HANCOCK ASSOCIATES

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COMMONWEALTH OF MASSACHUSETTS
DEBORAH L. COLBERT
CIVIL
No. 37073
REGISTERED PROFESSIONAL ENGINEER

Stormwater Report
In Support of

Comprehensive Permit Filing
for
Winn Development
21 Elm Place, 29 Essex Street, 25 and 35 Pitman Road
(Parcel ID 6-118, 6-195, 6-243, 6-199)
Swampscott, MA

Prepared For:
Winn Development Company Limited Partnership
January, 2021

DANVERS OFFICE
185 Centre Street, Danvers, MA 01923
Phone: (978) 777-3050 Fax: (978) 774-7816

MARLBOROUGH OFFICE
315 Elm Street, Marlborough, MA 01752
Phone: (508) 460-1111 Fax: (508) 460-1121

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Appendix

Introduction

Winn Development proposes to construct a 128-unit apartment building at the development parcels of 21 Elm Place, 129 Essex Street, 25 and 35 Pitman Road (Parcel ID 6-118, 6-195, 6-199, 6-243). Site improvements associated with construction of the new building will include: paved vehicular and pedestrian access, landscaped areas, connections to municipal utility services, and a stormwater management system.

An irregularly shaped parcel, the 71,135± sf site is bounded by Elm Place to the northeast, Essex Street to the northwest, Pitman Road to the east, and the Newburyport / Rockport MBTA Commuter Rail Line to the southeast. The site frontage and entrance drive is on Elm Place.

Presently, the site is divided into four parcels: 21 Elm Place, 129 Essex Street, 25 and 35 Pitman Road.

- 21 Elm Place is approximately 59% of the total development area. The lot is occupied by two 2-story metal buildings located along the eastern property line. The western side of the parcel is covered by parking areas and associated landscaped and grass areas. This lot will be subdivided as a part of this project where the northern building will remain as a separate parcel, and the southern building and parking areas will be demolished and incorporated into the development area.
- 129 Essex Street is approximately 17% of the development area. The plot is occupied by a 2 ½ story wood frame house located at the center of the parcel, a separate wood frame garage to the east, and various walks, grass, and landscaped areas throughout.
- 25 Pitman Road is located at the southernmost corner of the property. This parcel occupies 10% of the total development area and contains a 1.5-story wood frame building and parking area.
- 35 Pitman Road is approximately 13% of the total development area. The plot is occupied a 2-story wood frame dwelling with a driveway on the western side of the lot.

Existing Topography of the site varies from moderate to relatively flat slopes. The northwest corner of the site slopes steeply (±10% grade) away from Essex Street, and then transitions to a flatter slope (±2% grade) through the 21 Elm Place, 25 and 35 Pitman Road Parcels. The highest elevation onsite is 39.3± (NAVD88) on the northern corner of the site. The low elevation onsite is elevation 30.58± (NAVD88) and is located at a catch basin in the southern portion of the 21 Elm Place parking area.

All stormwater from the project site discharges to the Pitman Road drainage system. Under existing conditions, the majority of stormwater flows is captured by the onsite closed conduit stormwater management system on the 21 Elm Place Parcel. Stormwater from this system is discharged to the Pitman Road drain system via a 6" cast iron pipe. Portions of the 25 and 35 Pitman road lots discharge stormwater overland to Pitman Road. Finally, some stormwater from 129 Essex Street flows north overland to Essex Street. This stormwater in turn flows to the Pitman Road drain system.

The project site is not located within the 100-year flood plan according to current FEMA flood mapping. The site is not within any NHESP Priority or Estimated Habitats of Rare Species.

Standard 1: No New Untreated Discharges

The Massachusetts Stormwater Handbook states that no new stormwater conveyances may discharge untreated stormwater directly to or cause erosions in wetlands or waters of the Commonwealth. The project will not include new stormwater conveyances.

Standard 2: Peak Rate Attenuation

The Massachusetts Stormwater Handbook states that stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. A summary of the existing and proposed discharge rates follows. The proposed condition discharge rates of runoff are at or below the existing rates to the same discharge points. Please see the attached "Existing Drainage Areas" and "Proposed Drainage Areas" figures (Appendix IV) and Hydrocad output (Appendix V) for more information.

For the purpose of these calculations the following assumption was made:

- The same total watershed area of the drainage areas is used to compare the existing and proposed conditions.
- The Natural Resources Conservation Service (NRCS) Web Soil Survey of Essex County defines soils in the project area as Urban Land (Map Unit 602). Urban Land is classified as soils that have been disturbed by previous fill and grading operations. Urban fill is not given a hydrologic soil group designation. The soils of areas surrounding the site are classified as Hollis-Urban land-Rock outcrop complex, sloping (Map Unit 724C) which is considered to be Hydrologic Soil Group D, indicative of very slow infiltration when thoroughly wet.
- Eight soils borings were performed onsite at depths varying from 27 to 30.2 feet below ground surface (BGS) with one boring terminating 4 feet below ground surface. Soils nearest the proposed subsurface infiltration system were found to be 2 to 4 feet of miscellaneous fill over a marine deposit composed of silty sand to 19 feet BGS underlain by blue clay. Excavations for the proposed subsurface infiltration system extend approximately seven feet below ground surface at the deepest point. Therefore the stormwater structures are well within the silty sand layer. Silty sand is classified into hydrologic soil group "B," indicative of moderate infiltration when thoroughly wet with a Rawls Rate of 1.02 in/hr. Please see the attached NRCS Web Soil Survey summary (Appendix I) and Soil Testing Results (Appendix II).
- Groundwater elevations onsite varied from 24.9 to 23.8 in borings B-3 and B-7 respectively. Groundwater in Boring B-8 was recorded at elevation 28.1 but the geotechnical report notes that the observation of groundwater was performed immediately following drilling utilizing the wet rotary method due to time constraints and may not be valid. Therefore, groundwater elevations from borings B-3 and B-7 were used in the stormwater design.

Presently, stormwater runoff from watershed "2S" drains to catch basin "1P" which in turn discharges to the Pitman Road drain system. Also, two catch basin drywells onsite noted as watershed "3S" and "4S" were modeled as unconnected from the subsurface closed conduit system and overflow to watershed "2S."

Existing watersheds 1S and 5S are areas that drain overland to Pitman Road. Watershed 6S drains overland to Essex Street which in turn flows the catch basins in Pitman Road.

Under proposed conditions, the HydroCAD model was broken up into three watersheds: The parking area (40S), the building roof (30S), and the overland offsite flow (60S).

- Watershed 40S includes the parking area on the north side of the site. Stormwater from this parking area drains to the subsurface infiltration system 10P. The infiltration system is composed of 150 Stormtech SC-310 Chambers. Excess stormwater from this system discharges to a drain manhole to the south of the site that ties into the Swampscott storm drain system (Reach 10R).
- Watershed 30S contains the proposed building roof. Stormwater is captured by roof drains and discharged to the Swampscott drainage system via a drain lateral to the Pitman Road drain system in the southern portion of the site.

- Watershed 60S includes the areas to the east, west and south of the proposed building. Stormwater from this watershed flows overland offsite to Pitman Road.

Presently, an 18-inch drain line from the Pitman Road drain system runs through the southern corner of the development. As a part of this project, this line is being diverted around the proposed building and reconnecting to the existing drain system in the southern corner of the site. All stormwater attenuation onsite is provided by subsurface infiltration system 10P.

The following table compares the peak rates of runoff under the existing and proposed conditions:

Discharge Point	**2-Year Storm** (3.1" Rainfall Depth)		**10-Year Storm** (4.5" Rainfall Depth)		**25-Year Storm** (5.3" Rainfall Depth)		**100-Year Storm** (6.4" Rainfall Depth)	
	Existing (cfs)	Proposed (cfs)	Existing (cfs)	Proposed (cfs)	Existing (cfs)	Proposed (cfs)	Existing (cfs)	Proposed (cfs)
Pitman	4.46	1.69	8.71	6.40	9.64	8.31	11.35	9.22

cfs - Cubic Feet per Second

- *Flood-routing effect and offset times of concentration results in a combined peak runoff rate that can be less than the sum of the peak rates for the individual watersheds*

Standard 3: Recharge

The Massachusetts Stormwater Handbook states that loss of annual recharge to groundwater shall be eliminated or minimized. The annual recharge from the post-development site shall approximate the annual recharge from the pre-development conditions based on soil type.

As discussed under Standard 2, surficial soils on-site are assumed to be Hydrologic Soil Group D. Therefore, the required recharge volume is calculated based on a target depth of 0.1" over the proposed impervious area. Also, 65% of impervious area onsite is captured by the subsurface infiltration system. A capture area adjustment was performed to accommodate. The required and provided volumes for the recharge system is as follows:

Infiltration System 10P
Required Recharge Volume = Target Depth * Impervious Area / Capture Area = 0.35" * 71,135 SF / 0.65
= 3,192 Cubic Feet
Provided Recharge Volume = 3,333 Cubic Feet

Infiltration System 10P is composed of a series of HDPE Stormtech SC-310 Chambers surrounded by crushed stone and enveloped in filter fabric. The outlet in the outlet manhole is set 1.1-feet higher than the bottom elevation of the chambers.

The Massachusetts Stormwater Handbook states that the recharge volume must drain within 72 hours. The following "drawdown" calculation assumes a Rawl's Rate of 1.02 inches per hour, corresponding to texture class "Silt Loam."

Infiltration System 10P
Drawdown Time = Storage Volume / (Rawl's Rate * Bottom Area)
= 3,333 CF / (1.02 in/hr * 3828 SF) = 10.3 Hours

Since the drawdown time of 116 hours are greater than 72 hours, this requirement is met.

Standard 4: Water Quality

The Massachusetts Stormwater Handbook states that systems shall be designed to remove 80% of the average annual post-development construction load of Total Suspended Solids (TSS).

The project site is not in a wellhead protection area, near a critical area, has soils with a rapid infiltration rate, or a land use with higher potential pollutant loads. Therefore the water quality volume target depth is 0.5" over the inflowing impervious area (Watershed 40S).

Infiltration System 10P
Water Quality Volume = Target Depth * Impervious Area = 0.50" * 35,980 SF = 1,499 Cubic Feet
Water Quality Volume = 3,333 Cubic Feet

Stormwater runoff from the proposed roof areas is considered "clean" and will drain directly to the offsite storm drain system. Stormwater runoff from paved areas will undergo 80% TSS removal through the subsurface infiltration system. See Appendix VIII.

Standard 5: Land Uses with Higher Potential Pollutant Loads

There will be less than 1000 vehicle trips per day generated by the proposed development. Therefore, the project is not considered a Land Use with Higher Potential Pollutant Loads. Stormwater runoff from the project site will undergo 80% TSS removal.

Standard 6: Critical Areas

The proposed project is not in a critical area. Therefore this standard is not applicable.

Standard 7: Redevelopment

While the project is the redevelopment of an existing site, there will be an overall increase in impervious area. Therefore this development will comply with all ten stormwater management standards to improve post development conditions.

Standard 8: Construction Period Pollution Prevention and Erosion & Sedimentation Control

Best management practices (BMP) for erosion and sedimentation control are staked straw wattles, filter fences, hydro seeding, and phased development. Many stormwater BMP technologies (e.g., infiltration technologies) are not designed to handle the high concentrations of sediments typically found in construction runoff and must be protected from construction-related sediment loadings. Construction BMP's **must** be maintained. In developing the proposed project certain measures will be implemented to minimize impacts erosion and sedimentation could have on surrounding areas. This section addresses items that involve proper construction techniques, close surveillance of workmanship, and immediate response to emergency situations. The developer must be prepared to provide whatever reasonable measures are necessary to protect the environment during construction and to stabilize all disturbed areas as soon as construction ends.

Pre-Construction

1. The contractor shall have a stockpile of materials required to control erosion on-site to be used to supplement or repair erosion control devices. These materials shall include, but are not limited to straw wattles, silt fence and crushed stone.

2. The contractor is responsible for erosion control on site and shall utilize erosion control measures where needed, regardless of whether the measures are specified on the plan or in the order of conditions.

Preliminary Site Work

1. Excavated materials should be stockpiled, separating the topsoil for future use on the site. Erosion control shall be utilized along the down slope side of the piles and side slopes shall not exceed 2:1.
2. If intense rainfall is anticipated, the installation of supplemental straw bale dikes, silt fences, or armored dikes shall be considered.
3. Unsuitable excavated material shall be removed from the site.
4. Construction entrance shall be installed.
5. Existing catchbasins shall be protected with silt sacks.

Ongoing Site Work

1. Erosion control measures shall be regularly inspected and replaced as needed.
2. Dewatering shall be done in a manner so as not to transmit silt, sand or particulate matter to the receiving water or existing drainage system.

Landscaping

1. Landscaping shall occur as soon as possible to provide permanent stabilization of disturbed surfaces.
2. If the season or adverse weather conditions do not allow the establishment of vegetation, temporary mulching with straw or wood chips weighted with snow fence or branches, or other methods shall be provided.
3. A minimum of 4 inches of topsoil shall be placed and its surface smoothed to the specified grades.
4. The use of herbicides is strongly discouraged.
5. Hydro seeding is encouraged for steep slopes. Application rates on slopes greater than 3:1 shall have a minimum seeding rate of 5-lbs/1000 SF. A latex or fiber tackifier shall be used on these slopes at a minimum rate of 50 lbs. of tackifier per 500 gallons of water used.

Standard 9: Operations and Maintenance Plan

The information provided herein is intended to provide the base information for operation and maintenance of the site in perpetuity subject to updates and revisions as required at a future date. As such, all future property owners must be notified in writing of the this plan and be provided with a copy of this plan, a complete set of the design drawings and/or a completed as-built plan showing all the drainage features as they were constructed, which are considered part of this document. Please see the attached Operations and Maintenance Log (Appendix IX).

Stormwater management system owner:	Winn Development Company Limited Partnership
The party responsible for operation and maintenance:	Winn Development Company Limited Partnership One Washington Mall, Suite 500 Boston, Massachusetts 01749

Illicit Discharge - Practices to Minimize Storm Water Contamination

- All waste materials will be collected and stored in a securely lidded metal dumpster.
- All trash and debris from the site will be deposited in the dumpster. The dumpster will be emptied on a regular schedule prior to being over full.
- All personnel will be instructed regarding the correct procedure for waste disposal.
- Good housekeeping and spill control practices will be followed to minimize storm water contamination from petroleum products, paints, and cleaning products.

- All site vehicles will be monitored for leaks and receive regular preventive maintenance to reduce the chance of leakage.
- Spill kits will be provided with any activity that could provide contamination.
- All paint containers and curing compounds will be tightly sealed and stored when not required for use. Excess paint will not be discharged to the storm sewers, but will be properly disposed according to the manufacturer's instructions.
- All spills will be cleaned up immediately upon discovery. Spills large enough to reach the storm sewers will be reported to the Massachusetts Department of Environmental Protection Northeast Regional Office at 1-888-304-1133.

Infiltration BMP

The infiltration BMP (subsurface chamber system) shall be inspected after every major storm for the first few months to ensure it is stabilized and functioning properly. If necessary, corrective action shall be taken until the system functions properly. Inspectors should note how long water remains standing in the inspection port after a storm; standing water within the system 48 to 72 hours after a storm indicates that the infiltration capacity may have been overestimated. If the ponding is due to clogging, immediately address the reasons for the clogging. Thereafter, inspect the infiltration BMP at least twice per year.

Vegetated Areas Maintenance

Although not a structural component of the drainage system, the maintenance of vegetated areas may affect the functioning of stormwater management practices. This includes the health/density of vegetative cover and activities such as the application and disposal of lawn and garden care products, disposal of leaves and yard trimmings.

Initial Post-Construction Inspection

During the initial period of vegetation establishment, pruning and weeding are required twice in the first year by contractor or owner. Any dead vegetation/plantings found after the first year will be replaced. Proper mulching is mandatory and regular watering may be required initially to ensure proper establishment of new vegetation.

Long-Term Maintenance

The planted areas shall be inspected on a semi-annual basis and any litter removed. Weeds and invasive plant species shall be removed by hand. Maintain planted areas adjacent to pavement to prevent soil washout. Immediately clean any soil deposits on pavement. Leaf litter and other detritus shall be removed twice per year. If needed to maintain aesthetic appearance, perennial plantings may be trimmed at the end of the growing season.

Trees and shrubs shall be inspected twice per year to evaluate health and attended to as necessary. Seeded ground cover or grass areas shall not receive mulching. Re-seed bare areas; install appropriate erosion control measures when native soil is exposed or erosion channels are forming. Plant alternative mixtures of grass species in the event of unsuccessful establishment. The grass vegetation should not be cut to a height less than four inches.

Pesticide/Herbicide Usage

No pesticides are to be used unless a single spot treatment is required for a specific control application.

Conclusion

Significant attention and consideration has been given to proper management of stormwater runoff from the project site. The unique site-specific characteristics and hydrologic setting has been carefully studied to develop a comprehensive plan that fully utilizes and recognizes these attributes. Disposition of stormwater has been considered with respect to its peak rate, total volume and water quality aspects, to ensure appropriate mitigation upon project completion.

- There will be no adverse impact to any surrounding areas.
- The drainage system has been properly designed to handle the design flow rates.

