation at Required Volume)*
Cd, Coefficient of Discharge	0.60		*Value chosen by designer*
Q, Flowrate Through Low-flow Orifice	0.12	CFS	*Q=Cd*(Pi)*[(Diameter of Orifice)*(1 ft/12 in)]^2/4*[2*32.2*(Averge Head)]^1/2*
Drawdown Time for 1.5-inch Runoff	**2.29**	**DAYS**	*(Drawdown Time)=(1.5" Runoff Volume)/Q*(1 day/86400 seconds)*

Step 5: *Verify that time required to drawdown the provided temp pool volume is within 2 to 5 days.*

Diameter of Proposed Low-flow Orifice	3.25	IN	*Value chosen by designer*
Elevation of Outlet Structure	34.50	FT	*Value chosen by designer*
Total Elevation Head Above Orifice	1.90	FT	*(Total Elevation Head Above Orifice)=(Weir Elevation)-(Elevation of Permanent Pool Surface)*
Average Elevation Head Above Orifice	0.63	FT	*(Average Elevation Head Above Orifice)=[(Storage Elevation at Required Volume)+(Elevation of Permanent Pool Surface)]/3-(Storage Elevation at Required Volume)*
Cd, Coefficient of Discharge	0.60		*Value chosen by designer*
Q, Flowrate Through Low-flow Orifice	0.22	CFS	*Q=Cd*(Pi)*[(Diameter of Orifice)*(1 ft/12 in)]^2/4*[2*32.2*(Averge Head)]^1/2*
Drawdown Time for Provided Runoff	**4.45**	**DAYS**	*(Drawdown Time)=(Provided Runoff Volume)/Q*(1 day/86400 seconds)*

College Park Elementary Wet Pond 2

Stage-Storage Calculations for Proposed Wet Detention Pond

Stage/Storage Above Permanent Pool (Including Forebay)

Contour	Contour Area (SF)	Incremental Volume (CF)	Cumulative Volume, S (CF)	
32.60	**41,970**	0	0	←**Permanent Pool**
33.00	**43,380**	17,070	17,070	
34.00	**46,950**	45,165	62,235	
34.50	**48,758**	23,927	86,162	
35.00	**50,575**	24,833	110,995	
36.00	**54,255**	52,415	163,410	

Stage/Storage Total Pond (Including Forebay)

Contour	Contour Area (SF)	Incremental Volume (CF)	Cumulative Volume, S (CF)	
20.0		0	0	← **Sediment Storage**
21.0		0	0	
22.0		0	0	
23.0		0	0	
24.0		0	0	
25.0		0	0	
26.0		0	0	
27.0		0	0	←**Bottom Elev.**
28.0	*SEE BELOW*	12,100	12,100	
29.0		14,072	26,172	
30.0		16,148	42,320	
31.0		18,323	60,642	
31.6		12,060	72,702	
32.0		8,704	81,406	
32.6		14,469	95,875	←**Permanent Pool**

College Park Elementary Wet Pond 2

Stage-Storage Calculations for Proposed Wet Detention Pond

Main Pond

Contour	Contour Area (SF)	Incremental Volume (CF)	Cumulative Volume, S (CF)	
20.0	1,445	-	-	← **Sediment Storage**
21.0	2,120	0	0	
22.0	2,910	0	0	
23.0	3,870	0	0	
24.0	4,960	0	0	
25.0	6,175	0	0	
26.0	7,565	0	0	
27.0	9,040	0	0	←**Bottom Elev.**
28.0	10,590	9,815	9,815	
29.0	12,215	11,403	21,218	
30.0	13,915	13,065	34,283	
31.0	15,680	14,798	49,080	
31.6	16,775	9,737	58,817	
32.0	18,365	7,028	65,845	
32.6	20,470	11,651	77,495	←**Main Pond Volume**

Forebay

Contour	Contour Area (SF)	Incremental Volume (CF)	Cumulative Volume, S (CF)	
22.0		-	-	← **Sediment Storage**
23.0		-	-	
24.0		-	-	
25.0	1,444	-	-	
26.0	1,757	-	-	
27.0	2,099	0	0	←**Bottom Elev.**
28.0	2,470	2,285	2,285	
29.0	2,869	2,670	4,954	
30.0	3,297	3,083	8,037	
31.0	3,753	3,525	11,562	
31.6	3,992	2,324	13,886	
32.0	4,386	1,676	15,561	
32.6	5,010	2,819	18,380	←**Forebay Volume**

Project Name:	College Park Elem
Client:	LS3P
Project Number:	15185.PE
Prepared By:	RPB
Date:	2/9/17

PARAMOUNTE
ENGINEERING, INC.

Average Depth Calculation: (Option 2 per Errata)
**Note: Only used areas relative to the main pond*

Pond #1

$A_{Bottom\ Shelf}$ =	6,030	sf
$A_{Bottom\ Pond}$ =	750	sf
$A_{Perm\ Pool}$ =	8,548	sf
Depth =	6.5	ft
d_{avg} =	4.1	ft

Pond #2

$A_{Bottom\ Shelf}$ =	20,767	sf
$A_{Bottom\ Pond}$ =	9,040	sf
$A_{Perm\ Pool}$ =	25,480	sf
Depth =	4.6	ft
d_{avg} =	3.8	ft

College Park Elementary
10yr HGL Calculations

Upstream Node	Downstream Node	Diameter (in)	Pipe Length (ft)	Slope (%)	Upstream Pipe Invert (ft)	Downstream Pipe Invert(ft)	Upstream Rim Elev (ft)	Downstream Rim Elev (ft)	Upstream HGL (ft)	Downstream HGL (ft)
CB-206	MH-201	15	143	0.25	33.00	32.64	38.20	37.00	33.43	33.28
MH-201	FES-200	30	35	0.49	28.17	28.00	37.00	33.09	33.17	33.14
DI-112B	RD-112A	12	13	0.75	36.06	35.96	41.30	41.42	38.30	38.30
RD-112A	RD-111	15	56	0.75	35.71	35.28	41.42	41.88	38.15	37.99
RD-111	RD-110	15	43	0.75	35.28	34.96	41.88	41.84	37.79	37.67
RD-110	RD-109	15	35	0.75	34.96	34.70	41.84	41.84	37.46	37.37
RD-109	RD-108	15	64	0.74	34.70	34.22	41.84	41.78	37.15	36.95
RD-108	RD-107	15	64	0.75	34.22	33.74	41.78	41.71	36.69	36.46
RD-107	RD-106	15	52	0.75	33.74	33.35	41.71	41.71	36.18	35.97
RD-106	RD-105	15	31	0.75	33.35	33.11	41.71	41.47	35.66	35.53
RD-105	RD-104	15	40	0.74	33.11	32.82	41.47	41.80	35.15	34.90
RD-104	RD-103	18	124	0.75	32.57	31.64	41.80	36.40	34.59	34.28
RD-103	RD-102	24	95	0.70	29.66	28.99	36.40	36.29	34.01	33.84
RD-102	DI-101	24	92	0.70	28.99	28.35	36.29	34.30	33.57	33.37
DI-101	FES-100	30	48	0.72	27.85	27.50	34.30	30.00	33.19	33.14
DI-126	DI-125	12	134	0.51	31.10	30.41	34.30	34.30	33.43	33.40
DI-125	DI-101	12	130	0.50	30.41	29.76	34.30	34.30	33.39	33.30
DI-129	DI-128	12	134	0.29	32.03	31.63	34.30	34.30	34.69	34.63
DI-128	DI-127	15	131	0.30	31.13	30.74	34.30	34.30	34.60	34.54
DI-127	RD-103	18	109	0.30	30.49	30.16	34.30	36.40	34.47	34.26
DI-215	CB-205	15	230	0.50	34.34	33.19	38.80	38.12	35.68	35.64
CB-205	CB-204	15	120	0.50	31.43	30.83	38.12	36.52	35.57	35.29
CB-204	CB-203	18	246	0.50	30.83	29.60	36.52	36.52	35.09	33.89
CB-203	CB-202	24	124	0.51	29.60	28.97	36.52	35.98	33.66	33.46
CB-202	MH-201	30	59	0.51	28.47	28.17	35.98	37.00	33.34	33.29
DI-305	DI-304	18	168	0.61	35.94	34.92	39.70	39.70	39.44	39.16
DI-304	MH-303	24	163	0.30	34.92	34.44	39.70	41.20	39.05	38.86
MH-303	DI-302	24	128	0.30	34.44	34.05	41.20	39.70	38.68	38.49
DI-302	DI-301	30	100	0.30	34.05	33.75	39.70	39.71	38.37	38.32
DI-301	FES-300	30	50	0.50	33.75	33.50	39.71	35.50	38.22	38.19
DI-306	MH-303	15	86	0.30	36.00	35.75	40.00	41.20	38.88	38.83
FES-402	MH-401	24	8	1.00	32.02	31.94	32.65	34.55	34.37	34.37
MH-401	FES-400	24	38	0.50	31.94	31.75	34.55	36.00	33.68	33.28
OS POND 2	MH-401	18	50	0.90	32.45	32.00	34.50	34.55	35.08	34.56
RD-121	RD-120	8	43	0.75	39.00	38.68	41.94	41.99	40.36	40.35
RD-120	RD-119	8	14	0.75	38.68	38.57	41.99	41.90	40.34	40.33
RD-119	RD-118	8	19	0.75	38.57	38.43	41.90	41.92	40.31	40.30
RD-118	RD-117	8	16	0.75	38.43	38.31	41.92	41.93	40.28	40.27
RD-117	RD-116	8	20	0.74	38.31	38.16	41.93	41.93	40.21	40.12
RD-116	RD-115	12	43	0.75	37.83	37.51	41.93	41.90	40.01	39.87
RD-115	RD-114	12	87	0.75	37.51	36.85	41.90	41.87	39.67	39.29
RD-114	RD-113	12	68	0.75	36.85	36.35	41.87	41.90	39.02	38.65
RD-113	RD-112A	15	52	0.75	36.35	35.96	41.90	41.42	38.45	38.34
RD-124	RD-123	8	51	2.00	39.00	37.97	42.00	41.50	39.06	38.06
RD-123	RD-122	8	15	2.01	37.97	37.68	41.50	42.00	38.03	37.89
RD-122	RD-102	8	124	1.99	37.68	35.20	42.00	36.29	37.83	35.35
RD-212	RD-211	8	12	0.50	35.69	35.63	41.65	41.74	35.90	35.90
RD-211	RD-210	8	26	0.50	35.63	35.49	41.74	41.62	35.86	35.86
RD-210	RD-209	8	26	0.50	35.49	35.36	41.62	41.21	35.81	35.80
RD-209	RD-208	8	45	0.50	35.36	35.14	41.21	41.12	35.74	35.71
RD-208	CB-205	12	61	0.50	34.81	34.50	41.12	38.12	35.68	35.65
RD-214	RD-213	8	34	0.50	35.53	35.36	41.71	41.81	35.73	35.72
RD-213	RD-208	12	44	0.50	35.03	34.81	41.81	41.12	35.71	35.71

College Park Elementary
50yr HGL Calculations

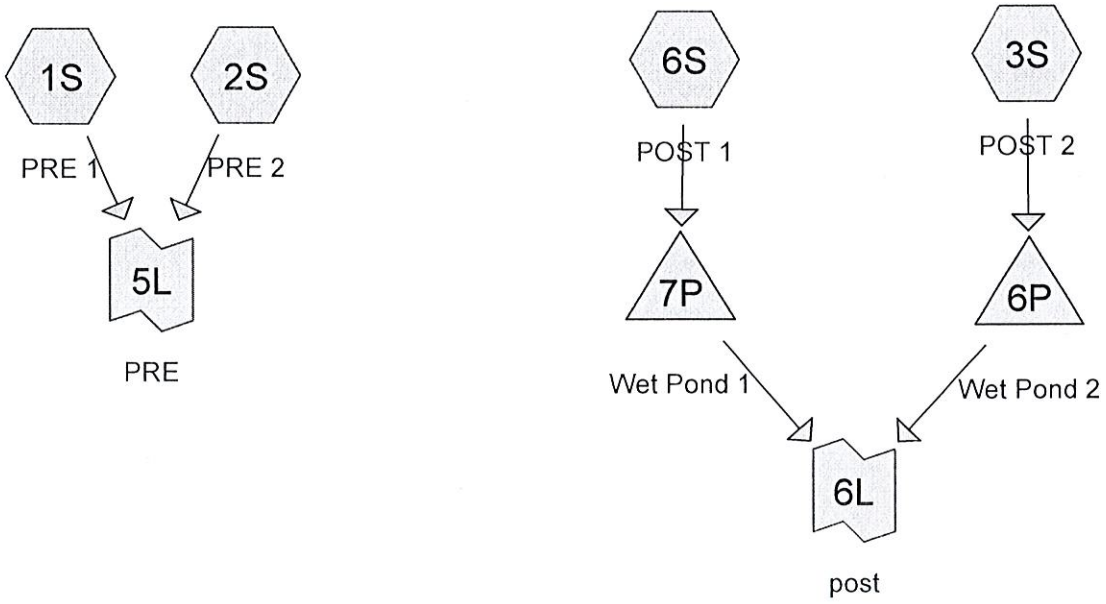
Upstream Node	Downstream Node	Diameter (in)	Pipe Length (ft)	Slope (%)	Upstream Pipe Invert (ft)	Downstream Pipe Invert(ft)	Upstream Rim Elev (ft)	Downstream Rim Elev (ft)	Upstream HGL (ft)	Downstream HGL (ft)
CB-206	MH-201	15	143	0.25	33.00	32.64	38.20	37.00	33.51	33.36
MH-201	FES-200	30	35	0.49	28.17	28.00	37.00	33.09	33.18	33.14
DI-112B	RD-112A	12	13	0.75	36.06	35.96	41.30	41.42	38.77	38.77
RD-112A	RD-111	15	56	0.75	35.71	35.28	41.42	41.88	38.60	38.44
RD-111	RD-110	15	43	0.75	35.28	34.96	41.88	41.84	38.22	38.10
RD-110	RD-109	15	35	0.75	34.96	34.70	41.84	41.84	37.88	37.78
RD-109	RD-108	15	64	0.74	34.70	34.22	41.84	41.78	37.55	37.34
RD-108	RD-107	15	64	0.75	34.22	33.74	41.78	41.71	37.07	36.83
RD-107	RD-106	15	52	0.75	33.74	33.35	41.71	41.71	36.53	36.32
RD-106	RD-105	15	31	0.75	33.35	33.11	41.71	41.47	36.00	35.86
RD-105	RD-104	15	40	0.74	33.11	32.82	41.47	41.80	35.46	35.20
RD-104	RD-103	18	124	0.75	32.57	31.64	41.80	36.40	34.88	34.56
RD-103	RD-102	24	95	0.70	29.66	28.99	36.40	36.29	34.24	34.02
RD-102	DI-101	24	92	0.70	28.99	28.35	36.29	34.30	33.69	33.43
DI-101	FES-100	30	48	0.72	27.85	27.50	34.30	30.00	33.20	33.14
DI-126	DI-125	12	134	0.51	31.10	30.41	34.30	34.30	33.55	33.51
DI-125	DI-101	12	130	0.50	30.41	29.76	34.30	34.30	33.48	33.36
DI-129	DI-128	12	134	0.29	32.03	31.63	34.30	34.30	35.25	35.14
DI-128	DI-127	15	131	0.30	31.13	30.74	34.30	34.30	35.11	35.01
DI-127	RD-103	18	109	0.30	30.49	30.16	34.30	36.40	34.91	34.57
DI-215	CB-205	15	230	0.50	34.34	33.19	38.80	38.12	37.03	36.97
CB-205	CB-204	15	120	0.50	31.43	30.83	38.12	36.52	36.87	36.47
CB-204	CB-203	18	246	0.50	30.83	29.60	36.52	36.52	36.18	34.33
CB-203	CB-202	24	124	0.51	29.60	28.97	36.52	35.98	33.97	33.65
CB-202	MH-201	30	59	0.51	28.47	28.17	35.98	37.00	33.45	33.39
DI-305	DI-304	18	168	0.61	35.94	34.92	39.70	39.70	40.11	39.69
DI-304	MH-303	24	163	0.30	34.92	34.44	39.70	41.20	39.53	39.24
MH-303	DI-302	24	128	0.30	34.44	34.05	41.20	39.70	38.96	38.65
DI-302	DI-301	30	100	0.30	34.05	33.75	39.70	39.71	38.48	38.39
DI-301	FES-300	30	50	0.50	33.75	33.50	39.71	35.50	38.24	38.19
DI-306	MH-303	15	86	0.30	36.00	35.75	40.00	41.20	39.26	39.19
FES-402	MH-401	24	8	1.00	32.02	31.94	32.65	34.55	34.37	34.37
MH-401	FES-400	24	38	0.50	31.94	31.75	34.55	36.00	33.68	33.28
OS POND 2	MH-401	18	50	0.90	32.45	32.00	34.50	34.55	35.08	34.56
RD-121	RD-120	8	43	0.75	39.00	38.68	41.94	41.99	40.83	40.81
RD-120	RD-119	8	14	0.75	38.68	38.57	41.99	41.90	40.80	40.79
RD-119	RD-118	8	19	0.75	38.57	38.43	41.90	41.92	40.77	40.76
RD-118	RD-117	8	16	0.75	38.43	38.31	41.92	41.93	40.74	40.73
RD-117	RD-116	8	20	0.74	38.31	38.16	41.93	41.93	40.67	40.58
RD-116	RD-115	12	43	0.75	37.83	37.51	41.93	41.90	40.47	40.34
RD-115	RD-114	12	87	0.75	37.51	36.85	41.90	41.87	40.13	39.76
RD-114	RD-113	12	68	0.75	36.85	36.35	41.87	41.90	39.49	39.11
RD-113	RD-112A	15	52	0.75	36.35	35.96	41.90	41.42	38.92	38.81
RD-124	RD-123	8	51	2.00	39.00	37.97	42.00	41.50	39.06	38.06
RD-123	RD-122	8	15	2.01	37.97	37.68	41.50	42.00	38.03	37.89
RD-122	RD-102	8	124	1.99	37.68	35.20	42.00	36.29	37.83	35.35
RD-212	RD-211	8	12	0.50	35.69	35.63	41.65	41.74	37.14	37.14
RD-211	RD-210	8	26	0.50	35.63	35.49	41.74	41.62	37.13	37.13
RD-210	RD-209	8	26	0.50	35.49	35.36	41.62	41.21	37.12	37.10
RD-209	RD-208	8	45	0.50	35.36	35.14	41.21	41.12	37.08	37.04
RD-208	CB-205	12	61	0.50	34.81	34.50	41.12	38.12	37.01	36.97
RD-214	RD-213	8	34	0.50	35.53	35.36	41.71	41.81	37.05	37.05
RD-213	RD-208	12	44	0.50	35.03	34.81	41.81	41.12	37.04	37.03

10-YEAR HGL CALCULATIONS

Upstream Node	Downstream Node	Diameter (in)	Pipe Length (ft)	Slope (%)	Upstream Pipe Invert (ft)	Downstream Pipe Invert(ft)	Upstream Rim Elev (ft)	Downstream Rim Elev (ft)	Upstream HGL (ft)	Downstream HGL (ft)	Drainage Area (Acres)	Total Area (Acres)	Runoff Coef.	Tc (min)	Compound Tc (min)	Rainfall Intensity (in/hr)	Runoff (cfs)	Pipe Material
CB-206	MH-201	15	143	0.25	33.00	32.64	38.20	37.00	33.39	33.03	0.28	0.28	0.49	5.00	5.00	7.23	0.99	RCP III
MH-201	FES-200	30	35	0.49	28.17	28.00	37.00	33.09	32.63	32.60	0.00	2.65	0.50	5.00	12.64	5.95	0.00	RCP III
DI-112B	RD-112A	12	13	0.75	36.06	35.96	41.30	41.42	37.54	37.53	0.15	0.15	0.41	5.00	5.00	7.23	0.46	HDPE
RD-112A	RD-111	15	56	0.75	35.71	35.28	41.42	41.88	37.38	37.23	0.00	0.15	0.50	5.00	8.39	6.60	0.00	HDPE
RD-111	RD-110	15	43	0.75	35.28	34.96	41.88	41.84	37.02	36.90	0.00	0.15	0.50	5.00	8.71	6.54	0.00	HDPE
RD-110	RD-109	15	35	0.75	34.96	34.70	41.84	41.84	36.70	36.60	0.00	0.15	0.50	5.00	8.95	6.50	0.00	HDPE
RD-109	RD-108	15	64	0.74	34.70	34.22	41.84	41.78	36.38	36.18	0.00	0.15	0.50	5.00	9.15	6.47	0.00	HDPE
RD-108	RD-107	15	64	0.75	34.22	33.74	41.78	41.71	35.92	35.70	0.00	0.15	0.50	5.00	9.48	6.42	0.00	HDPE
RD-107	RD-106	15	52	0.75	33.74	33.35	41.71	41.71	35.41	35.21	0.00	0.15	0.50	5.00	9.79	6.37	0.00	HDPE
RD-106	RD-105	15	31	0.75	33.35	33.11	41.71	41.47	34.90	34.76	0.00	0.15	0.50	5.00	10.04	6.33	0.00	HDPE
RD-105	RD-104	15	40	0.74	33.11	32.82	41.47	41.80	34.40	34.19	0.00	0.15	0.50	5.00	10.17	6.31	0.00	HDPE
RD-104	RD-103	18	124	0.75	32.57	31.64	41.80	36.40	33.90	33.66	0.00	0.15	0.50	5.00	10.33	6.28	0.00	HDPE
RD-103	RD-102	24	95	0.70	29.66	28.99	36.40	36.29	33.41	33.25	0.00	3.10	0.50	5.00	10.99	6.19	0.00	HDPE
RD-102	DI-101	24	92	0.70	28.99	28.35	36.29	34.30	33.00	32.81	0.00	3.10	0.50	5.00	11.48	6.11	0.00	RCP III
DI-101	FES-100	30	48	0.72	27.85	27.50	34.30	30.00	32.64	32.60	0.68	4.43	0.32	5.00	11.94	6.05	1.58	RCP III
DI-126	DI-125	12	134	0.51	31.10	30.41	34.30	34.30	32.88	32.85	0.27	0.27	0.26	5.00	5.00	7.23	0.52	HDPE
DI-125	DI-101	12	130	0.50	30.41	29.76	34.30	34.30	32.84	32.76	0.37	0.65	0.20	5.00	8.41	6.59	0.54	HDPE
DI-129	DI-128	12	134	0.29	32.03	31.63	34.30	34.30	34.08	34.01	0.53	0.53	0.23	5.00	5.00	7.23	0.88	HDPE
DI-128	DI-127	15	131	0.30	31.13	30.74	34.30	34.30	33.99	33.93	0.51	1.04	0.19	5.00	7.01	6.84	0.70	HDPE
DI-127	RD-103	18	109	0.30	30.49	30.16	34.30	36.40	33.86	33.65	1.91	2.95	0.29	5.00	8.80	6.53	4.00	HDPE
DI-215	CB-205	15	230	0.50	34.34	33.19	38.80	38.12	35.22	35.18	0.24	0.24	0.50	5.00	5.00	7.23	0.85	RCP III
CB-205	CB-204	15	120	0.50	31.43	30.83	38.12	36.52	35.11	34.82	0.39	0.63	0.60	5.00	9.76	6.37	1.71	RCP III
CB-204	CB-203	18	246	0.50	30.83	29.60	36.52	36.52	34.62	33.38	0.90	1.53	0.77	5.00	10.53	6.25	5.03	RCP III
CB-203	CB-202	24	124	0.51	29.60	28.97	36.52	35.98	33.14	32.93	0.39	1.93	0.83	5.00	11.50	6.11	2.35	RCP III
CB-202	MH-201	30	59	0.51	28.47	28.17	35.98	37.00	32.80	32.76	0.44	2.37	0.71	5.00	12.20	6.01	2.26	RCP III
DI-305	DI-304	18	168	0.61	35.94	34.92	39.70	39.70	38.75	38.47	1.01	1.01	0.59	5.00	5.00	7.23	4.30	RCP III
DI-304	MH-303	24	163	0.30	34.92	34.44	39.70	41.20	38.36	38.17	0.97	1.98	0.53	5.00	6.15	7.00	3.73	RCP III
MH-303	DI-302	24	128	0.30	34.44	34.05	41.20	39.70	37.99	37.80	0.00	2.30	0.50	5.00	7.25	6.80	0.00	RCP III
DI-302	DI-301	30	100	0.30	34.05	33.75	39.70	39.71	37.68	37.63	0.32	2.61	0.50	5.00	8.00	6.66	1.14	RCP III
DI-301	FES-300	30	50	0.50	33.75	33.50	39.71	35.50	37.53	37.50	0.18	2.79	0.52	5.00	8.84	6.52	0.66	RCP III
DI-306	MH-303	15	86	0.30	36.00	35.75	40.00	41.20	38.19	38.14	0.32	0.32	0.63	5.00	5.00	7.23	1.45	RCP III
FES-402	MH-401	24	8	1.00	32.02	31.94	32.65	36.00	34.37	34.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	RCP III
MH-401	FES-400	24	38	0.50	31.94	31.75	36.00	33.38	33.68	33.28	0.00	0.00	0.50	5.00	5.14	7.20	0.00	RCP III
OS POND 2	MH-401	18	50	0.90	32.45	32.00	34.50	36.00	35.08	34.56	0.00	0.00	0.50	5.00	5.00	7.23	0.00	RCP III
RD-121	RD-120	8	43	0.75	39.00	38.68	41.94	41.99	39.59	39.58	0.00	0.00	0.50	5.00	5.00	7.23	0.00	HDPE
RD-120	RD-119	8	14	0.75	38.68	38.57	41.99	41.90	39.57	39.56	0.00	0.00	0.50	5.00	6.04	7.02	0.00	HDPE
RD-119	RD-118	8	19	0.75	38.57	38.43	41.90	41.92	39.54	39.53	0.00	0.00	0.50	5.00	6.29	6.97	0.00	HDPE
RD-118	RD-117	8	16	0.75	38.43	38.31	41.92	41.93	39.51	39.50	0.00	0.00	0.50	5.00	6.63	6.91	0.00	HDPE
RD-117	RD-116	8	20	0.74	38.31	38.16	41.93	41.93	39.44	39.35	0.00	0.00	0.50	5.00	6.91	6.86	0.00	HDPE
RD-116	RD-115	12	43	0.75	37.83	37.51	41.93	41.90	39.24	39.11	0.00	0.00	0.50	5.00	7.05	6.83	0.00	HDPE
RD-115	RD-114	12	87	0.75	37.51	36.85	41.90	41.87	38.90	38.53	0.00	0.00	0.50	5.00	7.31	6.79	0.00	HDPE
RD-114	RD-113	12	68	0.75	36.85	36.35	41.87	41.90	38.25	37.88	0.00	0.00	0.50	5.00	7.76	6.71	0.00	HDPE
RD-113	RD-112A	15	52	0.75	36.35	35.96	41.90	41.42	37.69	37.58	0.00	0.00	0.50	5.00	8.06	6.65	0.00	HDPE
RD-124	RD-123	8	51	2.00	39.00	37.97	42.00	41.50	39.06	38.06	0.00	0.00	0.50	5.00	5.00	7.23	0.00	HDPE
RD-123	RD-122	8	15	2.01	37.97	37.68	41.50	42.00	38.03	37.89	0.00	0.00	0.50	5.00	5.91	7.05	0.00	HDPE
RD-122	RD-102	8	124	1.99	37.68	35.20	42.00	36.29	37.83	35.35	0.00	0.00	0.50	5.00	6.26	6.98	0.00	HDPE
RD-212	RD-211	8	12	0.50	35.69	35.63	41.65	41.74	35.89	35.89	0.00	0.00	0.50	5.00	5.00	7.23	0.00	HDPE
RD-211	RD-210	8	26	0.50	35.63	35.49	41.74	41.62	35.84	35.84	0.00	0.00	0.50	5.00	5.22	7.19	0.00	HDPE
RD-210	RD-209	8	26	0.50	35.49	35.36	41.62	41.21	35.78	35.77	0.00	0.00	0.50	5.00	5.49	7.13	0.00	HDPE
RD-209	RD-208	8	45	0.50	35.36	35.14	41.21	41.12	35.68	35.43	0.00	0.00	0.50	5.00	5.74	7.08	0.00	HDPE
RD-208	CB-205	12	61	0.50	34.81	34.50	41.12	38.12	35.21	35.19	0.00	0.00	0.50	5.00	6.03	7.02	0.00	HDPE
RD-214	RD-213	8	34	0.50	35.53	35.36	41.71	41.81	35.74	35.56	0.00	0.00	0.50	5.00	5.00	7.23	0.00	HDPE
RD-213	RD-208	12	44	0.50	35.03	34.81	41.81	41.12	35.38	35.38	0.00	0.00	0.50	5.00	5.27	7.18	0.00	HDPE

