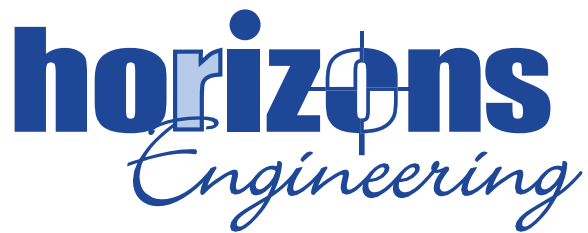


**TOWN OF DURHAM
STORMWATER MANAGEMENT PLAN**

**TOOMERFS, LLC
19 MAIN STREET and 21 MAIN STREET
TAX MAP 5, LOTS 1-9, 1-10, 1-15, and 1-16
Durham, New Hampshire**



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**TOWN OF DURHAM
STORMWATER MANAGEMENT PLAN
FOR
TOOMERFS, LLC**

**19 MAIN STREET and 21 MAIN STREET
TAX MAP 5, LOTS 1-9, 1-10, 1-15 and 1-16**

DURHAM, NEW HAMPSHIRE

FEBRUARY 2022

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SECTION 1.0 PROJECT INFORMATION NARRATIVE

1.1 Project Narrative

1.1.1 Project summary

Toomerfs, LLC intends to develop a parking facility at 19 and 21 Main Street, in Durham, New Hampshire, on Tax Map 5, Lots 1-9, 1-10, 1-15, and 1-16. The parking facility will serve the apartments at the front of the site, as well as providing needed extra parking capacity for the Main Street area. Additionally, the driveway to the site will be reconstructed to improve clearances to the existing buildings.

The parking area will be constructed on a filled pad, on the south end of the site. Fill and grading for subgrade preparation will be required to complete the pad improvements. Stormwater from the parking area will be directed via sheet flow to grass swales leading to catch basins feeding two underground ADS Stormtech chamber system within the fill area. The chambers will allow infiltration into the fill area and to native ground. An overflow structure is provided to control flow rates for larger storm events.

Table 1 shows the 1-inch storm; 2, 10, 25, 50, and 100 year peak flow rate comparison at the discharge points.

Peak flow [cubic feet per second]									
	1 inch			2 year			10 year		
	pre	post	diff	pre	post	diff	pre	post	diff
Dp-1	0.01	0	-0.01	2.35	1.67	-0.68	5.54	4.37	-1.17
Dp-2	0.15	0.1	-0.05	0.7	0.59	-0.11	1.11	0.96	-0.15
	25 year			50 year			100 year		
	pre	post	diff	pre	post	diff	pre	post	diff
Dp-1	8.33	7.19	-1.14	11.06	9.52	-1.54	14.39	13.07	-1.32
Dp-2	1.43	1.25	-0.18	1.72	1.52	-0.2	2.08	1.84	-0.24

Table 1: Peak flow rate during selected design storms

Impacts to watershed water quality from grading within the watersheds would be likely to occur from uncontrolled discharge of site runoff during construction activities and stabilized post-project surfaces. To minimize the impacts to the watersheds, the site has been designed to cause no increase in runoff and erosion control methods have been sized in accordance with the Env-Wq 1500 and the *New Hampshire Stormwater Management Manual* (December, 2008).

1.1.2 Existing site conditions

The proposed work is located on the south side of Main Street approximately 0.10 miles east of the intersection of Newmarket Road. The primary project site is located behind existing residential apartments.

The project site currently consists of forest sloping to the south down to College Brook. The upper portion of the site includes four residences, a garage, and 43 paved parking spaces.

There are existing no delineated wetlands located with the project disturbance area, and no wetland impacts are proposed as part of this project. Wetland exists in the extreme south of the property; buffer areas are to be maintained to the wetlands.

1.1.3 Proposed site conditions and disturbances

The project proposes the removal of an existing structure, reconstruction of the site's driveway, and construction of a 121-space parking lot. To create the relatively level area required for the parking lot, an engineered concrete block retaining wall will be constructed, and significant quantities of engineered fill will be imported to the site. An underground chamber system is proposed to detain and infiltrate stormwater from the site. In the immediate vicinity of the chamber system, the imported fill will be design to produce a hydraulic conductivity matching the underlying soils.

The impacts to water quality during site development will be minimized using erosion control measures. Frequent site inspections during construction are required during or directly following rainfall events to ensure erosion control devices are working properly. A copy of the Stormwater Inspection and Maintenance Manual can be found in section 2.6 of this report.

1.1.4 Rainfall data

Using SCS TR-20, run under HydroCAD Version 10.0 with Type III-24 hour rainfall events, pre- and post-development cover types and drainage paths were modeled to generate peak discharge rates. Rainfall events modeled have intensities described by data provided by the Northeast Regional Climate Center for the geographic location of the project. These data are provided in full in section 1.3 of this report, and are summarized below in Table 2.

Storm event	Depth (inches)
1-Inch	1.00
2-Year	3.14
10-Year	4.76
25-Year	6.03
50-Year	7.22
100-Year	8.64

Table 2: 24-h storm events for project site (data from NRCC)

1.1.5 Peak runoff control requirement

Town of Durham Site Design Standards require that measures be taken to control the post-development peak rate runoff so that it does not exceed pre-development runoff for the 2-year, 10-year, and 17-year^a, 24-hour storm events. Due to the post-project grading of the site and changes in land cover, stormwater devices were used to attenuate flow in order to meet these Peak

a Understood to be a typo, and the 25-year event is intended

Runoff Control requirements. Table 3 summarizes the stormwater runoff peak flow rate for the 1 inch, 2-, 10-, and 25-year storm events. Additionally, for reference we are providing a comparison of the 50- and 100-year storm events in the table.

Peak flow [cubic feet per second]									
	1 inch			2 year			10 year		
	pre	post	diff	pre	post	diff	pre	post	diff
Dp-1	0.01	0	-0.01	2.35	1.67	-0.68	5.54	4.37	-1.17
Dp-2	0.15	0.1	-0.05	0.7	0.59	-0.11	1.11	0.96	-0.15
	25 year			50 year			100 year		
	pre	post	diff	pre	post	diff	pre	post	diff
Dp-1	8.33	7.19	-1.14	11.06	9.52	-1.54	14.39	13.07	-1.32
Dp-2	1.43	1.25	-0.18	1.72	1.52	-0.2	2.08	1.84	-0.24

Table 3: Reprint of peak flow rate during selected design storms

1.1.6 Runoff volume requirement

Town of Durham Site Design Standards require that measures be taken to control the post-development peak rate runoff so that it does not exceed pre-development runoff for the 2-year, 10-year, and 17-year^a, 24-hour storm events. Additionally, shown in the table for reference, are the 50 and 100 year storm events. Receiving waters and downstream wetland channels must be protected from erosion and sedimentation resulting from the project development. Table 4 summarizes the flow volume data. While runoff volumes for larger events increase at Dp-1, overall volumes are reduced.

Runoff volume [cubic feet]									
	1 inch			2 year			10 year		
	pre	post	diff	pre	post	diff	pre	post	diff
Dp-1	169	36	-133	9 325	7 661	-1 664	20 671	20 208	-463
Dp-2	465	334	-131	2 297	1 906	-391	3 762	3 204	-558
Total	634	370	-264	11 622	9 567	-2 055	24 433	23 412	-1021
	25 year			50 year			100 year		
	pre	post	diff	pre	post	diff	pre	post	diff
Dp-1	30 736	31 026	290	40 727	41 619	892	53 131	54 618	1 487
Dp-2	4 921	4 238	-683	6 012	5 213	-799	7 316	6 381	-935
Total	35 657	35 264	-393	46 739	46 832	93	60 447	60 999	552

Table 4: Runoff volumes during selected design storms

^a Understood to be a typo, and the 25-year event is intended

1.1.7 Infiltration volume requirement

Town of Durham Site Design Standards require that a portion of the stormwater runoff be infiltrated to protect groundwater resources. The amount of groundwater recharge required per soil group, as a ratio of the Water Quality Volume is summarized in Table 1.5. To provide stormwater management an infiltrating underground chamber system is proposed, providing 5301 cubic feet of storage, equivalent to the full water quality volume for the area draining to the structure, for groundwater recharge through infiltration.