Appendix I. NRCS Soils Map

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,200 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

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

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Essex County, Massachusetts, Southern Part
Survey Area Data: Version 17, Jun 9, 2020

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

Date(s) aerial images were photographed: Aug 10, 2014—Aug 25, 2014

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
602	Urban land	5.2	97.8%
724C	Hollis-Urban land-Rock outcrop complex, sloping	0.1	2.2%
Totals for Area of Interest		**5.3**	**100.0%**

Map Unit Descriptions

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

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

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

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

onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

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

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

Essex County, Massachusetts, Southern Part

602—Urban land

Map Unit Setting

National map unit symbol: vkjv
Frost-free period: 145 to 175 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Urban Land

Setting

Parent material: Excavated, filled, and made land

Minor Components

Udorthents

Percent of map unit: 7 percent
Hydric soil rating: No

Hollis

Percent of map unit: 5 percent

Whitman

Percent of map unit: 3 percent
Landform: Depressions
Hydric soil rating: Yes

Freetown

Percent of map unit: 1 percent
Landform: Bogs
Hydric soil rating: Yes

Scarboro

Percent of map unit: 1 percent
Landform: Terraces
Hydric soil rating: Yes

Whately variant

Percent of map unit: 1 percent
Landform: Glacial lakes (relict)
Hydric soil rating: Yes

Swansea

Percent of map unit: 1 percent
Landform: Bogs
Hydric soil rating: Yes

Maybid

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

724C—Hollis-Urban land-Rock outcrop complex, sloping

Map Unit Setting

National map unit symbol: vk61
Elevation: 0 to 250 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Hollis and similar soils: 40 percent
Urban land: 30 percent
Rock outcrop: 15 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hollis

Setting

Landform: Ridges, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable, shallow loamy basal till derived from granite and gneiss over granite and gneiss

Typical profile

O - 0 to 2 inches: muck
H2 - 2 to 5 inches: fine sandy loam
H3 - 5 to 20 inches: gravelly fine sandy loam
H4 - 20 to 60 inches: unweathered bedrock

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D

Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Urban Land

Setting

Parent material: Excavated and filled land

Description of Rock Outcrop

Setting

Parent material: Granite and gneiss

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 0 inches to lithic bedrock

Interpretive groups

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

Minor Components

Canton

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

Scituate

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

Montauk

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

Paxton

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

Whitman

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

Woodbridge

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

Ridgebury

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

Appendix II. Soil Testing Results (by others)

FIGURE 2

NORTH

LOWEST LEVEL SLAB AT EL. +39.0

LOWEST LEVEL SLAB AT EL. +34.5

LOWEST LEVEL SLAB AT EL. +32.0

APPROXIMATE LIMITS OF PROPOSED BUILDING

B-1 (+30.2)

B-2 (NE)

B-3 (+29.4)

B-4 (+27.7)

B-5 (+27.5)

B-6 (+27.0)

B-7 (+27.8)

B-8 (+30.1)

LEGEND

⊕ — APPROXIMATE LOCATION OF BORING PERFORMED BY GEOLOGIC EARTH EXPLORATION, INC. DURING THE PERIOD OF AUGUST 24 THROUGH 26, 2020 FOR McPHAIL ASSOCIATES, LLC

(+34.1) — ELEVATION OF TOP OF MARINE DEPOSIT ENCOUNTERED AT EXPLORATION LOCATION

(NE) — INDICATES TOP OF MARINE DEPOSIT NOT ENCOUNTERED AT EXPLORATION LOCATION

REFERENCE: THIS PLAN WAS PREPARED FROM A 20-SCALE DRAWING ENTITLED "EXISTING CONDITIONS PLAN OF LAND IN SWAMPSCOTT, MA" DATED JULY 10, 2020 BY HANCOCK ASSOCIATES.

GRAPHIC SCALE

40 0 40 80

FILE NAME: N:\Acad\JOBS\7046\7046-F02.dwg

McPHAIL ASSOCIATES, LLC
Geotechnical and Geoenvironmental Engineers
2269 Massachusetts Avenue
Cambridge, MA 02140
617/868-1420
617/868-1423 (Fax)
www.mcphailgeo.com

ELM PLACE
SWAMPSCOTT MASSACHUSETTS

SUBSURFACE EXPLORATION PLAN

FOR
WINN COMPANIES
BY
McPHAIL ASSOCIATES, LLC

Date: SEPTEMBER 2020	Dwn: F.G.P.	Chkd: J.A.E.	Scale: 1" = 40'
Project No: 7046			

Project: Elm Place
Location: 21 Elm Place
City/State: Swampscott, MA

Job #: 7046
Date Started: 8-24-20
Date Finished: 8-24-20

Boring No. B-1

Contractor: Geologic
Driller/Helper: Paul/Jay
Logged By/Reviewed By: J. Finney
Surface Elevation (ft): 34.2

Casing Type/Depth (ft): 4" Casing
Casing Hammer (lbs)/Drop (in): 300lb/24in
Sampler Size/Type: 2' Split Spoon
Sampler Hammer (lbs)/Drop (in): 140lb/30in

Groundwater Observations			
Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value	Sample TVOC (ppm)	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows Per 6"	Sample Description and Boring Notes
	34		0.5 / 33.7	TOPSOIL						18	Compact, light-gray to brown, gravelly SAND, some silt w/ asphalt, ash & cinders (FILL).
1	33				20		S1	24/16	0.0-2.0	13	
										7	
2	32			FILL						7	
										10	Dense, light-brown to tan, SILT and SAND, trace gravel (FILL).
3	31				40		S2	24/12	2.0-4.0	18	
										22	
4	30		4.0 / 30.2							25	
										22	Dense, interbedded layers of orange-brown, SAND, some silt, trace gravel and gray-brown, CLAY and SILT, some sand (MARINE DEPOSIT).
5	29				39		S3	24/24	4.0-6.0	18	
										21	
6	28									28	
										23	Dense, gray-brown, CLAYEY SILT, trace sand (MARINE DEPOSIT).
7	27				44		S4	24/24	6.0-8.0	21	
										23	
8	26			MARINE DEPOSIT						26	
										8	Compact, gray-brown, interbedded layers of SAND, some silt, trace gravel and SANDY SILT, trace clay, trace gravel (MARINE DEPOSIT).
9	25				19		S5	24/24	8.0-10.0	10	
										9	Roller bit refusal at 12 ft. Bedrock in wash water.
10	24									10	
11	23										
12	22		12.0 / 22.2	Bottom of borehole 12 feet below ground surface.							
13	21										
14	20										
15	19										
16	18										
17	17										
18	16										
19	15										
20	14										
21	13										
22	12										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Sunny
Temperature:

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Elm Place
Location: 21 Elm Place
City/State: Swampscott, MA

Job #: 7046
Date Started: 8-25-20
Date Finished: 8-25-20

Boring No.

B-2

Contractor: Geologic
Driller/Helper: Paul/Jay
Logged By/Reviewed By: J. Finney
Surface Elevation (ft): 34.4

Casing Type/Depth (ft): 4" Casing
Casing Hammer (lbs)/Drop (in): 300lb/24in
Sampler Size/Type: 2' Split Spoon
Sampler Hammer (lbs)/Drop (in): 140lb/30in

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value	Sample TVOC (ppm)	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows Per 6"	Sample Description and Boring Notes
	34		0.4 / 34.0	ASPHALT							
1	33			FILL	40		S1	18/12	0.5-2.0	25 26 14	Dense, black to brown, SANDY GRAVEL, w/ brick (FILL).
2	32										
3	31				18		S2	24/16	2.0-4.0	10 7 11 9	Compact, black to brown, SANDY GRAVEL, w/ brick to light-brown, SILTY SAND, w/ brick (FILL). Petrol odor coming from casing at 4 ft. Called National Grid emergency line and they determined it was an abandoned gas line from a previous building in the area. Hole was backfilled and patched with 0.0 ppm PID readings the next day.
4	30		4.0 / 30.4	Bottom of borehole 4 feet below ground surface.							
5	29										
6	28										
7	27										
8	26										
9	25										
10	24										
11	23										
12	22										
13	21										
14	20										
15	19										
16	18										
17	17										
18	16										
19	15										
20	14										
21	13										
22	12										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Sunny
Temperature:

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
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Project: Elm Place
Location: 21 Elm Place
City/State: Swampscott, MA

Job #: 7046
Date Started: 8-24-20
Date Finished: 8-24-20

Boring No. B-3

Contractor: Geologic
Driller/Helper: Paul/Jay
Logged By/Reviewed By: J. Finney
Surface Elevation (ft): 33.4

Casing Type/Depth (ft): 4" Casing
Casing Hammer (lbs)/Drop (in): 300lb/24in
Sampler Size/Type: 2' Split Spoon
Sampler Hammer (lbs)/Drop (in): 140lb/30in

Groundwater Observations			
Date	Depth	Elev.	Notes
8-26-20	8.5	24.9	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value	Sample TVOC (ppm)	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows Per 6"	Sample Description and Boring Notes
0	33		0.1 / 33.3	CRUSHED STONE							
1	32			FILL	13		S1	24/12	0.0-2.0	6 6 7 3	Compact, black to brown, SAND, some silt, some gravel, w/ brick, ash & cinders (FILL).
2	31										
3	30				8		S2	24/10	2.0-4.0	3 4 4 11	Loose, brown to tan, SILT and SAND, some gravel (FILL).
4	29		4.0 / 29.4		36		S3	24/20	4.0-6.0	10 15 21 20	Dense, light-brown and gray, interbedded layers of SAND and SILT and SILT, some sand, trace gravel (MARINE DEPOSIT).
5	28										
6	27				50		S4	24/16	6.0-8.0	18 26 24 23	Dense to very dense, brown and gray, interbedded layers of SILT, some sand, trace gravel and SILT and CLAY, some sand, trace gravel (MARINE DEPOSIT).
7	26										
8	25										
9	24				32		S5	24/16	9.0-11.0	12 14 18 18	Dense, interbedded layers of brown, SAND, some silt and blue-gray, SILT, some clay, some sand (MARINE DEPOSIT).
10	23										
11	22										
12	21										
13	20			MARINE DEPOSIT							
14	19				10		S6	24/24	14.0-16.0	4 4 6 6	Stiff, blue-gray, CLAY, some silt, trace sand (MARINE DEPOSIT).
15	18										
16	17										
17	16										
18	15										
19	14				8		S7	12/12	19.0-20.0	3 5	Firm to stiff, blue-gray, CLAY, some silt (MARINE DEPOSIT).
20	13				23		S7A	12/6	20.0-21.0	11 12	Compact, brown to tan, SILTY SAND (MARINE DEPOSIT).
21	12										
22	11										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Sunny
Temperature:

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2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
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Project: Elm Place
Location: 21 Elm Place
City/State: Swampscott, MA

Job #: 7046
Date Started: 8-24-20
Date Finished: 8-24-20

Boring No.

B-3

Contractor: Geologic
Driller/Helper: Paul/Jay
Logged By/Reviewed By: J. Finney
Surface Elevation (ft): 33.4

Casing Type/Depth (ft): 4" Casing
Casing Hammer (lbs)/Drop (in): 300lb/24in
Sampler Size/Type: 2' Split Spoon
Sampler Hammer (lbs)/Drop (in): 140lb/30in

Groundwater Observations

Date	Depth	Elev.	Notes
8-26-20	8.5	24.9	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value	Sample TVOC (ppm)	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows Per 6"	Sample Description and Boring Notes
24	10										
25	9			MARINE DEPOSIT	21		S8	24/20	24.0-26.0	10 12 9 13	Compact, brown to tan, interbedded layers of SAND, trace silt to SILTY SAND (MARINE DEPOSIT). Roller bit refusal at 27.5 ft.
26	8										
27	7		27.0 / 6.4								
28	6		27.5 / 5.9	BEDROCK Bottom of borehole 27.5 feet below ground surface.							
29	5										
30	4										
31	3										
32	2										
33	1										
34	0										
35	-1										
36	-2										
37	-3										
38	-4										
39	-5										
40	-6										
41	-7										
42	-8										
43	-9										
44	-10										
45	-11										
	-12										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Sunny
Temperature:

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project:	Elm Place	**Job #:**	7046
Location:	21 Elm Place	**Date Started:**	8-26-20
City/State:	Swampscott, MA	**Date Finished:**	8-26-20

Boring No.

B-4

Contractor: Geologic
Driller/Helper: Paul/Jay
Logged By/Reviewed By: J. Finney
Surface Elevation (ft): 31.7

Casing Type/Depth (ft): 4" Casing
Casing Hammer (lbs)/Drop (in): 300lb/24in
Sampler Size/Type: 2' Split Spoon
Sampler Hammer (lbs)/Drop (in): 140lb/30in

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value	Sample TVOC (ppm)	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows Per 6"	Sample Description and Boring Notes
			0.4 / 31.3	ASPHALT							
1	31			FILL	18		S1	18/6	0.5-2.0	16 9 10	Compact, black to dark-brown, SILTY SAND, some gravel, w/ brick, ash & cinders (FILL).
2	30										
3	29				45		S2	24/8	2.0-4.0	6 19 26 18	Dense, dark-brown to tan, gravelly SILTY SAND (FILL).
4	28		4.0 / 27.7								
5	27			MARINE DEPOSIT	32		S3	24/12	4.0-6.0	10 15 17 18	Dense, dark-brown, SAND, trace gravel, trace silt (MARINE DEPOSIT).
6	26										
7	25										
8	24										
9	23				21		S4	24/6	9.0-11.0	11 10 11 11	Compact, dark-brown, GRAVELLY SAND, trace silt (MARINE DEPOSIT).
10	22										
11	21										
12	20										
13	19										
14	18										
15	17				21		S5	24/6	14.0-16.0	12 10 11 12	Compact, dark-brown to rust-brown, GRAVELLY SAND, trace silt (MARINE DEPOSIT).
16	16										
17	15										
18	14										
19	13										
20	12				26		S6	24/24	19.0-21.0	12 13 13 13	Compact, blue-gray, SAND and SILT, some clay (MARINE DEPOSIT).
21	11		21.0 / 10.7								
22	10			Bottom of borehole 21 feet below ground surface.							
	9										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Sunny
Temperature:

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CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Elm Place
Location: 21 Elm Place
City/State: Swampscott, MA

Job #: 7046
Date Started: 6-26-20
Date Finished: 6-26-20

Boring No.
B-5

Contractor: Geologic
Driller/Helper: Paul/Jay
Logged By/Reviewed By: J. Finney
Surface Elevation (ft): 31.5

Casing Type/Depth (ft): 3" Casing
Casing Hammer (lbs)/Drop (in): 300lb/24in
Sampler Size/Type: 2' Split Spoon
Sampler Hammer (lbs)/Drop (in): 140lb/30in

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value	Sample TVOC (ppm)	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows Per 6"	Sample Description and Boring Notes
	31		0.4 / 31.1	ASPHALT							
1	30			FILL	32		S1	18/8	0.5-2.0	17 16 32	Dense, black to brown, SANDY GRAVEL varying to SAND, some gravel, trace silt (FILL).
2	29				12		S2	24/8	2.0-4.0	6 7 5 3	Compact, black to brown, SANDY GRAVEL varying to SAND, some gravel, some silt w/ brick, ash & cinders (FILL).
3	28		4.0 / 27.5								
4	27			MARINE DEPOSIT	27		S3	24/3	4.0-6.0	16 13 14 14	Compact, brown to tan, SAND, some silt, trace gravel (MARINE DEPOSIT).
5	26										
6	25										
7	24										
8	23										
9	22				19		S4	24/12	9.0-11.0	6 10 9 9	Compact, brown to tan, SAND, some silt, trace gravel (MARINE DEPOSIT).
10	21										
11	20										
12	19										
13	18										
14	17				21		S5	24/10	14.0-16.0	8 10 11 11	Compact, brown to tan, SAND and GRAVEL, some silt (MARINE DEPOSIT).
15	16										
16	15										
17	14										
18	13										
19	12				25		S6	24/14	19.0-21.0	11 7 18 23	Compact, brown, SANDY GRAVEL varying to very stiff, blue-gray, SILT, trace clay, trace sand (MARINE DEPOSIT).
20	11										
21	10										
22	9										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Sunny
Temperature:

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CAMBRIDGE, MA 02140
TEL: 617-868-1420
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Project: Elm Place
Location: 21 Elm Place
City/State: Swampscott, MA

Job #: 7046
Date Started: 6-26-20
Date Finished: 6-26-20

Boring No.
B-5

Contractor: Geologic
Driller/Helper: Paul/Jay
Logged By/Reviewed By: J. Finney
Surface Elevation (ft): 31.5

Casing Type/Depth (ft): 3" Casing
Casing Hammer (lbs)/Drop (in): 300lb/24in
Sampler Size/Type: 2' Split Spoon
Sampler Hammer (lbs)/Drop (in): 140lb/30in

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value	Sample TVOC (ppm)	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows Per 6"	Sample Description and Boring Notes
24	8										
25	7				16		S7	24/20	24.0-26.0	8 9 7 7	Compact, blue-brown, SILTY SAND, trace clay varying to stiff, blue, SILTY CLAY (MARINE DEPOSIT).
26	6										
27	5										
28	4										
29	3										
30	2			MARINE DEPOSIT	11		S8	24/20	29.0-31.0	4 5 6 8	Stiff, blue, CLAY, trace silt, trace gravel (MARINE DEPOSIT).
31	1										
32	0										
33	-1										
34	-2										
35	-3				22		S9	24/24	34.0-36.0	6 9 13 17	Interbedded layers of very stiff, blue-brown, CLAY, some silt, trace sand and compact, brown to tan, SILT and SAND (MARINE DEPOSIT).
36	-4		36.0 / -4.5								
37	-5			Bottom of borehole 36 feet below ground surface.							
38	-6										
39	-7										
40	-8										
41	-9										
42	-10										
43	-11										
44	-12										
45	-13										
	-14										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Sunny
Temperature:

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TEL: 617-868-1420
FAX: 617-868-1423

Project: Elm Place
Location: 21 Elm Place
City/State: Swampscott, MA

Job #: 7046
Date Started: 8-24-20
Date Finished: 8-24-20

Boring No.
B-6

Contractor: Geologic
Driller/Helper: Paul/Jay
Logged By/Reviewed By: J. Finney
Surface Elevation (ft): 31.0

Casing Type/Depth (ft): 4" Casing
Casing Hammer (lbs)/Drop (in): 300lb/24in
Sampler Size/Type: 2' Split Spoon
Sampler Hammer (lbs)/Drop (in): 140lb/30in

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value	Sample TVOC (ppm)	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows Per 6"	Sample Description and Boring Notes
			0.1 / 30.9	CRUSHED STONE							
1	30			FILL	20		S1	24/18	0.0-2.0	12 12 8 6	Compact, black, SAND and GRAVEL, w/ brick, asphalt, ash & cinders (FILL).
2	29										
3	28				42		S2	24/10	2.0-4.0	3 10 32 16	Dense, black to brown, SAND, some gravel, some silt, w/ asphalt, ash & cinders (FILL).
4	27		4.0 / 27.0								
5	26			MARINE DEPOSIT	14		S3	24/10	4.0-6.0	11 8 6 8	Compact, gray to brown, interbedded layers of SAND, trace silt, trace gravel and sandy SILT, trace gravel (MARINE DEPOSIT).
6	25										
7	24				21		S4	24/18	6.0-8.0	9 9 12 13	Compact, gray to -brown, SAND and GRAVEL to SAND, some silt (MARINE DEPOSIT).
8	23										
9	22										
10	21				20		S5	24/16	9.0-11.0	6 10 10 11	Compact, gray to brown, interbedded layers of SAND, trace silt, trace gravel and SAND and SILT (MARINE DEPOSIT.
11	20										
12	19										
13	18										
14	17										
15	16				24		S6	24/14	14.0-16.0	8 10 12 12	Compact, gray-brown to tan, SILTY SAND (MARINE DEPOSIT).
16	15										
17	14										
18	13										
19	12										
20	11				23		S7	24/12	19.0-21.0	7 10 13 16	Compact, brown, GRAVELLY SAND (MARINE DEPOSIT).
21	10		21.0 / 10.0								
22	9			Bottom of borehole 21 feet below ground surface.							