50-YEAR HGL CALCULATIONS

Upstream Node	Downstream Node	Diameter (in)	Pipe Length (ft)	Slope (%)	Upstream Pipe Invert (ft)	Downstream Pipe Invert(ft)	Upstream Rim Elev (ft)	Downstream Rim Elev (ft)	Upstream HGL (ft)	Downstream HGL (ft)	Drainage Area (Acres)	Total Area (Acres)	Runoff Coef.	Tc (min)	Compound Tc (min)	Rainfall Intensity (in/hr)	Runoff (cfs)	Pipe Material
CB-206	MH-201	15	143.192788	0.25141	33	32.64	38.2034	37	33.43565	33.07565046	0.280319511	0.28031951	0.49	5	5	8.872304748	1.2187	RCP III
MH-201	FES-200	30.00	34.85	0.49	28.17	28.00	37.00	33.09	32.64	32.60	0.00	2.65	0.50	5.00	11.87	7.55	0.00	RCP III
DI-112B	RD-112A	12.00	13.20	0.75	36.06	35.96	41.30	41.42	38.00	38.00	0.15	0.15	0.41	5.00	5.00	8.87	0.56	HDPE
RD-112A	RD-111	15.00	56.46	0.75	35.71	35.28	41.42	41.88	37.84	37.67	0.00	0.15	0.50	5.00	8.43	8.15	0.00	HDPE
RD-111	RD-110	15.00	43.30	0.75	35.28	34.96	41.88	41.84	37.46	37.33	0.00	0.15	0.50	5.00	8.73	8.10	0.00	HDPE
RD-110	RD-109	15.00	34.55	0.75	34.96	34.70	41.84	41.84	37.12	37.02	0.00	0.15	0.50	5.00	8.97	8.05	0.00	HDPE
RD-109	RD-108	15.00	64.39	0.74	34.70	34.22	41.84	41.78	36.79	36.57	0.00	0.15	0.50	5.00	9.16	8.02	0.00	HDPE
RD-108	RD-107	15.00	64.17	0.75	34.22	33.74	41.78	41.71	36.30	36.06	0.00	0.15	0.50	5.00	9.48	7.96	0.00	HDPE
RD-107	RD-106	15.00	52.47	0.75	33.74	33.35	41.71	41.71	35.77	35.55	0.00	0.15	0.50	5.00	9.79	7.90	0.00	HDPE
RD-106	RD-105	15.00	30.88	0.75	33.35	33.11	41.71	41.47	35.23	35.09	0.00	0.15	0.50	5.00	10.03	7.86	0.00	HDPE
RD-105	RD-104	15.00	39.75	0.74	33.11	32.82	41.47	41.80	34.72	34.49	0.00	0.15	0.50	5.00	10.16	7.84	0.00	HDPE
RD-104	RD-103	18.00	124.17	0.75	32.57	31.64	41.80	36.40	34.21	33.93	0.00	0.15	0.50	5.00	10.32	7.81	0.00	HDPE
RD-103	RD-102	24.00	95.31	0.70	29.66	28.99	36.40	36.29	33.63	33.43	0.00	3.10	0.50	5.00	10.98	7.69	0.00	HDPE
RD-102	DI-101	24.00	91.92	0.70	28.99	28.35	36.29	34.30	33.11	32.87	0.00	3.10	0.50	5.00	11.42	7.62	0.00	RCP III
DI-101	FES-100	30.00	48.37	0.72	27.85	27.50	34.30	30.00	32.66	32.60	0.68	4.43	0.32	5.00	11.83	7.55	1.94	RCP III
DI-126	DI-125	12.00	134.20	0.51	31.10	30.41	34.30	34.30	33.00	32.96	0.27	0.27	0.26	5.00	5.00	8.87	0.63	HDPE
DI-125	DI-101	12.00	130.06	0.50	30.41	29.76	34.30	34.30	32.93	32.81	0.37	0.65	0.20	5.00	7.78	8.28	0.67	HDPE
DI-129	DI-128	12.00	134.42	0.29	32.03	31.63	34.30	34.30	34.62	34.52	0.53	0.53	0.23	5.00	5.00	8.87	1.08	HDPE
DI-128	DI-127	15.00	131.38	0.30	31.13	30.74	34.30	34.30	34.48	34.39	0.51	1.04	0.19	5.00	6.63	8.51	0.86	HDPE
DI-127	RD-103	18.00	109.22	0.30	30.49	30.16	34.30	36.40	34.28	33.95	1.91	2.95	0.29	5.00	8.08	8.22	4.91	HDPE
DI-215	CB-205	15.00	230.14	0.50	34.34	33.19	38.80	38.12	36.49	36.43	0.24	0.24	0.50	5.00	5.00	8.87	1.05	RCP III
CB-205	CB-204	15.00	120.00	0.50	31.43	30.83	38.12	36.52	36.33	35.93	0.39	0.63	0.60	5.00	9.50	7.95	2.09	RCP III
CB-204	CB-203	18.00	246.40	0.50	30.83	29.60	36.52	36.52	35.64	33.79	0.90	1.53	0.77	5.00	10.16	7.84	6.18	RCP III
CB-203	CB-202	24.00	124.20	0.51	29.60	28.97	36.52	35.98	33.43	33.11	0.39	1.93	0.83	5.00	10.95	7.70	2.89	RCP III
CB-202	MH-201	30.00	58.79	0.51	28.47	28.17	35.98	37.00	32.91	32.85	0.44	2.37	0.71	5.00	11.52	7.60	2.77	RCP III
DI-305	DI-304	18.00	167.55	0.61	35.94	34.92	39.70	39.70	39.42	39.00	1.01	1.01	0.59	5.00	5.00	8.87	5.27	RCP III
DI-304	MH-303	24.00	163.03	0.30	34.92	34.44	39.70	41.20	38.84	38.55	0.97	1.98	0.53	5.00	5.94	8.66	4.57	RCP III
MH-303	DI-302	24.00	127.81	0.30	34.44	34.05	41.20	39.70	38.27	37.96	0.00	2.30	0.50	5.00	6.82	8.47	0.00	RCP III
DI-302	DI-301	30.00	99.97	0.30	34.05	33.75	39.70	39.71	37.79	37.70	0.32	2.61	0.50	5.00	7.43	8.35	1.40	RCP III
DI-301	FES-300	30.00	50.32	0.50	33.75	33.50	39.71	35.50	37.55	37.50	0.18	2.79	0.52	5.00	8.09	8.22	0.81	RCP III
DI-306	MH-303	15.00	85.66	0.30	36.00	35.75	40.00	41.20	38.57	38.50	0.32	0.32	0.63	5.00	5.00	8.87	1.78	RCP III
FES-402	MH-401	24.00	8.00	1.00	32.02	31.94	32.65	36.00	34.37	34.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	RCP III
MH-401	FES-400	24.00	38.00	0.50	31.94	31.75	36.00	33.38	33.68	33.28	0.00	0.00	0.50	5.00	5.14	8.84	0.00	RCP III
OS POND 2	MH-401	18.00	50.16	0.90	32.45	32.00	34.50	36.00	35.08	34.56	0.00	0.00	0.50	5.00	5.00	8.87	0.00	RCP III
RD-121	RD-120	8.00	43.20	0.75	39.00	38.68	41.94	41.99	40.06	40.05	0.00	0.00	0.50	5.00	5.00	8.87	0.00	HDPE
RD-120	RD-119	8.00	14.00	0.75	38.68	38.57	41.99	41.90	40.03	40.02	0.00	0.00	0.50	5.00	6.07	8.63	0.00	HDPE
RD-119	RD-118	8.00	18.98	0.75	38.57	38.43	41.90	41.92	40.00	39.99	0.00	0.00	0.50	5.00	6.33	8.58	0.00	HDPE
RD-118	RD-117	8.00	15.64	0.75	38.43	38.31	41.92	41.93	39.97	39.96	0.00	0.00	0.50	5.00	6.67	8.51	0.00	HDPE
RD-117	RD-116	8.00	20.34	0.74	38.31	38.16	41.93	41.93	39.91	39.81	0.00	0.00	0.50	5.00	6.95	8.45	0.00	HDPE
RD-116	RD-115	12.00	42.60	0.75	37.83	37.51	41.93	41.90	39.71	39.57	0.00	0.00	0.50	5.00	7.08	8.42	0.00	HDPE
RD-115	RD-114	12.00	87.46	0.75	37.51	36.85	41.90	41.87	39.37	38.99	0.00	0.00	0.50	5.00	7.34	8.37	0.00	HDPE
RD-114	RD-113	12.00	67.81	0.75	36.85	36.35	41.87	41.90	38.72	38.34	0.00	0.00	0.50	5.00	7.79	8.28	0.00	HDPE
RD-113	RD-112A	15.00	51.89	0.75	36.35	35.96	41.90	41.42	38.15	38.04	0.00	0.00	0.50	5.00	8.10	8.22	0.00	HDPE
RD-124	RD-123	8.00	51.44	2.00	39.00	37.97	42.00	41.50	39.06	38.06	0.00	0.00	0.50	5.00	5.00	8.87	0.00	HDPE
RD-123	RD-122	8.00	14.50	2.01	37.97	37.68	41.50	42.00	38.03	37.89	0.00	0.00	0.50	5.00	5.91	8.67	0.00	HDPE
RD-122	RD-102	8.00	124.17	1.99	37.68	35.20	42.00	36.29	37.83	35.35	0.00	0.00	0.50	5.00	6.26	8.59	0.00	HDPE
RD-212	RD-211	8.00	12.12	0.50	35.69	35.63	41.65	41.74	36.60	36.60	0.00	0.00	0.50	5.00	5.00	8.87	0.00	HDPE
RD-211	RD-210	8.00	26.25	0.50	35.63	35.49	41.74	41.62	36.59	36.59	0.00	0.00	0.50	5.00	5.71	8.71	0.00	HDPE
RD-210	RD-209	8.00	26.25	0.50	35.49	35.36	41.62	41.21	36.58	36.56	0.00	0.00	0.50	5.00	6.47	8.55	0.00	HDPE
RD-209	RD-208	8.00	45.13	0.50	35.36	35.14	41.21	41.12	36.54	36.50	0.00	0.00	0.50	5.00	6.98	8.44	0.00	HDPE
RD-208	CB-205	12.00	61.48	0.50	34.81	34.50	41.12	38.12	36.47	36.43	0.00	0.00	0.50	5.00	7.63	8.31	0.00	HDPE
RD-214	RD-213	8.00	34.05	0.50	35.53	35.36	41.71	41.81	36.51	36.51	0.00	0.00	0.50	5.00	5.00	8.87	0.00	HDPE
RD-213	RD-208	12.00	43.80	0.50	35.03	34.81	41.81	41.12	36.50	36.49	0.00	0.00	0.50	5.00	5.98	8.65	0.00	HDPE



Subcat Reach Pond Link

Routing Diagram for College Park Elem SWM - 010617
Prepared by Microsoft, Printed 2/6/2017

Summary for Subcatchment 1S: PRE 1

Runoff = 0.41 cfs @ 12.58 hrs, Volume= 5,629 cf, Depth= 0.26"

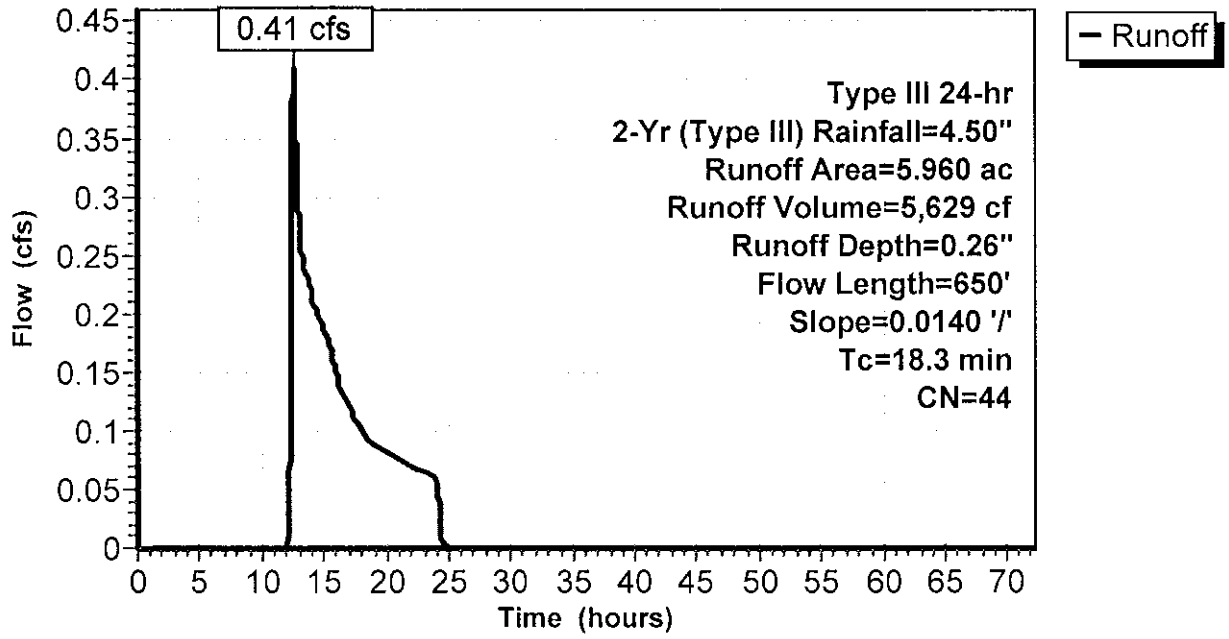
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr (Type III) Rainfall=4.50"

	Area (ac)	CN	Description
*	4.172	39	Woods, Fair, HSG A
*	1.788	55	Woods, Fair, HSG B
	5.960	44	Weighted Average
	5.960		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.3	650	0.0140	0.59		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps

Subcatchment 1S: PRE 1

Hydrograph



Summary for Subcatchment 2S: PRE 2

Runoff = 0.49 cfs @ 12.72 hrs, Volume= 7,692 cf, Depth= 0.26"

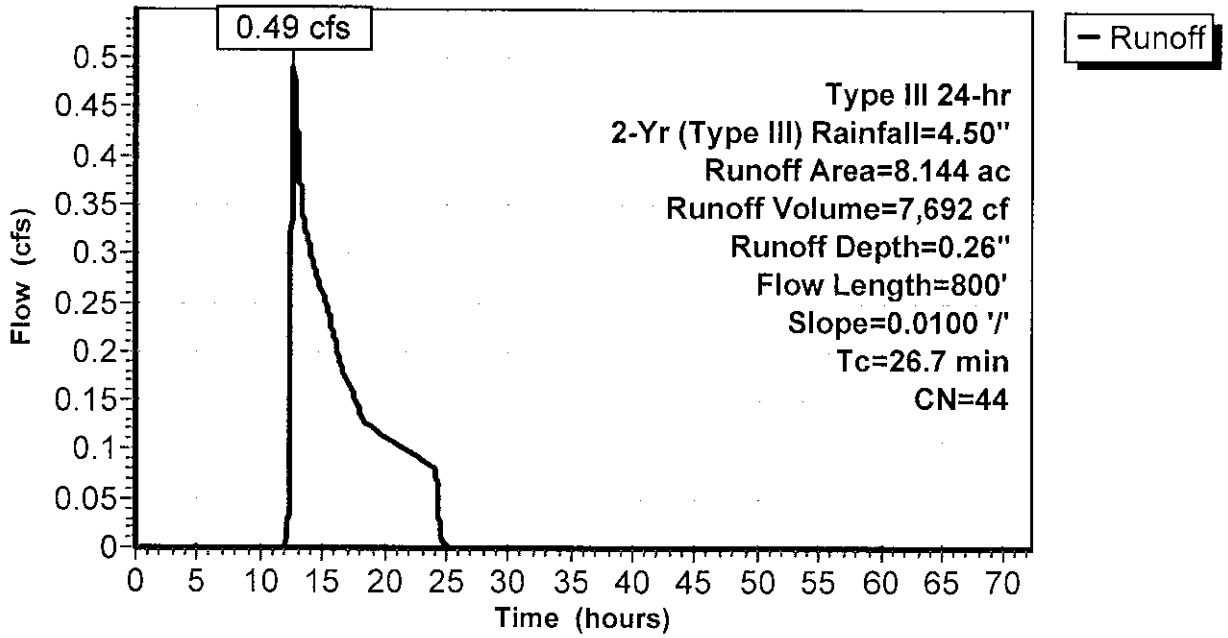
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr (Type III) Rainfall=4.50"

	Area (ac)	CN	Description
*	5.700	39	Woods, Fair, HSG A
*	2.444	55	Woods, Fair, HSG B
	8.144	44	Weighted Average
	8.144		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.7	800	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps

Subcatchment 2S: PRE 2

Hydrograph



Summary for Subcatchment 3S: POST 2

Runoff = 18.84 cfs @ 12.08 hrs, Volume= 59,885 cf, Depth= 1.40"

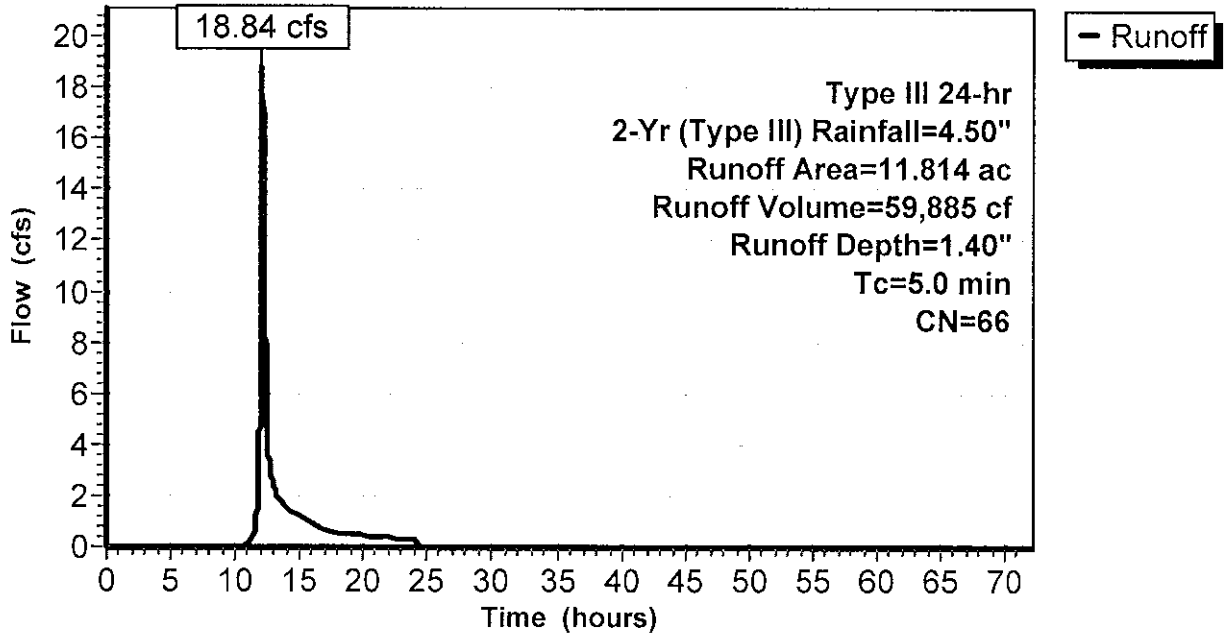
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr (Type III) Rainfall=4.50"

Area (ac)	CN	Description
2.816	98	Paved parking, HSG A
1.256	98	Paved parking, HSG B
5.066	39	>75% Grass cover, Good, HSG A
2.122	61	>75% Grass cover, Good, HSG B
0.388	98	Water Surface, 0% imp, HSG A
0.166	98	Water Surface, 0% imp, HSG B
11.814	66	Weighted Average
7.742		65.53% Pervious Area
4.072		34.47% Impervious Area

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

Subcatchment 3S: POST 2

Hydrograph



Summary for Subcatchment 6S: POST 1

Runoff = 5.80 cfs @ 12.08 hrs, Volume= 18,451 cf, Depth= 1.40"

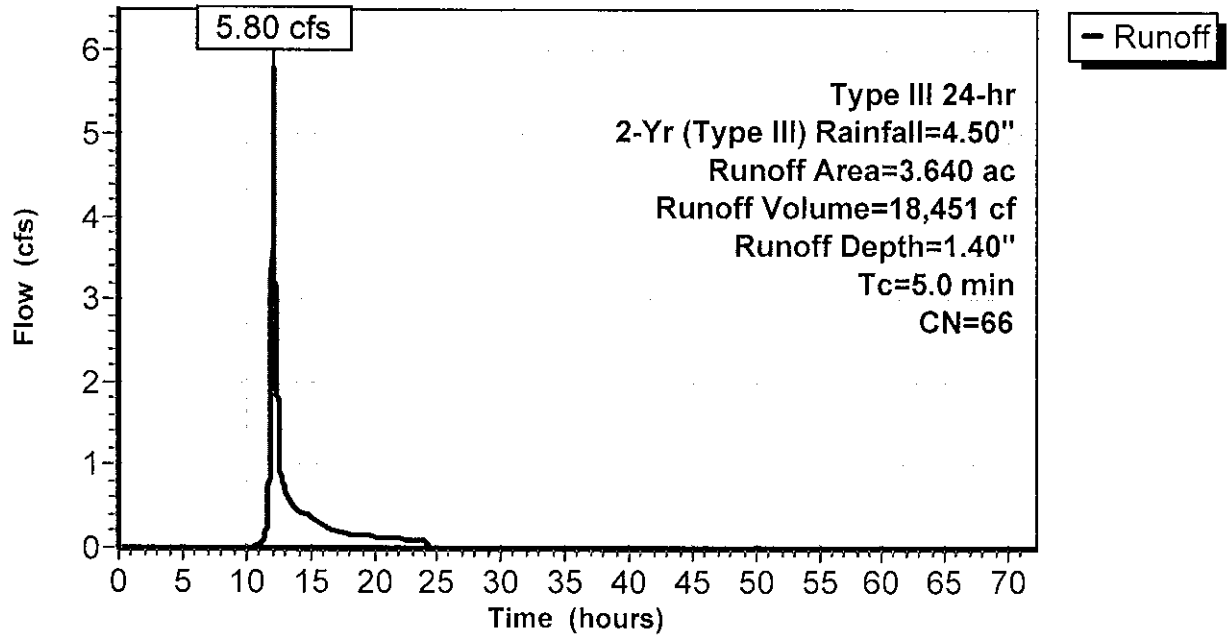
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Yr (Type III) Rainfall=4.50"

Area (ac)	CN	Description
1.030	98	Paved parking, HSG A
0.390	98	Paved parking, HSG B
1.510	39	>75% Grass cover, Good, HSG A
0.710	61	>75% Grass cover, Good, HSG B
3.640	66	Weighted Average
2.220		60.99% Pervious Area
1.420		39.01% Impervious Area

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

Subcatchment 6S: POST 1

Hydrograph



Summary for Pond 6P: Wet Pond 2

Inflow Area = 514,618 sf, 34.47% Impervious, Inflow Depth = 1.40" for 2-Yr (Type III) event
Inflow = 18.84 cfs @ 12.08 hrs, Volume= 59,885 cf
Outflow = 0.39 cfs @ 21.35 hrs, Volume= 52,958 cf, Atten= 98%, Lag= 556.0 min
Primary = 0.39 cfs @ 21.35 hrs, Volume= 52,958 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 33.64' @ 21.35 hrs Surf.Area= 43,724 sf Storage= 44,352 cf