1.2 NRCS Soils Information (SSURGO data)



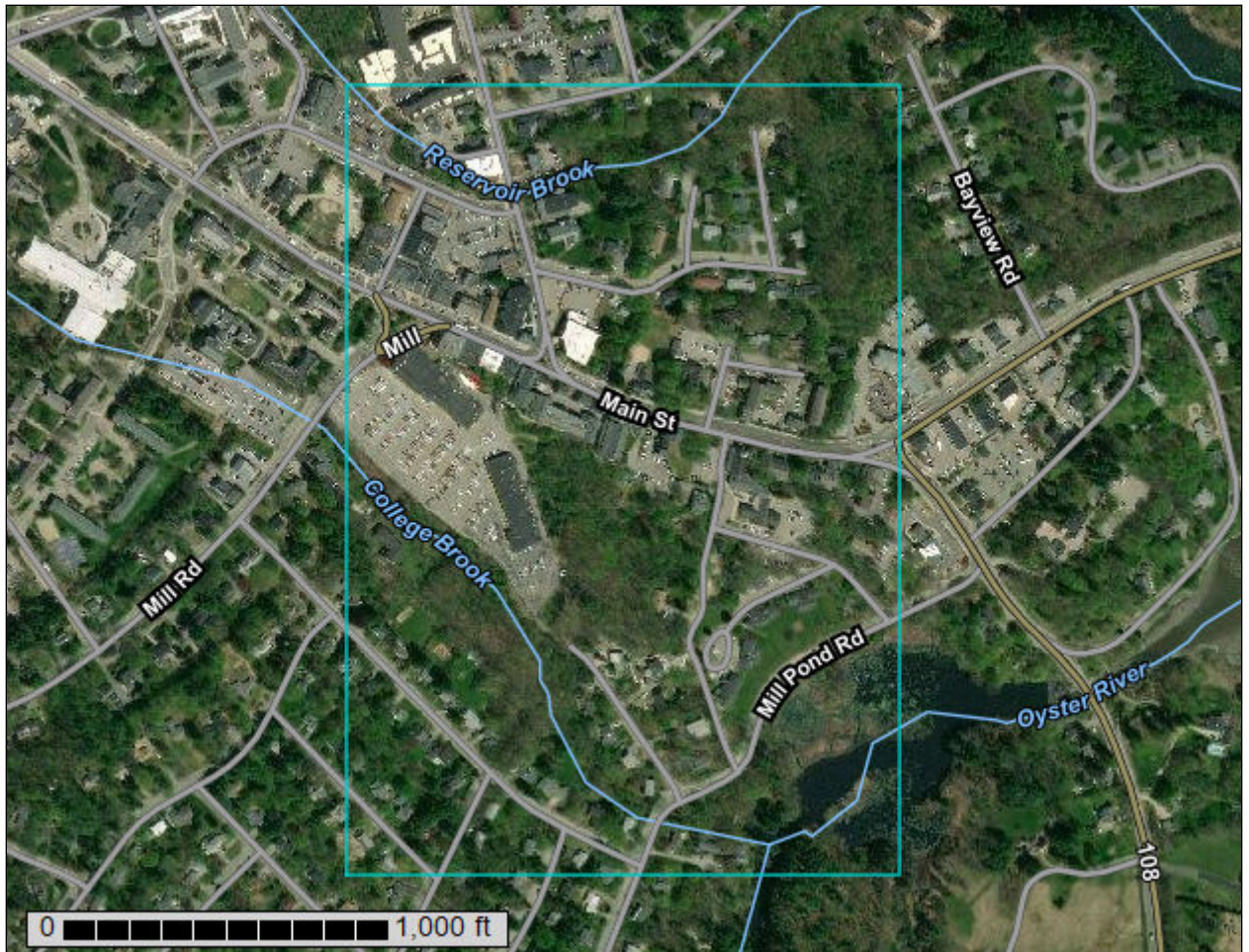
United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

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

Custom Soil Resource Report for Strafford County, New Hampshire



Preface

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

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

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

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

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

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

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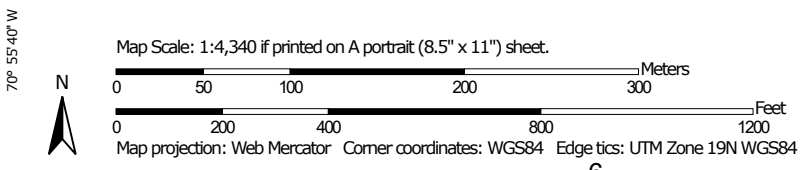
Soil Map

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

Custom Soil Resource Report Soil Map




Soil Map may not be valid at this scale.





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 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Strafford County, New Hampshire
 Survey Area Data: Version 20, May 29, 2020

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

Date(s) aerial images were photographed: Dec 31, 2009—Sep 9, 2017

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BzB	Buxton silt loam, 3 to 8 percent slopes	31.7	33.2%
CsC	Charlton fine sandy loam, 8 to 15 percent slopes, very stony	0.8	0.9%
HcB	Hollis-Charlton fine sandy loams, 3 to 8 percent slopes	10.0	10.5%
HcC	Hollis-Charlton fine sandy loams, 8 to 15 percent slopes	3.0	3.1%
HdB	Hollis-Charlton very rocky fine sandy loams, 3 to 8 percent slopes	8.2	8.5%
HdC	Hollis-Charlton very rocky fine sandy loams, 8 to 15 percent slopes	0.0	0.0%
HeD	Hollis-Charlton extremely rocky fine sandy loams, 8 to 25 percent slopes	7.5	7.8%
Sb	Saugatuck loamy sand	0.7	0.7%
SfC	Suffield silt loam, 8 to 15 percent slopes	26.9	28.1%
W	Water	4.1	4.3%
WfB	Windsor loamy fine sand, clay subsoil variant, 0 to 8 percent slopes	2.7	2.8%
Totals for Area of Interest		95.6	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.

Custom Soil Resource Report

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

Custom Soil Resource Report

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.

Strafford County, New Hampshire

BzB—Buxton silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9d6p
Elevation: 0 to 260 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Buxton and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Buxton

Setting

Parent material: Glaciomarine

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 28 inches: silty clay loam
H3 - 28 to 43 inches: silty clay

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C/D
Ecological site: F145XY006CT - Semi-Rich Moist Lake Plain
Hydric soil rating: No

Minor Components

Elmwood

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

Not named

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

CsC—Charlton fine sandy loam, 8 to 15 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2wh0p
Elevation: 0 to 1,570 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Charlton, very stony, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Charlton, Very Stony

Setting

Landform: Hills, ground moraines, ridges
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Parent material: Coarse-loamy melt-out till derived from granite, gneiss, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 4 inches: fine sandy loam
Bw - 4 to 27 inches: gravelly fine sandy loam
C - 27 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Moderate (about 8.7 inches)

Interpretive groups

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

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Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Sutton, very stony

Percent of map unit: 5 percent
Landform: Hills, ground moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Paxton, very stony

Percent of map unit: 5 percent
Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Shoulder, summit, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Chatfield, very stony

Percent of map unit: 3 percent
Landform: Hills, ridges
Landform position (two-dimensional): Summit, backslope, shoulder
Landform position (three-dimensional): Crest, side slope, nose slope
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Leicester, very stony

Percent of map unit: 2 percent
Landform: Drainageways, ground moraines, hills, depressions
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear, concave
Across-slope shape: Concave
Hydric soil rating: Yes

HcB—Hollis-Charlton fine sandy loams, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9d7j
Elevation: 0 to 1,020 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 120 to 240 days
Farmland classification: Farmland of local importance

Map Unit Composition

Hollis and similar soils: 55 percent

Charlton and similar soils: 35 percent

Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hollis

Setting

Parent material: Till

Typical profile

H1 - 0 to 14 inches: fine sandy loam

H2 - 14 to 18 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: 10 to 20 inches to lithic bedrock

Drainage class: Well drained

Runoff class: Very high

*Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.60 to 6.00 in/hr)*

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Very low (about 2.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: D

Ecological site: F144AY033MA - Shallow Dry Till Uplands

Hydric soil rating: No

Description of Charlton

Setting

Parent material: Till

Typical profile

H1 - 0 to 13 inches: fine sandy loam

H2 - 13 to 36 inches: fine sandy loam

H3 - 36 to 40 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

*Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00
in/hr)*

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Low (about 5.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Not named

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

Buxton

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

HcC—Hollis-Charlton fine sandy loams, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 9d7k
Elevation: 0 to 1,080 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 120 to 240 days
Farmland classification: Farmland of local importance

Map Unit Composition

Hollis and similar soils: 55 percent
Charlton and similar soils: 35 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hollis

Setting

Parent material: Till

Typical profile

H1 - 0 to 14 inches: fine sandy loam
H2 - 14 to 18 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches

Custom Soil Resource Report

Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: F144AY033MA - Shallow Dry Till Uplands
Hydric soil rating: No

Description of Charlton

Setting

Parent material: Till

Typical profile

H1 - 0 to 13 inches: fine sandy loam
H2 - 13 to 36 inches: fine sandy loam
H3 - 36 to 40 inches: gravelly loamy sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Not named

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

Buxton

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

HdB—Hollis-Charlton very rocky fine sandy loams, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9d7m
Elevation: 0 to 1,000 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 120 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Hollis and similar soils: 40 percent
Charlton and similar soils: 30 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hollis

Setting

Parent material: Till

Typical profile

H1 - 0 to 14 inches: very stony fine sandy loam
H2 - 14 to 18 inches: bedrock

Properties and qualities

Slope: 3 to 8 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
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.0 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 Charlton