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Sunny
Temperature:

McPHAIL ASSOCIATES, LLC
2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Elm Place
Location: 21 Elm Place
City/State: Swampscott, MA

Job #: 7046
Date Started: 8-25-20
Date Finished: 8-25-20

Boring No.
B-7

Contractor: Geologic
Driller/Helper: Paul/Jay
Logged By/Reviewed By: J. Finney
Surface Elevation (ft): 31.8

Casing Type/Depth (ft): 4" Casing
Casing Hammer (lbs)/Drop (in): 300lb/24in
Sampler Size/Type: 2' Split Spoon
Sampler Hammer (lbs)/Drop (in): 140lb/30in

Groundwater Observations

Date	Depth	Elev.	Notes
8-24-20	8	23.8	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value	Sample TVOC (ppm)	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows Per 6"	Sample Description and Boring Notes
1	31		0.1 / 31.7	CRUSHED STONE							
				FILL	29		S1	24/10	0.0-2.0	11 15 14 7	Compact, black to brown, SAND and GRAVEL, trace silt, w/ brick, ash & cinders (FILL).
2	30										
3	29				9		S2	24/2	2.0-4.0	6 5 4 7	Loose, black to brown, SAND, some silt, some gravel, w/ ash & cinders (FILL).
4	28		4.0 / 27.8								
5	27				40		S3	24/12	4.0-6.0	9 16 24 26	Dense, dark-brown to tan-brown, GRAVELLY SAND, trace silt (MARINE DEPOSIT).
6	26										
7	25										
8	24										
9	23										
10	22				20		S4	24/10	9.0-11.0	9 9 11 8	Compact, brown, interbedded layers of SAND and GRAVEL varying to SAND, some silt (MARINE DEPOSIT).
11	21										
12	20										
13	19			MARINE DEPOSIT							
14	18										
15	17				18		S5	24/16	14.0-16.0	6 4 6 9	Stiff, light-brown to tan, interbedded layers of SANDY SILT and SILTY SAND (MARINE DEPOSIT).
16	16										
17	15										
18	14										
19	13										
20	12				18		S6	24/8	19.0-21.0	7 8 10 9	Compact, light-brown to tan, interbedded layers of SILTY SAND and GRAVELLY SAND (MARINE DEPOSIT).
21	11										
22	10										
	9										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Sunny
Temperature:

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2269 MASSACHUSETTS AVENUE
CAMBRIDGE, MA 02140
TEL: 617-868-1420
FAX: 617-868-1423

Project: Elm Place
Location: 21 Elm Place
City/State: Swampscott, MA

Job #: 7046
Date Started: 8-25-20
Date Finished: 8-25-20

Boring No.
B-7

Contractor: Geologic
Driller/Helper: Paul/Jay
Logged By/Reviewed By: J. Finney
Surface Elevation (ft): 31.8

Casing Type/Depth (ft): 4" Casing
Casing Hammer (lbs)/Drop (in): 300lb/24in
Sampler Size/Type: 2' Split Spoon
Sampler Hammer (lbs)/Drop (in): 140lb/30in

Groundwater Observations

Date	Depth	Elev.	Notes
8-24-20	8	23.8	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value	Sample TVOC (ppm)	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows Per 6"	Sample Description and Boring Notes
24	8										
25	7				6		S7	24/10	24.0-26.0	3 3 3 3	Firm, blue, CLAY, some silt (MARINE DEPOSIT).
26	6										
27	5										
28	4										
29	3										
30	2				10		S8	24/16	29.0-31.0	6 7 3 6	Stiff, blue, CLAY, some silt (MARINE DEPOSIT).
31	1										
32	0			MARINE DEPOSIT							
33	-1										
34	-2										
35	-3				14		S9	24/16	34.0-36.0	5 4 10 5	Stiff, blue, CLAY, some silt (MARINE DEPOSIT).
36	-4										
37	-5										
38	-6										
39	-7										
40	-8				7		S10	24/24	39.0-41.0	3 4 3 5	Firm, blue, CLAY, trace silt (MARINE DEPOSIT).
41	-9		41.0 / -9.2								
42	-10			Bottom of borehole 41 feet below ground surface.							
43	-11										
44	-12										
45	-13										
	-14										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Sunny
Temperature:

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CAMBRIDGE, MA 02140
TEL: 617-868-1420
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Project: Elm Place
Location: 21 Elm Place
City/State: Swampscott, MA

Job #: 7046
Date Started: 8-25-20
Date Finished: 8-25-20

Boring No.

B-8

Contractor: Geologic
Driller/Helper: Paul/Jay
Logged By/Reviewed By: J. Finney
Surface Elevation (ft): 32.1

Casing Type/Depth (ft): 4" Casing
Casing Hammer (lbs)/Drop (in): 300lb/24in
Sampler Size/Type: 2' Split Spoon
Sampler Hammer (lbs)/Drop (in): 140lb/30in

Groundwater Observations

Date	Depth	Elev.	Notes
8-26-20	4	28.1	

Depth (ft)	Elev. (ft)	Symbol	Depth/EL to Strata Change (ft)	Stratum	Sample N-Value	Sample TVOC (ppm)	Sample No.	Sample Pen./Rec. (in)	Sample Depth (ft)	Sample Blows Per 6"	Sample Description and Boring Notes
1	31			FILL	9		S1	24/8	0.0-2.0	6 5 3 3	Loose, black to orange-brown, SAND and GRAVEL, trace silt, w/ brick (FILL).
2	30		2.0 / 30.1								
3	29				9		S2	24/12	2.0-4.0	4 4 5 8	Loose, light-brown to tan-brown, interbedded layers of SAND, trace silt, trace gravel varying to SILTY SAND (MARINE DEPOSIT).
4	28										
5	27				31		S3	24/10	4.0-6.0	14 14 17 18	Dense, brown, SAND and GRAVEL, trace silt (MARINE DEPOSIT).
6	26										
7	25										
8	24										
9	23				32		S4	24/12	9.0-11.0	11 13 19 13	Dense, brown to tan-brown, SAND, some gravel, trace silt (MARINE DEPOSIT).
10	22										
11	21			MARINE DEPOSIT							
12	20										
13	19										
14	18				19		S5	24/16	14.0-16.0	7 9 10 10	Compact, light-brown to dark-brown, SILTY SAND varying to SAND, some silt, trace gravel (MARINE DEPOSIT).
15	17										
16	16										
17	15										
18	14										
19	13				19		S6	24/22	19.0-21.0	7 7 12 15	Stiff, blue, CLAY and SILT varying to compact, brown to tan-brown, SILTY SAND (MARINE DEPOSIT).
20	12										
21	11		21.0 / 11.1								
22	10			Bottom of borehole 21 feet below ground surface.							

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	COMPACT
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	CONSISTENCY
<2	V.SOFT
2-4	SOFT
4-8	FIRM
8-15	STIFF
15-30	V.STIFF
>30	HARD

SOIL COMPONENT

DESCRIPTIVE TERM	PROPORTION OF TOTAL
"TRACE"	0-10%
"SOME"	10-20%
"ADJECTIVE" (eg SANDY, SILTY)	20-35%
"AND"	35-50%

SOIL CONTAINING THREE COMPONENTS EACH OF WHICH COMPRISE AT LEAST 25% OF THE TOTAL ARE CLASSIFIED AS "A WELL-GRADED MIXTURE OF"

Notes:

Total Volatile Organic Compounds (TVOC) measured w/ PID Model:
TVOC Background: ppm
Weather: Sunny
Temperature:

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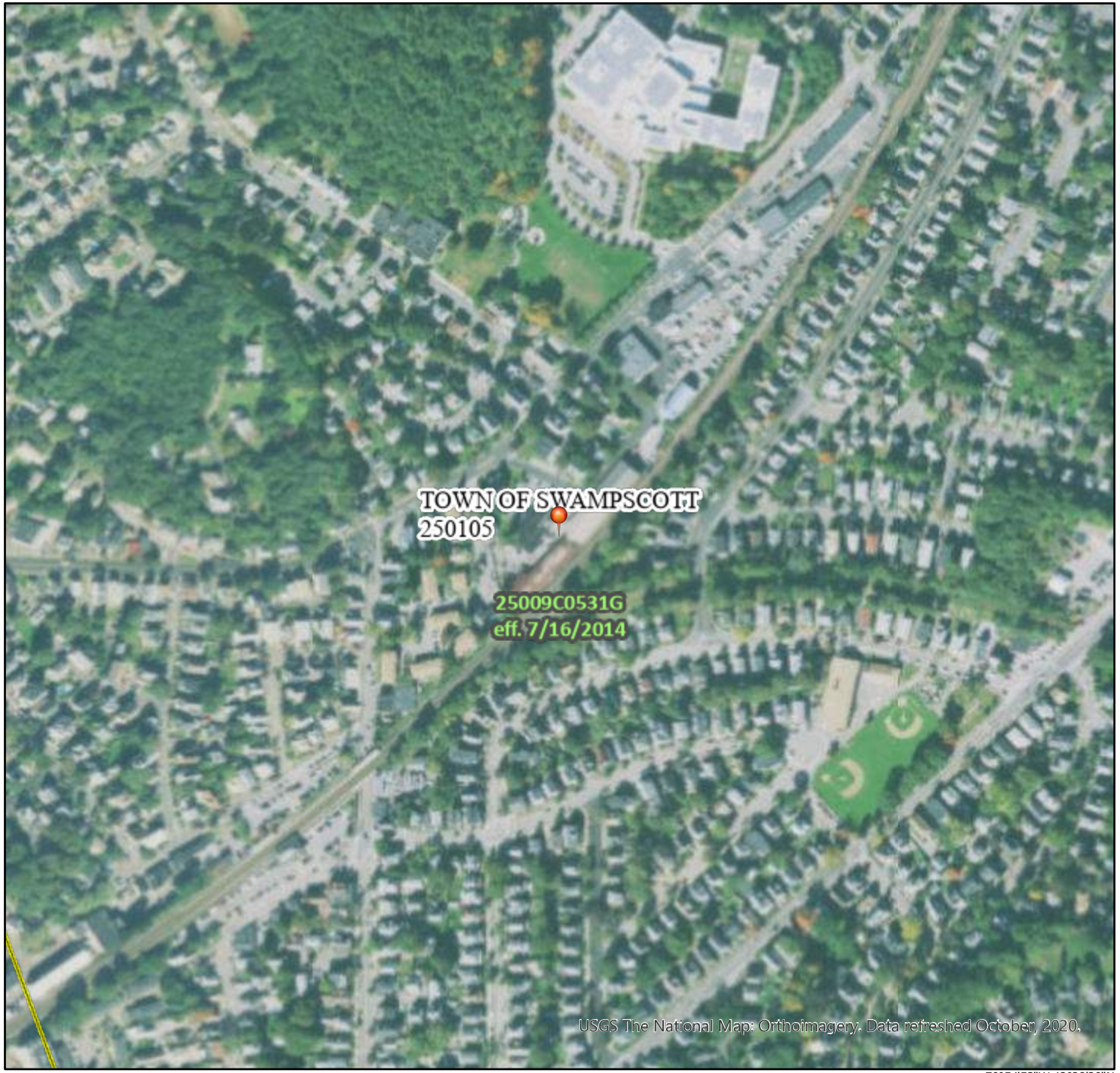
Appendix III. FEMA Firmette

National Flood Hazard Layer FIRMette

70°55'30"W 42°28'46"N



70°54'53"W 42°28'20"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 12/31/2020 at 2:20 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Appendix IV. Stormwater Checklist

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands Program

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary for a comprehensive Stormwater Report that addresses the ten Stormwater Standards.

Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.

Registered Professional Engineer Block and Signature

Deborah L. Colbert 1.15.21

Signature and Date

Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

☐ New development

☐ Redevelopment

☒ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

☒ No disturbance to any Wetland Resource Areas

☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)

☐ Reduced Impervious Area (Redevelopment Only)

☐ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

- ☐ Credit 1
- ☐ Credit 2
- ☐ Credit 3

☐ Use of "country drainage" versus curb and gutter conveyance and pipe

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☒ Other (describe): Subsurface Infiltration System

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

☐ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth

☐ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.

☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.

☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.

☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:

- ☐ Site is comprised solely of C and D soils and/or bedrock at the land surface
- ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
- ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

☐ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

[1] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

☐ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.

☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;
- Winter Road Salt and/or Sand Use and Storage restrictions;
- Street sweeping schedules;
- Provisions for prevention of illicit discharges to the stormwater management system;
- Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.

☒ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.

☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:

- ☐ is within the Zone II or Interim Wellhead Protection Area
- ☐ is near or to other critical areas
- ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
- ☐ involves runoff from land uses with higher potential pollutant loads.

☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.

☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

☒ The BMP is sized (and calculations provided) based on:

- ☒ The ½" or 1" Water Quality Volume or
- ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.

☒ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.

☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.

☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted ***prior to*** the discharge of stormwater to the post-construction stormwater BMPs.

☐ The NPDES Multi-Sector General Permit does ***not*** cover the land use.

☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.

☐ All exposure has been eliminated.

☐ All exposure has ***not*** been eliminated and all BMPs selected are on MassDEP LUHPPL list.

☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.

☐ Critical areas and BMPs are identified in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

☐ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:

- ☐ Limited Project
- ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- ☐ Bike Path and/or Foot Path
- ☐ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.

☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.

Checklist for Stormwater Report

Checklist (continued)

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control (continued)

☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has ***not*** been included in the Stormwater Report but will be submitted ***before*** land disturbance begins.

☐ The project is ***not*** covered by a NPDES Construction General Permit.

☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.

☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:

- ☒ Name of the stormwater management system owners;
- ☒ Party responsible for operation and maintenance;
- ☒ Schedule for implementation of routine and non-routine maintenance tasks;
- ☐ Plan showing the location of all stormwater BMPs maintenance access areas;
- ☒ Description and delineation of public safety features;
- ☐ Estimated operation and maintenance budget; and
- ☐ Operation and Maintenance Log Form.