Plug-Flow detention time= 1,264.1 min calculated for 52,958 cf (88% of inflow)
Center-of-Mass det. time= 1,209.3 min (2,073.1 - 863.8)

Volume	Invert	Avail.Storage	Storage Description
#1	32.60'	161,916 cf	**Contours (Prismatic)** Listed below (Recalc)

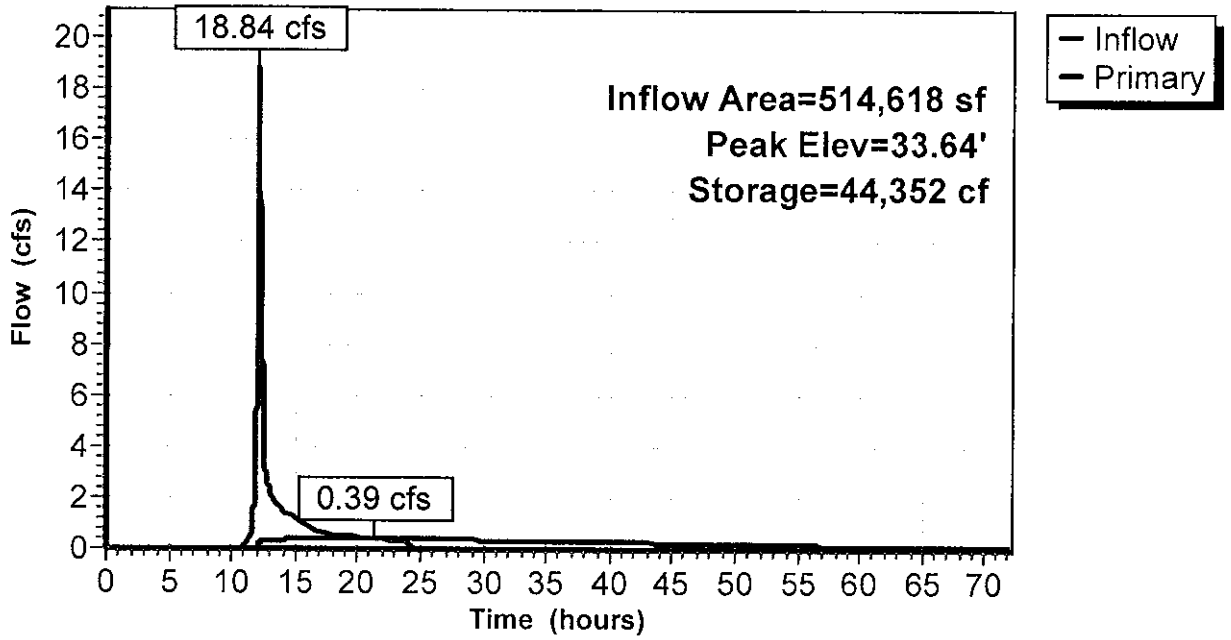
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
32.60	41,970	0	0
33.60	43,380	42,675	42,675
34.00	46,950	18,066	60,741
34.50	48,758	23,927	84,668
35.00	50,575	24,833	109,501
36.00	54,255	52,415	161,916

Device	Routing	Invert	Outlet Devices
#1	Primary	32.45'	**18.0" Round Culvert** L= 47.0' Box, headwall w/3 square edges, Ke= 0.500 Inlet / Outlet Invert= 32.45' / 32.00' S= 0.0096 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Device 1	32.60'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	33.90'	**60.0" W x 7.2" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	34.50'	**48.0" x 48.0" Horiz. Top of Box** C= 0.600 Limited to weir flow at low heads
#5	Primary	35.00'	**Emergency Spillway, C= 2.60** Offset (feet) 0.00 3.00 33.00 36.00 Height (feet) 1.00 0.00 0.00 1.00

Primary OutFlow Max=0.39 cfs @ 21.35 hrs HW=33.64' (Free Discharge)
- **1=Culvert** (Passes 0.39 cfs of 5.19 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 0.39 cfs @ 4.50 fps)
  - **3=Orifice/Grate** (Controls 0.00 cfs)
  - **4=Top of Box** (Controls 0.00 cfs)
- **5=Emergency Spillway** (Controls 0.00 cfs)

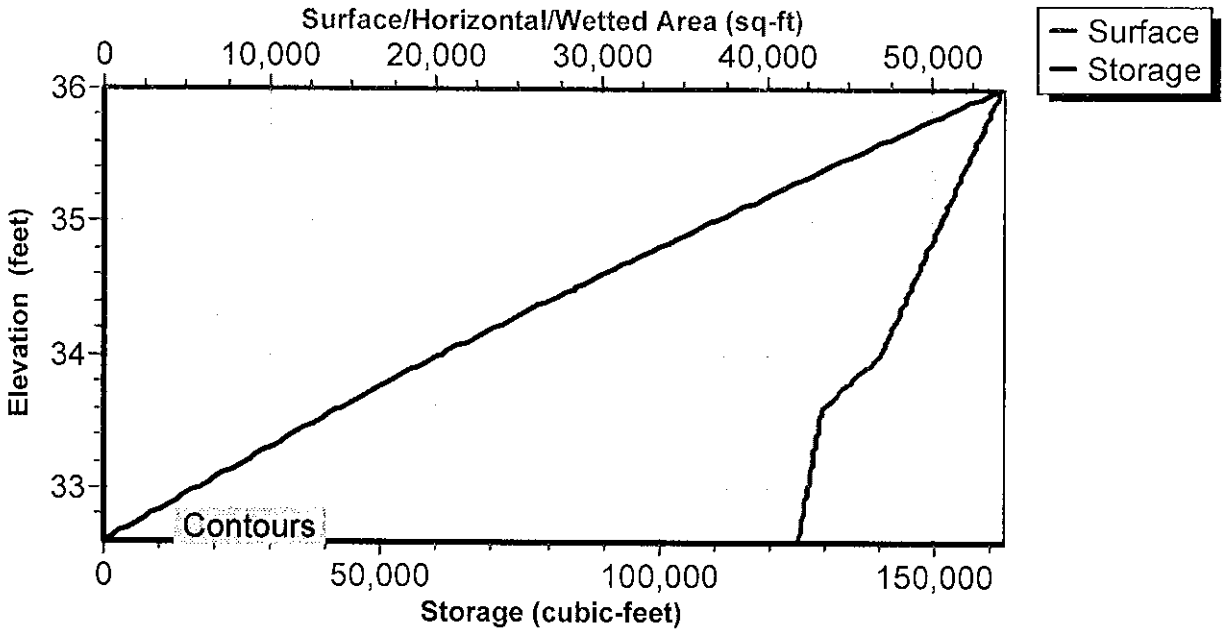
Pond 6P: Wet Pond 2

Hydrograph



Pond 6P: Wet Pond 2

Stage-Area-Storage



Summary for Pond 7P: Wet Pond 1

Inflow Area = 158,558 sf, 39.01% Impervious, Inflow Depth = 1.40" for 2-Yr (Type III) event
Inflow = 5.80 cfs @ 12.08 hrs, Volume= 18,451 cf
Outflow = 0.11 cfs @ 22.35 hrs, Volume= 16,648 cf, Atten= 98%, Lag= 616.3 min
Primary = 0.11 cfs @ 22.35 hrs, Volume= 16,648 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 38.68' @ 22.35 hrs Surf.Area= 12,695 sf Storage= 14,000 cf

Plug-Flow detention time= 1,384.0 min calculated for 16,648 cf (90% of inflow)
Center-of-Mass det. time= 1,336.3 min (2,200.1 - 863.8)

Volume	Invert	Avail.Storage	Storage Description
#1	37.50'	39,360 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

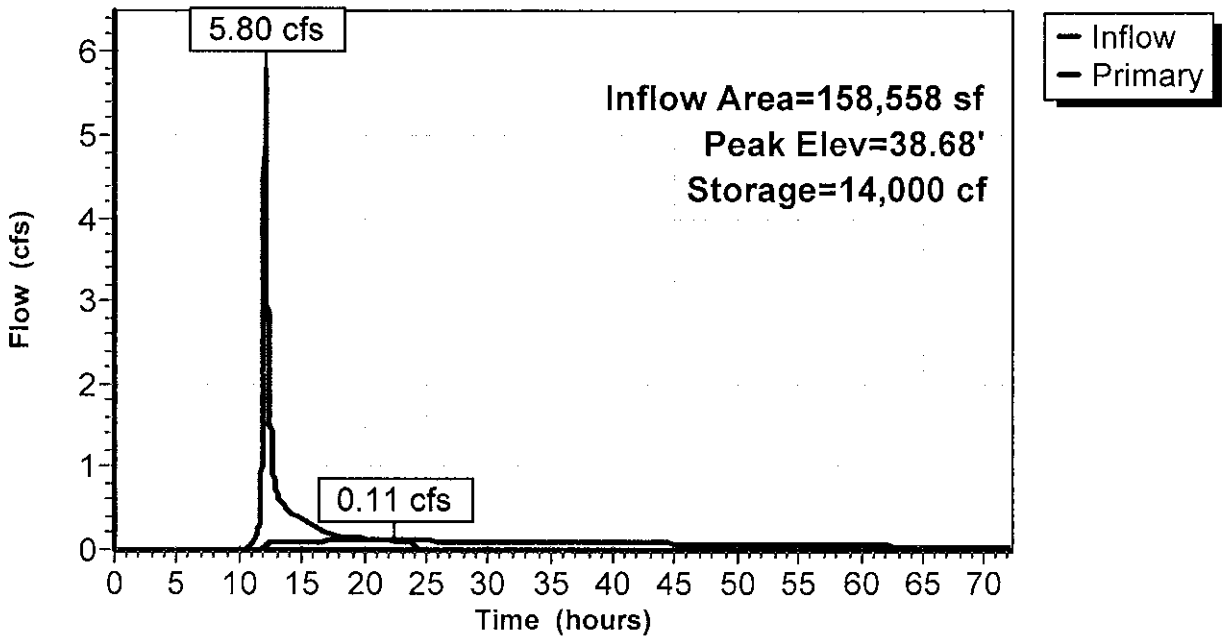
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
37.50	2,485	0	0
37.51	11,210	68	68
38.00	11,830	5,645	5,713
39.00	13,110	12,470	18,183
40.00	14,450	13,780	31,963
40.50	15,135	7,396	39,360

Device	Routing	Invert	Outlet Devices
#1	Primary	37.50'	**15.0" Round Culvert** L= 52.0' Box, headwall w/3 square edges, Ke= 0.500 Inlet / Outlet Invert= 37.50' / 36.98' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.23 sf
#2	Device 1	37.50'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	39.25'	**36.0" x 36.0" Horiz. Top of Box** C= 0.600 Limited to weir flow at low heads
#4	Primary	39.75'	**Emergency Spillway, C= 2.60** Offset (feet) 0.00 2.70 22.70 25.40 Height (feet) 0.90 0.00 0.00 0.90

Primary OutFlow Max=0.11 cfs @ 22.35 hrs HW=38.68' (Free Discharge)
- **1=Culvert** (Passes 0.11 cfs of 4.40 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 0.11 cfs @ 5.03 fps)
  - **3=Top of Box** (Controls 0.00 cfs)
- **4=Emergency Spillway** (Controls 0.00 cfs)

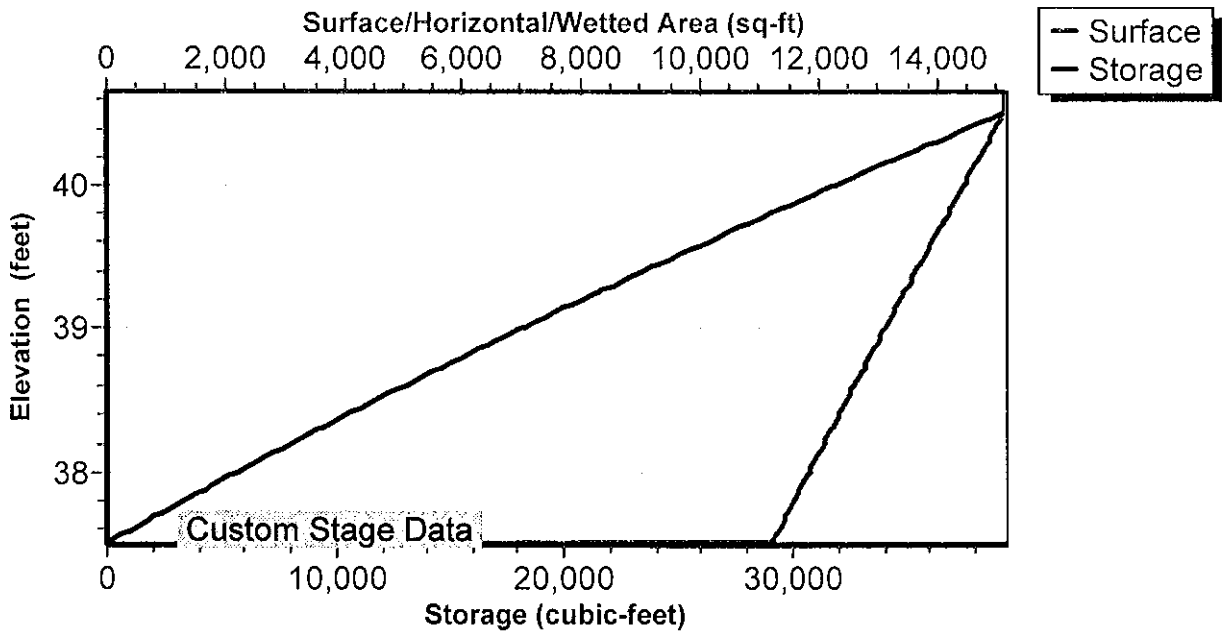
Pond 7P: Wet Pond 1

Hydrograph



Pond 7P: Wet Pond 1

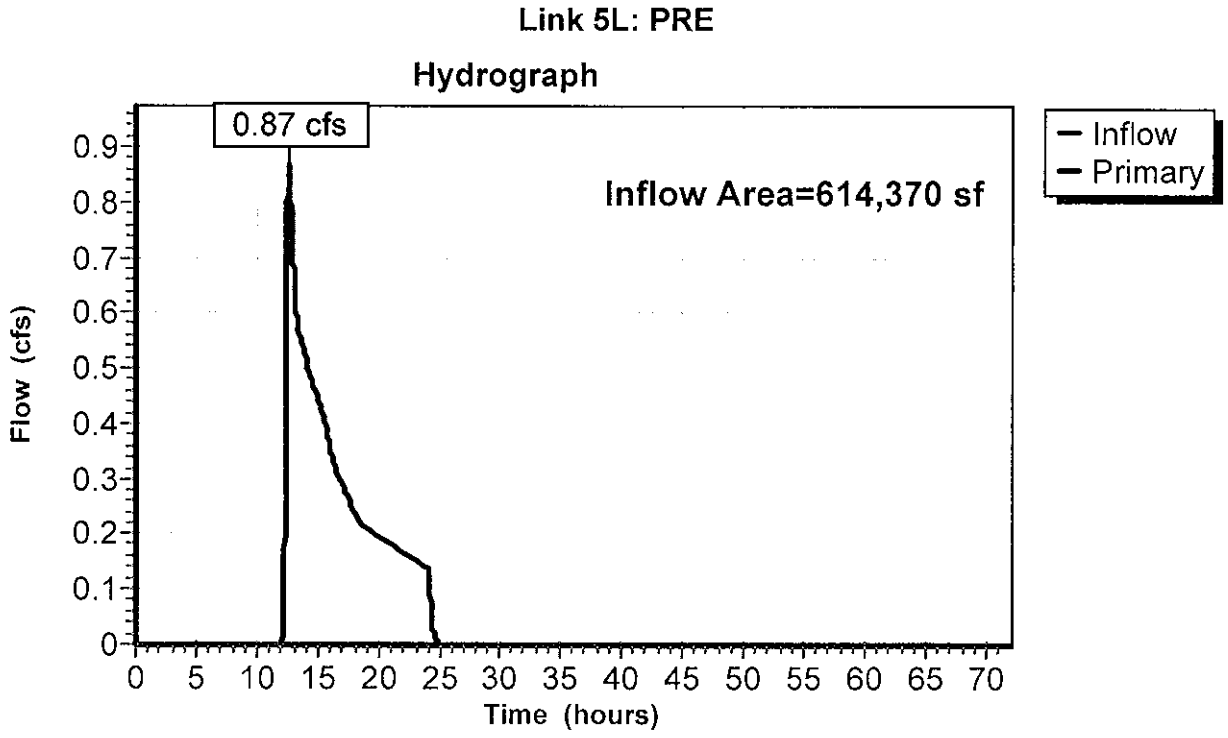
Stage-Area-Storage



Summary for Link 5L: PRE

Inflow Area = 614,370 sf, 0.00% Impervious, Inflow Depth = 0.26" for 2-Yr (Type III) event
Inflow = 0.87 cfs @ 12.66 hrs, Volume= 13,322 cf
Primary = 0.87 cfs @ 12.66 hrs, Volume= 13,322 cf, Atten= 0%, Lag= 0.0 min

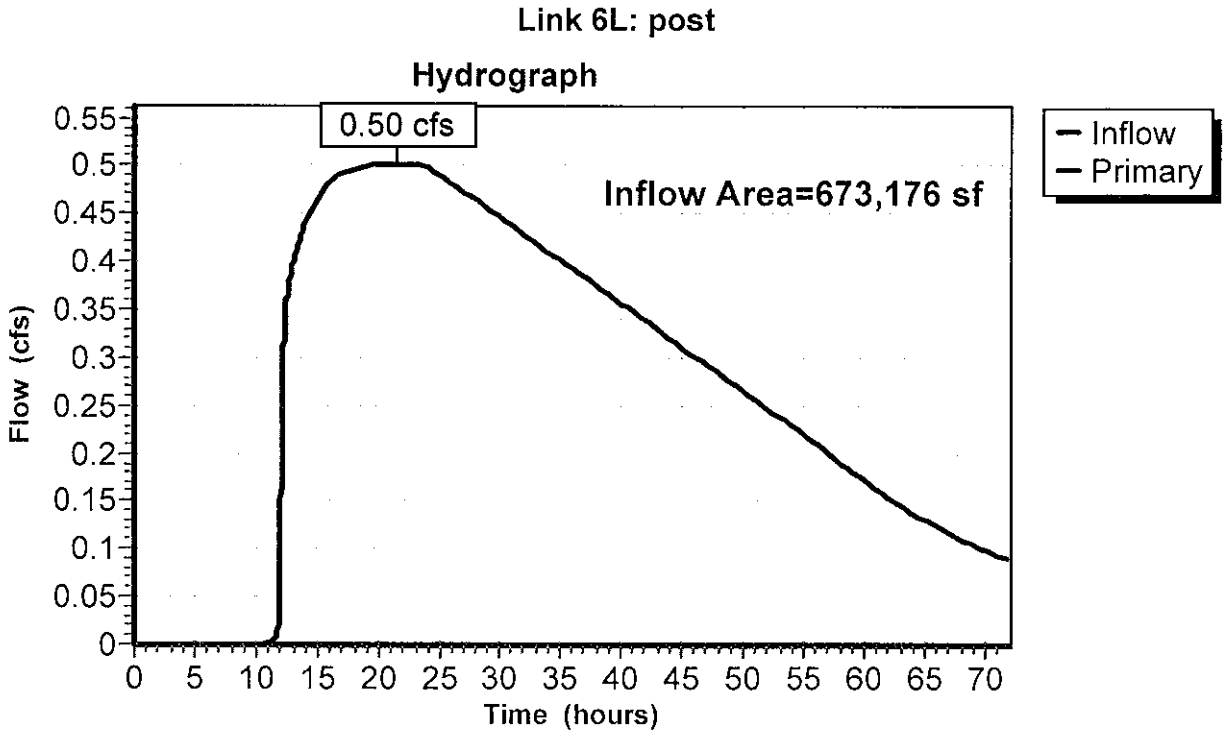
Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs



Summary for Link 6L: post

Inflow Area = 673,176 sf, 35.54% Impervious, Inflow Depth > 1.24" for 2-Yr (Type III) event
Inflow = 0.50 cfs @ 21.54 hrs, Volume= 69,606 cf
Primary = 0.50 cfs @ 21.54 hrs, Volume= 69,606 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs



Summary for Subcatchment 1S: PRE 1

Runoff = 4.08 cfs @ 12.34 hrs, Volume= 24,986 cf, Depth= 1.15"

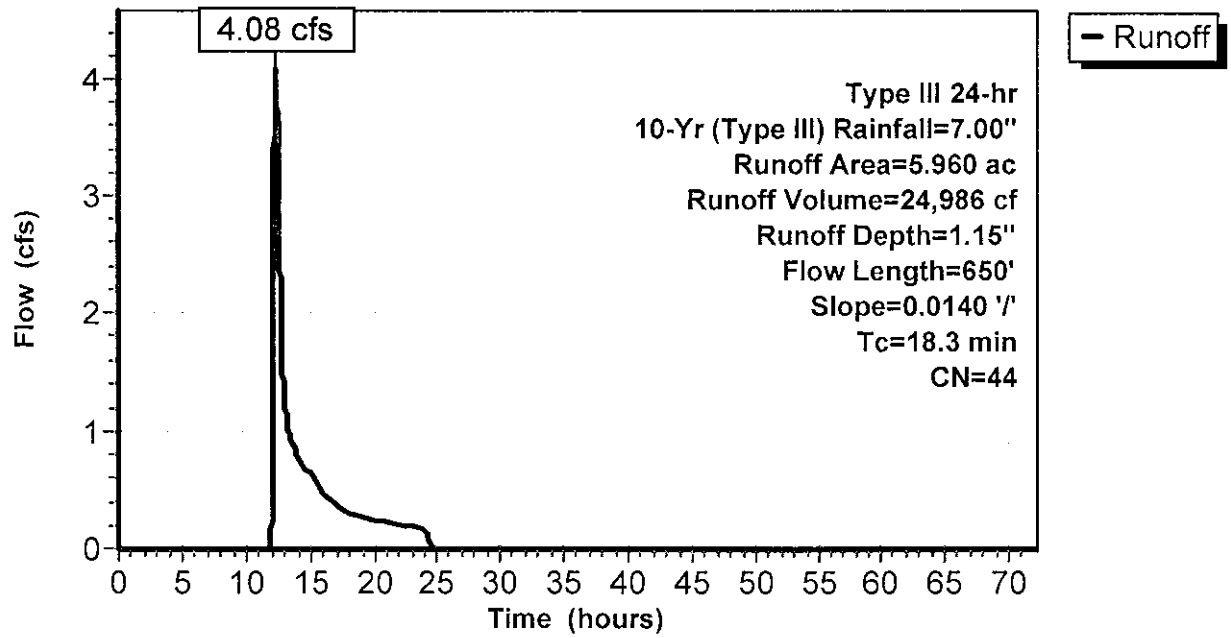
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr (Type III) Rainfall=7.00"

	Area (ac)	CN	Description
*	4.172	39	Woods, Fair, HSG A
*	1.788	55	Woods, Fair, HSG B
	5.960	44	Weighted Average
	5.960		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.3	650	0.0140	0.59		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps

Subcatchment 1S: PRE 1

Hydrograph



Summary for Subcatchment 2S: PRE 2

Runoff = 4.90 cfs @ 12.49 hrs, Volume= 34,141 cf, Depth= 1.15"

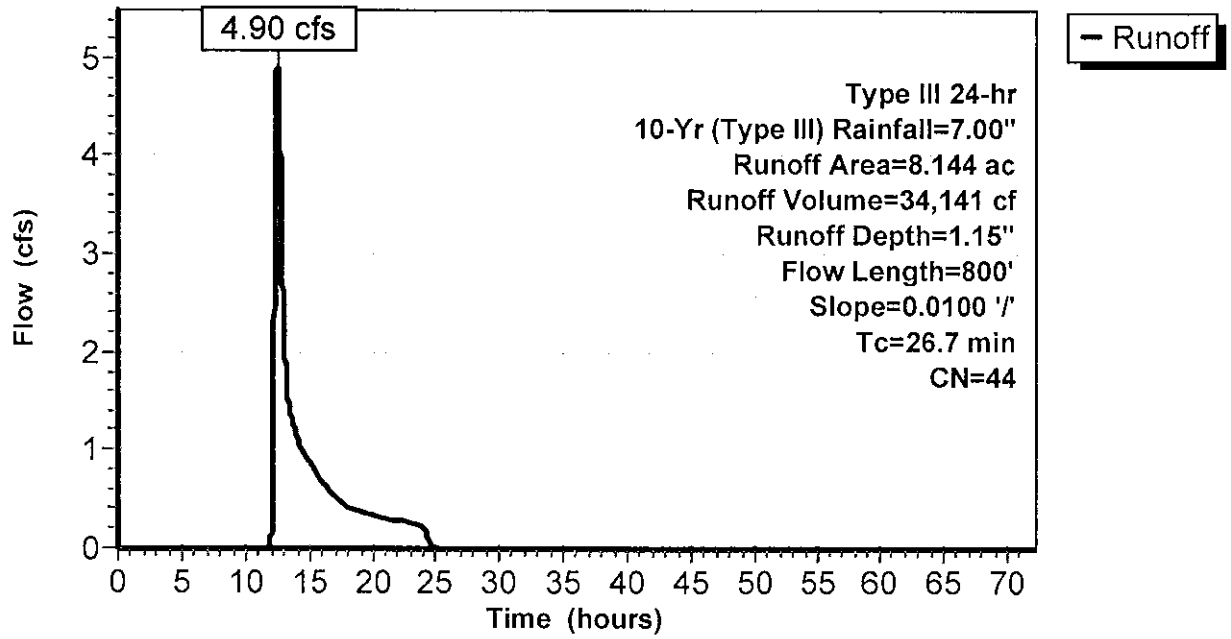
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr (Type III) Rainfall=7.00"

	Area (ac)	CN	Description
*	5.700	39	Woods, Fair, HSG A
*	2.444	55	Woods, Fair, HSG B
	8.144	44	Weighted Average
	8.144		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.7	800	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps

Subcatchment 2S: PRE 2

Hydrograph



Summary for Subcatchment 3S: POST 2

Runoff = 45.71 cfs @ 12.08 hrs, Volume= 137,422 cf, Depth= 3.20"

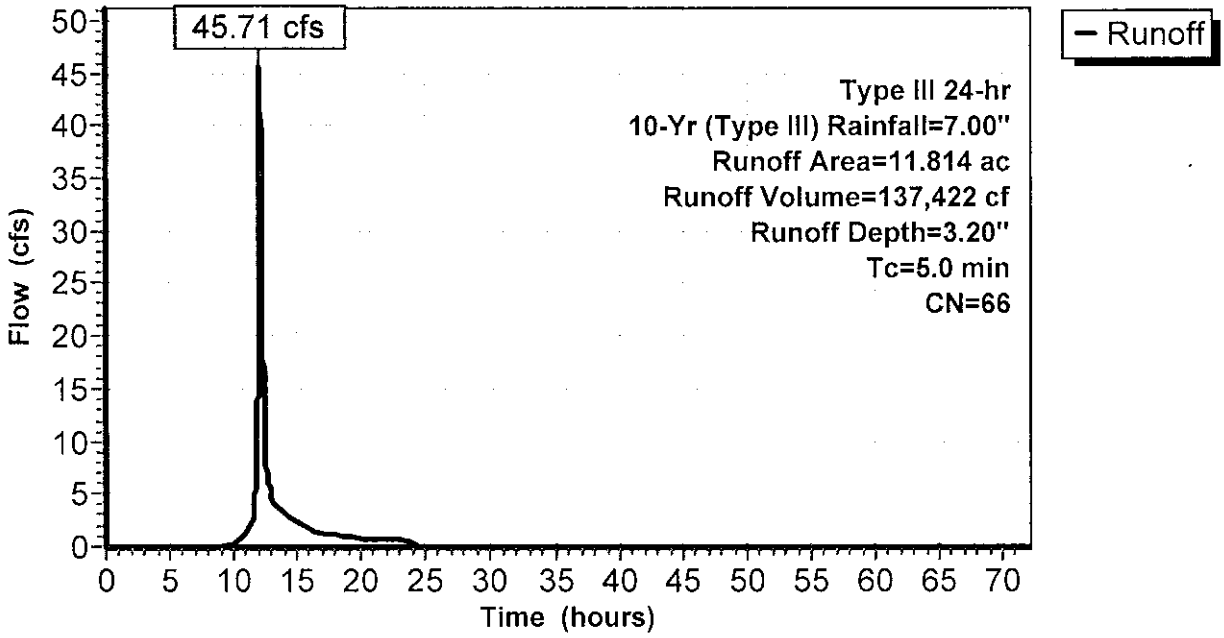
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr (Type III) Rainfall=7.00"

Area (ac)	CN	Description
2.816	98	Paved parking, HSG A
1.256	98	Paved parking, HSG B
5.066	39	>75% Grass cover, Good, HSG A
2.122	61	>75% Grass cover, Good, HSG B
0.388	98	Water Surface, 0% imp, HSG A
0.166	98	Water Surface, 0% imp, HSG B
11.814	66	Weighted Average
7.742		65.53% Pervious Area
4.072		34.47% Impervious Area

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

Subcatchment 3S: POST 2

Hydrograph



Summary for Subcatchment 6S: POST 1

Runoff = 14.08 cfs @ 12.08 hrs, Volume= 42,341 cf, Depth= 3.20"

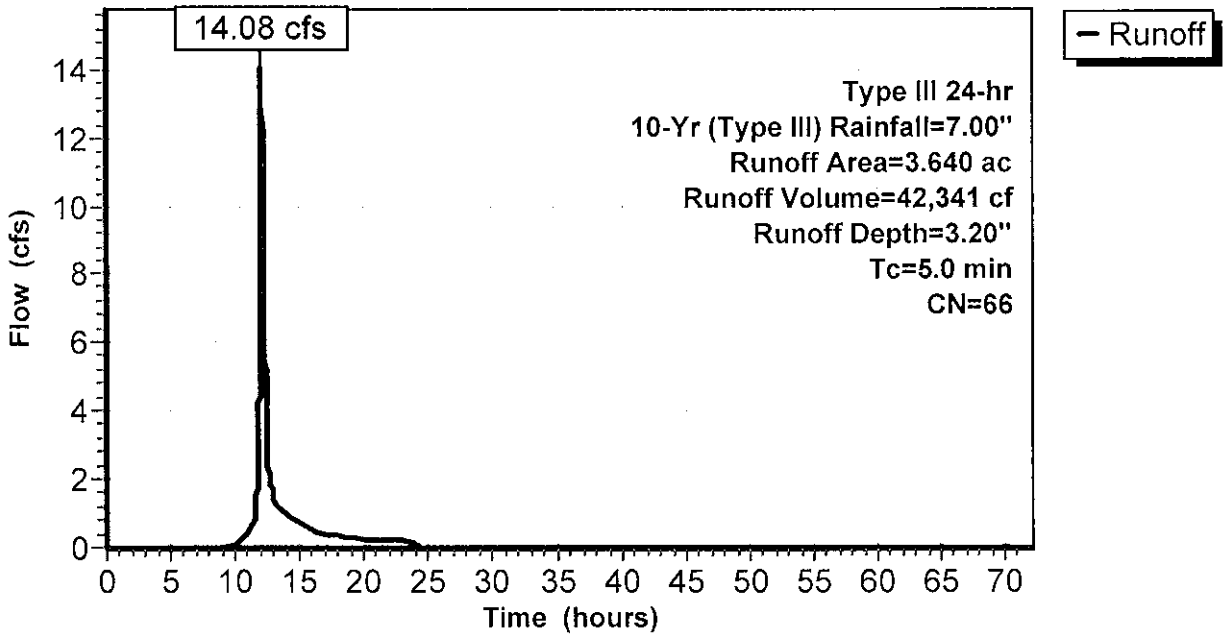
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Yr (Type III) Rainfall=7.00"

Area (ac)	CN	Description
1.030	98	Paved parking, HSG A
0.390	98	Paved parking, HSG B
1.510	39	>75% Grass cover, Good, HSG A
0.710	61	>75% Grass cover, Good, HSG B
3.640	66	Weighted Average
2.220		60.99% Pervious Area
1.420		39.01% Impervious Area

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

Subcatchment 6S: POST 1

Hydrograph



Summary for Pond 6P: Wet Pond 2

Inflow Area = 514,618 sf, 34.47% Impervious, Inflow Depth = 3.20" for 10-Yr (Type III) event
Inflow = 45.71 cfs @ 12.08 hrs, Volume= 137,422 cf
Outflow = 3.92 cfs @ 13.35 hrs, Volume= 127,777 cf, Atten= 91%, Lag= 76.1 min
Primary = 3.92 cfs @ 13.35 hrs, Volume= 127,777 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 34.26' @ 13.35 hrs Surf.Area= 47,874 sf Storage= 72,861 cf

Plug-Flow detention time= 792.1 min calculated for 127,759 cf (93% of inflow)
Center-of-Mass det. time= 756.0 min (1,594.8 - 838.8)

Volume	Invert	Avail.Storage	Storage Description
#1	32.60'	161,916 cf	**Contours (Prismatic)**Listed below (Recalc)

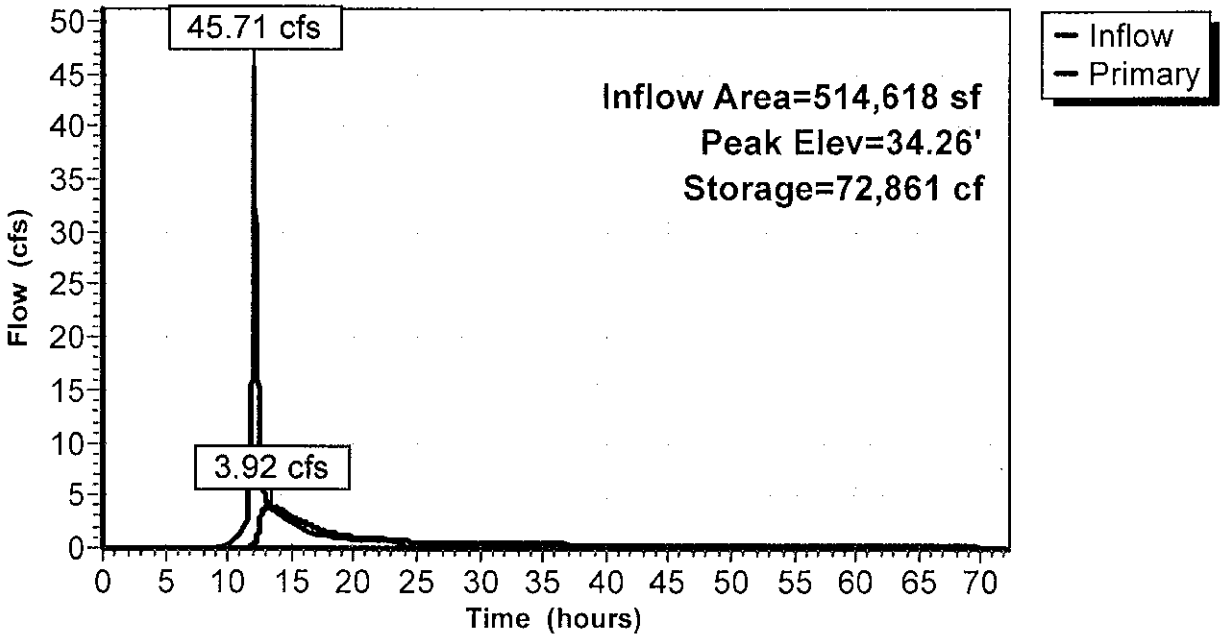
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
32.60	41,970	0	0
33.60	43,380	42,675	42,675
34.00	46,950	18,066	60,741
34.50	48,758	23,927	84,668
35.00	50,575	24,833	109,501
36.00	54,255	52,415	161,916

Device	Routing	Invert	Outlet Devices
#1	Primary	32.45'	**18.0" Round Culvert** L= 47.0' Box, headwall w/3 square edges, Ke= 0.500 Inlet / Outlet Invert= 32.45' / 32.00' S= 0.0096 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Device 1	32.60'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	33.90'	**60.0" W x 7.2" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	34.50'	**48.0" x 48.0" Horiz. Top of Box** C= 0.600 Limited to weir flow at low heads
#5	Primary	35.00'	**Emergency Spillway, C= 2.60** Offset (feet) 0.00 3.00 33.00 36.00 Height (feet) 1.00 0.00 0.00 1.00

Primary OutFlow Max=3.92 cfs @ 13.35 hrs HW=34.26' (Free Discharge)
- **1=Culvert** (Passes 3.92 cfs of 8.74 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 0.51 cfs @ 5.88 fps)
  - **3=Orifice/Grate** (Orifice Controls 3.40 cfs @ 1.91 fps)
  - **4=Top of Box** (Controls 0.00 cfs)
- **5=Emergency Spillway** (Controls 0.00 cfs)

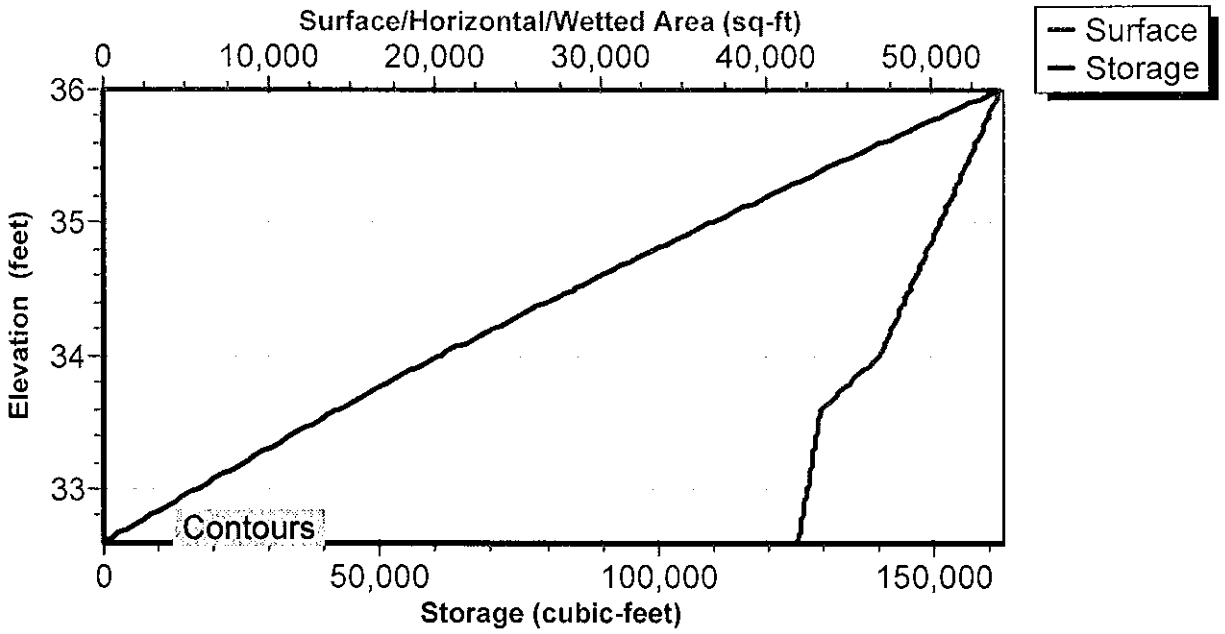
Pond 6P: Wet Pond 2

Hydrograph



Pond 6P: Wet Pond 2

Stage-Area-Storage



Summary for Pond 7P: Wet Pond 1

Inflow Area = 158,558 sf, 39.01% Impervious, Inflow Depth = 3.20" for 10-Yr (Type III) event
Inflow = 14.08 cfs @ 12.08 hrs, Volume= 42,341 cf
Outflow = 1.39 cfs @ 13.03 hrs, Volume= 37,741 cf, Atten= 90%, Lag= 56.9 min
Primary = 1.39 cfs @ 13.03 hrs, Volume= 37,741 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 39.35' @ 13.03 hrs Surf.Area= 13,579 sf Storage= 22,854 cf

Plug-Flow detention time= 965.8 min calculated for 37,741 cf (89% of inflow)
Center-of-Mass det. time= 913.9 min (1,752.6 - 838.8)

Volume	Invert	Avail.Storage	Storage Description
#1	37.50'	39,360 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

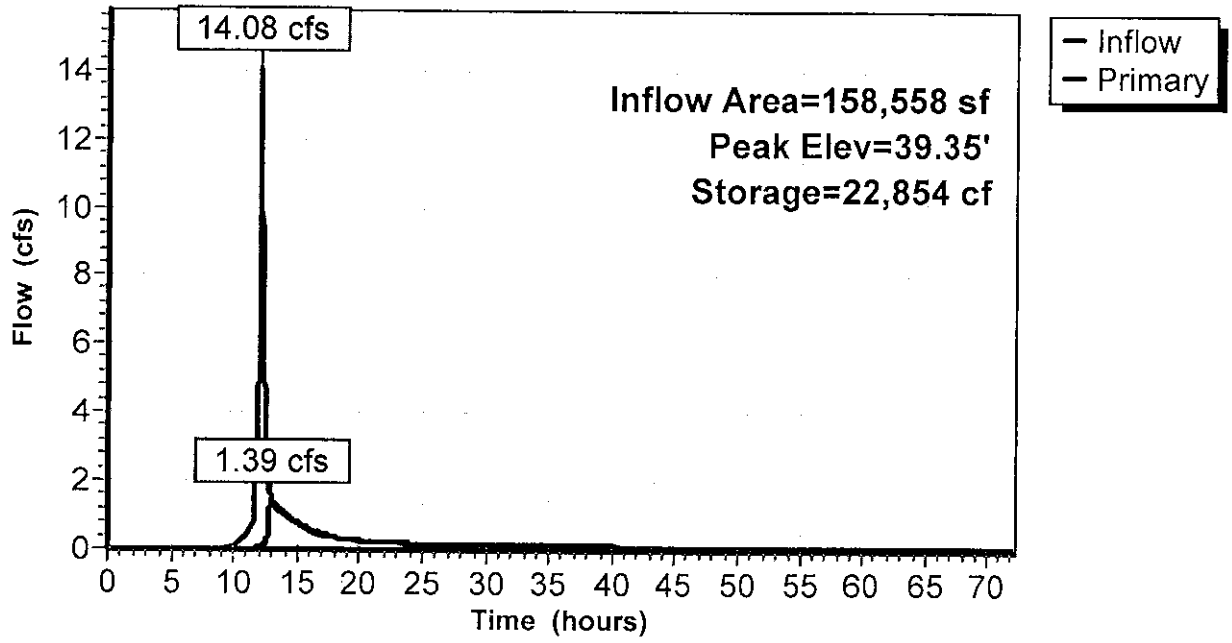
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
37.50	2,485	0	0
37.51	11,210	68	68
38.00	11,830	5,645	5,713
39.00	13,110	12,470	18,183
40.00	14,450	13,780	31,963
40.50	15,135	7,396	39,360

Device	Routing	Invert	Outlet Devices
#1	Primary	37.50'	**15.0" Round Culvert** L= 52.0' Box, headwall w/3 square edges, Ke= 0.500 Inlet / Outlet Invert= 37.50' / 36.98' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.23 sf
#2	Device 1	37.50'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	39.25'	**36.0" x 36.0" Horiz. Top of Box** C= 0.600 Limited to weir flow at low heads
#4	Primary	39.75'	**Emergency Spillway, C= 2.60** Offset (feet) 0.00 2.70 22.70 25.40 Height (feet) 0.90 0.00 0.00 0.90

Primary OutFlow Max=1.38 cfs @ 13.03 hrs HW=39.35' (Free Discharge)
- **1=Culvert** (Passes 1.38 cfs of 6.54 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 0.14 cfs @ 6.40 fps)
  - **3=Top of Box** (Weir Controls 1.24 cfs @ 1.03 fps)
- **4=Emergency Spillway** (Controls 0.00 cfs)

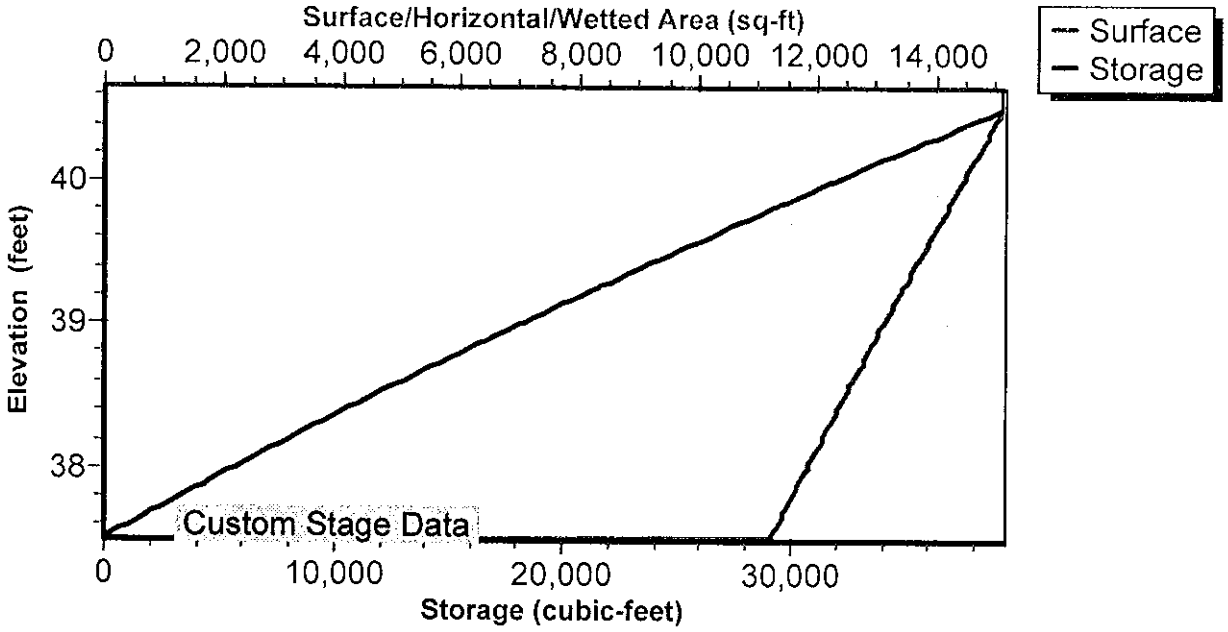
Pond 7P: Wet Pond 1

Hydrograph



Pond 7P: Wet Pond 1

Stage-Area-Storage



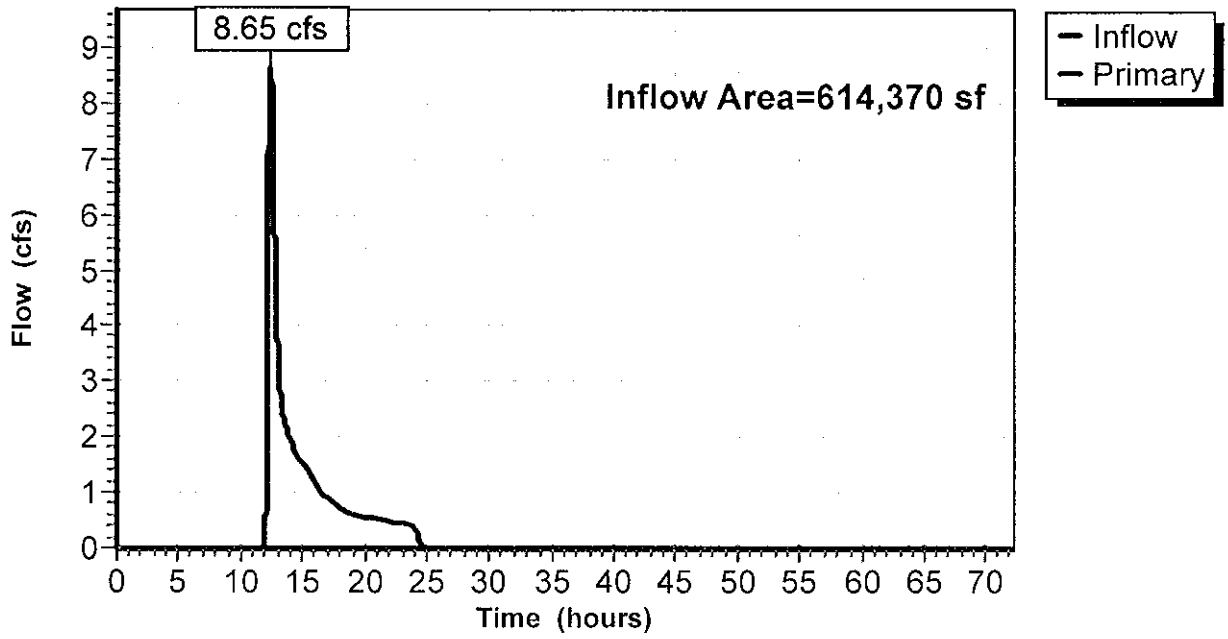
Summary for Link 5L: PRE

Inflow Area = 614,370 sf, 0.00% Impervious, Inflow Depth = 1.15" for 10-Yr (Type III) event
Inflow = 8.65 cfs @ 12.43 hrs, Volume= 59,127 cf
Primary = 8.65 cfs @ 12.43 hrs, Volume= 59,127 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 5L: PRE

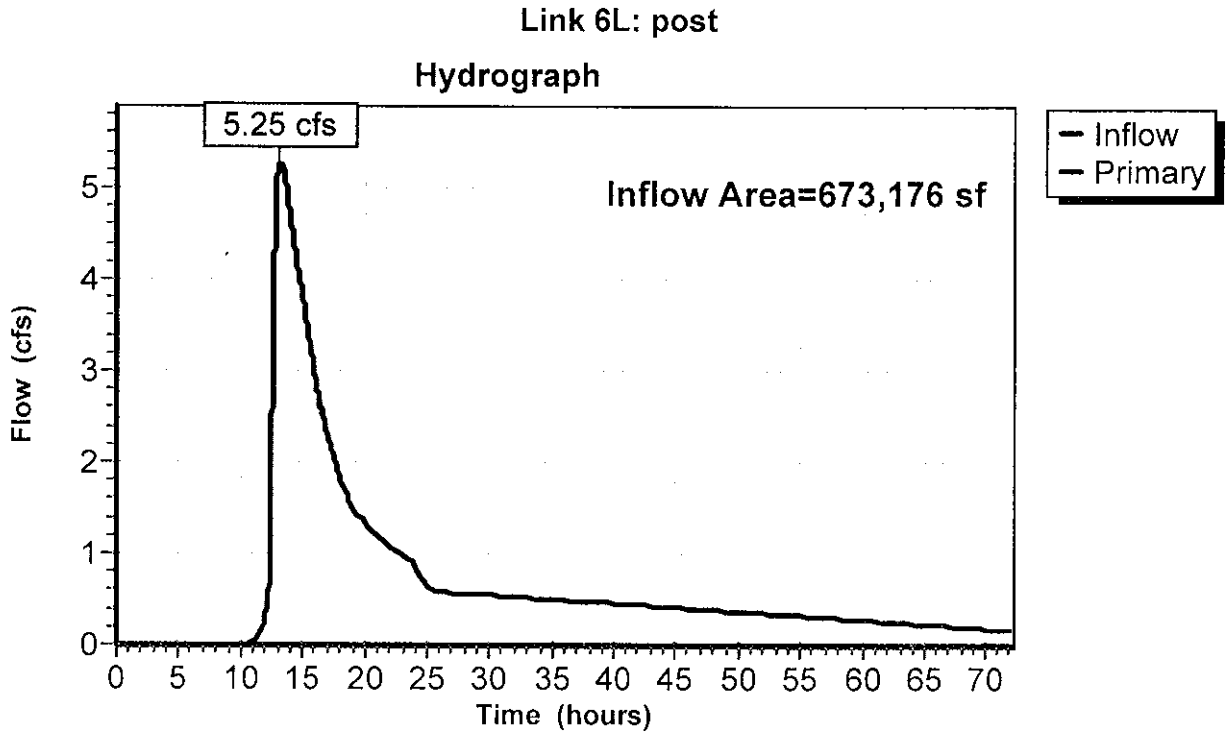
Hydrograph



Summary for Link 6L: post

Inflow Area = 673,176 sf, 35.54% Impervious, Inflow Depth > 2.95" for 10-Yr (Type III) event
Inflow = 5.25 cfs @ 13.13 hrs, Volume= 165,518 cf
Primary = 5.25 cfs @ 13.13 hrs, Volume= 165,518 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs



Summary for Subcatchment 1S: PRE 1

Runoff = 6.61 cfs @ 12.30 hrs, Volume= 35,956 cf, Depth= 1.66"

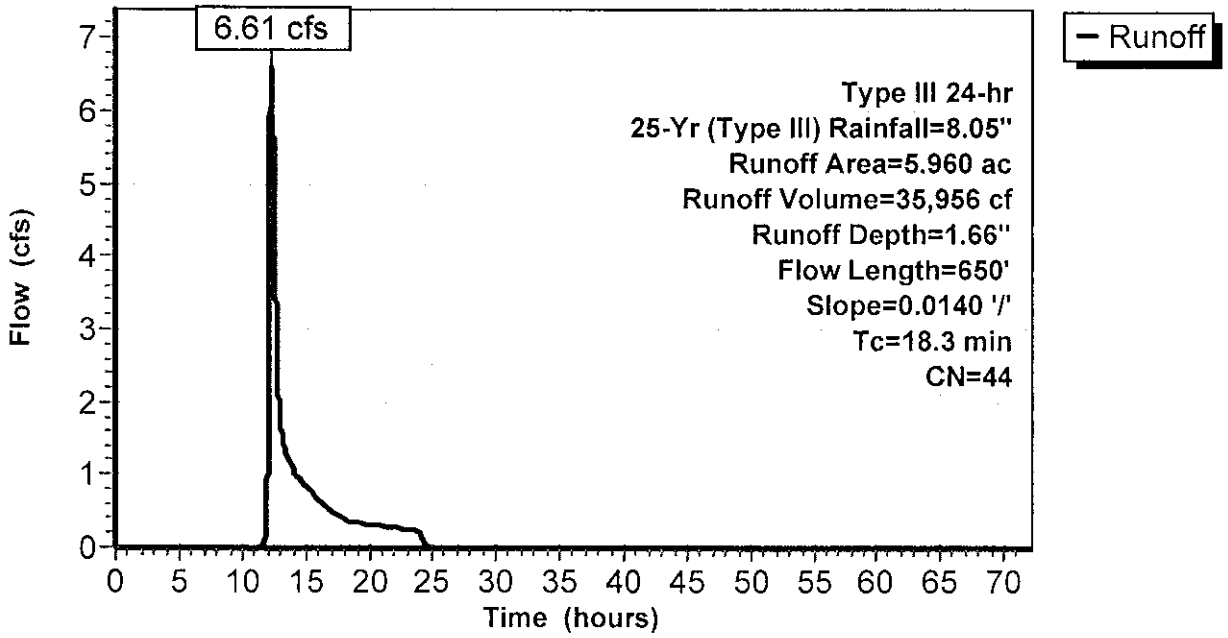
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr (Type III) Rainfall=8.05"

	Area (ac)	CN	Description
*	4.172	39	Woods, Fair, HSG A
*	1.788	55	Woods, Fair, HSG B
	5.960	44	Weighted Average
	5.960		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.3	650	0.0140	0.59		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps

Subcatchment 1S: PRE 1

Hydrograph



Summary for Subcatchment 2S: PRE 2

Runoff = 7.81 cfs @ 12.44 hrs, Volume= 49,131 cf, Depth= 1.66"

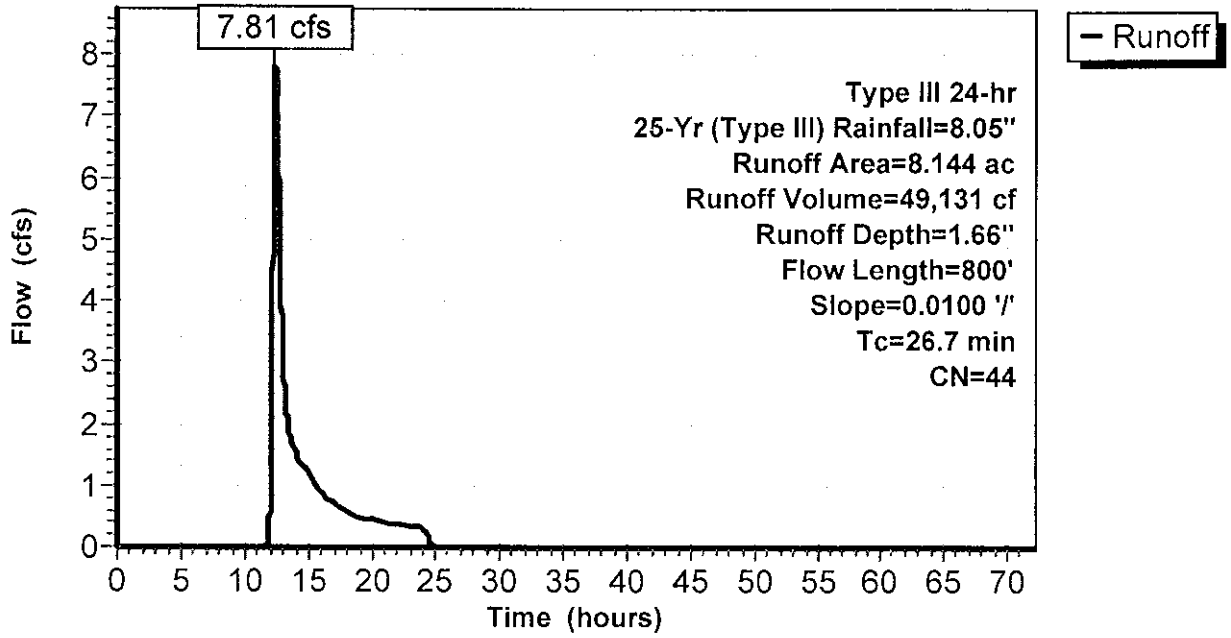
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr (Type III) Rainfall=8.05"

	Area (ac)	CN	Description
*	5.700	39	Woods, Fair, HSG A
*	2.444	55	Woods, Fair, HSG B
	8.144	44	Weighted Average
	8.144		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.7	800	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps

Subcatchment 2S: PRE 2

Hydrograph



Summary for Subcatchment 3S: POST 2

Runoff = 58.05 cfs @ 12.08 hrs, Volume= 173,623 cf, Depth= 4.05"

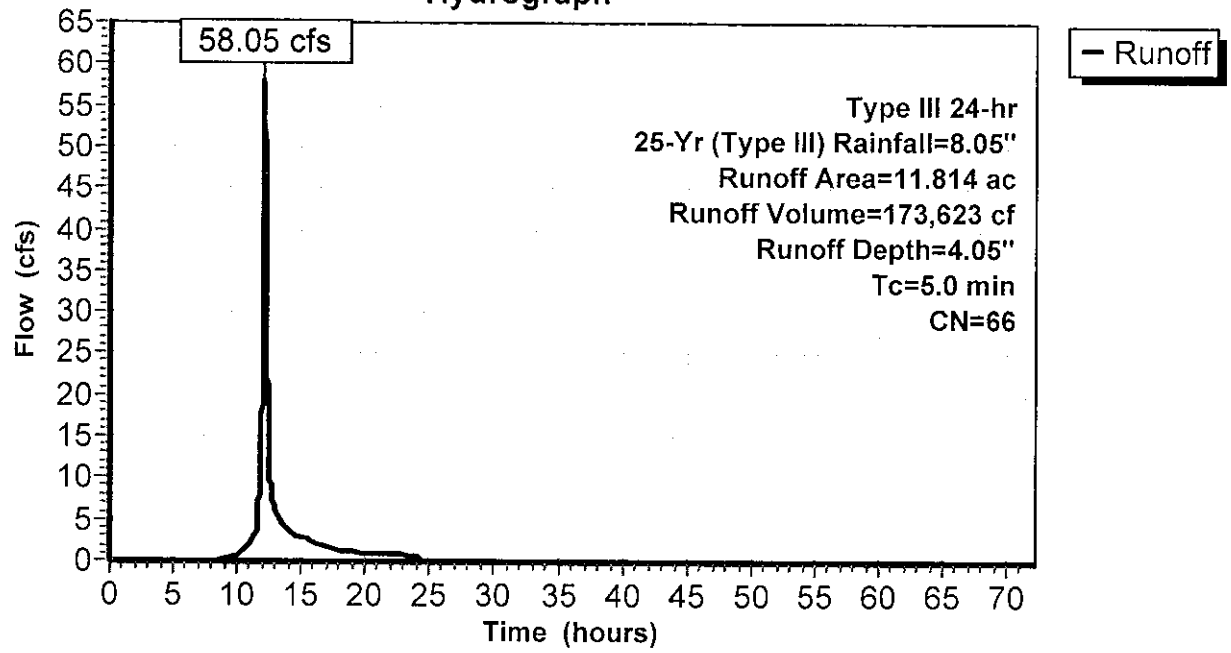
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr (Type III) Rainfall=8.05"

Area (ac)	CN	Description
2.816	98	Paved parking, HSG A
1.256	98	Paved parking, HSG B
5.066	39	>75% Grass cover, Good, HSG A
2.122	61	>75% Grass cover, Good, HSG B
0.388	98	Water Surface, 0% imp, HSG A
0.166	98	Water Surface, 0% imp, HSG B
11.814	66	Weighted Average
7.742		65.53% Pervious Area
4.072		34.47% Impervious Area

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

Subcatchment 3S: POST 2

Hydrograph



Summary for Subcatchment 6S: POST 1

Runoff = 17.89 cfs @ 12.08 hrs, Volume= 53,495 cf, Depth= 4.05"

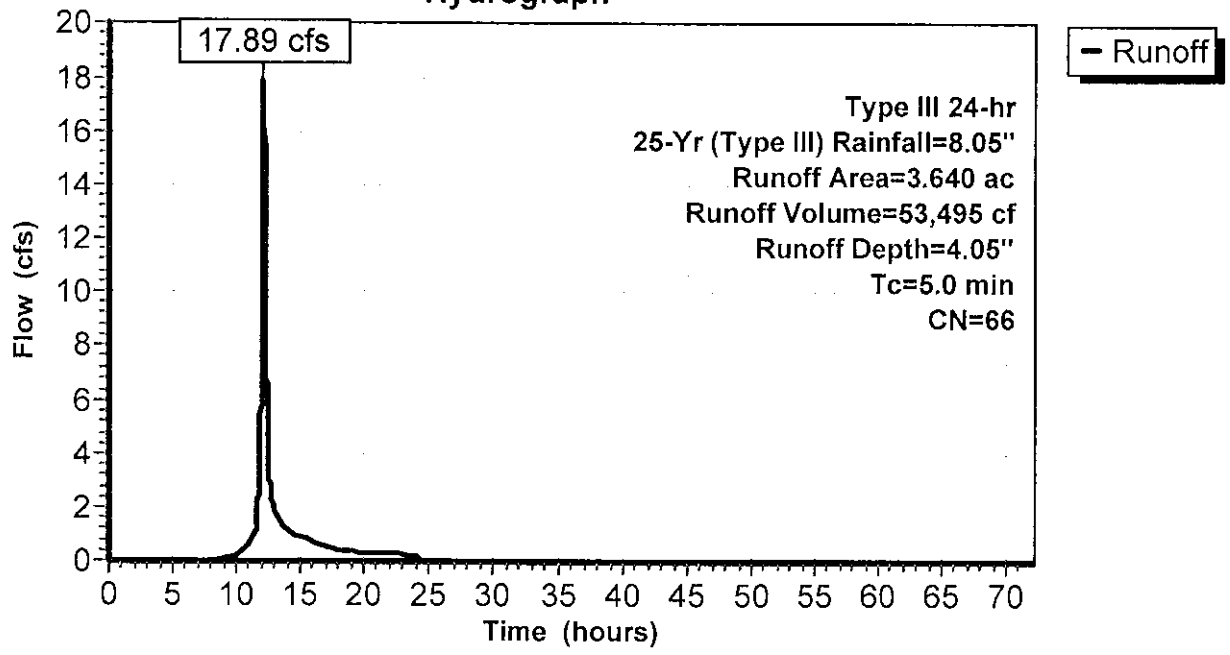
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Yr (Type III) Rainfall=8.05"

Area (ac)	CN	Description
1.030	98	Paved parking, HSG A
0.390	98	Paved parking, HSG B
1.510	39	>75% Grass cover, Good, HSG A
0.710	61	>75% Grass cover, Good, HSG B
3.640	66	Weighted Average
2.220		60.99% Pervious Area
1.420		39.01% Impervious Area

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

Subcatchment 6S: POST 1

Hydrograph



Summary for Pond 6P: Wet Pond 2

Inflow Area = 514,618 sf, 34.47% Impervious, Inflow Depth = 4.05" for 25-Yr (Type III) event
Inflow = 58.05 cfs @ 12.08 hrs, Volume= 173,623 cf
Outflow = 7.99 cfs @ 12.64 hrs, Volume= 163,856 cf, Atten= 86%, Lag= 33.9 min
Primary = 7.99 cfs @ 12.64 hrs, Volume= 163,856 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 34.50' @ 12.64 hrs Surf.Area= 48,753 sf Storage= 84,603 cf

Plug-Flow detention time= 638.9 min calculated for 163,856 cf (94% of inflow)
Center-of-Mass det. time= 608.7 min (1,440.7 - 832.0)

Volume	Invert	Avail.Storage	Storage Description
#1	32.60'	161,916 cf	**Contours (Prismatic)**Listed below (Recalc)

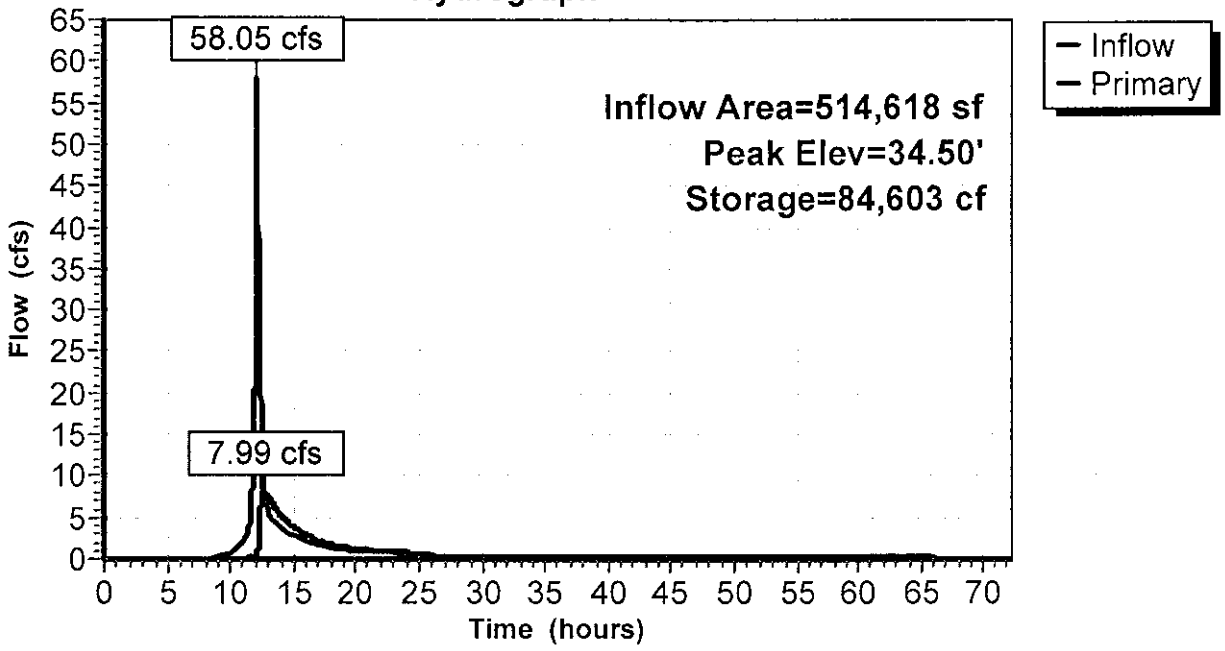
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
32.60	41,970	0	0
33.60	43,380	42,675	42,675
34.00	46,950	18,066	60,741
34.50	48,758	23,927	84,668
35.00	50,575	24,833	109,501
36.00	54,255	52,415	161,916

Device	Routing	Invert	Outlet Devices
#1	Primary	32.45'	**18.0" Round Culvert** L= 47.0' Box, headwall w/3 square edges, Ke= 0.500 Inlet / Outlet Invert= 32.45' / 32.00' S= 0.0096 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Device 1	32.60'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	33.90'	**60.0" W x 7.2" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	34.50'	**48.0" x 48.0" Horiz. Top of Box** C= 0.600 Limited to weir flow at low heads
#5	Primary	35.00'	**Emergency Spillway, C= 2.60** Offset (feet) 0.00 3.00 33.00 36.00 Height (feet) 1.00 0.00 0.00 1.00

Primary OutFlow Max=7.99 cfs @ 12.64 hrs HW=34.50' (Free Discharge)
- **1=Culvert** (Passes 7.99 cfs of 9.49 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 0.55 cfs @ 6.34 fps)
  - **3=Orifice/Grate** (Orifice Controls 7.43 cfs @ 2.48 fps)
  - **4=Top of Box** (Controls 0.00 cfs)
- **5=Emergency Spillway** (Controls 0.00 cfs)

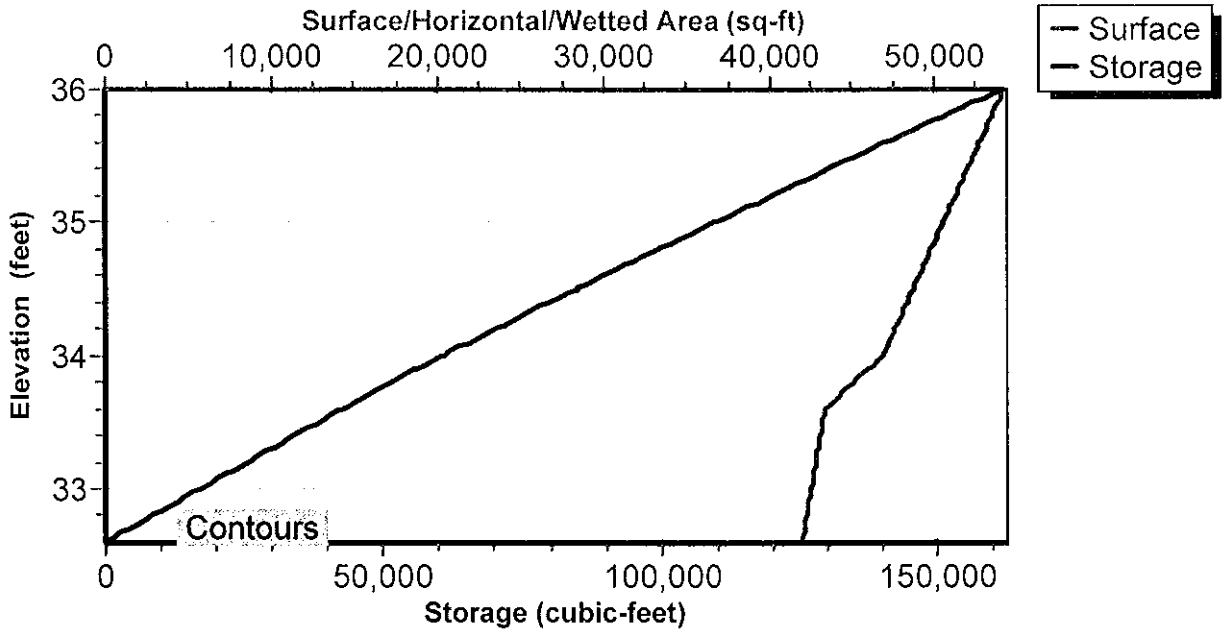
Pond 6P: Wet Pond 2

Hydrograph



Pond 6P: Wet Pond 2

Stage-Area-Storage



Summary for Pond 7P: Wet Pond 1

Inflow Area = 158,558 sf, 39.01% Impervious, Inflow Depth = 4.05" for 25-Yr (Type III) event
Inflow = 17.89 cfs @ 12.08 hrs, Volume= 53,495 cf
Outflow = 4.49 cfs @ 12.47 hrs, Volume= 48,876 cf, Atten= 75%, Lag= 23.7 min
Primary = 4.49 cfs @ 12.47 hrs, Volume= 48,876 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 39.48' @ 12.47 hrs Surf.Area= 13,754 sf Storage= 24,638 cf

Plug-Flow detention time= 756.7 min calculated for 48,876 cf (91% of inflow)
Center-of-Mass det. time= 713.4 min (1,545.4 - 832.0)

Volume	Invert	Avail.Storage	Storage Description
#1	37.50'	39,360 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

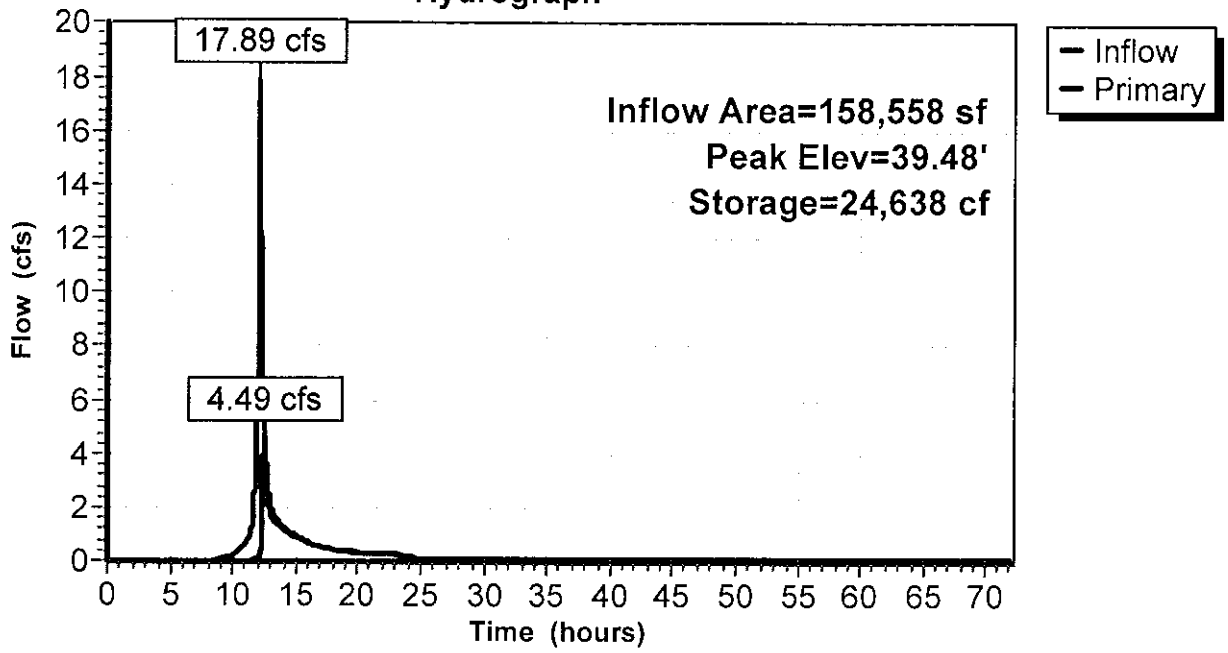
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
37.50	2,485	0	0
37.51	11,210	68	68
38.00	11,830	5,645	5,713
39.00	13,110	12,470	18,183
40.00	14,450	13,780	31,963
40.50	15,135	7,396	39,360

Device	Routing	Invert	Outlet Devices
#1	Primary	37.50'	**15.0" Round Culvert** L= 52.0' Box, headwall w/3 square edges, Ke= 0.500 Inlet / Outlet Invert= 37.50' / 36.98' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.23 sf
#2	Device 1	37.50'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	39.25'	**36.0" x 36.0" Horiz. Top of Box** C= 0.600 Limited to weir flow at low heads
#4	Primary	39.75'	**Emergency Spillway, C= 2.60** Offset (feet) 0.00 2.70 22.70 25.40 Height (feet) 0.90 0.00 0.00 0.90

Primary OutFlow Max=4.49 cfs @ 12.47 hrs HW=39.48' (Free Discharge)
- **1=Culvert** (Passes 4.49 cfs of 6.88 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 0.14 cfs @ 6.63 fps)
  - **3=Top of Box** (Weir Controls 4.34 cfs @ 1.57 fps)
- **4=Emergency Spillway** (Controls 0.00 cfs)