Setting

Parent material: Till

Custom Soil Resource Report

Typical profile

H1 - 0 to 13 inches: very stony fine sandy loam

H2 - 13 to 36 inches: fine sandy loam

H3 - 36 to 40 inches: gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent

Surface area covered with cobbles, stones or boulders: 1.6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: A

Ecological site: F144AY034CT - Well Drained Till Uplands

Hydric soil rating: No

Minor Components

Rock outcrop

Percent of map unit: 10 percent

Hydric soil rating: No

Not named

Percent of map unit: 5 percent

Hydric soil rating: No

Sutton

Percent of map unit: 5 percent

Hydric soil rating: No

Buxton

Percent of map unit: 5 percent

Hydric soil rating: No

Leicester

Percent of map unit: 5 percent

Landform: Depressions

Hydric soil rating: Yes

HdC—Hollis-Charlton very rocky fine sandy loams, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 9d7n
Elevation: 0 to 1,200 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 120 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Hollis and similar soils: 40 percent
Charlton and similar soils: 30 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hollis

Setting

Parent material: Till

Typical profile

H1 - 0 to 14 inches: very stony fine sandy loam
H2 - 14 to 18 inches: 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
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.0 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 Charlton

Setting

Parent material: Till

Typical profile

H1 - 0 to 13 inches: very stony fine sandy loam

H2 - 13 to 36 inches: fine sandy loam

H3 - 36 to 40 inches: gravelly loamy sand

Properties and qualities

Slope: 8 to 15 percent

Surface area covered with cobbles, stones or boulders: 1.6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: A

Ecological site: F144AY034CT - Well Drained Till Uplands

Hydric soil rating: No

Minor Components

Rock outcrop

Percent of map unit: 10 percent

Hydric soil rating: No

Not named

Percent of map unit: 10 percent

Hydric soil rating: No

Woodbridge

Percent of map unit: 5 percent

Hydric soil rating: No

Sutton

Percent of map unit: 5 percent

Hydric soil rating: No

HeD—Hollis-Charlton extremely rocky fine sandy loams, 8 to 25 percent slopes

Map Unit Setting

National map unit symbol: 9d7q
Elevation: 0 to 1,180 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 120 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Hollis and similar soils: 30 percent
Charlton and similar soils: 25 percent
Minor components: 45 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hollis

Setting

Parent material: Till

Typical profile

H1 - 0 to 14 inches: extremely stony fine sandy loam
H2 - 14 to 18 inches: bedrock

Properties and qualities

Slope: 8 to 25 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
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.0 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 Charlton

Setting

Parent material: Till

Typical profile

H1 - 0 to 13 inches: extremely stony fine sandy loam

H2 - 13 to 36 inches: fine sandy loam

H3 - 36 to 40 inches: gravelly loamy sand

Properties and qualities

Slope: 8 to 25 percent

Surface area covered with cobbles, stones or boulders: 1.6 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water capacity: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s

Hydrologic Soil Group: A

Ecological site: F144AY034CT - Well Drained Till Uplands

Hydric soil rating: No

Minor Components

Rock outcrop

Percent of map unit: 25 percent

Hydric soil rating: No

Not named

Percent of map unit: 10 percent

Hydric soil rating: No

Leicester

Percent of map unit: 5 percent

Landform: Depressions

Hydric soil rating: Yes

Sutton

Percent of map unit: 5 percent

Hydric soil rating: No

Sb—Saugatuck loamy sand

Map Unit Setting

National map unit symbol: 9d8r
Elevation: 300 to 1,000 feet
Mean annual precipitation: 27 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 125 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Saugatuck and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Saugatuck

Setting

Landform: Outwash terraces
Parent material: Outwash

Typical profile

H1 - 0 to 4 inches: loamy sand
H2 - 4 to 7 inches: sand
H3 - 7 to 26 inches: loamy sand
H4 - 26 to 42 inches: sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 10 to 16 inches to undefined
Drainage class: Poorly drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.60 to 2.00 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 1.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Not named wet

Percent of map unit: 15 percent

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Landform: Outwash terraces
Hydric soil rating: Yes

SfC—Suffield silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 9d8v
Elevation: 0 to 250 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Suffield and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Suffield

Typical profile

H1 - 0 to 19 inches: silt loam
H2 - 19 to 28 inches: silt loam
H3 - 28 to 41 inches: silty clay

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 7.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: F144AY017NH - Well Drained Lake Plain
Hydric soil rating: No

Minor Components

Not named

Percent of map unit: 9 percent
Hydric soil rating: No

Buxton

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

Rock outcrop

Percent of map unit: 1 percent
Hydric soil rating: No

W—Water

Map Unit Composition

Water (less than 40 acres): 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

WfB—Windsor loamy fine sand, clay subsoil variant, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9d9b
Elevation: 0 to 280 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Windsor variant and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Windsor Variant

Typical profile

H1 - 0 to 26 inches: loamy fine sand
H2 - 26 to 30 inches: loamy sand
H3 - 30 to 42 inches: silt loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.1 inches)

Custom Soil Resource Report

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3s

Hydrologic Soil Group: A

Ecological site: F144AY022MA - Dry Outwash

Hydric soil rating: No

Minor Components

Not named

Percent of map unit: 15 percent

Hydric soil rating: No

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

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

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

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

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

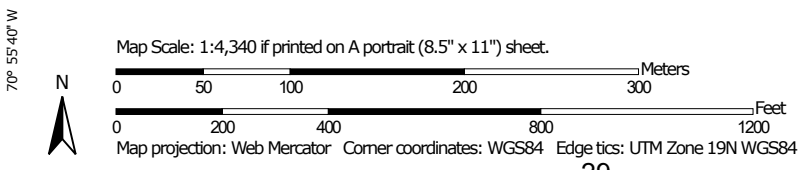
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Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water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


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

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

Custom Soil Resource Report Map—Hydrologic Soil Group











MAP LEGEND









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

Soils





Soil Rating Polygons


-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available


Soil Rating Lines


-  A
-  A/D
-  B
-  B/D
-  C
-  C/D
-  D
-  Not rated or not available


Soil Rating Points

-  A
-  A/D
-  B
-  B/D


 C

 C/D






 D

 Not rated or not available


Water Features

-  Streams and Canals

Transportation

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

Background

-  Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Strafford County, New Hampshire
 Survey Area Data: Version 20, May 29, 2020

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

Date(s) aerial images were photographed: Dec 31, 2009—Sep 9, 2017

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

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
BzB	Buxton silt loam, 3 to 8 percent slopes	C/D	31.7	33.2%
CsC	Charlton fine sandy loam, 8 to 15 percent slopes, very stony	B	0.8	0.9%
HcB	Hollis-Charlton fine sandy loams, 3 to 8 percent slopes	D	10.0	10.5%
HcC	Hollis-Charlton fine sandy loams, 8 to 15 percent slopes	D	3.0	3.1%
HdB	Hollis-Charlton very rocky fine sandy loams, 3 to 8 percent slopes	D	8.2	8.5%
HdC	Hollis-Charlton very rocky fine sandy loams, 8 to 15 percent slopes	D	0.0	0.0%
HeD	Hollis-Charlton extremely rocky fine sandy loams, 8 to 25 percent slopes		7.5	7.8%
Sb	Saugatuck loamy sand	B/D	0.7	0.7%
SfC	Suffield silt loam, 8 to 15 percent slopes	C	26.9	28.1%
W	Water		4.1	4.3%
WfB	Windsor loamy fine sand, clay subsoil variant, 0 to 8 percent slopes	A	2.7	2.8%
Totals for Area of Interest			95.6	100.0%

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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1.3 Extreme precipitation tables (Northeast Regional Climate Center)

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	No
State	New Hampshire
Location	
Longitude	70.923 degrees West
Latitude	43.133 degrees North
Elevation	0 feet
Date/Time	Tue, 20 Oct 2020 14:53:49 -0400

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.26	0.40	0.49	0.66	0.81	1.00	1yr	0.70	0.98	1.13	1.59	2.03	2.61	2.84	1yr	2.31	2.74	3.14	3.86	4.44	1yr
2yr	0.32	0.49	0.61	0.82	1.01	1.19	2yr	0.88	1.17	1.39	1.86	2.41	3.14	3.48	2yr	2.78	3.34	3.84	4.57	5.21	2yr
5yr	0.37	0.57	0.70	0.96	1.23	1.48	5yr	1.06	1.44	1.72	2.32	2.96	3.98	4.46	5yr	3.52	4.29	4.90	5.79	6.55	5yr
10yr	0.41	0.63	0.78	1.10	1.42	1.73	10yr	1.22	1.69	2.02	2.73	3.46	4.76	5.39	10yr	4.21	5.18	5.90	6.92	7.80	10yr
25yr	0.48	0.74	0.91	1.31	1.72	2.14	25yr	1.48	2.09	2.51	3.40	4.26	6.03	6.91	25yr	5.34	6.65	7.53	8.78	9.83	25yr
50yr	0.54	0.83	1.03	1.48	2.00	2.51	50yr	1.72	2.46	2.96	4.01	4.99	7.22	8.36	50yr	6.39	8.04	9.06	10.51	11.72	50yr
100yr	0.62	0.93	1.17	1.69	2.32	2.95	100yr	2.00	2.89	3.48	4.73	5.84	8.64	10.11	100yr	7.65	9.72	10.91	12.58	13.97	100yr
200yr	0.70	1.05	1.33	1.93	2.69	3.48	200yr	2.32	3.40	4.10	5.59	6.84	10.36	12.22	200yr	9.16	11.75	13.14	15.07	16.66	200yr
500yr	0.83	1.24	1.59	2.31	3.29	4.31	500yr	2.84	4.22	5.10	6.97	8.45	13.16	15.72	500yr	11.64	15.12	16.81	19.15	21.05	500yr