☐ The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:

- ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
- ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

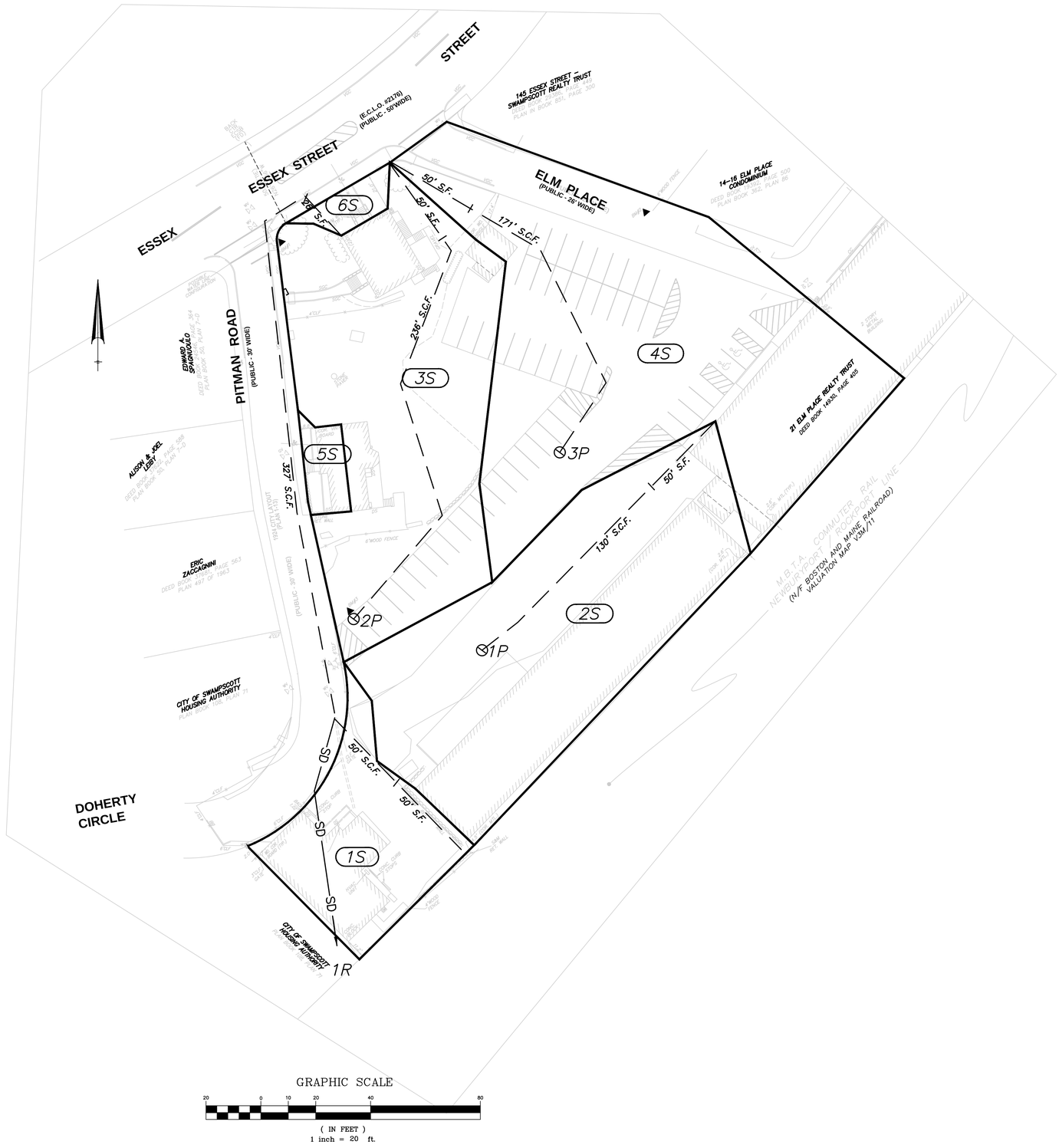
Standard 10: Prohibition of Illicit Discharges

☒ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ An Illicit Discharge Compliance Statement is attached;

☒ NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

Appendix V. Existing and Proposed Drainage Figures



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50 Commandant's Way at Admiral's Hill
Chelsea MA 02150
O 617.889.4402
F 617.884.4329
architecturalteam.com

Consultant:

HANCOCK ASSOCIATES
185 CENTRE STREET, DANVERS, MA 01923
VOICE (978) 777-3050, FAX (978) 774-7816
WWW.HANCOCKASSOCIATES.COM

Revision:

Engineer of Record:

Drawn: JTL

Checked: JP, DC

Scale: 1"=20'

Key Plan:

Project Name:

Elm Place

Sheet Name:

PRE-DEVELOPMENT SUBCATCHMENT PLAN

Project Number:

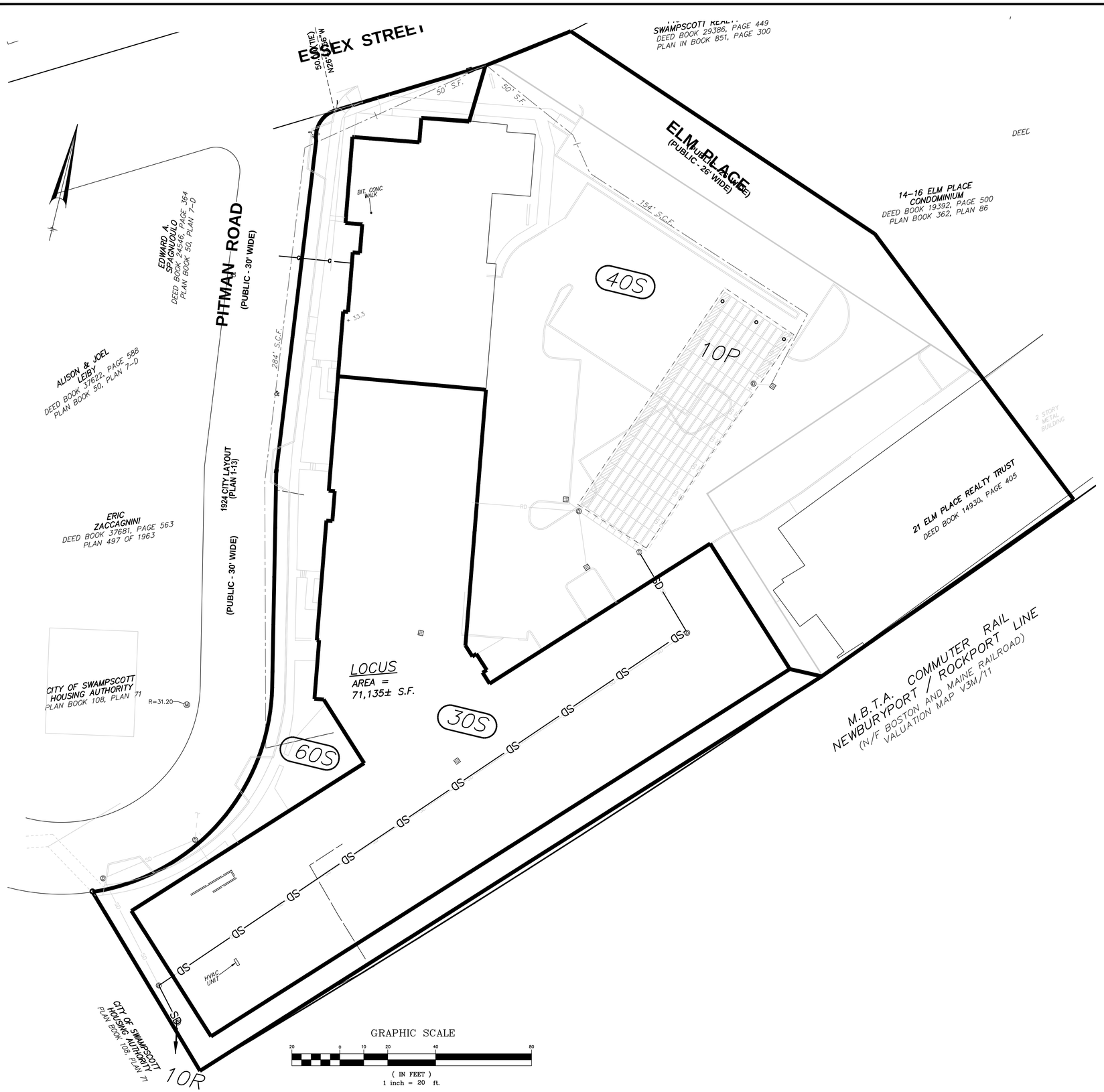
23892

Issue Date:

January 13, 2021

Sheet Number:

PRE



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WWW.HANCOCKASSOCIATES.COM

Revision:

Engineer of Record:

Drawn: JTL

Checked: JP, DC

Scale: 1"=20'

Key Plan:

Project Name:
Elm Place

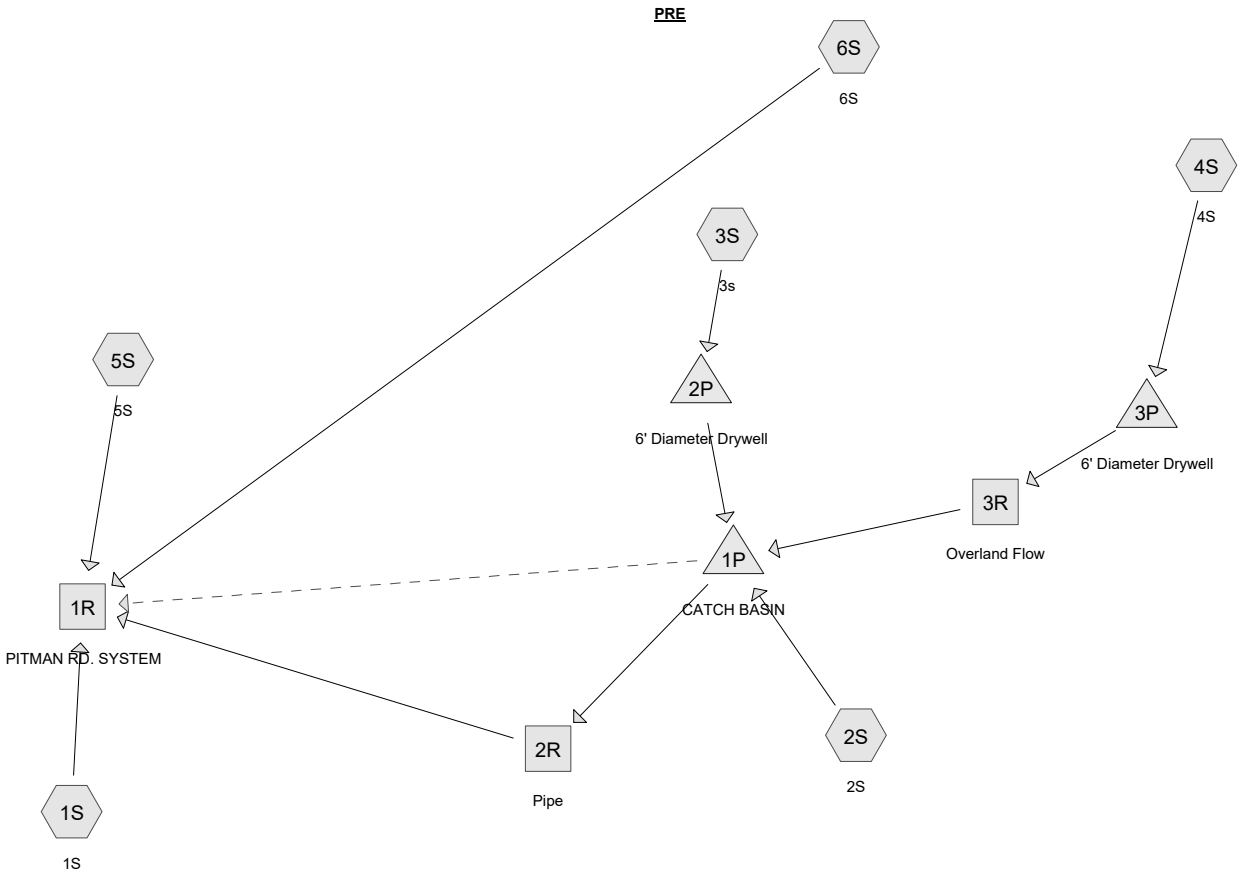
Sheet Name:
POST-DEVELOPMENT SUBCATCHMENT PLAN

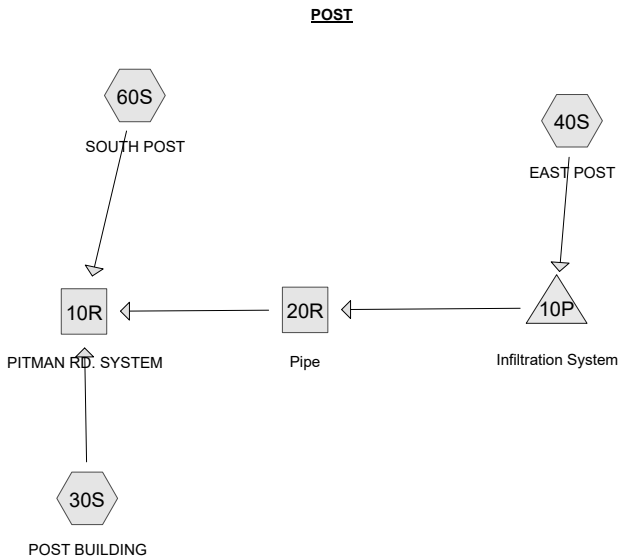
Project Number:
23892

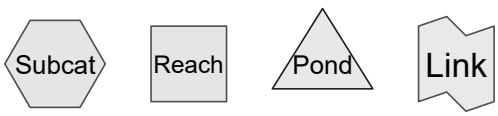
Issue Date:
January 13, 2021

Sheet Number:
POST

Appendix VI. Hydrocad Output







Routing Diagram for 23892-hydro-rev-3
Prepared by {enter your company name here}, Printed 1/14/2021

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: 1S Runoff Area=7,751 sf 84.67% Impervious Runoff Depth>2.31"
Flow Length=100' Slope=0.0200 '/' Tc=5.0 min CN=94 Runoff=0.49 cfs 1,494 cf

Subcatchment2S: 2S Runoff Area=21,935 sf 64.03% Impervious Runoff Depth>2.59"
Flow Length=180' Slope=0.0200 '/' Tc=5.0 min CN=97 Runoff=1.50 cfs 4,743 cf

Subcatchment3S: 3s Runoff Area=21,055 sf 40.94% Impervious Runoff Depth>1.35"
Flow Length=286' Tc=5.7 min CN=82 Runoff=0.81 cfs 2,370 cf

Subcatchment4S: 4S Runoff Area=31,001 sf 92.98% Impervious Runoff Depth>2.59"
Flow Length=221' Tc=5.3 min CN=97 Runoff=2.09 cfs 6,703 cf

Subcatchment5S: 5S Runoff Area=1,123 sf 58.06% Impervious Runoff Depth>1.35"
Flow Length=10' Slope=0.0200 '/' Tc=5.0 min CN=82 Runoff=0.04 cfs 126 cf

Subcatchment6S: 6S Runoff Area=950 sf 20.32% Impervious Runoff Depth>0.65"
Flow Length=353' Slope=0.0200 '/' Tc=5.3 min CN=69 Runoff=0.02 cfs 52 cf

Subcatchment30S: POST BUILDING Runoff Area=20,530 sf 100.00% Impervious Runoff Depth>2.68"
Tc=5.0 min CN=98 Runoff=1.43 cfs 4,589 cf

Subcatchment40S: EAST POST Runoff Area=51,539 sf 89.52% Impervious Runoff Depth>2.31"
Tc=5.0 min CN=94 Runoff=3.28 cfs 9,934 cf

Subcatchment60S: SOUTH POST Runoff Area=11,746 sf 31.82% Impervious Runoff Depth>0.84"
Tc=5.0 min CN=73 Runoff=0.27 cfs 818 cf

Reach 1R: PITMAN RD. SYSTEM Inflow=4.46 cfs 13,309 cf
Outflow=4.46 cfs 13,309 cf

Reach 2R: Pipe Avg. Flow Depth=0.50' Max Vel=3.83 fps Inflow=1.47 cfs 10,729 cf
6.0" Round Pipe n=0.010 L=36.0' S=0.0083 '/' Capacity=0.67 cfs Outflow=0.67 cfs 10,729 cf

Reach 3R: Overland Flow Avg. Flow Depth=0.11' Max Vel=2.04 fps Inflow=2.07 cfs 5,382 cf
n=0.016 L=42.0' S=0.0155 '/' Capacity=11.66 cfs Outflow=2.07 cfs 5,382 cf

Reach 10R: PITMAN RD. SYSTEM Inflow=1.69 cfs 7,757 cf
Outflow=1.69 cfs 7,757 cf

Reach 20R: Pipe Avg. Flow Depth=0.37' Max Vel=3.26 fps Inflow=0.99 cfs 2,351 cf
15.0" Round Pipe n=0.013 L=274.0' S=0.0066 '/' Capacity=5.24 cfs Outflow=0.98 cfs 2,351 cf

Pond 1P: CATCH BASIN Peak Elev=31.32' Storage=1,341 cf Inflow=4.48 cfs 11,690 cf
Primary=1.47 cfs 10,729 cf Secondary=3.40 cfs 908 cf Outflow=4.87 cfs 11,637 cf

Pond 2P: 6' Diameter Drywell Peak Elev=31.32' Storage=350 cf Inflow=0.81 cfs 2,370 cf
Discarded=0.02 cfs 461 cf Primary=0.97 cfs 1,565 cf Outflow=0.98 cfs 2,026 cf

Pond 3P: 6' Diameter Drywell Peak Elev=31.64' Storage=182 cf Inflow=2.09 cfs 6,703 cf
Discarded=0.02 cfs 1,140 cf Primary=2.07 cfs 5,382 cf Outflow=2.10 cfs 6,522 cf

Pond 10P: Infiltration System Peak Elev=29.24' Storage=4,167 cf Inflow=3.28 cfs 9,934 cf
Discarded=0.10 cfs 4,348 cf Primary=0.99 cfs 2,351 cf Outflow=1.09 cfs 6,698 cf

Summary for Subcatchment 1S: 1S

Runoff = 0.49 cfs @ 12.07 hrs, Volume= 1,494 cf, Depth> 2.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
2,699	98	Roofs, HSG B
3,864	98	Paved parking, HSG B
246	85	Gravel roads, HSG B
942	69	50-75% Grass cover, Fair, HSG B
7,751	94	Weighted Average
1,188		15.33% Pervious Area
6,563		84.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.18		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.3	50	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.0					**Direct Entry, Minimum = 5 min**
5.0	100	Total			

Summary for Subcatchment 2S: 2S

Runoff = 1.50 cfs @ 12.07 hrs, Volume= 4,743 cf, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
10,549	98	Roofs, HSG B
3,496	98	Paved parking, HSG B
7,890	96	Gravel surface, HSG B
21,935	97	Weighted Average
7,890		35.97% Pervious Area
14,045		64.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.18		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
1.0	130	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
3.3					**Direct Entry, Minimum = 5 min**
5.0	180	Total			

Summary for Subcatchment 3S: 3s

Runoff = 0.81 cfs @ 12.09 hrs, Volume= 2,370 cf, Depth> 1.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
2,150	98	Roofs, HSG B
6,470	98	Paved parking, HSG B
9,106	61	>75% Grass cover, Good, HSG B
3,329	96	Gravel surface, HSG B
21,055	82	Weighted Average
12,435		59.06% Pervious Area
8,620		40.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.0500	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.7	236	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
5.7	286	Total			