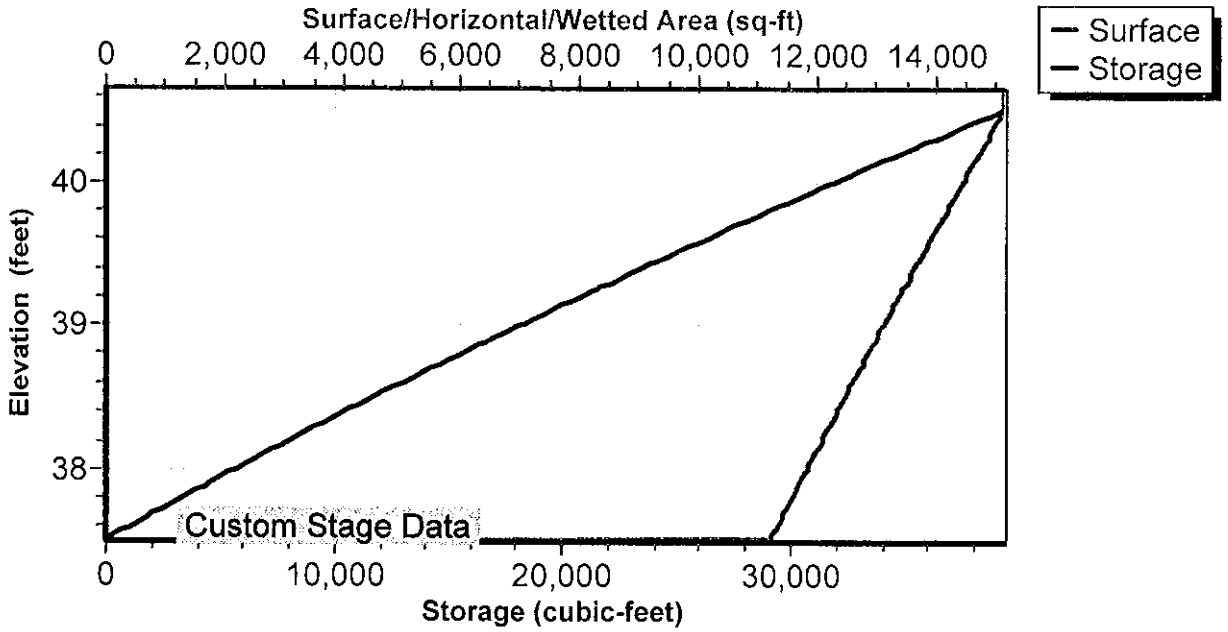
Pond 7P: Wet Pond 1

Hydrograph



Pond 7P: Wet Pond 1

Stage-Area-Storage



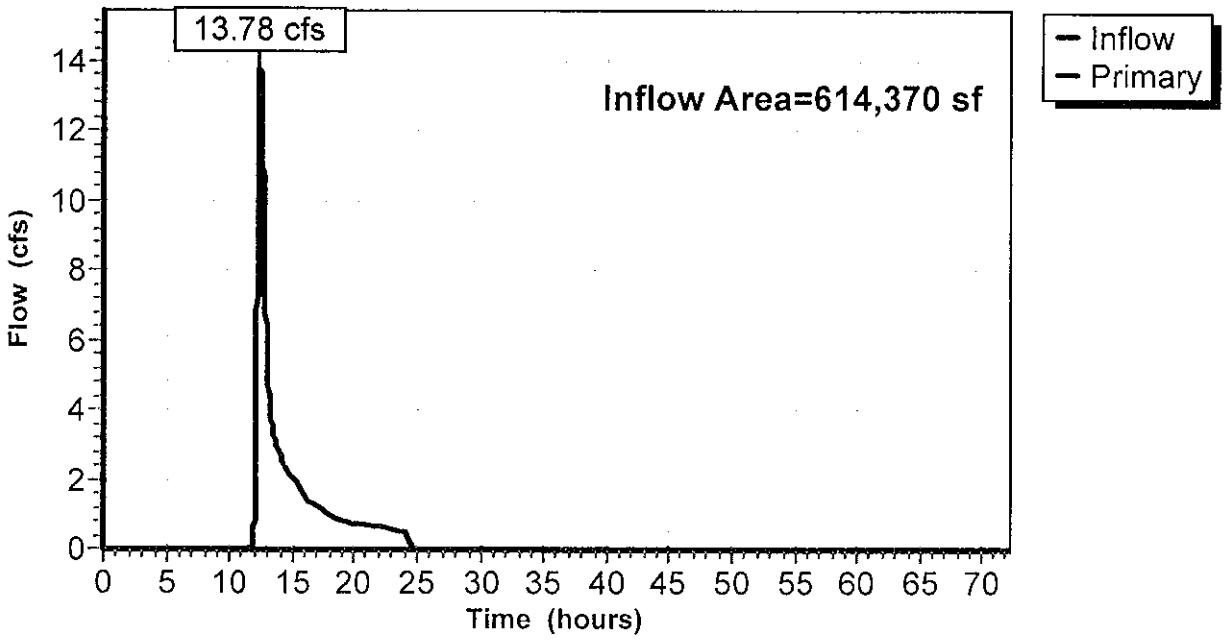
Summary for Link 5L: PRE

Inflow Area = 614,370 sf, 0.00% Impervious, Inflow Depth = 1.66" for 25-Yr (Type III) event
Inflow = 13.78 cfs @ 12.38 hrs, Volume= 85,087 cf
Primary = 13.78 cfs @ 12.38 hrs, Volume= 85,087 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 5L: PRE

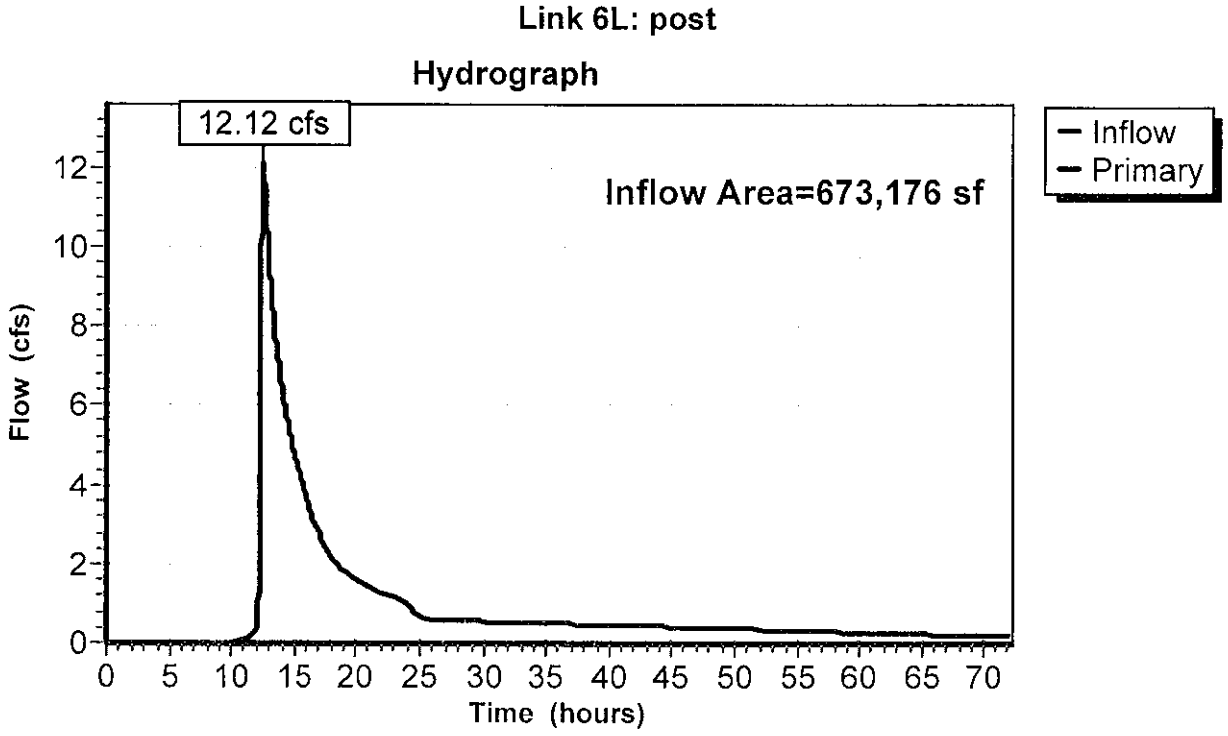
Hydrograph



Summary for Link 6L: post

Inflow Area = 673,176 sf, 35.54% Impervious, Inflow Depth > 3.79" for 25-Yr (Type III) event
Inflow = 12.12 cfs @ 12.52 hrs, Volume= 212,732 cf
Primary = 12.12 cfs @ 12.52 hrs, Volume= 212,732 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs



Summary for Subcatchment 1S: PRE 1

Runoff = 9.18 cfs @ 12.29 hrs, Volume= 46,989 cf, Depth= 2.17"

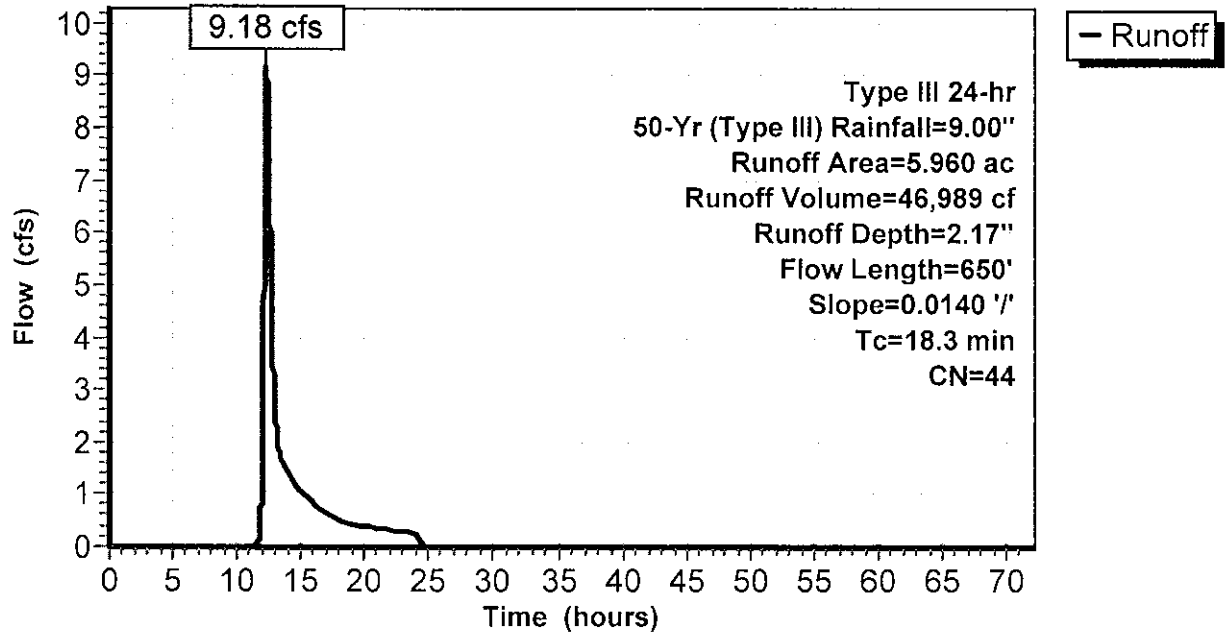
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Yr (Type III) Rainfall=9.00"

	Area (ac)	CN	Description
*	4.172	39	Woods, Fair, HSG A
*	1.788	55	Woods, Fair, HSG B
	5.960	44	Weighted Average
	5.960		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.3	650	0.0140	0.59		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps

Subcatchment 1S: PRE 1

Hydrograph



Summary for Subcatchment 2S: PRE 2

Runoff = 10.82 cfs @ 12.43 hrs, Volume= 64,208 cf, Depth= 2.17"

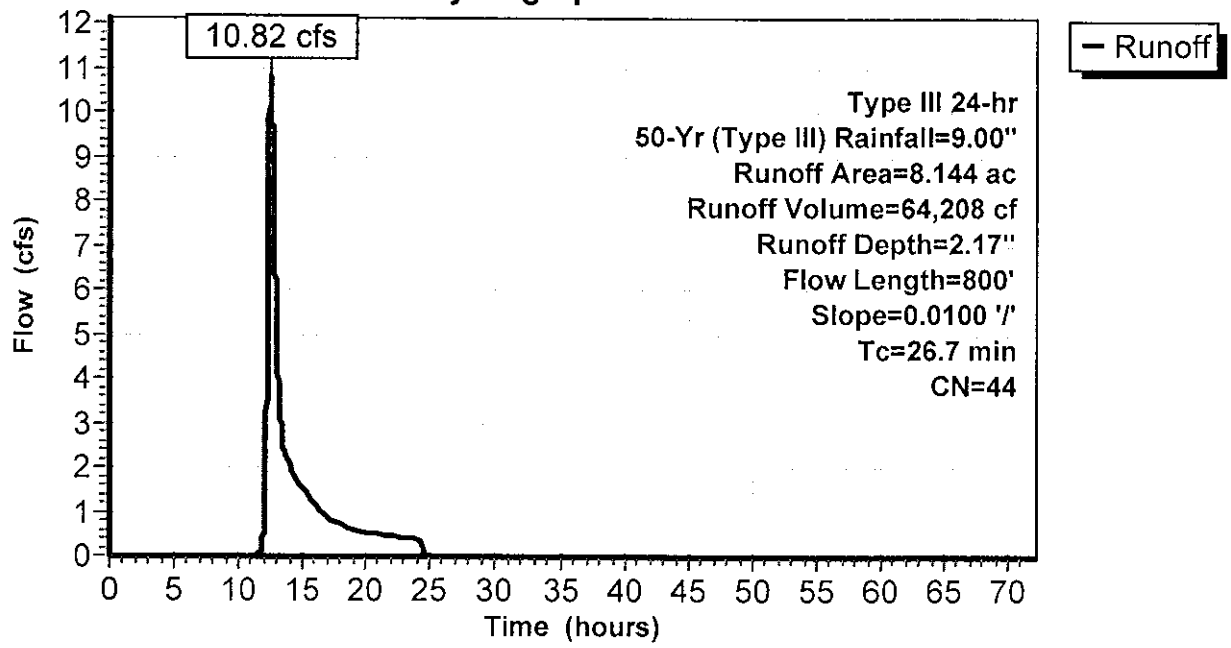
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Yr (Type III) Rainfall=9.00"

	Area (ac)	CN	Description
*	5.700	39	Woods, Fair, HSG A
*	2.444	55	Woods, Fair, HSG B
	8.144	44	Weighted Average
	8.144		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.7	800	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps

Subcatchment 2S: PRE 2

Hydrograph



Summary for Subcatchment 3S: POST 2

Runoff = 69.53 cfs @ 12.08 hrs, Volume= 207,593 cf, Depth= 4.84"

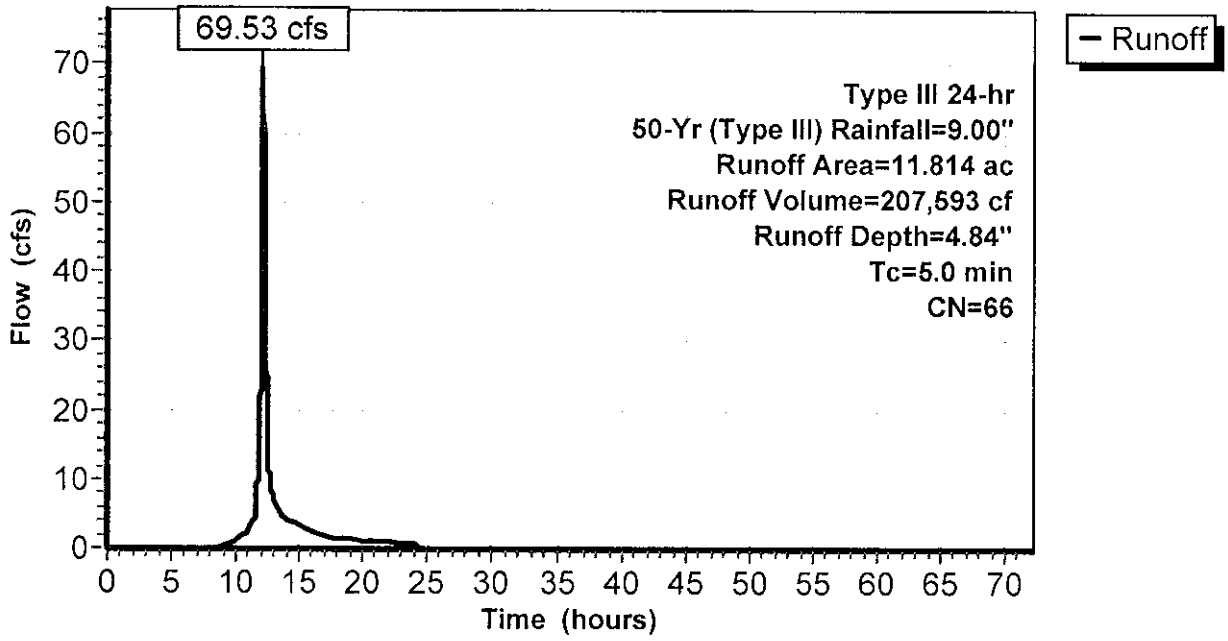
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Yr (Type III) Rainfall=9.00"

Area (ac)	CN	Description
2.816	98	Paved parking, HSG A
1.256	98	Paved parking, HSG B
5.066	39	>75% Grass cover, Good, HSG A
2.122	61	>75% Grass cover, Good, HSG B
0.388	98	Water Surface, 0% imp, HSG A
0.166	98	Water Surface, 0% imp, HSG B
11.814	66	Weighted Average
7.742		65.53% Pervious Area
4.072		34.47% Impervious Area

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

Subcatchment 3S: POST 2

Hydrograph



Summary for Subcatchment 6S: POST 1

Runoff = 21.42 cfs @ 12.08 hrs, Volume= 63,961 cf, Depth= 4.84"

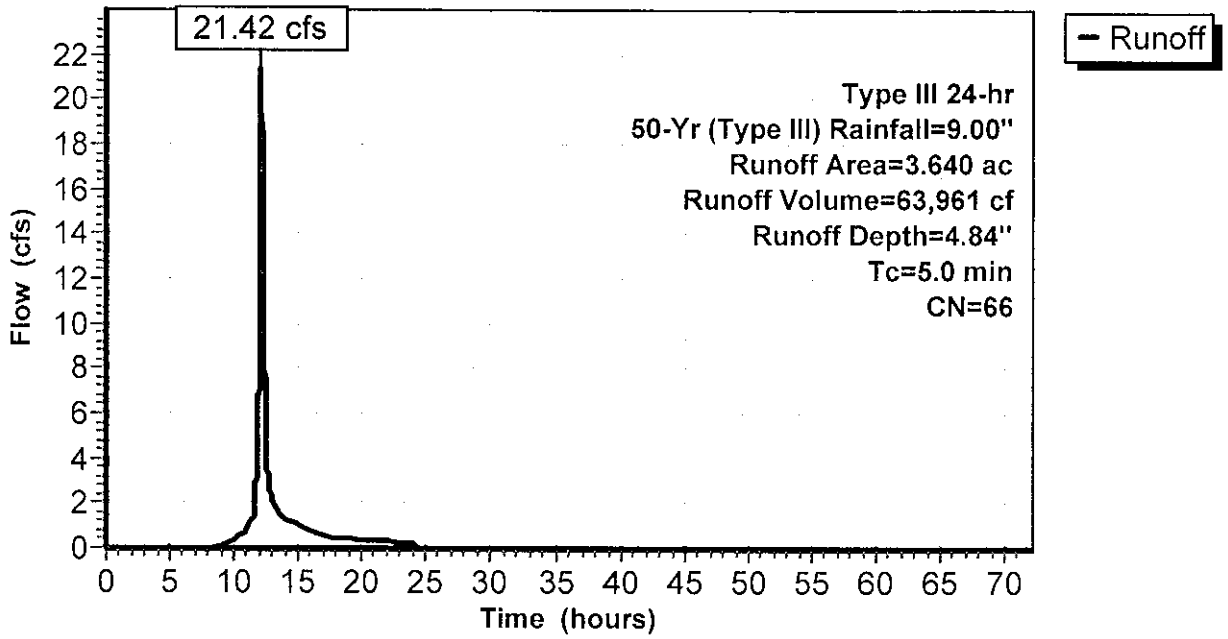
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Yr (Type III) Rainfall=9.00"

Area (ac)	CN	Description
1.030	98	Paved parking, HSG A
0.390	98	Paved parking, HSG B
1.510	39	>75% Grass cover, Good, HSG A
0.710	61	>75% Grass cover, Good, HSG B
3.640	66	Weighted Average
2.220		60.99% Pervious Area
1.420		39.01% Impervious Area

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

Subcatchment 6S: POST 1

Hydrograph



Summary for Pond 6P: Wet Pond 2

Inflow Area = 514,618 sf, 34.47% Impervious, Inflow Depth = 4.84" for 50-Yr (Type III) event
Inflow = 69.53 cfs @ 12.08 hrs, Volume= 207,593 cf
Outflow = 10.69 cfs @ 12.57 hrs, Volume= 197,738 cf, Atten= 85%, Lag= 29.9 min
Primary = 10.69 cfs @ 12.57 hrs, Volume= 197,738 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 34.78' @ 12.57 hrs Surf.Area= 49,775 sf Storage= 98,450 cf

Plug-Flow detention time= 545.1 min calculated for 197,738 cf (95% of inflow)
Center-of-Mass det. time= 519.0 min (1,345.8 - 826.8)

Volume	Invert	Avail.Storage	Storage Description
#1	32.60'	161,916 cf	**Contours (Prismatic)**Listed below (Recalc)

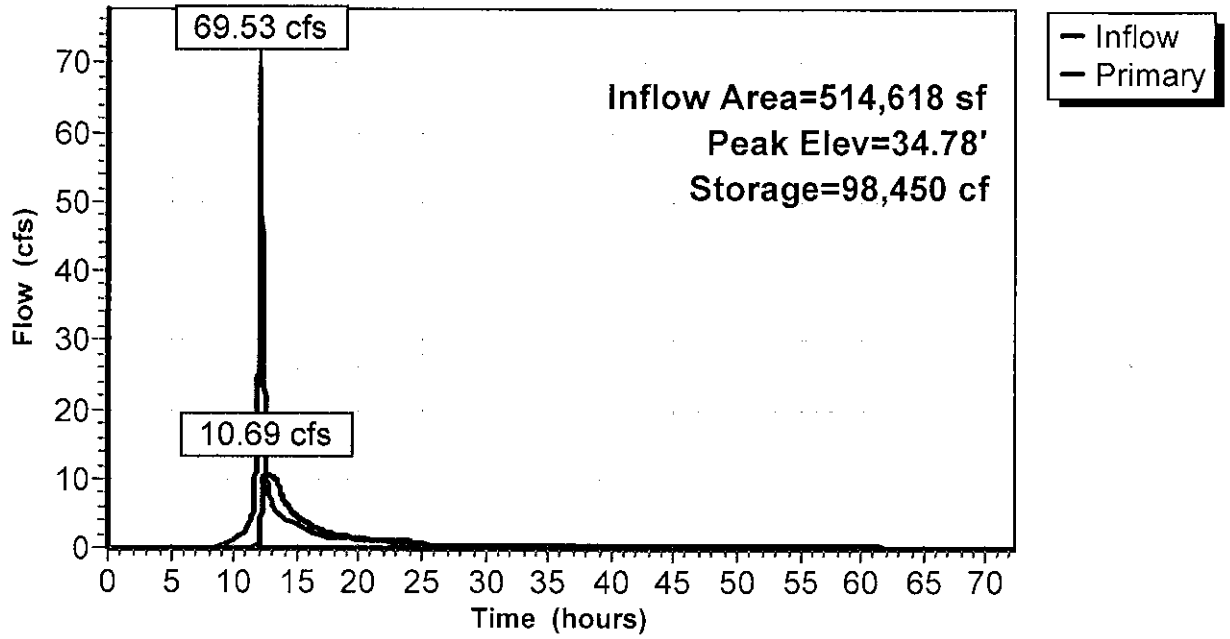
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
32.60	41,970	0	0
33.60	43,380	42,675	42,675
34.00	46,950	18,066	60,741
34.50	48,758	23,927	84,668
35.00	50,575	24,833	109,501
36.00	54,255	52,415	161,916

Device	Routing	Invert	Outlet Devices
#1	Primary	32.45'	**18.0" Round Culvert** L= 47.0' Box, headwall w/3 square edges, Ke= 0.500 Inlet / Outlet Invert= 32.45' / 32.00' S= 0.0096 '/' Cc= 0.900 n= 0.012, Flow Area= 1.77 sf
#2	Device 1	32.60'	**4.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	33.90'	**60.0" W x 7.2" H Vert. Orifice/Grate** C= 0.600
#4	Device 1	34.50'	**48.0" x 48.0" Horiz. Top of Box** C= 0.600 Limited to weir flow at low heads
#5	Primary	35.00'	**Emergency Spillway, C= 2.60** Offset (feet) 0.00 3.00 33.00 36.00 Height (feet) 1.00 0.00 0.00 1.00

Primary OutFlow Max=10.69 cfs @ 12.57 hrs HW=34.78' (Free Discharge)
- **1=Culvert** (Inlet Controls 10.69 cfs @ 6.05 fps)
  - **2=Orifice/Grate** (Passes < 0.60 cfs potential flow)
  - **3=Orifice/Grate** (Passes < 10.87 cfs potential flow)
  - **4=Top of Box** (Passes < 7.74 cfs potential flow)
- **5=Emergency Spillway** (Controls 0.00 cfs)

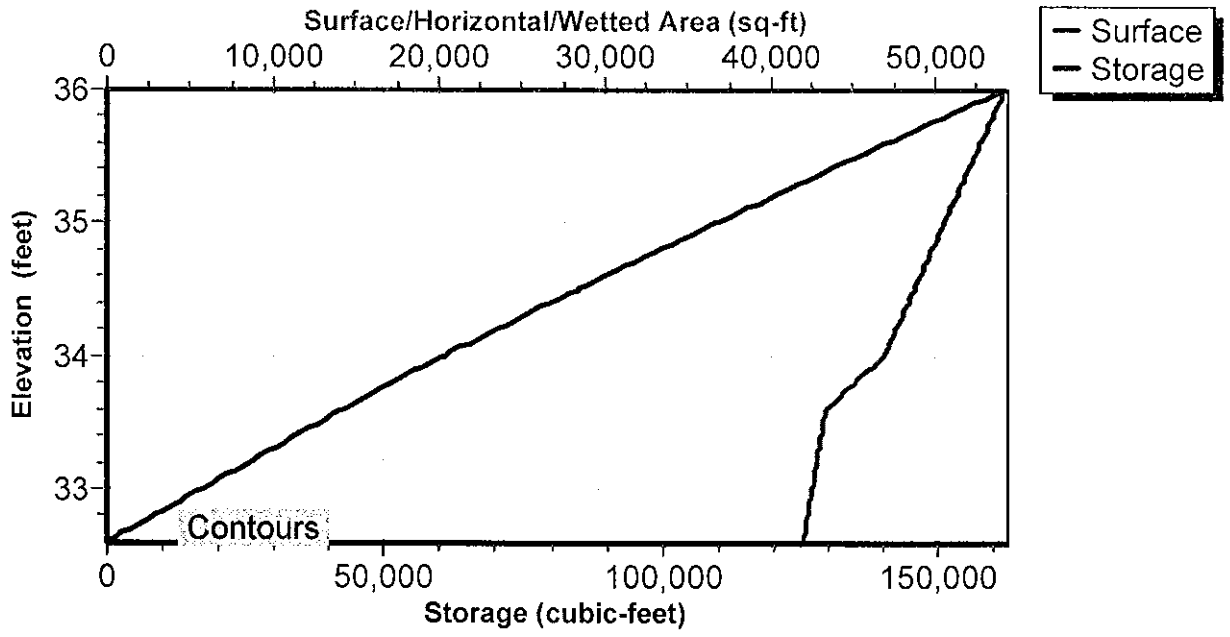
Pond 6P: Wet Pond 2

Hydrograph



Pond 6P: Wet Pond 2

Stage-Area-Storage



Summary for Pond 7P: Wet Pond 1

Inflow Area = 158,558 sf, 39.01% Impervious, Inflow Depth = 4.84" for 50-Yr (Type III) event
Inflow = 21.42 cfs @ 12.08 hrs, Volume= 63,961 cf
Outflow = 7.17 cfs @ 12.38 hrs, Volume= 59,331 cf, Atten= 67%, Lag= 18.1 min
Primary = 7.17 cfs @ 12.38 hrs, Volume= 59,331 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 39.60' @ 12.38 hrs Surf.Area= 13,913 sf Storage= 26,279 cf