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.24	0.37	0.45	0.60	0.74	0.90	1yr	0.64	0.88	0.91	1.26	1.56	2.02	2.52	1yr	1.79	2.42	2.93	3.27	4.01	1yr
2yr	0.31	0.49	0.60	0.81	1.00	1.18	2yr	0.86	1.16	1.37	1.83	2.36	3.04	3.39	2yr	2.69	3.26	3.74	4.46	5.05	2yr
5yr	0.35	0.54	0.67	0.92	1.16	1.40	5yr	1.01	1.37	1.62	2.15	2.78	3.72	4.14	5yr	3.29	3.98	4.59	5.43	6.14	5yr
10yr	0.38	0.59	0.73	1.02	1.32	1.60	10yr	1.14	1.57	1.82	2.45	3.13	4.30	4.82	10yr	3.80	4.63	5.34	6.30	7.08	10yr
25yr	0.44	0.67	0.83	1.18	1.56	1.91	25yr	1.35	1.87	2.11	2.85	3.66	5.03	5.87	25yr	4.45	5.65	6.54	7.68	8.56	25yr
50yr	0.48	0.74	0.92	1.32	1.77	2.19	50yr	1.53	2.14	2.36	3.20	4.11	5.77	6.81	50yr	5.11	6.55	7.63	8.92	9.87	50yr
100yr	0.54	0.82	1.02	1.48	2.03	2.51	100yr	1.75	2.45	2.64	3.59	4.60	6.60	7.89	100yr	5.84	7.59	8.91	10.35	11.35	100yr
200yr	0.60	0.90	1.15	1.66	2.31	2.87	200yr	2.00	2.80	2.94	4.01	5.14	7.55	9.15	200yr	6.68	8.80	10.41	12.02	13.08	200yr
500yr	0.70	1.05	1.34	1.95	2.78	3.45	500yr	2.40	3.37	3.42	4.65	5.98	8.99	11.12	500yr	7.95	10.69	12.80	14.67	15.72	500yr

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.43	0.53	0.71	0.87	1.08	1yr	0.75	1.05	1.24	1.75	2.22	2.84	3.03	1yr	2.51	2.91	3.38	4.18	4.78	1yr
2yr	0.33	0.51	0.62	0.84	1.04	1.25	2yr	0.90	1.22	1.48	1.95	2.50	3.26	3.58	2yr	2.88	3.44	3.95	4.71	5.40	2yr
5yr	0.39	0.60	0.75	1.03	1.31	1.58	5yr	1.13	1.55	1.85	2.50	3.19	4.23	4.77	5yr	3.74	4.59	5.22	6.16	6.93	5yr
10yr	0.46	0.70	0.87	1.21	1.57	1.92	10yr	1.35	1.88	2.23	3.04	3.84	5.21	5.94	10yr	4.61	5.71	6.48	7.56	8.45	10yr
25yr	0.55	0.84	1.05	1.50	1.97	2.48	25yr	1.70	2.42	2.87	3.96	4.93	7.05	7.95	25yr	6.24	7.65	8.59	9.94	11.01	25yr
50yr	0.64	0.97	1.21	1.74	2.34	2.99	50yr	2.02	2.92	3.48	4.83	5.99	8.73	9.93	50yr	7.73	9.55	10.65	12.21	13.47	50yr
100yr	0.74	1.12	1.41	2.03	2.79	3.61	100yr	2.40	3.53	4.23	5.91	7.27	10.81	12.40	100yr	9.57	11.92	13.19	15.02	16.48	100yr
200yr	0.86	1.29	1.64	2.37	3.31	4.38	200yr	2.86	4.28	5.14	7.23	8.81	13.43	15.50	200yr	11.88	14.91	16.34	18.47	20.19	200yr
500yr	1.05	1.56	2.01	2.92	4.15	5.63	500yr	3.58	5.50	6.63	9.47	11.40	17.92	20.82	500yr	15.86	20.02	21.69	24.30	26.43	500yr



SECTION 2.0 DRAINAGE CALCULATIONS, ANALYSIS, & DESIGN

2.1 BMP worksheets for all treatment systems

18-041_POST_02*Type III 24-hr 100-YR Rainfall=8.64"*

Prepared by Horizons Engineering

HydroCAD® 10.00-25 s/n 08064 © 2019 HydroCAD Software Solutions LLC

Stage-Area-Storage for Pond 4P: Top MC-3500

Elevation (feet)	Horizontal (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Horizontal (sq-ft)	Storage (cubic-feet)
51.75	1,807	0	57.05	1,807	5,899
51.85	1,807	72	57.15	1,807	5,971
51.95	1,807	145	57.25	1,807	6,043
52.05	1,807	217	57.35	1,807	6,116
52.15	1,807	289	57.45	1,807	6,188
52.25	1,807	361			
52.35	1,807	434			
52.45	1,807	506			
52.55	1,807	578			
52.65	1,807	650			
52.75	1,807	723			
52.85	1,807	874			
52.95	1,807	1,025			
53.05	1,807	1,175			
53.15	1,807	1,324			
53.25	1,807	1,473			
53.35	1,807	1,621			
53.45	1,807	1,769			
53.55	1,807	1,916			
53.65	1,807	2,062			
53.75	1,807	2,207			
53.85	1,807	2,352			
53.95	1,807	2,495			
54.05	1,807	2,638			
54.15	1,807	2,779			
54.25	1,807	2,920			
54.35	1,807	3,059			
54.45	1,807	3,197			
54.55	1,807	3,333			
54.65	1,807	3,469			
54.75	1,807	3,602			
54.85	1,807	3,735			
54.95	1,807	3,865			
55.05	1,807	3,994			
55.15	1,807	4,120			
55.25	1,807	4,245			
55.35	1,807	4,367			
55.45	1,807	4,487			
55.55	1,807	4,604			
55.65	1,807	4,718			
55.75	1,807	4,829			
55.85	1,807	4,937			
55.95	1,807	5,040			
56.05	1,807	5,137			
56.15	1,807	5,228			
56.25	1,807	5,310			
56.35	1,807	5,389			
56.45	1,807	5,465			
56.55	1,807	5,537			
56.65	1,807	5,610			
56.75	1,807	5,682			
56.85	1,807	5,754			
56.95	1,807	5,826			

18-041_POST_02*Type III 24-hr 100-YR Rainfall=8.64"*

Prepared by Horizons Engineering

HydroCAD® 10.00-25 s/n 08064 © 2019 HydroCAD Software Solutions LLC

Stage-Area-Storage for Pond 2P: Bot MC-3500

Elevation (feet)	Horizontal (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Horizontal (sq-ft)	Storage (cubic-feet)
47.35	2,316	0	52.65	2,316	7,619
47.45	2,316	93	52.75	2,316	7,712
47.55	2,316	185	52.85	2,316	7,805
47.65	2,316	278	52.95	2,316	7,897
47.75	2,316	370	53.05	2,316	7,990
47.85	2,316	463			
47.95	2,316	556			
48.05	2,316	648			
48.15	2,316	741			
48.25	2,316	834			
48.35	2,316	926			
48.45	2,316	1,122			
48.55	2,316	1,318			
48.65	2,316	1,512			
48.75	2,316	1,706			
48.85	2,316	1,899			
48.95	2,316	2,091			
49.05	2,316	2,283			
49.15	2,316	2,473			
49.25	2,316	2,663			
49.35	2,316	2,851			
49.45	2,316	3,038			
49.55	2,316	3,224			
49.65	2,316	3,409			
49.75	2,316	3,592			
49.85	2,316	3,774			
49.95	2,316	3,954			
50.05	2,316	4,133			
50.15	2,316	4,310			
50.25	2,316	4,485			
50.35	2,316	4,658			
50.45	2,316	4,829			
50.55	2,316	4,998			
50.65	2,316	5,164			
50.75	2,316	5,328			
50.85	2,316	5,489			
50.95	2,316	5,648			
51.05	2,316	5,802			
51.15	2,316	5,954			
51.25	2,316	6,102			
51.35	2,316	6,245			
51.45	2,316	6,384			
51.55	2,316	6,517			
51.65	2,316	6,642			
51.75	2,316	6,759			
51.85	2,316	6,865			
51.95	2,316	6,966			
52.05	2,316	7,063			
52.15	2,316	7,156			
52.25	2,316	7,249			
52.35	2,316	7,341			
52.45	2,316	7,434			
52.55	2,316	7,527			

2.2 Pre-development analysis

2.2.1 Pre-development analysis

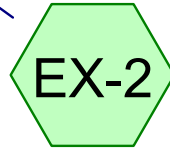
A pre-development analysis covering 129 549 square feet which includes the area to be disturbed by the proposed project. The site has been divided into two pre-development subcatchment area. Subcatchments EX-1 and EX-2 representing the areas draining directly to Drainage Point 1 (Dp-1) and Drainage Point 2 (Dp-2) respectively. EX-1 models area at the front of the site which drains to a point on Main Street, and consists primarily of the existing developed areas at the front of the project site. Drainage Point 2 is in the south of the site, and represents flow toward college brook. EX-2 represents the area draining to Dp-2, and consists primarily of forested slope, but includes a portion of the existing developed area at the north end of the project site.