Summary for Subcatchment 4S: 4S

Runoff = 2.09 cfs @ 12.08 hrs, Volume= 6,703 cf, Depth> 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
6,139	98	Roofs, HSG B
22,685	98	Paved parking, HSG B
835	61	>75% Grass cover, Good, HSG B
1,342	96	Gravel surface, HSG B
31,001	97	Weighted Average
2,177		7.02% Pervious Area
28,824		92.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.0500	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.3	171	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
5.3	221	Total			

Summary for Subcatchment 5S: 5S

Runoff = 0.04 cfs @ 12.08 hrs, Volume= 126 cf, Depth> 1.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
593	98	Roofs, HSG B
59	98	Paved parking, HSG B
471	61	>75% Grass cover, Good, HSG B
1,123	82	Weighted Average
471		41.94% Pervious Area
652		58.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	10	0.0200	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
3.4					**Direct Entry, Minimum = 5 min**
5.0	10	Total			

Summary for Subcatchment 6S: 6S

Runoff = 0.02 cfs @ 12.10 hrs, Volume= 52 cf, Depth> 0.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
193	98	Paved parking, HSG B
757	61	>75% Grass cover, Good, HSG B
950	69	Weighted Average
757		79.68% Pervious Area
193		20.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	26	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.9	327	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.3	353	Total			

Summary for Subcatchment 30S: POST BUILDING

Runoff = 1.43 cfs @ 12.07 hrs, Volume= 4,589 cf, Depth> 2.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
20,530	98	Roofs, HSG B
20,530		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum = 5 min**

Summary for Subcatchment 40S: EAST POST

Runoff = 3.28 cfs @ 12.07 hrs, Volume= 9,934 cf, Depth> 2.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10"

	Area (sf)	CN	Description
	6,891	98	Roofs, HSG B
	29,089	98	Paved parking, HSG B
	5,401	61	>75% Grass cover, Good, HSG B
*	10,158	98	Roofs, HSG B
	51,539	94	Weighted Average
	5,401		10.48% Pervious Area
	46,138		89.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum = 5 min**

Summary for Subcatchment 60S: SOUTH POST

Runoff = 0.27 cfs @ 12.09 hrs, Volume= 818 cf, Depth> 0.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-yr Rainfall=3.10"

Area (sf)	CN	Description
8,009	61	>75% Grass cover, Good, HSG B
3,737	98	Paved parking, HSG B
11,746	73	Weighted Average
8,009		68.18% Pervious Area
3,737		31.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum = 5 min**

Summary for Reach 1R: PITMAN RD. SYSTEM

Inflow Area = 83,815 sf, 70.27% Impervious, Inflow Depth > 1.91" for 2-yr event
Inflow = 4.46 cfs @ 12.15 hrs, Volume= 13,309 cf
Outflow = 4.46 cfs @ 12.15 hrs, Volume= 13,309 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

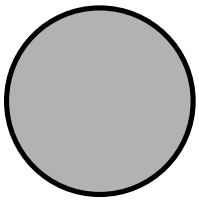
Summary for Reach 2R: Pipe

Inflow Area = 73,991 sf, 69.59% Impervious, Inflow Depth > 1.74" for 2-yr event
Inflow = 1.47 cfs @ 12.15 hrs, Volume= 10,729 cf
Outflow = 0.67 cfs @ 11.70 hrs, Volume= 10,729 cf, Atten= 55%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.83 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.46 fps, Avg. Travel Time= 0.2 min

Peak Storage= 7 cf @ 11.70 hrs
Average Depth at Peak Storage= 0.50'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 0.67 cfs

6.0" Round Pipe
n= 0.010 Cast iron, coated
Length= 36.0' Slope= 0.0083 '/'
Inlet Invert= 28.40', Outlet Invert= 28.10'



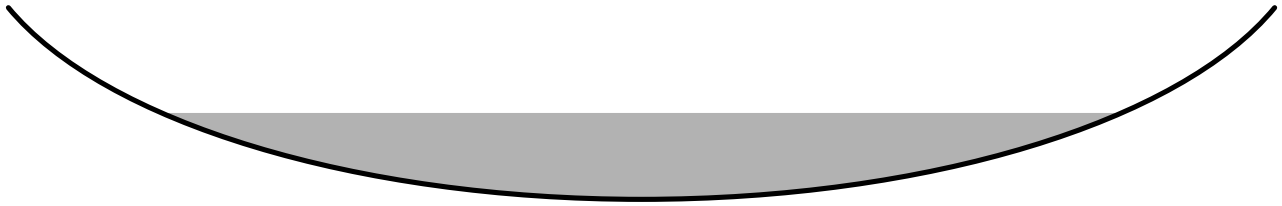
Summary for Reach 3R: Overland Flow

Inflow Area = 31,001 sf, 92.98% Impervious, Inflow Depth > 2.08" for 2-yr event
Inflow = 2.07 cfs @ 12.07 hrs, Volume= 5,382 cf
Outflow = 2.07 cfs @ 12.08 hrs, Volume= 5,382 cf, Atten= 0%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.04 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 0.69 fps, Avg. Travel Time= 1.0 min

Peak Storage= 42 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.11'
Bank-Full Depth= 0.25' Flow Area= 3.3 sf, Capacity= 11.66 cfs

20.00' x 0.25' deep Parabolic Channel, n= 0.016 Asphalt, rough
Length= 42.0' Slope= 0.0155 '/'
Inlet Invert= 31.45', Outlet Invert= 30.80'



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Summary for Reach 10R: PITMAN RD. SYSTEM

Inflow Area = 83,815 sf, 84.00% Impervious, Inflow Depth > 1.11" for 2-yr event
Inflow = 1.69 cfs @ 12.07 hrs, Volume= 7,757 cf
Outflow = 1.69 cfs @ 12.07 hrs, Volume= 7,757 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

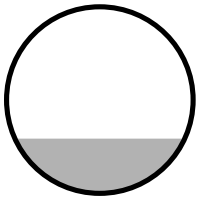
Summary for Reach 20R: Pipe

Inflow Area = 51,539 sf, 89.52% Impervious, Inflow Depth = 0.55" for 2-yr event
Inflow = 0.99 cfs @ 12.36 hrs, Volume= 2,351 cf
Outflow = 0.98 cfs @ 12.38 hrs, Volume= 2,351 cf, Atten= 1%, Lag= 0.9 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.26 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 1.45 fps, Avg. Travel Time= 3.2 min

Peak Storage= 82 cf @ 12.38 hrs
Average Depth at Peak Storage= 0.37'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 5.24 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 274.0' Slope= 0.0066 '/'
Inlet Invert= 27.90', Outlet Invert= 26.10'



Summary for Pond 1P: CATCH BASIN

Inflow Area = 73,991 sf, 69.59% Impervious, Inflow Depth > 1.90" for 2-yr event
Inflow = 4.48 cfs @ 12.09 hrs, Volume= 11,690 cf
Outflow = 4.87 cfs @ 12.15 hrs, Volume= 11,637 cf, Atten= 0%, Lag= 3.7 min
Primary = 1.47 cfs @ 12.15 hrs, Volume= 10,729 cf
Secondary = 3.40 cfs @ 12.15 hrs, Volume= 908 cf

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 31.32' @ 12.15 hrs Surf.Area= 4,837 sf Storage= 1,341 cf

Plug-Flow detention time= 8.1 min calculated for 11,597 cf (99% of inflow)
Center-of-Mass det. time= 6.1 min (754.3 - 748.2)

Volume	Invert	Avail.Storage	Storage Description
#1	24.40'	1,341 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
24.40	13	0	0
30.58	13	80	80
31.10	4,837	1,261	1,341

Device	Routing	Invert	Outlet Devices
#1	Primary	28.40'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	31.05'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=1.47 cfs @ 12.15 hrs HW=31.32' TW=28.90' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 1.47 cfs @ 7.49 fps)

Secondary OutFlow Max=3.39 cfs @ 12.15 hrs HW=31.32' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 3.39 cfs @ 1.25 fps)

Summary for Pond 2P: 6' Diameter Drywell

Inflow Area = 21,055 sf, 40.94% Impervious, Inflow Depth > 1.35" for 2-yr event
Inflow = 0.81 cfs @ 12.09 hrs, Volume= 2,370 cf
Outflow = 0.98 cfs @ 12.10 hrs, Volume= 2,026 cf, Atten= 0%, Lag= 0.4 min
Discarded = 0.02 cfs @ 11.95 hrs, Volume= 461 cf
Primary = 0.97 cfs @ 12.10 hrs, Volume= 1,565 cf

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 31.32' @ 12.20 hrs Surf.Area= 654 sf Storage= 350 cf

Plug-Flow detention time= 62.4 min calculated for 2,020 cf (85% of inflow)
Center-of-Mass det. time= 20.1 min (819.7 - 799.6)

Volume	Invert	Avail.Storage	Storage Description
#1	23.40'	350 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
23.40	28	0	0
29.40	28	168	168
29.41	4	0	168
30.43	4	4	172
30.97	654	178	350

Device	Routing	Invert	Outlet Devices
#1	Discarded	23.40'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	30.96'	**18.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=0.02 cfs @ 11.95 hrs HW=30.98' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 12.10 hrs HW=31.04' TW=31.07' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 3P: 6' Diameter Drywell

Inflow Area = 31,001 sf, 92.98% Impervious, Inflow Depth > 2.59" for 2-yr event
Inflow = 2.09 cfs @ 12.08 hrs, Volume= 6,703 cf
Outflow = 2.10 cfs @ 12.07 hrs, Volume= 6,522 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.02 cfs @ 8.05 hrs, Volume= 1,140 cf
Primary = 2.07 cfs @ 12.07 hrs, Volume= 5,382 cf

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 31.64' @ 12.08 hrs Surf.Area= 1,032 sf Storage= 182 cf

Plug-Flow detention time= 21.3 min calculated for 6,499 cf (97% of inflow)
Center-of-Mass det. time= 10.1 min (753.7 - 743.6)

Volume	Invert	Avail.Storage	Storage Description
#1	26.50'	182 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
26.50	28	0	0
30.00	28	98	98
30.10	4	2	100
31.31	4	5	104
31.46	1,032	78	182

Device	Routing	Invert	Outlet Devices
#1	Discarded	31.30'	**1.020 in/hr Exfiltration over Surface area above 31.30'** Excluded Surface area = 4 sf
#2	Primary	31.45'	**12.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Discarded OutFlow Max=0.02 cfs @ 8.05 hrs HW=31.46' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=1.92 cfs @ 12.07 hrs HW=31.64' TW=31.56' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 1.92 cfs @ 0.85 fps)

Summary for Pond 10P: Infiltration System

Inflow Area = 51,539 sf, 89.52% Impervious, Inflow Depth > 2.31" for 2-yr event
Inflow = 3.28 cfs @ 12.07 hrs, Volume= 9,934 cf
Outflow = 1.09 cfs @ 12.36 hrs, Volume= 6,698 cf, Atten= 67%, Lag= 17.5 min
Discarded = 0.10 cfs @ 12.36 hrs, Volume= 4,348 cf
Primary = 0.99 cfs @ 12.36 hrs, Volume= 2,351 cf

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 29.24' @ 12.36 hrs Surf.Area= 3,825 sf Storage= 4,167 cf

Plug-Flow detention time= 128.1 min calculated for 6,698 cf (67% of inflow)
Center-of-Mass det. time= 58.9 min (816.9 - 758.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	27.40'	2,663 cf	**34.83'W x 109.24'L x 2.33'H Field A** 8,879 cf Overall - 2,220 cf Embedded = 6,658 cf x 40.0% Voids
#2A	27.90'	2,220 cf	**ADS_StormTech SC-310** x 150 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 2.07 sf x 10 rows
#3	27.40'	90 cf	**5.00'D x 4.60'H DMH Storage**
		4,974 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	27.40'	**1.020 in/hr Exfiltration over Wetted area**
#2	Primary	29.00'	**3.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.10 cfs @ 12.36 hrs HW=29.24' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.10 cfs)

Primary OutFlow Max=0.98 cfs @ 12.36 hrs HW=29.24' TW=28.26' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.98 cfs @ 1.37 fps)

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: 1S Runoff Area=7,751 sf 84.67% Impervious Runoff Depth>3.60"
Flow Length=100' Slope=0.0200 '/' Tc=5.0 min CN=94 Runoff=0.75 cfs 2,327 cf

Subcatchment2S: 2S Runoff Area=21,935 sf 64.03% Impervious Runoff Depth>3.88"
Flow Length=180' Slope=0.0200 '/' Tc=5.0 min CN=97 Runoff=2.21 cfs 7,098 cf

Subcatchment3S: 3s Runoff Area=21,055 sf 40.94% Impervious Runoff Depth>2.46"
Flow Length=286' Tc=5.7 min CN=82 Runoff=1.47 cfs 4,323 cf

Subcatchment4S: 4S Runoff Area=31,001 sf 92.98% Impervious Runoff Depth>3.88"
Flow Length=221' Tc=5.3 min CN=97 Runoff=3.07 cfs 10,031 cf

Subcatchment5S: 5S Runoff Area=1,123 sf 58.06% Impervious Runoff Depth>2.46"
Flow Length=10' Slope=0.0200 '/' Tc=5.0 min CN=82 Runoff=0.08 cfs 231 cf

Subcatchment6S: 6S Runoff Area=950 sf 20.32% Impervious Runoff Depth>1.47"
Flow Length=353' Slope=0.0200 '/' Tc=5.3 min CN=69 Runoff=0.04 cfs 116 cf

Subcatchment30S: POST BUILDING Runoff Area=20,530 sf 100.00% Impervious Runoff Depth>3.96"
Tc=5.0 min CN=98 Runoff=2.09 cfs 6,780 cf

Subcatchment40S: EAST POST Runoff Area=51,539 sf 89.52% Impervious Runoff Depth>3.60"
Tc=5.0 min CN=94 Runoff=4.99 cfs 15,474 cf

Subcatchment60S: SOUTH POST Runoff Area=11,746 sf 31.82% Impervious Runoff Depth>1.75"
Tc=5.0 min CN=73 Runoff=0.59 cfs 1,712 cf

Reach 1R: PITMAN RD. SYSTEM Inflow=8.71 cfs 21,818 cf
Outflow=8.71 cfs 21,818 cf

Reach 2R: Pipe Avg. Flow Depth=0.50' Max Vel=3.87 fps Inflow=1.52 cfs 15,226 cf
6.0" Round Pipe n=0.010 L=36.0' S=0.0083 '/' Capacity=0.67 cfs Outflow=0.70 cfs 15,225 cf

Reach 3R: Overland Flow Avg. Flow Depth=0.13' Max Vel=2.30 fps Inflow=3.05 cfs 8,639 cf
n=0.016 L=42.0' S=0.0155 '/' Capacity=11.66 cfs Outflow=3.06 cfs 8,637 cf

Reach 10R: PITMAN RD. SYSTEM Inflow=6.40 cfs 15,588 cf
Outflow=6.40 cfs 15,588 cf

Reach 20R: Pipe Avg. Flow Depth=0.84' Max Vel=4.73 fps Inflow=4.25 cfs 7,096 cf
15.0" Round Pipe n=0.013 L=274.0' S=0.0066 '/' Capacity=5.24 cfs Outflow=4.15 cfs 7,096 cf

Pond 1P: CATCH BASIN Peak Elev=31.49' Storage=1,341 cf Inflow=6.67 cfs 19,199 cf
Primary=1.52 cfs 15,226 cf Secondary=7.19 cfs 3,919 cf Outflow=8.71 cfs 19,145 cf

Pond 2P: 6' Diameter Drywell Peak Elev=31.49' Storage=350 cf Inflow=1.47 cfs 4,323 cf
Discarded=0.02 cfs 513 cf Primary=1.43 cfs 3,464 cf Outflow=1.45 cfs 3,977 cf

Pond 3P: 6' Diameter Drywell Peak Elev=31.70' Storage=182 cf Inflow=3.07 cfs 10,031 cf
Discarded=0.02 cfs 1,210 cf Primary=3.05 cfs 8,639 cf Outflow=3.08 cfs 9,849 cf

Pond 10P: Infiltration System Peak Elev=29.60' Storage=4,724 cf Inflow=4.99 cfs 15,474 cf
Discarded=0.11 cfs 4,801 cf Primary=4.25 cfs 7,096 cf Outflow=4.36 cfs 11,897 cf

Summary for Subcatchment 1S: 1S

Runoff = 0.75 cfs @ 12.07 hrs, Volume= 2,327 cf, Depth> 3.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
2,699	98	Roofs, HSG B
3,864	98	Paved parking, HSG B
246	85	Gravel roads, HSG B
942	69	50-75% Grass cover, Fair, HSG B
7,751	94	Weighted Average
1,188		15.33% Pervious Area
6,563		84.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.18		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.3	50	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.0					**Direct Entry, Minimum = 5 min**
5.0	100	Total			

Summary for Subcatchment 2S: 2S

Runoff = 2.21 cfs @ 12.07 hrs, Volume= 7,098 cf, Depth> 3.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
10,549	98	Roofs, HSG B
3,496	98	Paved parking, HSG B
7,890	96	Gravel surface, HSG B
21,935	97	Weighted Average
7,890		35.97% Pervious Area
14,045		64.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.18		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
1.0	130	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
3.3					**Direct Entry, Minimum = 5 min**
5.0	180	Total			

Summary for Subcatchment 3S: 3s

Runoff = 1.47 cfs @ 12.09 hrs, Volume= 4,323 cf, Depth> 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
2,150	98	Roofs, HSG B
6,470	98	Paved parking, HSG B
9,106	61	>75% Grass cover, Good, HSG B
3,329	96	Gravel surface, HSG B
21,055	82	Weighted Average
12,435		59.06% Pervious Area
8,620		40.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.0500	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.7	236	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
5.7	286	Total			