Plug-Flow detention time= 630.3 min calculated for 59,331 cf (93% of inflow)
Center-of-Mass det. time= 592.7 min (1,419.6 - 826.8)

Volume	Invert	Avail.Storage	Storage Description
#1	37.50'	39,360 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

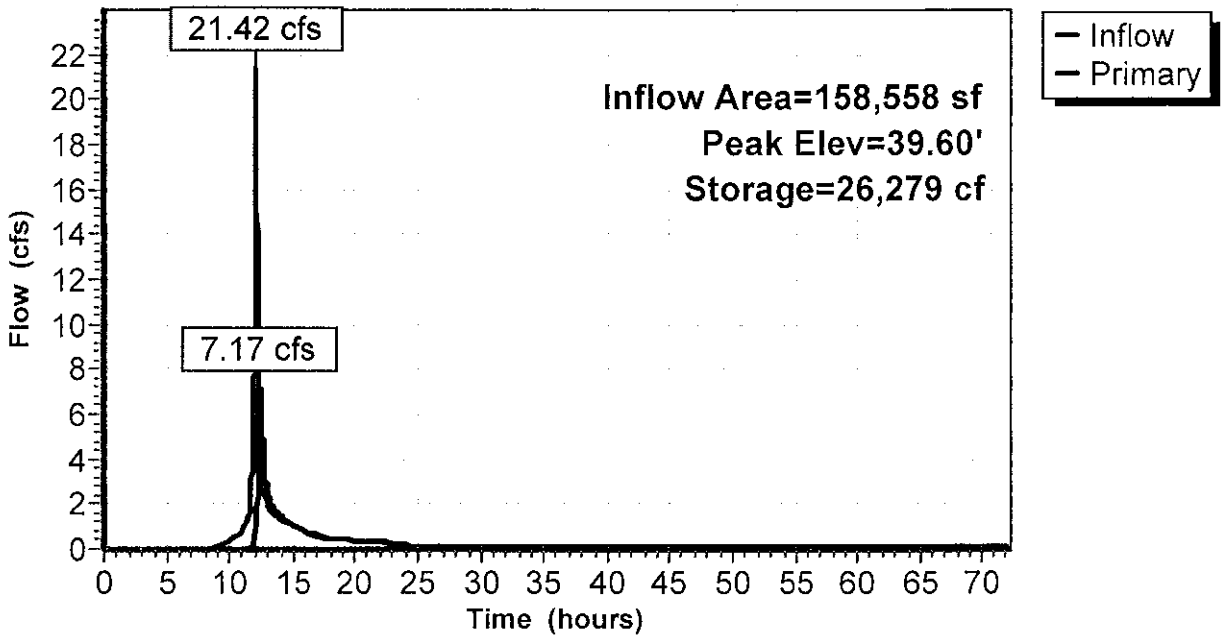
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
37.50	2,485	0	0
37.51	11,210	68	68
38.00	11,830	5,645	5,713
39.00	13,110	12,470	18,183
40.00	14,450	13,780	31,963
40.50	15,135	7,396	39,360

Device	Routing	Invert	Outlet Devices
#1	Primary	37.50'	**15.0" Round Culvert** L= 52.0' Box, headwall w/3 square edges, Ke= 0.500 Inlet / Outlet Invert= 37.50' / 36.98' S= 0.0100 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.23 sf
#2	Device 1	37.50'	**2.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	39.25'	**36.0" x 36.0" Horiz. Top of Box** C= 0.600 Limited to weir flow at low heads
#4	Primary	39.75'	**Emergency Spillway, C= 2.60** Offset (feet) 0.00 2.70 22.70 25.40 Height (feet) 0.90 0.00 0.00 0.90

Primary OutFlow Max=7.17 cfs @ 12.38 hrs HW=39.60' (Free Discharge)
- **1=Culvert** (Inlet Controls 7.17 cfs @ 5.85 fps)
  - **2=Orifice/Grate** (Passes < 0.15 cfs potential flow)
  - **3=Top of Box** (Passes < 8.10 cfs potential flow)
- **4=Emergency Spillway** (Controls 0.00 cfs)

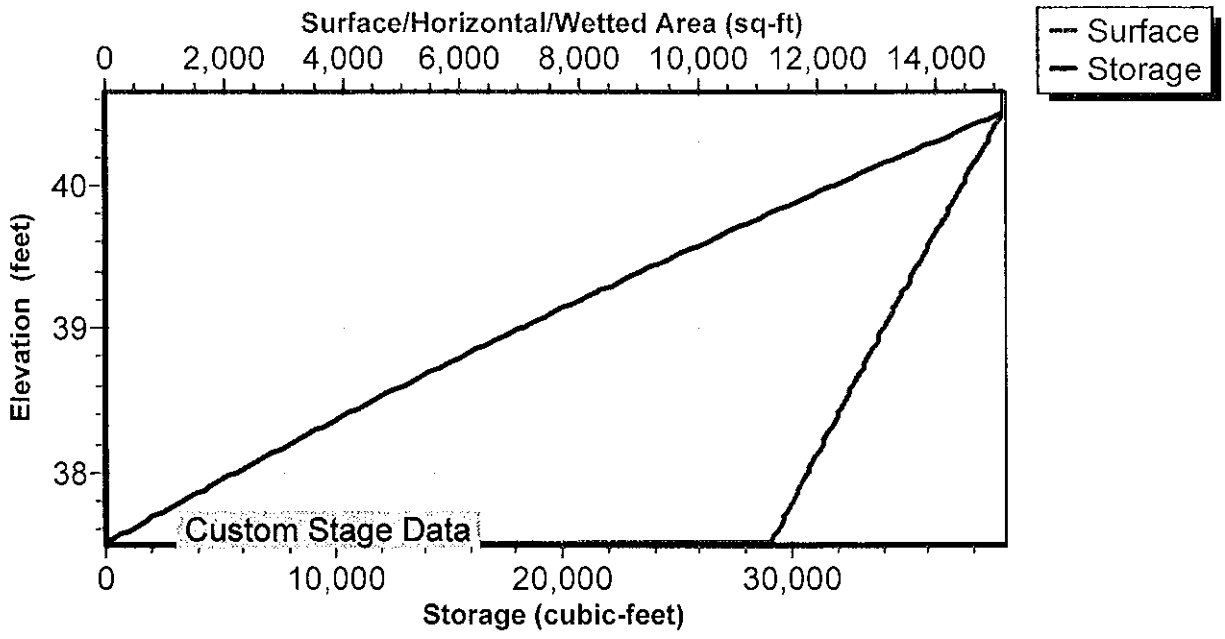
Pond 7P: Wet Pond 1

Hydrograph



Pond 7P: Wet Pond 1

Stage-Area-Storage



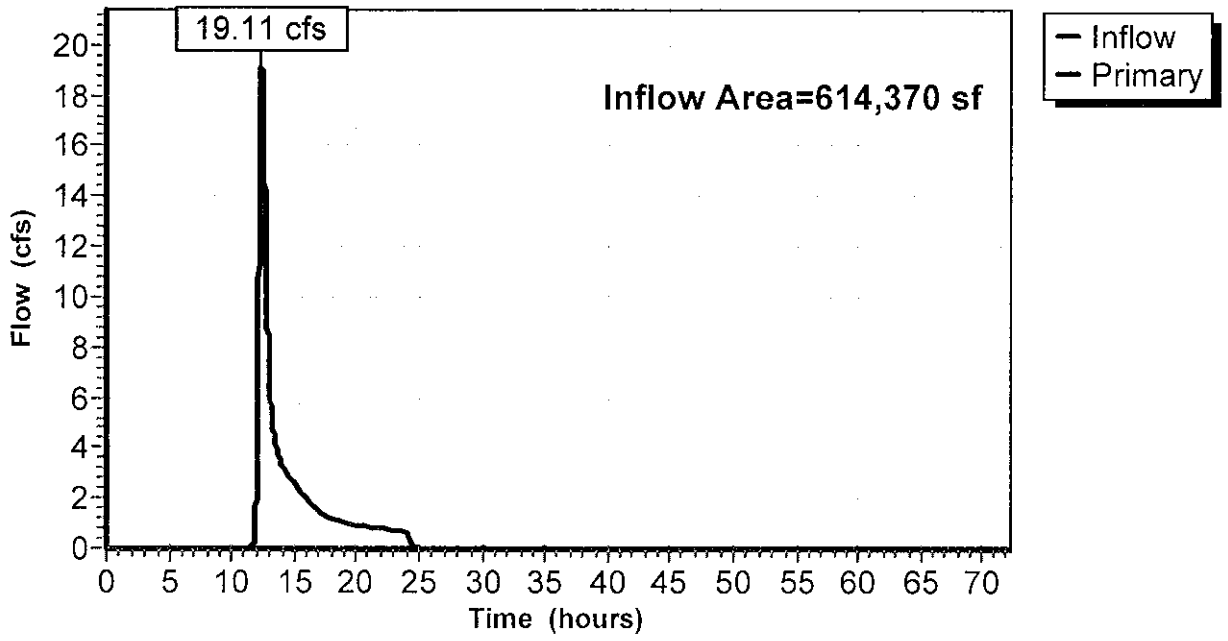
Summary for Link 5L: PRE

Inflow Area = 614,370 sf, 0.00% Impervious, Inflow Depth = 2.17" for 50-Yr (Type III) event
Inflow = 19.11 cfs @ 12.37 hrs, Volume= 111,196 cf
Primary = 19.11 cfs @ 12.37 hrs, Volume= 111,196 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 5L: PRE

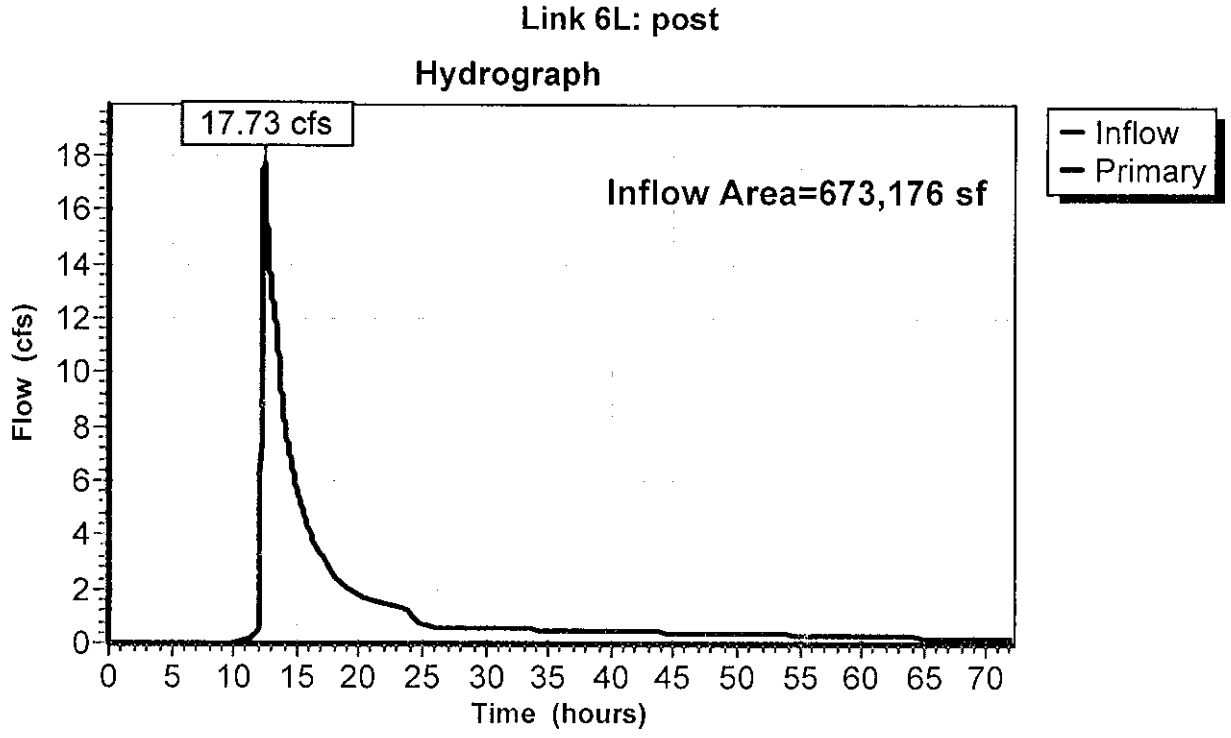
Hydrograph

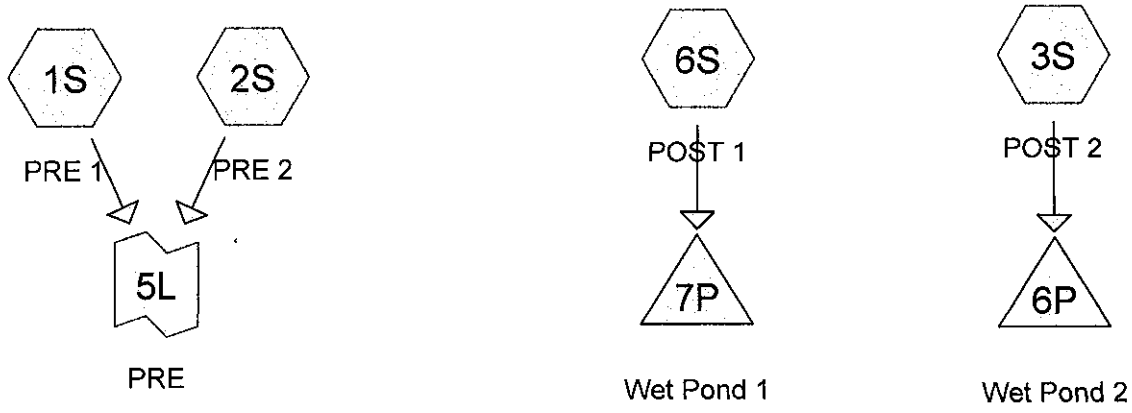


Summary for Link 6L: post

Inflow Area = 673,176 sf, 35.54% Impervious, Inflow Depth > 4.58" for 50-Yr (Type III) event
Inflow = 17.73 cfs @ 12.46 hrs, Volume= 257,069 cf
Primary = 17.73 cfs @ 12.46 hrs, Volume= 257,069 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs





Subcat Reach Pond Link

Routing Diagram for College Park Elem SWM 50-yr check - 010617
Prepared by Microsoft, Printed 1/16/2017

Summary for Subcatchment 1S: PRE 1

Runoff = 8.52 cfs @ 12.30 hrs, Volume= 44,482 cf, Depth= 2.06"

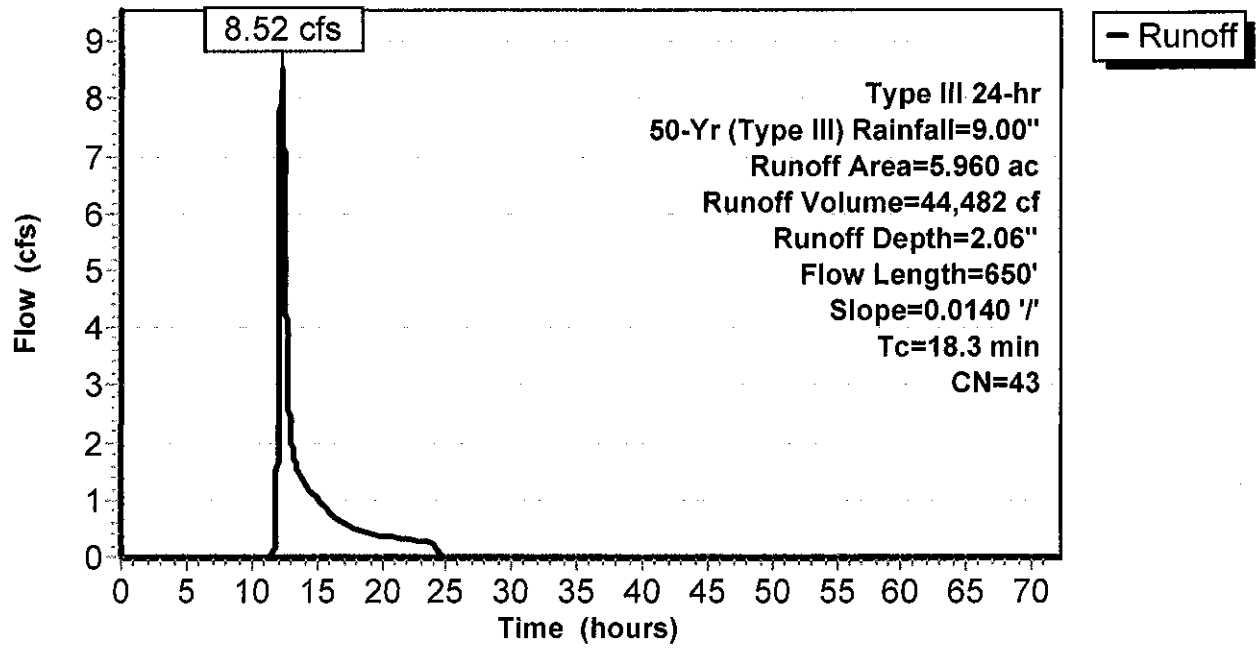
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Yr (Type III) Rainfall=9.00"

Area (ac)	CN	Description
4.172	36	Woods, Fair, HSG A
1.788	60	Woods, Fair, HSG B
5.960	43	Weighted Average
5.960		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.3	650	0.0140	0.59		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps

Subcatchment 1S: PRE 1

Hydrograph



Summary for Subcatchment 2S: PRE 2

Runoff = 10.05 cfs @ 12.43 hrs, Volume= 60,782 cf, Depth= 2.06"

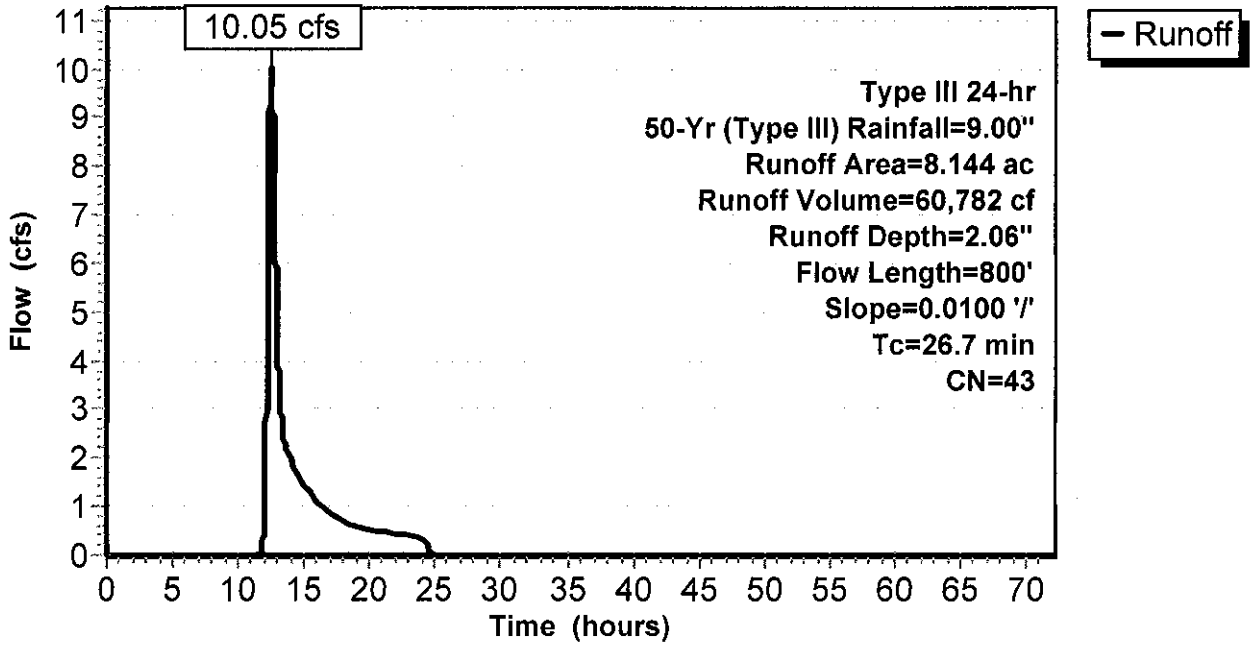
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Yr (Type III) Rainfall=9.00"

Area (ac)	CN	Description
5.700	36	Woods, Fair, HSG A
2.444	60	Woods, Fair, HSG B
8.144	43	Weighted Average
8.144		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.7	800	0.0100	0.50		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps

Subcatchment 2S: PRE 2

Hydrograph



Summary for Subcatchment 3S: POST 2

Runoff = 69.53 cfs @ 12.08 hrs, Volume= 207,593 cf, Depth= 4.84"

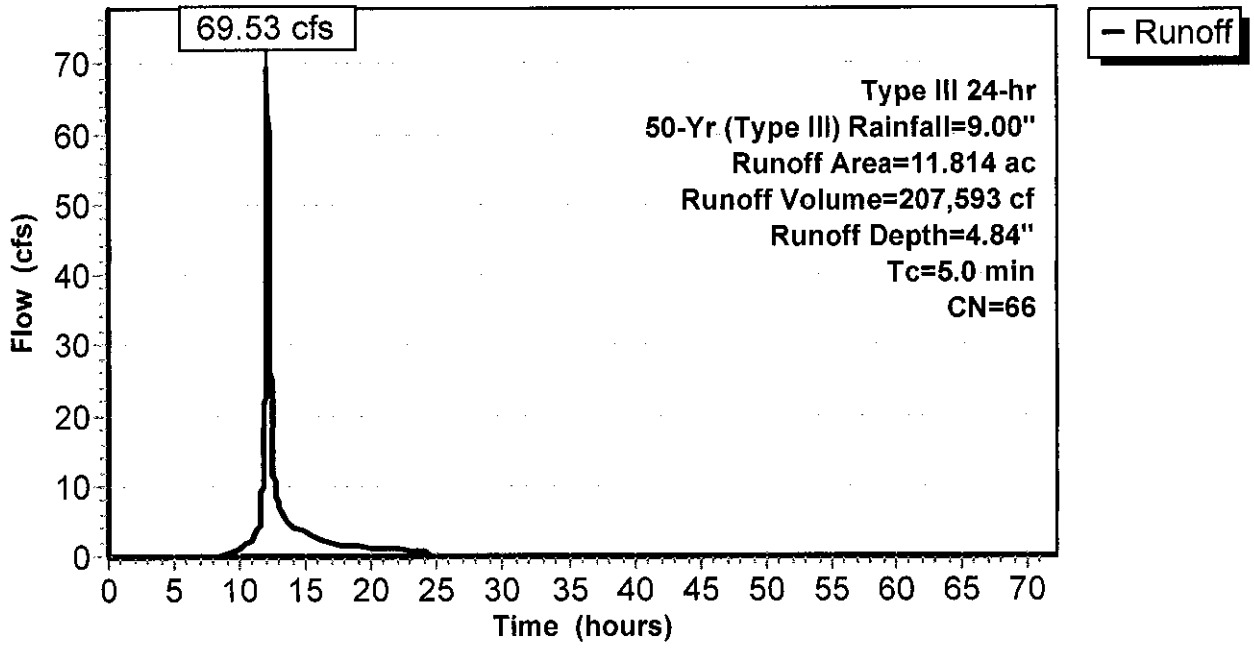
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Yr (Type III) Rainfall=9.00"

Area (ac)	CN	Description
2.816	98	Paved parking, HSG A
1.256	98	Paved parking, HSG B
5.066	39	>75% Grass cover, Good, HSG A
2.122	61	>75% Grass cover, Good, HSG B
0.388	98	Water Surface, 0% imp, HSG A
0.166	98	Water Surface, 0% imp, HSG B
11.814	66	Weighted Average
7.742		65.53% Pervious Area
4.072		34.47% Impervious Area

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

Subcatchment 3S: POST 2

Hydrograph



Summary for Subcatchment 6S: POST 1

Runoff = 21.42 cfs @ 12.08 hrs, Volume= 63,961 cf, Depth= 4.84"