For more detailed information on the pre-developed area, including watershed areas and drainage paths, see attached drainage plans found in Section 3 and the HydroCAD area listing found in section 2.2.2. A pre- versus post-development comparison flow rate table for the 1-inch; 2-, 10-, 25-, 50-, and 100-year storm events can be found in Table 1 in section 1.1.1.

A High Intensity Soil Survey (HISS) within the work area was completed by Joseph W. Noel, Certified Soil Scientist #17, on 16 October, 2020. This information can be found included on the Existing Conditions Plan.

2.2.2 Pre-development diagram, area listing, soil listing

Dp-2
Analysis Point



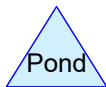
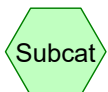
Subcat EX-2



Subcat EX-1



Analysis Point



Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
6,023	61	>75% Grass cover, Good, HSG B (EX-1)
189	74	>75% Grass cover, Good, HSG C (EX-1)
8,746	80	>75% Grass cover, Good, HSG D (EX-1, EX-2)
395	98	Paved parking, HSG B (EX-1)
0	98	Paved parking, HSG C (EX-1)
22,014	98	Paved parking, HSG D (EX-1, EX-2)
792	98	Roofs, HSG B (EX-1)
4,217	98	Roofs, HSG D (EX-1, EX-2)
18,347	55	Woods, Good, HSG B (EX-1)
51,733	70	Woods, Good, HSG C (EX-1)
17,094	77	Woods, Good, HSG D (EX-1)
129,549	75	TOTAL AREA

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
25,556	HSG B	EX-1
51,923	HSG C	EX-1
52,071	HSG D	EX-1, EX-2
0	Other	
129,549		TOTAL AREA

2.2.3 Pre-development node listing for design storm events

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX-1: Subcat EX-1

Runoff Area=118,462 sf 15.79% Impervious Runoff Depth=0.02"
Flow Length=653' Tc=11.0 min CN=73 Runoff=0.01 cfs 169 cf

Subcatchment EX-2: Subcat EX-2

Runoff Area=11,087 sf 78.61% Impervious Runoff Depth=0.50"
Flow Length=154' Tc=6.0 min CN=94 Runoff=0.15 cfs 465 cf

Link Dp-1: Analysis Point

Inflow=0.01 cfs 169 cf
Primary=0.01 cfs 169 cf

Link Dp-2: Analysis Point

Inflow=0.15 cfs 465 cf
Primary=0.15 cfs 465 cf

Total Runoff Area = 129,549 sf Runoff Volume = 634 cf Average Runoff Depth = 0.06"
78.84% Pervious = 102,133 sf 21.16% Impervious = 27,417 sf

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX-1: Subcat EX-1

Runoff Area=118,462 sf 15.79% Impervious Runoff Depth=0.94"
Flow Length=653' Tc=11.0 min CN=73 Runoff=2.35 cfs 9,325 cf

Subcatchment EX-2: Subcat EX-2

Runoff Area=11,087 sf 78.61% Impervious Runoff Depth=2.49"
Flow Length=154' Tc=6.0 min CN=94 Runoff=0.70 cfs 2,297 cf

Link Dp-1: Analysis Point

Inflow=2.35 cfs 9,325 cf
Primary=2.35 cfs 9,325 cf

Link Dp-2: Analysis Point

Inflow=0.70 cfs 2,297 cf
Primary=0.70 cfs 2,297 cf

**Total Runoff Area = 129,549 sf Runoff Volume = 11,622 cf Average Runoff Depth = 1.08"
78.84% Pervious = 102,133 sf 21.16% Impervious = 27,417 sf**

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX-1: Subcat EX-1

Runoff Area=118,462 sf 15.79% Impervious Runoff Depth=2.09"
Flow Length=653' Tc=11.0 min CN=73 Runoff=5.54 cfs 20,671 cf

Subcatchment EX-2: Subcat EX-2

Runoff Area=11,087 sf 78.61% Impervious Runoff Depth=4.07"
Flow Length=154' Tc=6.0 min CN=94 Runoff=1.11 cfs 3,762 cf

Link Dp-1: Analysis Point

Inflow=5.54 cfs 20,671 cf
Primary=5.54 cfs 20,671 cf

Link Dp-2: Analysis Point

Inflow=1.11 cfs 3,762 cf
Primary=1.11 cfs 3,762 cf

Total Runoff Area = 129,549 sf Runoff Volume = 24,432 cf Average Runoff Depth = 2.26"
78.84% Pervious = 102,133 sf 21.16% Impervious = 27,417 sf

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX-1: Subcat EX-1

Runoff Area=118,462 sf 15.79% Impervious Runoff Depth=3.11"
Flow Length=653' Tc=11.0 min CN=73 Runoff=8.33 cfs 30,736 cf

Subcatchment EX-2: Subcat EX-2

Runoff Area=11,087 sf 78.61% Impervious Runoff Depth=5.33"
Flow Length=154' Tc=6.0 min CN=94 Runoff=1.43 cfs 4,921 cf

Link Dp-1: Analysis Point

Inflow=8.33 cfs 30,736 cf
Primary=8.33 cfs 30,736 cf

Link Dp-2: Analysis Point

Inflow=1.43 cfs 4,921 cf
Primary=1.43 cfs 4,921 cf

Total Runoff Area = 129,549 sf Runoff Volume = 35,657 cf Average Runoff Depth = 3.30"
78.84% Pervious = 102,133 sf 21.16% Impervious = 27,417 sf

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX-1: Subcat EX-1

Runoff Area=118,462 sf 15.79% Impervious Runoff Depth=4.13"
Flow Length=653' Tc=11.0 min CN=73 Runoff=11.06 cfs 40,727 cf

Subcatchment EX-2: Subcat EX-2

Runoff Area=11,087 sf 78.61% Impervious Runoff Depth=6.51"
Flow Length=154' Tc=6.0 min CN=94 Runoff=1.72 cfs 6,012 cf

Link Dp-1: Analysis Point

Inflow=11.06 cfs 40,727 cf
Primary=11.06 cfs 40,727 cf

Link Dp-2: Analysis Point

Inflow=1.72 cfs 6,012 cf
Primary=1.72 cfs 6,012 cf

**Total Runoff Area = 129,549 sf Runoff Volume = 46,739 cf Average Runoff Depth = 4.33"
78.84% Pervious = 102,133 sf 21.16% Impervious = 27,417 sf**

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment EX-1: Subcat EX-1

Runoff Area=118,462 sf 15.79% Impervious Runoff Depth=5.38"
Flow Length=653' Tc=11.0 min CN=73 Runoff=14.39 cfs 53,121 cf

Subcatchment EX-2: Subcat EX-2

Runoff Area=11,087 sf 78.61% Impervious Runoff Depth=7.92"
Flow Length=154' Tc=6.0 min CN=94 Runoff=2.08 cfs 7,316 cf

Link Dp-1: Analysis Point

Inflow=14.39 cfs 53,121 cf
Primary=14.39 cfs 53,121 cf

Link Dp-2: Analysis Point

Inflow=2.08 cfs 7,316 cf
Primary=2.08 cfs 7,316 cf

**Total Runoff Area = 129,549 sf Runoff Volume = 60,437 cf Average Runoff Depth = 5.60"
78.84% Pervious = 102,133 sf 21.16% Impervious = 27,417 sf**

2.2.4 Pre-development: full summary of 10-year storm event

Summary for Subcatchment EX-1: Subcat EX-1

Runoff = 5.54 cfs @ 12.16 hrs, Volume= 20,671 cf, Depth= 2.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 010-YR Rainfall=4.76"