Summary for Subcatchment 4S: 4S

Runoff = 3.07 cfs @ 12.08 hrs, Volume= 10,031 cf, Depth> 3.88"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
6,139	98	Roofs, HSG B
22,685	98	Paved parking, HSG B
835	61	>75% Grass cover, Good, HSG B
1,342	96	Gravel surface, HSG B
31,001	97	Weighted Average
2,177		7.02% Pervious Area
28,824		92.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.0500	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.3	171	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
5.3	221	Total			

Summary for Subcatchment 5S: 5S

Runoff = 0.08 cfs @ 12.08 hrs, Volume= 231 cf, Depth> 2.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
593	98	Roofs, HSG B
59	98	Paved parking, HSG B
471	61	>75% Grass cover, Good, HSG B
1,123	82	Weighted Average
471		41.94% Pervious Area
652		58.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	10	0.0200	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
3.4					**Direct Entry, Minimum = 5 min**
5.0	10	Total			

Summary for Subcatchment 6S: 6S

Runoff = 0.04 cfs @ 12.09 hrs, Volume= 116 cf, Depth> 1.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
193	98	Paved parking, HSG B
757	61	>75% Grass cover, Good, HSG B
950	69	Weighted Average
757		79.68% Pervious Area
193		20.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	26	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.9	327	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.3	353	Total			

Summary for Subcatchment 30S: POST BUILDING

Runoff = 2.09 cfs @ 12.07 hrs, Volume= 6,780 cf, Depth> 3.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
20,530	98	Roofs, HSG B
20,530		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum = 5 min**

Summary for Subcatchment 40S: EAST POST

Runoff = 4.99 cfs @ 12.07 hrs, Volume= 15,474 cf, Depth> 3.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.50"

	Area (sf)	CN	Description
	6,891	98	Roofs, HSG B
	29,089	98	Paved parking, HSG B
	5,401	61	>75% Grass cover, Good, HSG B
*	10,158	98	Roofs, HSG B
	51,539	94	Weighted Average
	5,401		10.48% Pervious Area
	46,138		89.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum = 5 min**

Summary for Subcatchment 60S: SOUTH POST

Runoff = 0.59 cfs @ 12.08 hrs, Volume= 1,712 cf, Depth> 1.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-yr Rainfall=4.50"

Area (sf)	CN	Description
8,009	61	>75% Grass cover, Good, HSG B
3,737	98	Paved parking, HSG B
11,746	73	Weighted Average
8,009		68.18% Pervious Area
3,737		31.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum = 5 min**

Summary for Reach 1R: PITMAN RD. SYSTEM

Inflow Area = 83,815 sf, 70.27% Impervious, Inflow Depth > 3.12" for 10-yr event
Inflow = 8.71 cfs @ 12.06 hrs, Volume= 21,818 cf
Outflow = 8.71 cfs @ 12.06 hrs, Volume= 21,818 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

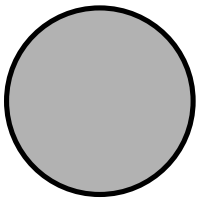
Summary for Reach 2R: Pipe

Inflow Area = 73,991 sf, 69.59% Impervious, Inflow Depth > 2.47" for 10-yr event
Inflow = 1.52 cfs @ 12.06 hrs, Volume= 15,226 cf
Outflow = 0.70 cfs @ 11.55 hrs, Volume= 15,225 cf, Atten= 54%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.87 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.77 fps, Avg. Travel Time= 0.2 min

Peak Storage= 7 cf @ 11.60 hrs
Average Depth at Peak Storage= 0.50'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 0.67 cfs

6.0" Round Pipe
n= 0.010 Cast iron, coated
Length= 36.0' Slope= 0.0083 '/'
Inlet Invert= 28.40', Outlet Invert= 28.10'



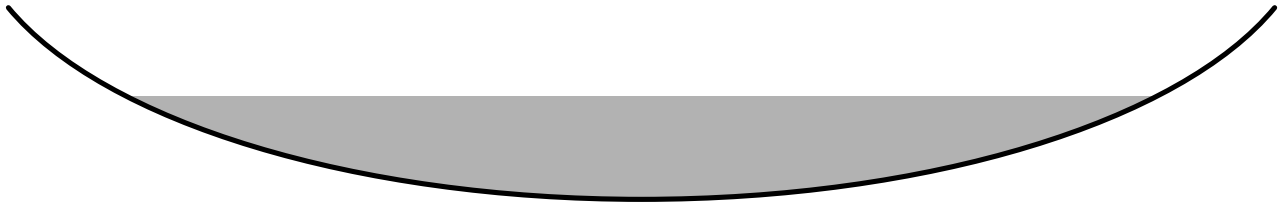
Summary for Reach 3R: Overland Flow

Inflow Area = 31,001 sf, 92.98% Impervious, Inflow Depth > 3.34" for 10-yr event
Inflow = 3.05 cfs @ 12.08 hrs, Volume= 8,639 cf
Outflow = 3.06 cfs @ 12.08 hrs, Volume= 8,637 cf, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.30 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 0.81 fps, Avg. Travel Time= 0.9 min

Peak Storage= 55 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.13'
Bank-Full Depth= 0.25' Flow Area= 3.3 sf, Capacity= 11.66 cfs

20.00' x 0.25' deep Parabolic Channel, n= 0.016 Asphalt, rough
Length= 42.0' Slope= 0.0155 '/'
Inlet Invert= 31.45', Outlet Invert= 30.80'



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Summary for Reach 10R: PITMAN RD. SYSTEM

Inflow Area = 83,815 sf, 84.00% Impervious, Inflow Depth > 2.23" for 10-yr event
Inflow = 6.40 cfs @ 12.12 hrs, Volume= 15,588 cf
Outflow = 6.40 cfs @ 12.12 hrs, Volume= 15,588 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

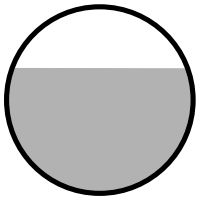
Summary for Reach 20R: Pipe

Inflow Area = 51,539 sf, 89.52% Impervious, Inflow Depth = 1.65" for 10-yr event
Inflow = 4.25 cfs @ 12.12 hrs, Volume= 7,096 cf
Outflow = 4.15 cfs @ 12.15 hrs, Volume= 7,096 cf, Atten= 3%, Lag= 1.3 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.73 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 1.70 fps, Avg. Travel Time= 2.7 min

Peak Storage= 240 cf @ 12.15 hrs
Average Depth at Peak Storage= 0.84'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 5.24 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 274.0' Slope= 0.0066 '/'
Inlet Invert= 27.90', Outlet Invert= 26.10'



Summary for Pond 1P: CATCH BASIN

Inflow Area = 73,991 sf, 69.59% Impervious, Inflow Depth > 3.11" for 10-yr event
Inflow = 6.67 cfs @ 12.08 hrs, Volume= 19,199 cf
Outflow = 8.71 cfs @ 12.06 hrs, Volume= 19,145 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.52 cfs @ 12.06 hrs, Volume= 15,226 cf
Secondary = 7.19 cfs @ 12.06 hrs, Volume= 3,919 cf

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 31.49' @ 12.06 hrs Surf.Area= 4,837 sf Storage= 1,341 cf

Plug-Flow detention time= 6.2 min calculated for 19,080 cf (99% of inflow)
Center-of-Mass det. time= 4.9 min (752.5 - 747.6)

Volume	Invert	Avail.Storage	Storage Description
#1	24.40'	1,341 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
24.40	13	0	0
30.58	13	80	80
31.10	4,837	1,261	1,341

Device	Routing	Invert	Outlet Devices
#1	Primary	28.40'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	31.05'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=1.51 cfs @ 12.06 hrs HW=31.45' TW=28.90' (Dynamic Tailwater)
└**1=Orifice/Grate** (Orifice Controls 1.51 cfs @ 7.68 fps)

Secondary OutFlow Max=6.51 cfs @ 12.06 hrs HW=31.46' TW=0.00' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 6.51 cfs @ 1.60 fps)

Summary for Pond 2P: 6' Diameter Drywell

Inflow Area = 21,055 sf, 40.94% Impervious, Inflow Depth > 2.46" for 10-yr event
Inflow = 1.47 cfs @ 12.09 hrs, Volume= 4,323 cf
Outflow = 1.45 cfs @ 12.08 hrs, Volume= 3,977 cf, Atten= 2%, Lag= 0.0 min
Discarded = 0.02 cfs @ 11.45 hrs, Volume= 513 cf
Primary = 1.43 cfs @ 12.08 hrs, Volume= 3,464 cf

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 31.49' @ 12.11 hrs Surf.Area= 654 sf Storage= 350 cf

Plug-Flow detention time= 41.3 min calculated for 3,964 cf (92% of inflow)
Center-of-Mass det. time= 14.5 min (800.4 - 785.9)

Volume	Invert	Avail.Storage	Storage Description
#1	23.40'	350 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
23.40	28	0	0
29.40	28	168	168
29.41	4	0	168
30.43	4	4	172
30.97	654	178	350

Device	Routing	Invert	Outlet Devices
#1	Discarded	23.40'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	30.96'	**18.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=0.02 cfs @ 11.45 hrs HW=30.98' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 12.08 hrs HW=31.35' TW=31.36' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 3P: 6' Diameter Drywell

Inflow Area = 31,001 sf, 92.98% Impervious, Inflow Depth > 3.88" for 10-yr event
Inflow = 3.07 cfs @ 12.08 hrs, Volume= 10,031 cf
Outflow = 3.08 cfs @ 12.08 hrs, Volume= 9,849 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.02 cfs @ 6.85 hrs, Volume= 1,210 cf
Primary = 3.05 cfs @ 12.08 hrs, Volume= 8,639 cf

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 31.70' @ 12.08 hrs Surf.Area= 1,032 sf Storage= 182 cf

Plug-Flow detention time= 15.1 min calculated for 9,814 cf (98% of inflow)
Center-of-Mass det. time= 7.2 min (746.0 - 738.8)

Volume	Invert	Avail.Storage	Storage Description
#1	26.50'	182 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
26.50	28	0	0
30.00	28	98	98
30.10	4	2	100
31.31	4	5	104
31.46	1,032	78	182

Device	Routing	Invert	Outlet Devices
#1	Discarded	31.30'	**1.020 in/hr Exfiltration over Surface area above 31.30'** Excluded Surface area = 4 sf
#2	Primary	31.45'	**12.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Discarded OutFlow Max=0.02 cfs @ 6.85 hrs HW=31.46' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=2.87 cfs @ 12.08 hrs HW=31.69' TW=31.58' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 2.87 cfs @ 0.99 fps)

Summary for Pond 10P: Infiltration System

Inflow Area = 51,539 sf, 89.52% Impervious, Inflow Depth > 3.60" for 10-yr event
Inflow = 4.99 cfs @ 12.07 hrs, Volume= 15,474 cf
Outflow = 4.36 cfs @ 12.12 hrs, Volume= 11,897 cf, Atten= 13%, Lag= 3.2 min
Discarded = 0.11 cfs @ 12.12 hrs, Volume= 4,801 cf
Primary = 4.25 cfs @ 12.12 hrs, Volume= 7,096 cf

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 29.60' @ 12.12 hrs Surf.Area= 3,825 sf Storage= 4,724 cf

Plug-Flow detention time= 91.5 min calculated for 11,897 cf (77% of inflow)
Center-of-Mass det. time= 33.0 min (782.4 - 749.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	27.40'	2,663 cf	**34.83'W x 109.24'L x 2.33'H Field A** 8,879 cf Overall - 2,220 cf Embedded = 6,658 cf x 40.0% Voids
#2A	27.90'	2,220 cf	**ADS_StormTech SC-310** x 150 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 2.07 sf x 10 rows
#3	27.40'	90 cf	**5.00'D x 4.60'H DMH Storage**
		4,974 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	27.40'	**1.020 in/hr Exfiltration over Wetted area**
#2	Primary	29.00'	**3.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.11 cfs @ 12.12 hrs HW=29.58' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.11 cfs)

Primary OutFlow Max=4.01 cfs @ 12.12 hrs HW=29.58' TW=28.70' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 4.01 cfs @ 2.32 fps)

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: 1S Runoff Area=7,751 sf 84.67% Impervious Runoff Depth>4.34"
Flow Length=100' Slope=0.0200 '/' Tc=5.0 min CN=94 Runoff=0.90 cfs 2,804 cf

Subcatchment2S: 2S Runoff Area=21,935 sf 64.03% Impervious Runoff Depth>4.62"
Flow Length=180' Slope=0.0200 '/' Tc=5.0 min CN=97 Runoff=2.61 cfs 8,439 cf

Subcatchment3S: 3s Runoff Area=21,055 sf 40.94% Impervious Runoff Depth>3.14"
Flow Length=286' Tc=5.7 min CN=82 Runoff=1.86 cfs 5,509 cf

Subcatchment4S: 4S Runoff Area=31,001 sf 92.98% Impervious Runoff Depth>4.62"
Flow Length=221' Tc=5.3 min CN=97 Runoff=3.63 cfs 11,926 cf

Subcatchment5S: 5S Runoff Area=1,123 sf 58.06% Impervious Runoff Depth>3.14"
Flow Length=10' Slope=0.0200 '/' Tc=5.0 min CN=82 Runoff=0.10 cfs 294 cf

Subcatchment6S: 6S Runoff Area=950 sf 20.32% Impervious Runoff Depth>2.01"
Flow Length=353' Slope=0.0200 '/' Tc=5.3 min CN=69 Runoff=0.05 cfs 159 cf

Subcatchment30S: POST BUILDING Runoff Area=20,530 sf 100.00% Impervious Runoff Depth>4.69"
Tc=5.0 min CN=98 Runoff=2.46 cfs 8,028 cf

Subcatchment40S: EAST POST Runoff Area=51,539 sf 89.52% Impervious Runoff Depth>4.34"
Tc=5.0 min CN=94 Runoff=5.95 cfs 18,647 cf

Subcatchment60S: SOUTH POST Runoff Area=11,746 sf 31.82% Impervious Runoff Depth>2.33"
Tc=5.0 min CN=73 Runoff=0.79 cfs 2,285 cf

Reach 1R: PITMAN RD. SYSTEM Inflow=9.64 cfs 26,767 cf
Outflow=9.64 cfs 26,767 cf

Reach 2R: Pipe Avg. Flow Depth=0.50' Max Vel=3.87 fps Inflow=1.53 cfs 17,755 cf
6.0" Round Pipe n=0.010 L=36.0' S=0.0083 '/' Capacity=0.67 cfs Outflow=0.69 cfs 17,754 cf

Reach 3R: Overland Flow Avg. Flow Depth=0.15' Max Vel=2.43 fps Inflow=3.62 cfs 10,513 cf
n=0.016 L=42.0' S=0.0155 '/' Capacity=11.66 cfs Outflow=3.62 cfs 10,510 cf

Reach 10R: PITMAN RD. SYSTEM Inflow=8.31 cfs 20,277 cf
Outflow=8.31 cfs 20,277 cf

Reach 20R: Pipe Avg. Flow Depth=1.04' Max Vel=4.86 fps Inflow=5.47 cfs 9,964 cf
15.0" Round Pipe n=0.013 L=274.0' S=0.0066 '/' Capacity=5.24 cfs Outflow=5.34 cfs 9,964 cf

Pond 1P: CATCH BASIN Peak Elev=31.51' Storage=1,341 cf Inflow=8.03 cfs 23,565 cf
Primary=1.53 cfs 17,755 cf Secondary=7.96 cfs 5,756 cf Outflow=9.49 cfs 23,511 cf

Pond 2P: 6' Diameter Drywell Peak Elev=31.51' Storage=350 cf Inflow=1.86 cfs 5,509 cf
Discarded=0.02 cfs 546 cf Primary=1.84 cfs 4,616 cf Outflow=1.85 cfs 5,162 cf

Pond 3P: 6' Diameter Drywell Peak Elev=31.72' Storage=182 cf Inflow=3.63 cfs 11,926 cf
Discarded=0.02 cfs 1,232 cf Primary=3.62 cfs 10,513 cf Outflow=3.64 cfs 11,745 cf

Pond 10P: Infiltration System Peak Elev=29.69' Storage=4,863 cf Inflow=5.95 cfs 18,647 cf
Discarded=0.11 cfs 4,989 cf Primary=5.47 cfs 9,964 cf Outflow=5.57 cfs 14,953 cf

Summary for Subcatchment 1S: 1S

Runoff = 0.90 cfs @ 12.07 hrs, Volume= 2,804 cf, Depth> 4.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.30"

Area (sf)	CN	Description
2,699	98	Roofs, HSG B
3,864	98	Paved parking, HSG B
246	85	Gravel roads, HSG B
942	69	50-75% Grass cover, Fair, HSG B
7,751	94	Weighted Average
1,188		15.33% Pervious Area
6,563		84.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.18		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.3	50	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.0					**Direct Entry, Minimum = 5 min**
5.0	100	Total			

Summary for Subcatchment 2S: 2S

Runoff = 2.61 cfs @ 12.07 hrs, Volume= 8,439 cf, Depth> 4.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.30"

Area (sf)	CN	Description
10,549	98	Roofs, HSG B
3,496	98	Paved parking, HSG B
7,890	96	Gravel surface, HSG B
21,935	97	Weighted Average
7,890		35.97% Pervious Area
14,045		64.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.18		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
1.0	130	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
3.3					**Direct Entry, Minimum = 5 min**
5.0	180	Total			