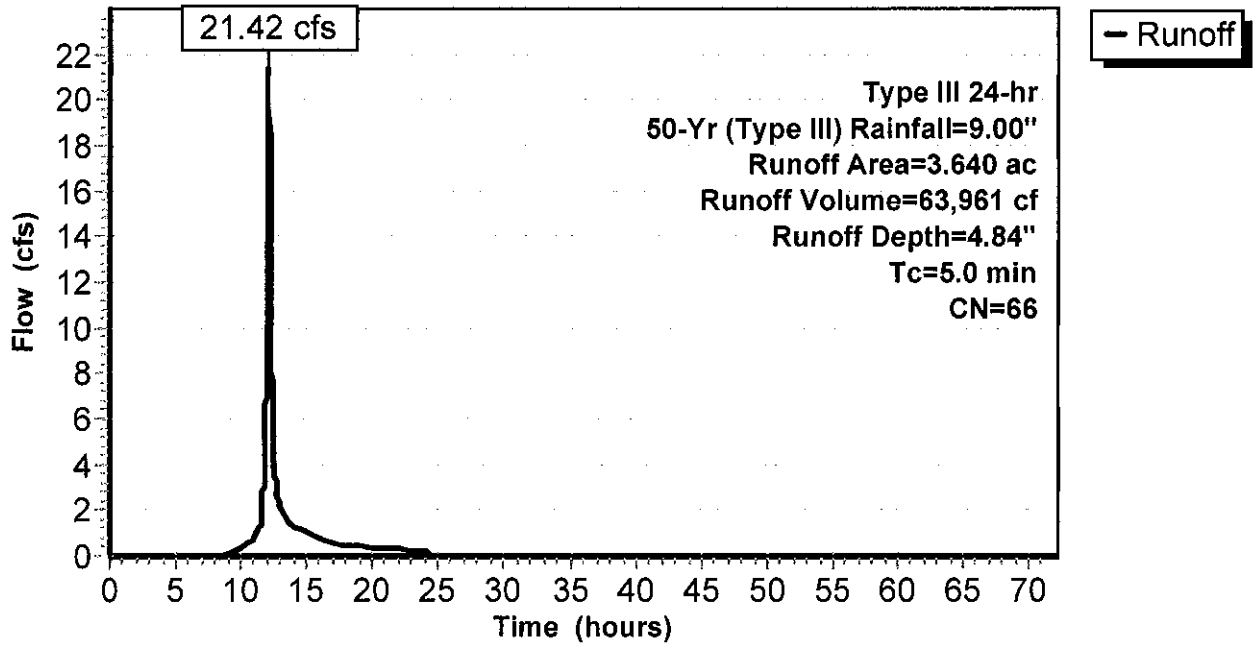
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 50-Yr (Type III) Rainfall=9.00"

Area (ac)	CN	Description
1.030	98	Paved parking, HSG A
0.390	98	Paved parking, HSG B
1.510	39	>75% Grass cover, Good, HSG A
0.710	61	>75% Grass cover, Good, HSG B
3.640	66	Weighted Average
2.220		60.99% Pervious Area
1.420		39.01% Impervious Area

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

Subcatchment 6S: POST 1

Hydrograph



Summary for Pond 6P: Wet Pond 2

Inflow Area = 514,618 sf, 34.47% Impervious, Inflow Depth = 4.84" for 50-Yr (Type III) event
Inflow = 69.53 cfs @ 12.08 hrs, Volume= 207,593 cf
Outflow = 6.46 cfs @ 13.02 hrs, Volume= 98,090 cf, Atten= 91%, Lag= 57.0 min
Primary = 6.46 cfs @ 13.02 hrs, Volume= 98,090 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 35.19' @ 13.02 hrs Surf.Area= 51,267 sf Storage= 119,074 cf

Plug-Flow detention time= 280.1 min calculated for 98,076 cf (47% of inflow)
Center-of-Mass det. time= 161.9 min (988.8 - 826.8)

Volume	Invert	Avail.Storage	Storage Description
#1	32.60'	161,918 cf	**Contours (Prismatic)**Listed below (Recalc)

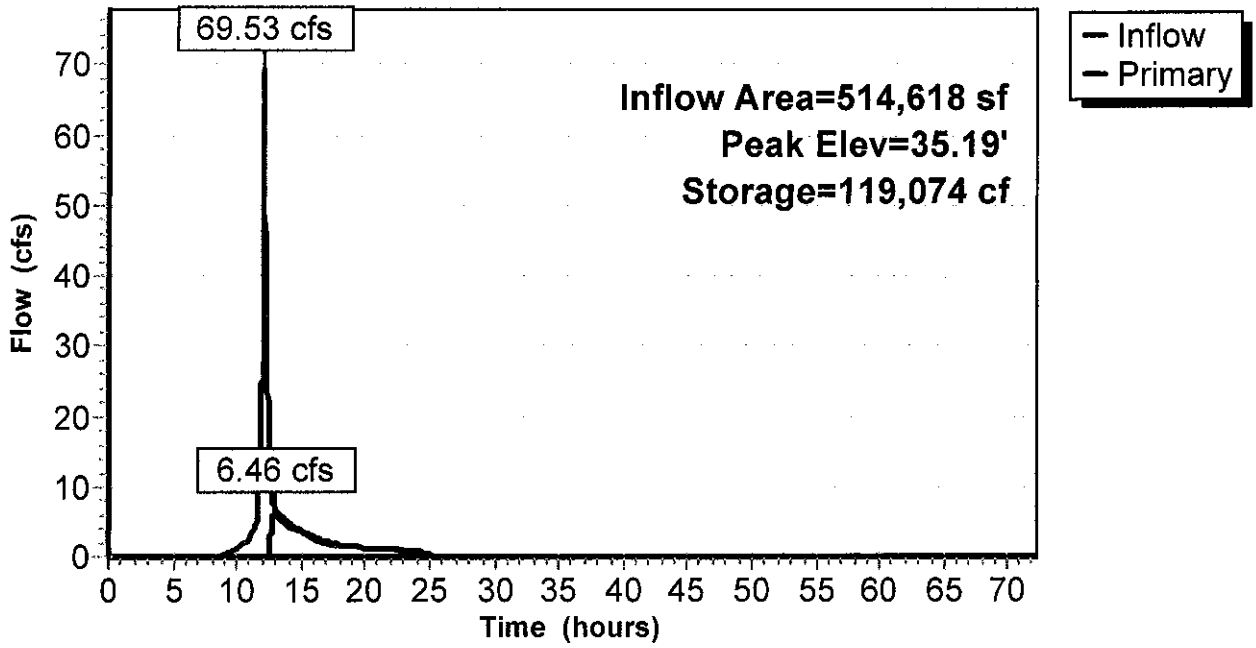
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
32.60	41,970	0	0
33.60	43,380	42,675	42,675
34.00	46,950	18,066	60,741
35.00	50,575	48,763	109,503
36.00	54,255	52,415	161,918

Device	Routing	Invert	Outlet Devices
#1	Primary	35.00'	**Emergency Spillway, C= 2.60** Offset (feet) 0.00 3.00 33.00 36.00 Height (feet) 1.00 0.00 0.00 1.00

Primary OutFlow Max=6.45 cfs @ 13.02 hrs HW=35.19' (Free Discharge)
↑—**1=Emergency Spillway** (Weir Controls 6.45 cfs @ 1.10 fps)

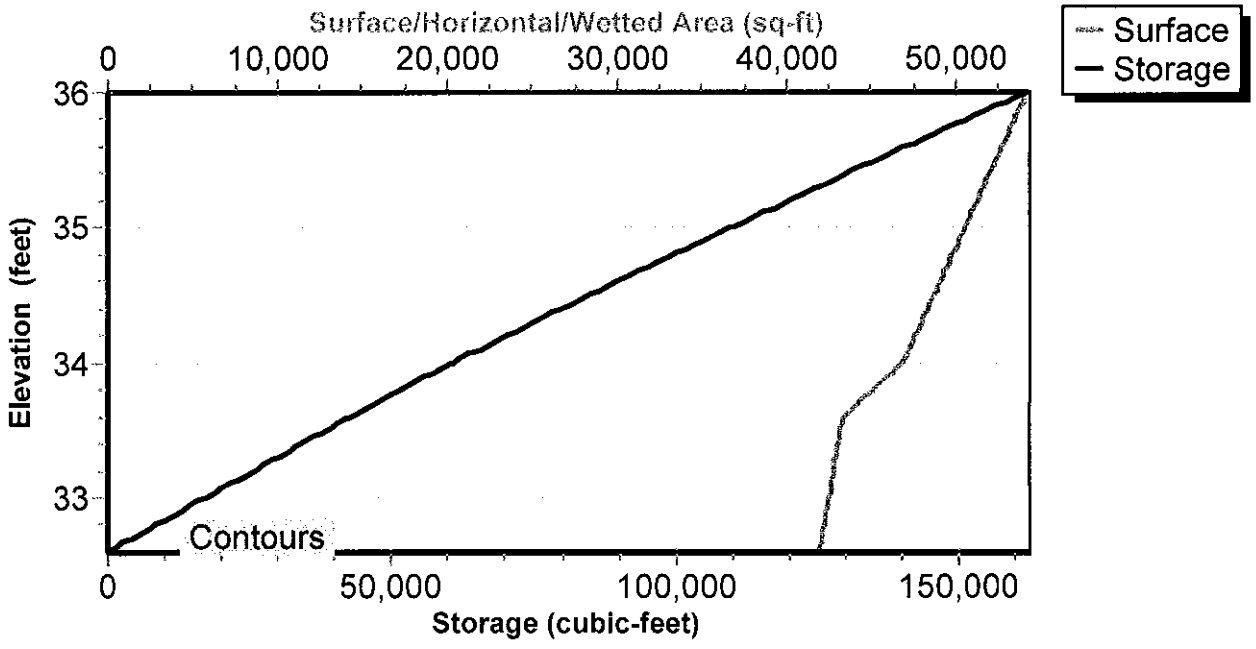
Pond 6P: Wet Pond 2

Hydrograph



Pond 6P: Wet Pond 2

Stage-Area-Storage



Summary for Pond 7P: Wet Pond 1

Inflow Area = 158,558 sf, 39.01% Impervious, Inflow Depth = 4.84" for 50-Yr (Type III) event
Inflow = 21.42 cfs @ 12.08 hrs, Volume= 63,961 cf
Outflow = 5.16 cfs @ 12.48 hrs, Volume= 35,569 cf, Atten= 76%, Lag= 24.0 min
Primary = 5.16 cfs @ 12.48 hrs, Volume= 35,569 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 39.96' @ 12.48 hrs Surf.Area= 14,397 sf Storage= 31,395 cf

Plug-Flow detention time= 225.1 min calculated for 35,569 cf (56% of inflow)
Center-of-Mass det. time= 112.3 min (939.2 - 826.8)

Volume	Invert	Avail.Storage	Storage Description
#1	37.50'	39,360 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

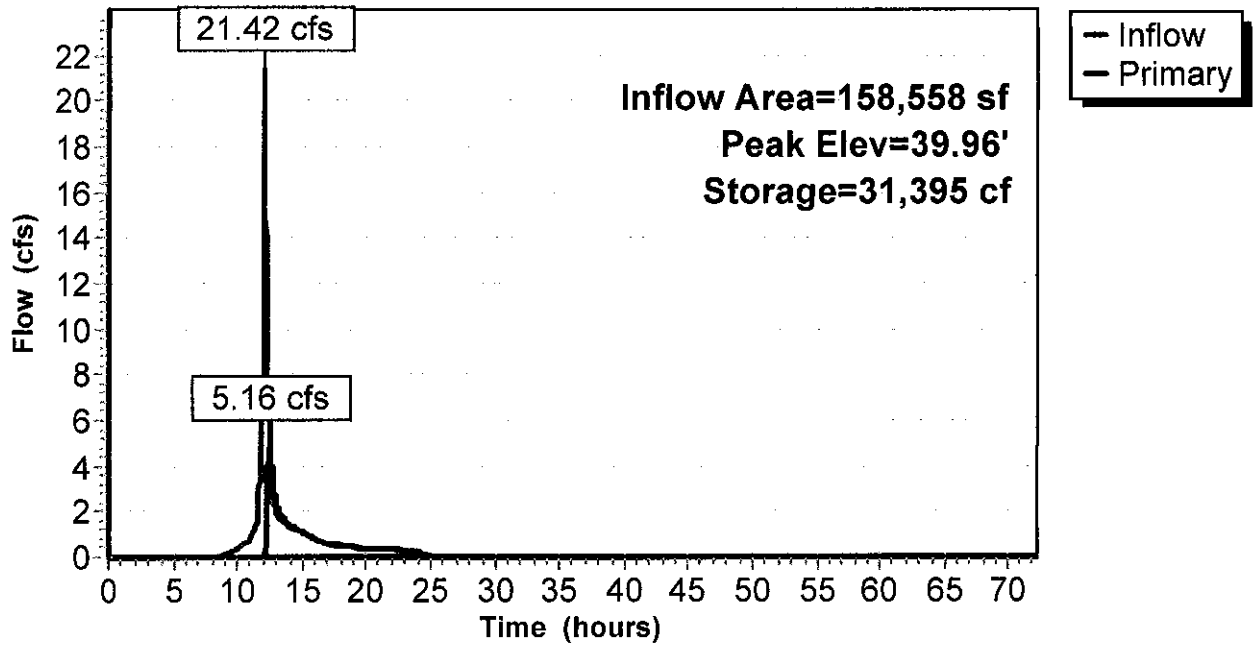
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
37.50	2,485	0	0
37.51	11,210	68	68
38.00	11,830	5,645	5,713
39.00	13,110	12,470	18,183
40.00	14,450	13,780	31,963
40.50	15,135	7,396	39,360

Device	Routing	Invert	Outlet Devices
#1	Primary	39.75'	**Emergency Spillway, C= 2.60** Offset (feet) 0.00 2.70 22.70 25.40 Height (feet) 0.90 0.00 0.00 0.90

Primary OutFlow Max=5.15 cfs @ 12.48 hrs HW=39.96' (Free Discharge)
↑**1=Emergency Spillway** (Weir Controls 5.15 cfs @ 1.15 fps)

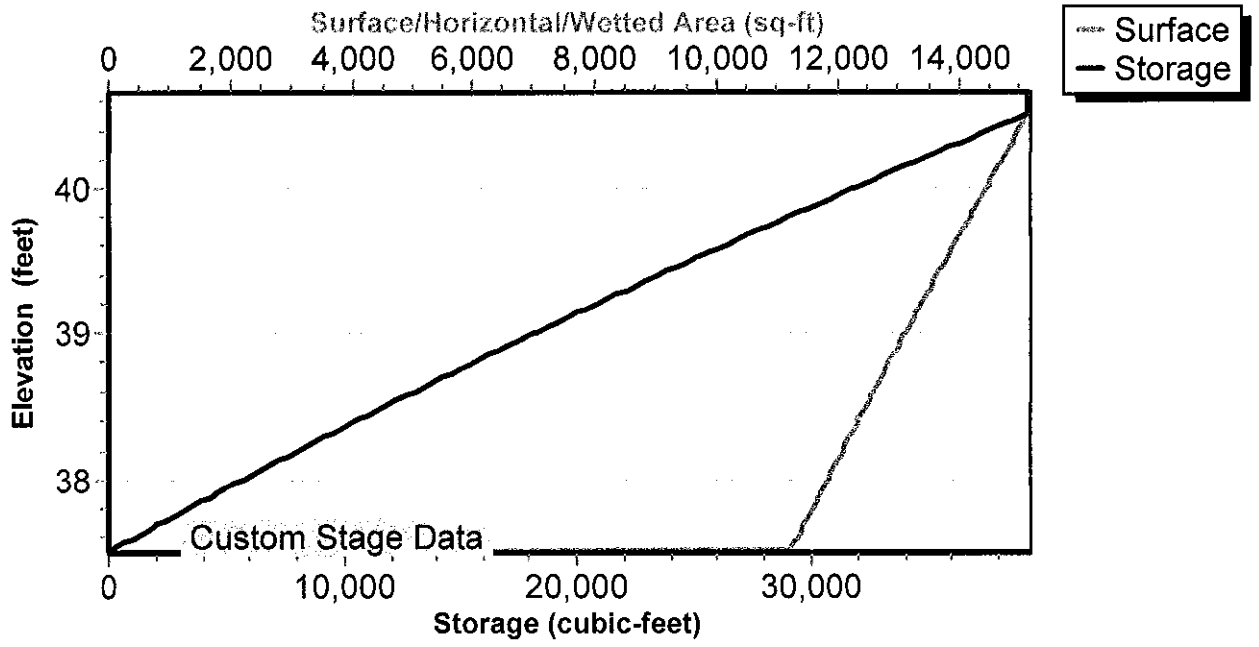
Pond 7P: Wet Pond 1

Hydrograph



Pond 7P: Wet Pond 1

Stage-Area-Storage



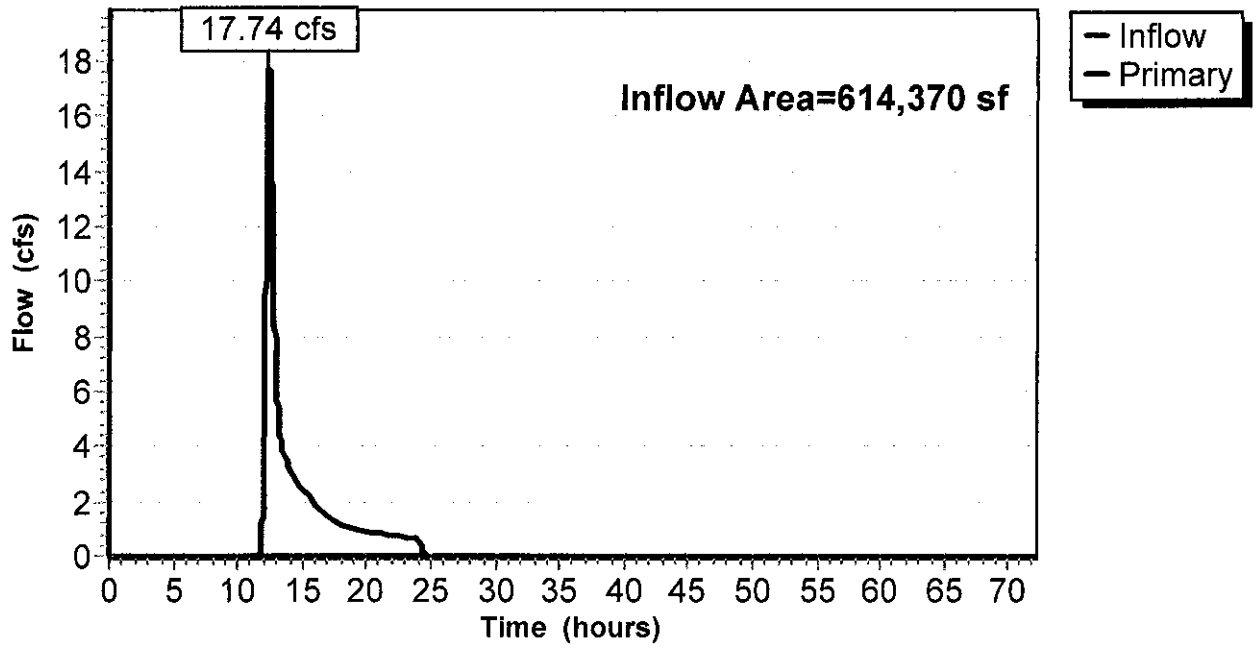
Summary for Link 5L: PRE

Inflow Area = 614,370 sf, 0.00% Impervious, Inflow Depth = 2.06" for 50-Yr (Type III) event
Inflow = 17.74 cfs @ 12.37 hrs, Volume= 105,264 cf
Primary = 17.74 cfs @ 12.37 hrs, Volume= 105,264 cf, Atten= 0%, Lag= 0.0 min

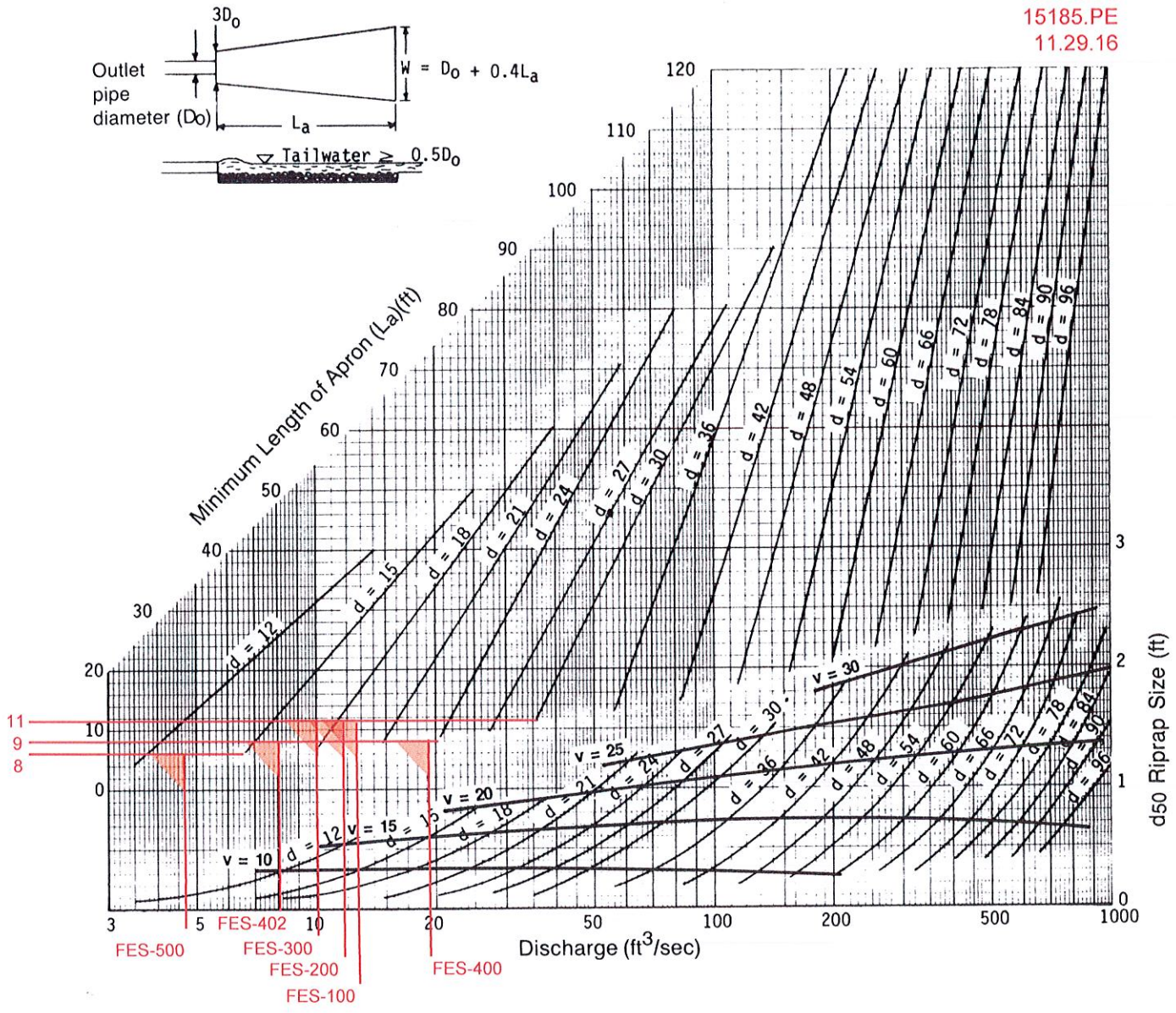
Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Link 5L: PRE

Hydrograph



FLARED END SECTIONS
COLLEGE PARK ELEMENTARY SCHOOL
15185.PE
11.29.16



Curves may not be extrapolated.

Figure 8.06b Design of outlet protection from a round pipe flowing full, maximum tailwater condition ($T_w \geq 0.5$ diameter).

FES-100	FES-200	FES-300	FES-400	FES-402	FES-500
Do = 30"	Do = 30"	Do = 30"	Do = 24"	Do = 24"	Do = 15"
3Do = 7.5'	3Do = 7.5'	3Do = 7.5'	3Do = 6.0'	3Do = 6.0'	3Do = 3.75'
La = 11'	La = 11'	La = 11'	La = 9'	La = 9'	La = 8'
W = 6.9'	W = 6.9'	W = 6.9'	W = 5.6'	W = 5.6'	W = 4.5'

Project Name: College Park Elementary
Client: LS3P
Project Number: 15185.PE
Prepared By: DJF
Date: 11/22/16

PARAMOUNTE
ENGINEERING, INC

Infiltration Basin #1

Soils Information:

Soil Type =	Baymeade / Urban land	
SHWL =	36.45 El.	
Average Infiltration Rate =	2 In/Hr	

Stormwater Quality Requirement:

Drainage Area to System =	3.206 Ac.	
Impervious Area =	1.39 Ac.	
% Impervious	43.23 %	
Runoff Coefficent (Rv) =	0.439 in/in	
Req. 1.5" Runoff Volume =	7,665 cf	
Volume Provided =	22,364 cf	2.5 times (removes offline bypass & veg filter)
Elevation @ Volume Provided =	39.30 EL.	Primary Outlet Device
Surface Area @ Volume Provided=	13,505 sf	

Draw Down Analysis:

Bottom Infiltration Area	2,485 sf	
Bottom Elevation of Pond	37.5 ft	
Draw Down Time =	4.50 days	(At 1/2 Infiltration Rate)

CONTOUR	CONTOUR AREA [sq ft]	INCR. VOLUME [cu ft]	ACCUM. VOLUME [cu ft]
37.5	11,210	0	0
38.0	11,830	5,760	5,760
39.0	13,110	12,470	18,230
40.0	14,450	13,780	32,010
40.5	15,135	7,396	39,406

Project Name:	College Park Elementary
Client:	LS3P
Project Number:	15185.PE
Prepared By:	DJF
Date:	11/22/16

PARAMOUNTE
ENGINEERING, INC

Infiltration Basin #2

Soils Information:

Soil Type =	Baymeade / Urban land	
SHWL =	30.60	El.
Average Infiltration Rate =	1	In/Hr

Stormwater Quality Requirement:

Drainage Area to System =	10.000	Ac.	
Impervious Area =	4.11	Ac.	
% Impervious	41.10	%	
Runoff Coefficent (Rv) =	0.420	in/in	
Req. 1.5" Runoff Volume =	22,864	cf	
Volume Provided =	57,718	cf	2.5 times (removes offline bypass & veg filter)
Elevation @ Volume Provided =	33.90	EL.	Primary Outlet Device
Surface Area @ Volume Provided=	46,590	sf	

Draw Down Analysis:

Bottom Infiltration Area	16,075	sf	
Bottom Elevation of Pond	32.6	ft	
Draw Down Time =	3.59	days	(At 1/2 Infiltration Rate)

CONTOUR	CONTOUR AREA	INCR. VOLUME	ACCUM. VOLUME
	[sq ft]	[cu ft]	[cu ft]
32.6	41,970	0	0
33.0	43,380	17,070	17,070
34.0	46,950	45,165	62,235
35.0	50,575	48,763	110,998
36.0	54,255	52,415	163,413