Area (sf)	CN	Description
6,023	61	>75% Grass cover, Good, HSG B
189	74	>75% Grass cover, Good, HSG C
6,375	80	>75% Grass cover, Good, HSG D
395	98	Paved parking, HSG B
0	98	Paved parking, HSG C
14,583	98	Paved parking, HSG D
792	98	Roofs, HSG B
2,932	98	Roofs, HSG D
18,347	55	Woods, Good, HSG B
51,733	70	Woods, Good, HSG C
17,094	77	Woods, Good, HSG D
118,462	73	Weighted Average
99,762		84.21% Pervious Area
18,701		15.79% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	64	0.0435	0.21		Sheet Flow, 1A Grass: Short n= 0.150 P2= 3.14"
0.5	35	0.0291	1.28		Sheet Flow, 1B Smooth surfaces n= 0.011 P2= 3.14"
0.3	96	0.0528	4.66		Shallow Concentrated Flow, 2A Paved Kv= 20.3 fps
5.1	458	0.0879	1.48		Shallow Concentrated Flow, 2B Woodland Kv= 5.0 fps
11.0	653	Total			

Summary for Subcatchment EX-2: Subcat EX-2

Runoff = 1.11 cfs @ 12.09 hrs, Volume= 3,762 cf, Depth= 4.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 010-YR Rainfall=4.76"

Area (sf)	CN	Description
2,371	80	>75% Grass cover, Good, HSG D
7,431	98	Paved parking, HSG D
1,285	98	Roofs, HSG D
11,087	94	Weighted Average
2,371		21.39% Pervious Area
8,716		78.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.8	14	0.2021	0.29		Sheet Flow, 1A Grass: Short n= 0.150 P2= 3.14"
0.6	140	0.0374	3.93		Shallow Concentrated Flow, 2A Paved Kv= 20.3 fps
4.6					Direct Entry, CORRECT TO TR-55 MIN.
6.0	154	Total			

Summary for Link Dp-1: Analysis Point

Inflow Area = 118,462 sf, 15.79% Impervious, Inflow Depth = 2.09" for 010-YR event
 Inflow = 5.54 cfs @ 12.16 hrs, Volume= 20,671 cf
 Primary = 5.54 cfs @ 12.16 hrs, Volume= 20,671 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Link Dp-2: Analysis Point

Inflow Area = 11,087 sf, 78.61% Impervious, Inflow Depth = 4.07" for 010-YR event
 Inflow = 1.11 cfs @ 12.09 hrs, Volume= 3,762 cf
 Primary = 1.11 cfs @ 12.09 hrs, Volume= 3,762 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

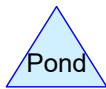
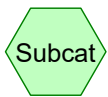
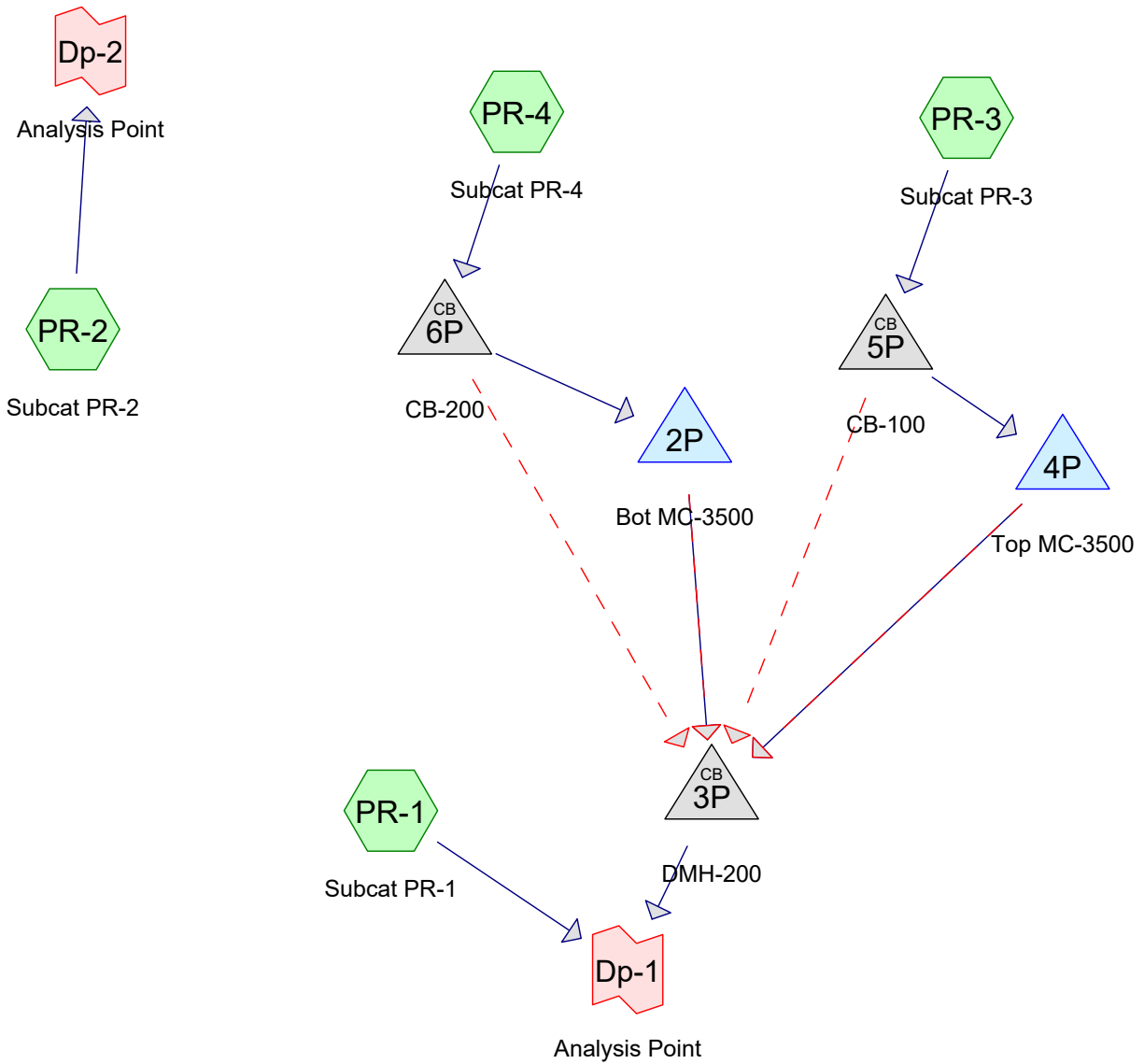
2.3 Post-development Analysis

2.3.1 Post-development analysis

A post-development analysis covering 129 549 square feet includes the 79,700 square feet of disturbed area within the proposed project site as well as previously developed areas and undisturbed areas. The site has been divided into four post-development subcatchment areas. Subcatchments PR-1 and PR-2 representing the areas draining directly to Drainage Point 1 (Dp-1) and Drainage Point 2 (Dp-2) respectively. PR-1 is modified from the pre-development condition by the reconstruction of the site driveway, resulting in a smaller area draining to Dp-1. PR-2 is smaller than the pre-development equivalent, EX-2, due to the exclusion of areas draining to an underground chamber system. A third and fourth subcatchment, PR-3 and PR-4, each represent the flow contributing to underground chamber systems, and consists primarily of parking lot areas. PR-3 stores water from the upper part of the parking lot, while PR-4 stores water from the lower part of the parking lot. Stormwater from the proposed parking area will be conveyed via sheet flow to grass swale islands which lead to catch basins. These catch basins then direct stormwater into the isolator row of an underground chamber system under the parking lot. The chamber systems have been designed to detain a volume greater than the water quality volume. An overflow structure has been designed to maintain water levels within the profile of the chamber system during events up to the 100-year storm event. Orifices within the overflow structure additionally manage peak flow rates out of the system during storm events.

For more detailed information on the post-developed area, see attached drainage plans found in Section 4 and the HydroCAD area listing found in section 2.3.2. A pre- versus postdevelopment comparison flow rate table for the 1-inch; 2-, 10-, 25-, 50-, and 100-year storm events can be found in Table 1 in Section 1.1.1.