Summary for Subcatchment 3S: 3s

Runoff = 1.86 cfs @ 12.09 hrs, Volume= 5,509 cf, Depth> 3.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.30"

Area (sf)	CN	Description
2,150	98	Roofs, HSG B
6,470	98	Paved parking, HSG B
9,106	61	>75% Grass cover, Good, HSG B
3,329	96	Gravel surface, HSG B
21,055	82	Weighted Average
12,435		59.06% Pervious Area
8,620		40.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.0500	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.7	236	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
5.7	286	Total			

Summary for Subcatchment 4S: 4S

Runoff = 3.63 cfs @ 12.08 hrs, Volume= 11,926 cf, Depth> 4.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.30"

Area (sf)	CN	Description
6,139	98	Roofs, HSG B
22,685	98	Paved parking, HSG B
835	61	>75% Grass cover, Good, HSG B
1,342	96	Gravel surface, HSG B
31,001	97	Weighted Average
2,177		7.02% Pervious Area
28,824		92.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.0500	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.3	171	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
5.3	221	Total			

Summary for Subcatchment 5S: 5S

Runoff = 0.10 cfs @ 12.08 hrs, Volume= 294 cf, Depth> 3.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.30"

Area (sf)	CN	Description
593	98	Roofs, HSG B
59	98	Paved parking, HSG B
471	61	>75% Grass cover, Good, HSG B
1,123	82	Weighted Average
471		41.94% Pervious Area
652		58.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	10	0.0200	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
3.4					**Direct Entry, Minimum = 5 min**
5.0	10	Total			

Summary for Subcatchment 6S: 6S

Runoff = 0.05 cfs @ 12.09 hrs, Volume= 159 cf, Depth> 2.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.30"

Area (sf)	CN	Description
193	98	Paved parking, HSG B
757	61	>75% Grass cover, Good, HSG B
950	69	Weighted Average
757		79.68% Pervious Area
193		20.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	26	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.9	327	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.3	353	Total			

Summary for Subcatchment 30S: POST BUILDING

Runoff = 2.46 cfs @ 12.07 hrs, Volume= 8,028 cf, Depth> 4.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.30"

Area (sf)	CN	Description
20,530	98	Roofs, HSG B
20,530		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum = 5 min**

Summary for Subcatchment 40S: EAST POST

Runoff = 5.95 cfs @ 12.07 hrs, Volume= 18,647 cf, Depth> 4.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.30"

	Area (sf)	CN	Description
	6,891	98	Roofs, HSG B
	29,089	98	Paved parking, HSG B
	5,401	61	>75% Grass cover, Good, HSG B
*	10,158	98	Roofs, HSG B
	51,539	94	Weighted Average
	5,401		10.48% Pervious Area
	46,138		89.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum = 5 min**

Summary for Subcatchment 60S: SOUTH POST

Runoff = 0.79 cfs @ 12.08 hrs, Volume= 2,285 cf, Depth> 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-yr Rainfall=5.30"

Area (sf)	CN	Description
8,009	61	>75% Grass cover, Good, HSG B
3,737	98	Paved parking, HSG B
11,746	73	Weighted Average
8,009		68.18% Pervious Area
3,737		31.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum = 5 min**

Summary for Reach 1R: PITMAN RD. SYSTEM

Inflow Area = 83,815 sf, 70.27% Impervious, Inflow Depth > 3.83" for 25-yr event
Inflow = 9.64 cfs @ 12.09 hrs, Volume= 26,767 cf
Outflow = 9.64 cfs @ 12.09 hrs, Volume= 26,767 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

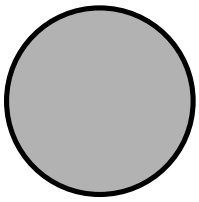
Summary for Reach 2R: Pipe

Inflow Area = 73,991 sf, 69.59% Impervious, Inflow Depth > 2.88" for 25-yr event
Inflow = 1.53 cfs @ 12.09 hrs, Volume= 17,755 cf
Outflow = 0.69 cfs @ 11.35 hrs, Volume= 17,754 cf, Atten= 55%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.87 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.90 fps, Avg. Travel Time= 0.2 min

Peak Storage= 7 cf @ 11.40 hrs
Average Depth at Peak Storage= 0.50'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 0.67 cfs

6.0" Round Pipe
n= 0.010 Cast iron, coated
Length= 36.0' Slope= 0.0083 '/'
Inlet Invert= 28.40', Outlet Invert= 28.10'



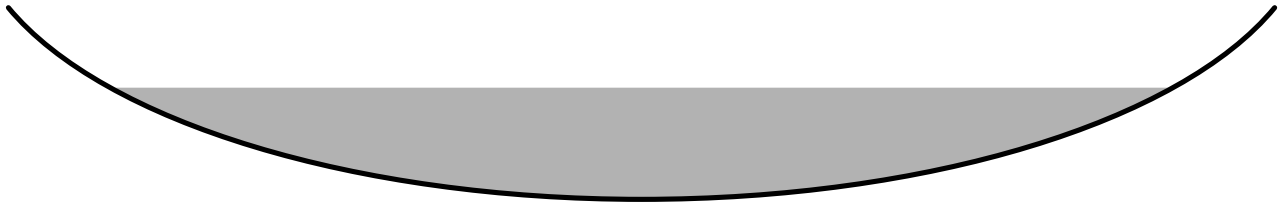
Summary for Reach 3R: Overland Flow

Inflow Area = 31,001 sf, 92.98% Impervious, Inflow Depth > 4.07" for 25-yr event
Inflow = 3.62 cfs @ 12.08 hrs, Volume= 10,513 cf
Outflow = 3.62 cfs @ 12.08 hrs, Volume= 10,510 cf, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.43 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 0.86 fps, Avg. Travel Time= 0.8 min

Peak Storage= 62 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.15'
Bank-Full Depth= 0.25' Flow Area= 3.3 sf, Capacity= 11.66 cfs

20.00' x 0.25' deep Parabolic Channel, n= 0.016 Asphalt, rough
Length= 42.0' Slope= 0.0155 '/'
Inlet Invert= 31.45', Outlet Invert= 30.80'



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Summary for Reach 10R: PITMAN RD. SYSTEM

Inflow Area = 83,815 sf, 84.00% Impervious, Inflow Depth > 2.90" for 25-yr event
Inflow = 8.31 cfs @ 12.10 hrs, Volume= 20,277 cf
Outflow = 8.31 cfs @ 12.10 hrs, Volume= 20,277 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

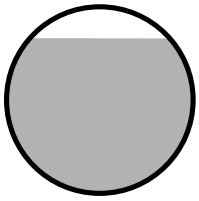
Summary for Reach 20R: Pipe

Inflow Area = 51,539 sf, 89.52% Impervious, Inflow Depth = 2.32" for 25-yr event
Inflow = 5.47 cfs @ 12.11 hrs, Volume= 9,964 cf
Outflow = 5.34 cfs @ 12.12 hrs, Volume= 9,964 cf, Atten= 2%, Lag= 0.9 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.86 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.78 fps, Avg. Travel Time= 2.6 min

Peak Storage= 300 cf @ 12.12 hrs
Average Depth at Peak Storage= 1.04'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 5.24 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 274.0' Slope= 0.0066 '/'
Inlet Invert= 27.90', Outlet Invert= 26.10'



Summary for Pond 1P: CATCH BASIN

Inflow Area = 73,991 sf, 69.59% Impervious, Inflow Depth > 3.82" for 25-yr event
Inflow = 8.03 cfs @ 12.08 hrs, Volume= 23,565 cf
Outflow = 9.49 cfs @ 12.09 hrs, Volume= 23,511 cf, Atten= 0%, Lag= 1.0 min
Primary = 1.53 cfs @ 12.09 hrs, Volume= 17,755 cf
Secondary = 7.96 cfs @ 12.09 hrs, Volume= 5,756 cf

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 31.51' @ 12.09 hrs Surf.Area= 4,837 sf Storage= 1,341 cf

Plug-Flow detention time= 5.5 min calculated for 23,431 cf (99% of inflow)
Center-of-Mass det. time= 4.5 min (751.2 - 746.7)

Volume	Invert	Avail.Storage	Storage Description
#1	24.40'	1,341 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
24.40	13	0	0
30.58	13	80	80
31.10	4,837	1,261	1,341

Device	Routing	Invert	Outlet Devices
#1	Primary	28.40'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	31.05'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=1.52 cfs @ 12.09 hrs HW=31.49' TW=28.90' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 1.52 cfs @ 7.75 fps)

Secondary OutFlow Max=7.53 cfs @ 12.09 hrs HW=31.49' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 7.53 cfs @ 1.70 fps)

Summary for Pond 2P: 6' Diameter Drywell

Inflow Area = 21,055 sf, 40.94% Impervious, Inflow Depth > 3.14" for 25-yr event
Inflow = 1.86 cfs @ 12.09 hrs, Volume= 5,509 cf
Outflow = 1.85 cfs @ 12.09 hrs, Volume= 5,162 cf, Atten= 1%, Lag= 0.0 min
Discarded = 0.02 cfs @ 10.95 hrs, Volume= 546 cf
Primary = 1.84 cfs @ 12.09 hrs, Volume= 4,616 cf

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 31.51' @ 12.14 hrs Surf.Area= 654 sf Storage= 350 cf

Plug-Flow detention time= 35.6 min calculated for 5,162 cf (94% of inflow)
Center-of-Mass det. time= 13.2 min (793.5 - 780.2)

Volume	Invert	Avail.Storage	Storage Description
#1	23.40'	350 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
23.40	28	0	0
29.40	28	168	168
29.41	4	0	168
30.43	4	4	172
30.97	654	178	350

Device	Routing	Invert	Outlet Devices
#1	Discarded	23.40'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	30.96'	**18.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=0.02 cfs @ 10.95 hrs HW=30.97' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.00 cfs @ 12.09 hrs HW=31.39' TW=31.47' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 3P: 6' Diameter Drywell

Inflow Area = 31,001 sf, 92.98% Impervious, Inflow Depth > 4.62" for 25-yr event
Inflow = 3.63 cfs @ 12.08 hrs, Volume= 11,926 cf
Outflow = 3.64 cfs @ 12.08 hrs, Volume= 11,745 cf, Atten= 0%, Lag= 0.1 min
Discarded = 0.02 cfs @ 6.50 hrs, Volume= 1,232 cf
Primary = 3.62 cfs @ 12.08 hrs, Volume= 10,513 cf

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 31.72' @ 12.08 hrs Surf.Area= 1,032 sf Storage= 182 cf

Plug-Flow detention time= 13.0 min calculated for 11,702 cf (98% of inflow)
Center-of-Mass det. time= 6.2 min (743.4 - 737.2)

Volume	Invert	Avail.Storage	Storage Description
#1	26.50'	182 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
26.50	28	0	0
30.00	28	98	98
30.10	4	2	100
31.31	4	5	104
31.46	1,032	78	182

Device	Routing	Invert	Outlet Devices
#1	Discarded	31.30'	**1.020 in/hr Exfiltration over Surface area above 31.30'** Excluded Surface area = 4 sf
#2	Primary	31.45'	**12.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Discarded OutFlow Max=0.02 cfs @ 6.50 hrs HW=31.47' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=3.40 cfs @ 12.08 hrs HW=31.72' TW=31.59' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 3.40 cfs @ 1.06 fps)

Summary for Pond 10P: Infiltration System

Inflow Area = 51,539 sf, 89.52% Impervious, Inflow Depth > 4.34" for 25-yr event
Inflow = 5.95 cfs @ 12.07 hrs, Volume= 18,647 cf
Outflow = 5.57 cfs @ 12.11 hrs, Volume= 14,953 cf, Atten= 6%, Lag= 2.2 min
Discarded = 0.11 cfs @ 12.11 hrs, Volume= 4,989 cf
Primary = 5.47 cfs @ 12.11 hrs, Volume= 9,964 cf

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 29.69' @ 12.11 hrs Surf.Area= 3,825 sf Storage= 4,863 cf

Plug-Flow detention time= 82.2 min calculated for 14,953 cf (80% of inflow)
Center-of-Mass det. time= 28.5 min (774.9 - 746.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	27.40'	2,663 cf	**34.83'W x 109.24'L x 2.33'H Field A** 8,879 cf Overall - 2,220 cf Embedded = 6,658 cf x 40.0% Voids
#2A	27.90'	2,220 cf	**ADS_StormTech SC-310** x 150 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 2.07 sf x 10 rows
#3	27.40'	90 cf	**5.00'D x 4.60'H DMH Storage**
		4,974 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	27.40'	**1.020 in/hr Exfiltration over Wetted area**
#2	Primary	29.00'	**3.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.11 cfs @ 12.11 hrs HW=29.68' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.11 cfs)

Primary OutFlow Max=5.36 cfs @ 12.11 hrs HW=29.68' TW=28.91' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 5.36 cfs @ 2.62 fps)

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment1S: 1S Runoff Area=7,751 sf 84.67% Impervious Runoff Depth>5.36"
Flow Length=100' Slope=0.0200 '/' Tc=5.0 min CN=94 Runoff=1.09 cfs 3,460 cf

Subcatchment2S: 2S Runoff Area=21,935 sf 64.03% Impervious Runoff Depth>5.62"
Flow Length=180' Slope=0.0200 '/' Tc=5.0 min CN=97 Runoff=3.17 cfs 10,278 cf

Subcatchment3S: 3s Runoff Area=21,055 sf 40.94% Impervious Runoff Depth>4.10"
Flow Length=286' Tc=5.7 min CN=82 Runoff=2.40 cfs 7,189 cf

Subcatchment4S: 4S Runoff Area=31,001 sf 92.98% Impervious Runoff Depth>5.62"
Flow Length=221' Tc=5.3 min CN=97 Runoff=4.40 cfs 14,525 cf

Subcatchment5S: 5S Runoff Area=1,123 sf 58.06% Impervious Runoff Depth>4.10"
Flow Length=10' Slope=0.0200 '/' Tc=5.0 min CN=82 Runoff=0.13 cfs 384 cf

Subcatchment6S: 6S Runoff Area=950 sf 20.32% Impervious Runoff Depth>2.81"
Flow Length=353' Slope=0.0200 '/' Tc=5.3 min CN=69 Runoff=0.08 cfs 222 cf

Subcatchment30S: POST BUILDING Runoff Area=20,530 sf 100.00% Impervious Runoff Depth>5.69"
Tc=5.0 min CN=98 Runoff=2.98 cfs 9,739 cf

Subcatchment40S: EAST POST Runoff Area=51,539 sf 89.52% Impervious Runoff Depth>5.36"
Tc=5.0 min CN=94 Runoff=7.27 cfs 23,007 cf

Subcatchment60S: SOUTH POST Runoff Area=11,746 sf 31.82% Impervious Runoff Depth>3.19"
Tc=5.0 min CN=73 Runoff=1.08 cfs 3,121 cf

Reach 1R: PITMAN RD. SYSTEM Inflow=11.35 cfs 33,632 cf
Outflow=11.35 cfs 33,632 cf

Reach 2R: Pipe Avg. Flow Depth=0.50' Max Vel=3.87 fps Inflow=1.54 cfs 21,133 cf
6.0" Round Pipe n=0.010 L=36.0' S=0.0083 '/' Capacity=0.67 cfs Outflow=0.70 cfs 21,132 cf

Reach 3R: Overland Flow Avg. Flow Depth=0.16' Max Vel=2.57 fps Inflow=4.40 cfs 13,091 cf
n=0.016 L=42.0' S=0.0155 '/' Capacity=11.66 cfs Outflow=4.39 cfs 13,090 cf

Reach 10R: PITMAN RD. SYSTEM Inflow=9.22 cfs 26,926 cf
Outflow=9.22 cfs 26,926 cf

Reach 20R: Pipe Avg. Flow Depth=1.25' Max Vel=4.86 fps Inflow=7.59 cfs 14,067 cf
15.0" Round Pipe n=0.013 L=274.0' S=0.0066 '/' Capacity=5.24 cfs Outflow=5.27 cfs 14,065 cf

Pond 1P: CATCH BASIN Peak Elev=31.56' Storage=1,341 cf Inflow=9.90 cfs 29,622 cf
Primary=1.54 cfs 21,133 cf Secondary=9.40 cfs 8,435 cf Outflow=10.94 cfs 29,568 cf

Pond 2P: 6' Diameter Drywell Peak Elev=31.56' Storage=350 cf Inflow=2.40 cfs 7,189 cf
Discarded=0.02 cfs 587 cf Primary=2.40 cfs 6,255 cf Outflow=2.42 cfs 6,841 cf

Pond 3P: 6' Diameter Drywell Peak Elev=31.76' Storage=182 cf Inflow=4.40 cfs 14,525 cf
Discarded=0.02 cfs 1,251 cf Primary=4.40 cfs 13,091 cf Outflow=4.42 cfs 14,342 cf

Pond 10P: Infiltration System Peak Elev=29.84' Storage=4,932 cf Inflow=7.27 cfs 23,007 cf
Discarded=0.11 cfs 5,173 cf Primary=7.59 cfs 14,067 cf Outflow=7.70 cfs 19,240 cf

Summary for Subcatchment 1S: 1S

Runoff = 1.09 cfs @ 12.07 hrs, Volume= 3,460 cf, Depth> 5.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=6.40"

Area (sf)	CN	Description
2,699	98	Roofs, HSG B
3,864	98	Paved parking, HSG B
246	85	Gravel roads, HSG B
942	69	50-75% Grass cover, Fair, HSG B
7,751	94	Weighted Average
1,188		15.33% Pervious Area
6,563		84.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.18		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
0.3	50	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
4.0					**Direct Entry, Minimum = 5 min**
5.0	100	Total			

Summary for Subcatchment 2S: 2S

Runoff = 3.17 cfs @ 12.07 hrs, Volume= 10,278 cf, Depth> 5.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=6.40"