2.3.2 Diagram, area listing, soil listing



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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
9,342	61	>75% Grass cover, Good, HSG B (PR-1, PR-3, PR-4)
17,237	74	>75% Grass cover, Good, HSG C (PR-1, PR-3, PR-4)
11,742	80	>75% Grass cover, Good, HSG D (PR-1, PR-2, PR-3, PR-4)
10,404	98	Paved parking, HSG B (PR-1, PR-3, PR-4)
25,515	98	Paved parking, HSG C (PR-1, PR-3, PR-4)
19,610	98	Paved parking, HSG D (PR-1, PR-2, PR-3, PR-4)
4,217	98	Roofs, HSG D (PR-2, PR-3, PR-4)
5,810	55	Woods, Good, HSG B (PR-1)
9,171	70	Woods, Good, HSG C (PR-1)
16,502	77	Woods, Good, HSG D (PR-1)
129,549	84	TOTAL AREA

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Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
25,556	HSG B	PR-1, PR-3, PR-4
51,923	HSG C	PR-1, PR-3, PR-4
52,071	HSG D	PR-1, PR-2, PR-3, PR-4
0	Other	
129,549		TOTAL AREA

2.3.3 Post-development node listing for design storm events

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Type III 24-hr 1-INCH Rainfall=1.00"

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Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR-1: Subcat PR-1	Runoff Area=55,656 sf 3.78% Impervious Runoff Depth=0.01" Tc=6.0 min CN=71 Runoff=0.00 cfs 36 cf
Subcatchment PR-2: Subcat PR-2	Runoff Area=9,973 sf 67.62% Impervious Runoff Depth=0.40" Tc=6.0 min CN=92 Runoff=0.10 cfs 334 cf
Subcatchment PR-3: Subcat PR-3	Runoff Area=21,985 sf 67.17% Impervious Runoff Depth=0.32" Tc=6.0 min CN=90 Runoff=0.18 cfs 587 cf
Subcatchment PR-4: Subcat PR-4	Runoff Area=41,936 sf 86.15% Impervious Runoff Depth=0.56" Tc=6.0 min CN=95 Runoff=0.62 cfs 1,969 cf
Pond 2P: Bot MC-3500	Peak Elev=48.30' Storage=879 cf Inflow=0.62 cfs 1,969 cf Discarded=0.04 cfs 1,969 cf Primary=0.00 cfs 0 cf Outflow=0.04 cfs 1,969 cf
Pond 3P: DMH-200	Peak Elev=44.80' Inflow=0.00 cfs 0 cf 15.0" Round Culvert n=0.012 L=150.0' S=0.0253 '/' Outflow=0.00 cfs 0 cf
Pond 4P: Top MC-3500	Peak Elev=51.98' Storage=167 cf Inflow=0.18 cfs 587 cf Discarded=0.03 cfs 587 cf Primary=0.00 cfs 0 cf Outflow=0.03 cfs 587 cf
Pond 5P: CB-100	Peak Elev=55.90' Inflow=0.18 cfs 587 cf Primary=0.18 cfs 587 cf Secondary=0.00 cfs 0 cf Outflow=0.18 cfs 587 cf
Pond 6P: CB-200	Peak Elev=50.97' Inflow=0.62 cfs 1,969 cf Primary=0.62 cfs 1,969 cf Secondary=0.00 cfs 0 cf Outflow=0.62 cfs 1,969 cf
Link Dp-1: Analysis Point	Inflow=0.00 cfs 36 cf Primary=0.00 cfs 36 cf
Link Dp-2: Analysis Point	Inflow=0.10 cfs 334 cf Primary=0.10 cfs 334 cf

Total Runoff Area = 129,549 sf Runoff Volume = 2,926 cf Average Runoff Depth = 0.27"
53.88% Pervious = 69,804 sf 46.12% Impervious = 59,746 sf

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Type III 24-hr 002-YR Rainfall=3.14"

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Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR-1: Subcat PR-1	Runoff Area=55,656 sf 3.78% Impervious Runoff Depth=0.84" Tc=6.0 min CN=71 Runoff=1.13 cfs 3,906 cf
Subcatchment PR-2: Subcat PR-2	Runoff Area=9,973 sf 67.62% Impervious Runoff Depth=2.29" Tc=6.0 min CN=92 Runoff=0.59 cfs 1,906 cf
Subcatchment PR-3: Subcat PR-3	Runoff Area=21,985 sf 67.17% Impervious Runoff Depth=2.11" Tc=6.0 min CN=90 Runoff=1.21 cfs 3,871 cf
Subcatchment PR-4: Subcat PR-4	Runoff Area=41,936 sf 86.15% Impervious Runoff Depth=2.59" Tc=6.0 min CN=95 Runoff=2.70 cfs 9,038 cf
Pond 2P: Bot MC-3500	Peak Elev=49.78' Storage=3,654 cf Inflow=2.70 cfs 9,038 cf Discarded=0.04 cfs 5,460 cf Primary=0.95 cfs 3,578 cf Outflow=0.99 cfs 9,038 cf
Pond 3P: DMH-200	Peak Elev=45.26' Inflow=0.95 cfs 3,754 cf 15.0" Round Culvert n=0.012 L=150.0' S=0.0253 '/ Outflow=0.95 cfs 3,754 cf
Pond 4P: Top MC-3500	Peak Elev=53.78' Storage=2,247 cf Inflow=1.21 cfs 3,871 cf Discarded=0.03 cfs 3,694 cf Primary=0.03 cfs 177 cf Outflow=0.06 cfs 3,871 cf
Pond 5P: CB-100	Peak Elev=56.28' Inflow=1.21 cfs 3,871 cf Primary=1.21 cfs 3,871 cf Secondary=0.00 cfs 0 cf Outflow=1.21 cfs 3,871 cf
Pond 6P: CB-200	Peak Elev=51.43' Inflow=2.70 cfs 9,038 cf Primary=2.70 cfs 9,038 cf Secondary=0.00 cfs 0 cf Outflow=2.70 cfs 9,038 cf
Link Dp-1: Analysis Point	Inflow=1.67 cfs 7,661 cf Primary=1.67 cfs 7,661 cf
Link Dp-2: Analysis Point	Inflow=0.59 cfs 1,906 cf Primary=0.59 cfs 1,906 cf

Total Runoff Area = 129,549 sf Runoff Volume = 18,722 cf Average Runoff Depth = 1.73"
53.88% Pervious = 69,804 sf 46.12% Impervious = 59,746 sf

18-041_POST_02*Type III 24-hr 025-YR Rainfall=6.03"*

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Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR-1: Subcat PR-1 Runoff Area=55,656 sf 3.78% Impervious Runoff Depth=2.92"
 Tc=6.0 min CN=71 Runoff=4.28 cfs 13,557 cf

Subcatchment PR-2: Subcat PR-2 Runoff Area=9,973 sf 67.62% Impervious Runoff Depth=5.10"
 Tc=6.0 min CN=92 Runoff=1.25 cfs 4,238 cf

Subcatchment PR-3: Subcat PR-3 Runoff Area=21,985 sf 67.17% Impervious Runoff Depth=4.88"
 Tc=6.0 min CN=90 Runoff=2.69 cfs 8,931 cf

Subcatchment PR-4: Subcat PR-4 Runoff Area=41,936 sf 86.15% Impervious Runoff Depth=5.44"
 Tc=6.0 min CN=95 Runoff=5.45 cfs 19,016 cf

Pond 2P: Bot MC-3500 Peak Elev=51.40' Storage=6,318 cf Inflow=5.45 cfs 19,016 cf
 Discarded=0.04 cfs 6,109 cf Primary=2.44 cfs 12,906 cf Outflow=2.49 cfs 19,016 cf

Pond 3P: DMH-200 Peak Elev=45.82' Inflow=3.71 cfs 17,470 cf
 15.0" Round Culvert n=0.012 L=150.0' S=0.0253 '/' Outflow=3.71 cfs 17,470 cf

Pond 4P: Top MC-3500 Peak Elev=54.46' Storage=3,206 cf Inflow=2.69 cfs 8,931 cf
 Discarded=0.03 cfs 4,368 cf Primary=1.27 cfs 4,563 cf Outflow=1.30 cfs 8,931 cf

Pond 5P: CB-100 Peak Elev=56.70' Inflow=2.69 cfs 8,931 cf
 Primary=2.69 cfs 8,931 cf Secondary=0.00 cfs 0 cf Outflow=2.69 cfs 8,931 cf

Pond 6P: CB-200 Peak Elev=52.07' Inflow=5.45 cfs 19,016 cf
 Primary=5.45 cfs 19,016 cf Secondary=0.00 cfs 0 cf Outflow=5.45 cfs 19,016 cf

Link Dp-1: Analysis Point Inflow=7.19 cfs 31,026 cf
 Primary=7.19 cfs 31,026 cf

Link Dp-2: Analysis Point Inflow=1.25 cfs 4,238 cf
 Primary=1.25 cfs 4,238 cf

Total Runoff Area = 129,549 sf Runoff Volume = 45,741 cf Average Runoff Depth = 4.24"
53.88% Pervious = 69,804 sf 46.12% Impervious = 59,746 sf