Area (sf)	CN	Description
10,549	98	Roofs, HSG B
3,496	98	Paved parking, HSG B
7,890	96	Gravel surface, HSG B
21,935	97	Weighted Average
7,890		35.97% Pervious Area
14,045		64.03% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	50	0.0200	1.18		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 3.10"
1.0	130	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
3.3					**Direct Entry, Minimum = 5 min**
5.0	180	Total			

Summary for Subcatchment 3S: 3s

Runoff = 2.40 cfs @ 12.09 hrs, Volume= 7,189 cf, Depth> 4.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=6.40"

Area (sf)	CN	Description
2,150	98	Roofs, HSG B
6,470	98	Paved parking, HSG B
9,106	61	>75% Grass cover, Good, HSG B
3,329	96	Gravel surface, HSG B
21,055	82	Weighted Average
12,435		59.06% Pervious Area
8,620		40.94% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.0500	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.7	236	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
5.7	286	Total			

Summary for Subcatchment 4S: 4S

Runoff = 4.40 cfs @ 12.08 hrs, Volume= 14,525 cf, Depth> 5.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=6.40"

Area (sf)	CN	Description
6,139	98	Roofs, HSG B
22,685	98	Paved parking, HSG B
835	61	>75% Grass cover, Good, HSG B
1,342	96	Gravel surface, HSG B
31,001	97	Weighted Average
2,177		7.02% Pervious Area
28,824		92.98% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.0	50	0.0500	0.21		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.3	171	0.0200	2.28		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
5.3	221	Total			

Summary for Subcatchment 5S: 5S

Runoff = 0.13 cfs @ 12.07 hrs, Volume= 384 cf, Depth> 4.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=6.40"

Area (sf)	CN	Description
593	98	Roofs, HSG B
59	98	Paved parking, HSG B
471	61	>75% Grass cover, Good, HSG B
1,123	82	Weighted Average
471		41.94% Pervious Area
652		58.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.6	10	0.0200	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
3.4					**Direct Entry, Minimum = 5 min**
5.0	10	Total			

Summary for Subcatchment 6S: 6S

Runoff = 0.08 cfs @ 12.09 hrs, Volume= 222 cf, Depth> 2.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=6.40"

Area (sf)	CN	Description
193	98	Paved parking, HSG B
757	61	>75% Grass cover, Good, HSG B
950	69	Weighted Average
757		79.68% Pervious Area
193		20.32% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.4	26	0.0200	0.13		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.10"
1.9	327	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
5.3	353	Total			

Summary for Subcatchment 30S: POST BUILDING

Runoff = 2.98 cfs @ 12.07 hrs, Volume= 9,739 cf, Depth> 5.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=6.40"

Area (sf)	CN	Description
20,530	98	Roofs, HSG B
20,530		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum = 5 min**

Summary for Subcatchment 40S: EAST POST

Runoff = 7.27 cfs @ 12.07 hrs, Volume= 23,007 cf, Depth> 5.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=6.40"

	Area (sf)	CN	Description
	6,891	98	Roofs, HSG B
	29,089	98	Paved parking, HSG B
	5,401	61	>75% Grass cover, Good, HSG B
*	10,158	98	Roofs, HSG B
	51,539	94	Weighted Average
	5,401		10.48% Pervious Area
	46,138		89.52% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum = 5 min**

Summary for Subcatchment 60S: SOUTH POST

Runoff = 1.08 cfs @ 12.08 hrs, Volume= 3,121 cf, Depth> 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-yr Rainfall=6.40"

Area (sf)	CN	Description
8,009	61	>75% Grass cover, Good, HSG B
3,737	98	Paved parking, HSG B
11,746	73	Weighted Average
8,009		68.18% Pervious Area
3,737		31.82% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Minimum = 5 min**

Summary for Reach 1R: PITMAN RD. SYSTEM

Inflow Area = 83,815 sf, 70.27% Impervious, Inflow Depth > 4.82" for 100-yr event
Inflow = 11.35 cfs @ 12.06 hrs, Volume= 33,632 cf
Outflow = 11.35 cfs @ 12.06 hrs, Volume= 33,632 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

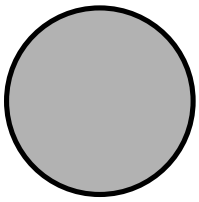
Summary for Reach 2R: Pipe

Inflow Area = 73,991 sf, 69.59% Impervious, Inflow Depth > 3.43" for 100-yr event
Inflow = 1.54 cfs @ 12.06 hrs, Volume= 21,133 cf
Outflow = 0.70 cfs @ 11.15 hrs, Volume= 21,132 cf, Atten= 55%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.87 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.05 fps, Avg. Travel Time= 0.2 min

Peak Storage= 7 cf @ 11.20 hrs
Average Depth at Peak Storage= 0.50'
Bank-Full Depth= 0.50' Flow Area= 0.2 sf, Capacity= 0.67 cfs

6.0" Round Pipe
n= 0.010 Cast iron, coated
Length= 36.0' Slope= 0.0083 '/'
Inlet Invert= 28.40', Outlet Invert= 28.10'



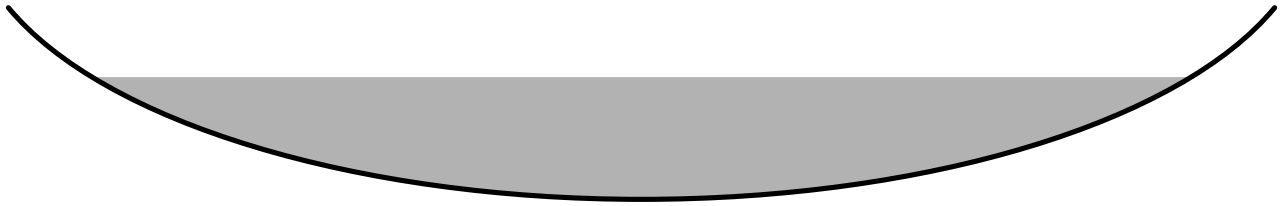
Summary for Reach 3R: Overland Flow

Inflow Area = 31,001 sf, 92.98% Impervious, Inflow Depth > 5.07" for 100-yr event
Inflow = 4.40 cfs @ 12.07 hrs, Volume= 13,091 cf
Outflow = 4.39 cfs @ 12.08 hrs, Volume= 13,090 cf, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 2.57 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 0.92 fps, Avg. Travel Time= 0.8 min

Peak Storage= 71 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.16'
Bank-Full Depth= 0.25' Flow Area= 3.3 sf, Capacity= 11.66 cfs

20.00' x 0.25' deep Parabolic Channel, n= 0.016 Asphalt, rough
Length= 42.0' Slope= 0.0155 '/'
Inlet Invert= 31.45', Outlet Invert= 30.80'



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Summary for Reach 10R: PITMAN RD. SYSTEM

Inflow Area = 83,815 sf, 84.00% Impervious, Inflow Depth > 3.86" for 100-yr event
Inflow = 9.22 cfs @ 12.08 hrs, Volume= 26,926 cf
Outflow = 9.22 cfs @ 12.08 hrs, Volume= 26,926 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

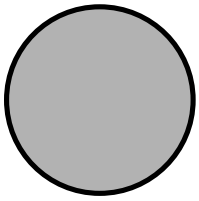
Summary for Reach 20R: Pipe

Inflow Area = 51,539 sf, 89.52% Impervious, Inflow Depth > 3.28" for 100-yr event
Inflow = 7.59 cfs @ 12.10 hrs, Volume= 14,067 cf
Outflow = 5.27 cfs @ 12.25 hrs, Volume= 14,065 cf, Atten= 31%, Lag= 9.2 min

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.86 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.94 fps, Avg. Travel Time= 2.3 min

Peak Storage= 336 cf @ 12.10 hrs
Average Depth at Peak Storage= 1.25'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 5.24 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 274.0' Slope= 0.0066 '/'
Inlet Invert= 27.90', Outlet Invert= 26.10'



Summary for Pond 1P: CATCH BASIN

Inflow Area = 73,991 sf, 69.59% Impervious, Inflow Depth > 4.80" for 100-yr event
Inflow = 9.90 cfs @ 12.08 hrs, Volume= 29,622 cf
Outflow = 10.94 cfs @ 12.06 hrs, Volume= 29,568 cf, Atten= 0%, Lag= 0.0 min
Primary = 1.54 cfs @ 12.06 hrs, Volume= 21,133 cf
Secondary = 9.40 cfs @ 12.06 hrs, Volume= 8,435 cf

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 31.56' @ 12.06 hrs Surf.Area= 4,837 sf Storage= 1,341 cf

Plug-Flow detention time= 4.9 min calculated for 29,467 cf (99% of inflow)
Center-of-Mass det. time= 4.0 min (749.5 - 745.5)

Volume	Invert	Avail.Storage	Storage Description
#1	24.40'	1,341 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
24.40	13	0	0
30.58	13	80	80
31.10	4,837	1,261	1,341

Device	Routing	Invert	Outlet Devices
#1	Primary	28.40'	**6.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	31.05'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Primary OutFlow Max=1.53 cfs @ 12.06 hrs HW=31.53' TW=28.90' (Dynamic Tailwater)
↑—**1=Orifice/Grate** (Orifice Controls 1.53 cfs @ 7.81 fps)

Secondary OutFlow Max=8.76 cfs @ 12.06 hrs HW=31.54' TW=0.00' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 8.76 cfs @ 1.80 fps)

Summary for Pond 2P: 6' Diameter Drywell

Inflow Area = 21,055 sf, 40.94% Impervious, Inflow Depth > 4.10" for 100-yr event
Inflow = 2.40 cfs @ 12.09 hrs, Volume= 7,189 cf
Outflow = 2.42 cfs @ 12.09 hrs, Volume= 6,841 cf, Atten= 0%, Lag= 0.1 min
Discarded = 0.02 cfs @ 10.30 hrs, Volume= 587 cf
Primary = 2.40 cfs @ 12.09 hrs, Volume= 6,255 cf

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 31.56' @ 12.11 hrs Surf.Area= 654 sf Storage= 350 cf

Plug-Flow detention time= 29.8 min calculated for 6,841 cf (95% of inflow)
Center-of-Mass det. time= 11.9 min (785.8 - 773.9)

Volume	Invert	Avail.Storage	Storage Description
#1	23.40'	350 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
23.40	28	0	0
29.40	28	168	168
29.41	4	0	168
30.43	4	4	172
30.97	654	178	350

Device	Routing	Invert	Outlet Devices
#1	Discarded	23.40'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	30.96'	**18.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=0.02 cfs @ 10.30 hrs HW=30.97' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=4.68 cfs @ 12.09 hrs HW=31.50' TW=31.49' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 4.68 cfs @ 0.48 fps)

Summary for Pond 3P: 6' Diameter Drywell

Inflow Area = 31,001 sf, 92.98% Impervious, Inflow Depth > 5.62" for 100-yr event
Inflow = 4.40 cfs @ 12.08 hrs, Volume= 14,525 cf
Outflow = 4.42 cfs @ 12.07 hrs, Volume= 14,342 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.02 cfs @ 6.15 hrs, Volume= 1,251 cf
Primary = 4.40 cfs @ 12.07 hrs, Volume= 13,091 cf

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 31.76' @ 12.08 hrs Surf.Area= 1,032 sf Storage= 182 cf

Plug-Flow detention time= 10.9 min calculated for 14,290 cf (98% of inflow)
Center-of-Mass det. time= 5.1 min (740.8 - 735.7)

Volume	Invert	Avail.Storage	Storage Description
#1	26.50'	182 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
26.50	28	0	0
30.00	28	98	98
30.10	4	2	100
31.31	4	5	104
31.46	1,032	78	182

Device	Routing	Invert	Outlet Devices
#1	Discarded	31.30'	**1.020 in/hr Exfiltration over Surface area above 31.30'** Excluded Surface area = 4 sf
#2	Primary	31.45'	**12.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Discarded OutFlow Max=0.02 cfs @ 6.15 hrs HW=31.47' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=4.13 cfs @ 12.07 hrs HW=31.75' TW=31.61' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 4.13 cfs @ 1.15 fps)

Summary for Pond 10P: Infiltration System

Inflow Area = 51,539 sf, 89.52% Impervious, Inflow Depth > 5.36" for 100-yr event
Inflow = 7.27 cfs @ 12.07 hrs, Volume= 23,007 cf
Outflow = 7.70 cfs @ 12.10 hrs, Volume= 19,240 cf, Atten= 0%, Lag= 1.6 min
Discarded = 0.11 cfs @ 12.09 hrs, Volume= 5,173 cf
Primary = 7.59 cfs @ 12.10 hrs, Volume= 14,067 cf

Routing by Dyn-Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 29.84' @ 12.10 hrs Surf.Area= 3,825 sf Storage= 4,932 cf

Plug-Flow detention time= 73.9 min calculated for 19,176 cf (83% of inflow)
Center-of-Mass det. time= 27.0 min (770.3 - 743.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	27.40'	2,663 cf	**34.83'W x 109.24'L x 2.33'H Field A** 8,879 cf Overall - 2,220 cf Embedded = 6,658 cf x 40.0% Voids
#2A	27.90'	2,220 cf	**ADS_StormTech SC-310** x 150 Inside #1 Effective Size= 28.9"W x 16.0"H => 2.07 sf x 7.12'L = 14.7 cf Overall Size= 34.0"W x 16.0"H x 7.56'L with 0.44' Overlap Row Length Adjustment= +0.44' x 2.07 sf x 10 rows
#3	27.40'	90 cf	**5.00'D x 4.60'H DMH Storage**
		4,974 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	27.40'	**1.020 in/hr Exfiltration over Wetted area**
#2	Primary	29.00'	**3.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.11 cfs @ 12.09 hrs HW=29.82' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.11 cfs)

Primary OutFlow Max=7.27 cfs @ 12.10 hrs HW=29.83' TW=29.13' (Dynamic Tailwater)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 7.27 cfs @ 2.93 fps)

Appendix VII. Recharge Calculations

HANCOCK ASSOCIATES

Elm Place
Swampscott

PAGE: 1 of 1
DATE: 1/11/21
REVISED:

RECHARGE CALCULATION

INFILTRATION SYSTEM 103B

INFILTRATION SYSTEM STORAGE VOLUME

SC-310 CHAMBER VOUME

	OUTLET ORIFICE INVERT	I_W	=	29.0	ft.
	BOTTOM INVERT CHAMBERS	I_C	=	27.9	ft.
	STORMWATER DEPTH	D_C	=	1.1	ft.
	VOLUME PER CHAMBER	V_C	=	14.3	cf.
	NUMER OF ROWS	R_C	=	10	
	CHAMBERS PER ROW	C_C	=	15	
$N_C = (R_C * C_C)$	NUMBER OF CHAMBERS	N_C	=	150	
$V_{CHAMBERS} = (V_C * N_C)$	TOTAL VOLUME OF CHAMBERS BELOW OUTLET	$V_{CHAMBERS}$	=	2142.0	cf.

STONE VOLUME

	STONE BOTTOM INVERT	I_S	=	27.4	ft.
$D_S = I_W - I_S$	STONE STORMWATER DEPTH	D_S		1.6	
	STONE WIDTH	W_S	=	34.8	ft.
	STONE LENGTH	L_S	=	109.8	ft.
	% VOIDS	VOIDS	=	30%	
$V_{STONE} = [(W_S * L_S * (I_W - I_S)) - V_{CHAMBERS}] * VOIDS$	STONE VOLUME	V_{stone}	=	1191.5	cf.

TOTAL VOLUME BELOW INVERT

$V_{TOTAL} = V_{CHAMBERS} + V_{STONE}$	**TOTAL STORAGE VOLUME**	V_{TOTAL}	=	**3333.5**	cf.

BOTTOM AREA

$A_{bottom} = W_S * L_S$	BOTTOM SURFACE AREA	A_{bottom}	=	**3821.0**	sf.

REQUIRED RECHARGE VOLUME

STATIC METHOD

	SOIL TYPE		=	B	
	RECHARGE DEPTH	F	=	0.35	in.
	IMPERVIOUS AREA	A_{IMP}	=	**71,135**	sf
	% IMPERVIOUS AREA CAPTURED		=	65%	
$Rv = (F * A_{imp})$	RECHARGE STORAGE VOLUME	Rv	=	**3192.0**	cf.

3333.5 cf. >>> 3192.0 cf.

STANDARD 3 SATISFIED

72 HOUR DRAWDOWN

	SOIL TYPE		=	B	
	RAWLS RATE	K	=	1.02	in/hr
	REQUIRED RECHARGE VOLUME	Rv	=	3333.5	cf.
	BOTTOM AREA	A_{bottom}	=	3821.0	sf.
$T_D = (Rv) / (K * A_{bottom})$	DRAWDOWN TIME	T_D	=	**10.3**	hr.

10.3 hr. <<< 72.0 hr.

72 DRAWDOWN SATISFIED

Appendix VIII. Water Quality Calculations

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: Infiltration System 103B

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Subsurface Infiltration System	80%	1.00	0.80	0.80

Total TSS Removal = 0.80

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 21 Elm Place

Prepared By: DTW

Date: 1/11/21

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

Appendix XI. Operations and Maintenance Log

Elm Place, Swampscott, Massachusetts
Stormwater Operation and Maintenance Plan

INSPECTION SCHEDULE AND EVALUATION CHECKLIST

Best Management practice	Inspection Frequency	Date Inspected	Contractor	Current Conditions and Minimum Maintenance / Repairs, If Necessary	Completed Maintenance / Repair (i.e. date, contractor, tasks complete, etc.)
Catch Basins	Quarterly				
Infiltration System	Biannual				
Overall Site Condition	Quarterly				

Property Manager: _____ Date: _____