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Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR-1: Subcat PR-1	Runoff Area=55,656 sf 3.78% Impervious Runoff Depth=3.91" Tc=6.0 min CN=71 Runoff=5.74 cfs 18,131 cf
Subcatchment PR-2: Subcat PR-2	Runoff Area=9,973 sf 67.62% Impervious Runoff Depth=6.27" Tc=6.0 min CN=92 Runoff=1.52 cfs 5,213 cf
Subcatchment PR-3: Subcat PR-3	Runoff Area=21,985 sf 67.17% Impervious Runoff Depth=6.04" Tc=6.0 min CN=90 Runoff=3.29 cfs 11,064 cf
Subcatchment PR-4: Subcat PR-4	Runoff Area=41,936 sf 86.15% Impervious Runoff Depth=6.62" Tc=6.0 min CN=95 Runoff=6.56 cfs 23,151 cf
Pond 2P: Bot MC-3500	Peak Elev=52.00' Storage=7,017 cf Inflow=6.56 cfs 23,151 cf Discarded=0.04 cfs 6,225 cf Primary=3.23 cfs 16,926 cf Outflow=3.27 cfs 23,151 cf
Pond 3P: DMH-200	Peak Elev=46.09' Inflow=4.83 cfs 23,487 cf 15.0" Round Culvert n=0.012 L=150.0' S=0.0253 '/' Outflow=4.83 cfs 23,487 cf
Pond 4P: Top MC-3500	Peak Elev=54.83' Storage=3,708 cf Inflow=3.15 cfs 11,028 cf Discarded=0.03 cfs 4,503 cf Primary=1.60 cfs 6,525 cf Outflow=1.64 cfs 11,028 cf
Pond 5P: CB-100	Peak Elev=56.89' Inflow=3.29 cfs 11,064 cf Primary=3.15 cfs 11,028 cf Secondary=0.14 cfs 36 cf Outflow=3.29 cfs 11,064 cf
Pond 6P: CB-200	Peak Elev=52.45' Inflow=6.56 cfs 23,151 cf Primary=6.56 cfs 23,151 cf Secondary=0.00 cfs 0 cf Outflow=6.56 cfs 23,151 cf
Link Dp-1: Analysis Point	Inflow=9.52 cfs 41,618 cf Primary=9.52 cfs 41,618 cf
Link Dp-2: Analysis Point	Inflow=1.52 cfs 5,213 cf Primary=1.52 cfs 5,213 cf
Total Runoff Area = 129,549 sf Runoff Volume = 57,559 cf Average Runoff Depth = 5.33"	
53.88% Pervious = 69,804 sf 46.12% Impervious = 59,746 sf	

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Type III 24-hr 100-YR Rainfall=8.64"

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Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
 Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment PR-1: Subcat PR-1	Runoff Area=55,656 sf 3.78% Impervious Runoff Depth=5.14" Tc=6.0 min CN=71 Runoff=7.53 cfs 23,838 cf
Subcatchment PR-2: Subcat PR-2	Runoff Area=9,973 sf 67.62% Impervious Runoff Depth=7.68" Tc=6.0 min CN=92 Runoff=1.84 cfs 6,381 cf
Subcatchment PR-3: Subcat PR-3	Runoff Area=21,985 sf 67.17% Impervious Runoff Depth=7.44" Tc=6.0 min CN=90 Runoff=4.00 cfs 13,623 cf
Subcatchment PR-4: Subcat PR-4	Runoff Area=41,936 sf 86.15% Impervious Runoff Depth=8.04" Tc=6.0 min CN=95 Runoff=7.89 cfs 28,094 cf
Pond 2P: Bot MC-3500	Peak Elev=52.74' Storage=7,704 cf Inflow=7.66 cfs 27,684 cf Discarded=0.04 cfs 6,323 cf Primary=3.87 cfs 21,361 cf Outflow=3.92 cfs 27,684 cf
Pond 3P: DMH-200	Peak Elev=46.58' Inflow=6.36 cfs 30,781 cf 15.0" Round Culvert n=0.012 L=150.0' S=0.0253 '/' Outflow=6.36 cfs 30,781 cf
Pond 4P: Top MC-3500	Peak Elev=55.20' Storage=4,184 cf Inflow=3.50 cfs 13,459 cf Discarded=0.03 cfs 4,614 cf Primary=1.88 cfs 8,845 cf Outflow=1.91 cfs 13,459 cf
Pond 5P: CB-100	Peak Elev=57.06' Inflow=4.00 cfs 13,623 cf Primary=3.50 cfs 13,459 cf Secondary=0.50 cfs 165 cf Outflow=4.00 cfs 13,623 cf
Pond 6P: CB-200	Peak Elev=53.01' Inflow=7.89 cfs 28,094 cf Primary=7.66 cfs 27,684 cf Secondary=0.65 cfs 410 cf Outflow=7.89 cfs 28,094 cf
Link Dp-1: Analysis Point	Inflow=13.07 cfs 54,618 cf Primary=13.07 cfs 54,618 cf
Link Dp-2: Analysis Point	Inflow=1.84 cfs 6,381 cf Primary=1.84 cfs 6,381 cf

Total Runoff Area = 129,549 sf Runoff Volume = 71,935 cf Average Runoff Depth = 6.66"
53.88% Pervious = 69,804 sf 46.12% Impervious = 59,746 sf

2.3.4 Post developments: full summary of 10-year storm event

Summary for Subcatchment PR-1: Subcat PR-1

Runoff = 2.80 cfs @ 12.10 hrs, Volume= 8,983 cf, Depth= 1.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 010-YR Rainfall=4.76"

Area (sf)	CN	Description
7,713	61	>75% Grass cover, Good, HSG B
13,042	74	>75% Grass cover, Good, HSG C
1,312	80	>75% Grass cover, Good, HSG D
1	98	Paved parking, HSG B
33	98	Paved parking, HSG C
2,073	98	Paved parking, HSG D
5,810	55	Woods, Good, HSG B
9,171	70	Woods, Good, HSG C
16,502	77	Woods, Good, HSG D
55,656	71	Weighted Average
53,549		96.22% Pervious Area
2,106		3.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 Minimum

Summary for Subcatchment PR-2: Subcat PR-2

Runoff = 0.96 cfs @ 12.09 hrs, Volume= 3,204 cf, Depth= 3.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 010-YR Rainfall=4.76"

Area (sf)	CN	Description
3,229	80	>75% Grass cover, Good, HSG D
5,533	98	Paved parking, HSG D
1,211	98	Roofs, HSG D
9,973	92	Weighted Average
3,229		32.38% Pervious Area
6,744		67.62% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 Minimum

Summary for Subcatchment PR-3: Subcat PR-3

Runoff = 2.04 cfs @ 12.09 hrs, Volume= 6,678 cf, Depth= 3.65"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 010-YR Rainfall=4.76"

Area (sf)	CN	Description
1,593	61	>75% Grass cover, Good, HSG B
1,587	74	>75% Grass cover, Good, HSG C
4,037	80	>75% Grass cover, Good, HSG D
4,071	98	Paved parking, HSG B
1,367	98	Paved parking, HSG C
8,114	98	Paved parking, HSG D
1,214	98	Roofs, HSG D
21,985	90	Weighted Average
7,218		32.83% Pervious Area
14,767		67.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 Minimum

Summary for Subcatchment PR-4: Subcat PR-4

Runoff = 4.25 cfs @ 12.09 hrs, Volume= 14,614 cf, Depth= 4.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 010-YR Rainfall=4.76"

Area (sf)	CN	Description
36	61	>75% Grass cover, Good, HSG B
2,607	74	>75% Grass cover, Good, HSG C
3,164	80	>75% Grass cover, Good, HSG D
6,333	98	Paved parking, HSG B
24,115	98	Paved parking, HSG C
3,890	98	Paved parking, HSG D
1,792	98	Roofs, HSG D
41,936	95	Weighted Average
5,807		13.85% Pervious Area
36,129		86.15% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 Minimum

Summary for Pond 2P: Bot MC-3500

ADS Stormtech MC4500 chamber system.

Exfiltration rate based on published Ksat value (23.2833um/s) for Hollis-Charlton fine sandy loam, converted to in/hr with a 4X factor of safety applied via discharge multiplier.

Note: Due to program limitations, 80 chambers are included in this model. 81 chambers are depicted on the project plan. This should make the hydraulic model more conservative.

Inflow Area = 41,936 sf, 86.15% Impervious, Inflow Depth = 4.18" for 010-YR event
 Inflow = 4.25 cfs @ 12.09 hrs, Volume= 14,614 cf
 Outflow = 1.85 cfs @ 12.28 hrs, Volume= 14,614 cf, Atten= 56%, Lag= 11.5 min
 Discarded = 0.04 cfs @ 6.90 hrs, Volume= 5,925 cf
 Primary = 1.81 cfs @ 12.28 hrs, Volume= 8,689 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Peak Elev= 50.70' @ 12.28 hrs Surf.Area= 2,316 sf Storage= 5,249 cf

Plug-Flow detention time= 274.0 min calculated for 14,604 cf (100% of inflow)

Center-of-Mass det. time= 274.5 min (1,044.1 - 769.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	47.35'	3,519 cf	29.92'W x 77.40'L x 5.75'H Field A 13,314 cf Overall - 4,517 cf Embedded = 8,797 cf x 40.0% Voids
#2A	48.35'	4,517 cf	ADS_StormTech MC-3500 d +Cap x 40 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 40 Chambers in 4 Rows Cap Storage= +14.9 cf x 2 x 4 rows = 119.2 cf
		8,036 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	47.35'	3.300 in/hr Exfiltration X 0.25 over Horizontal area Phase-In= 0.05'
#2	Device 5	49.35'	24.0" W x 2.0" H Vert. Low Orifice 4"HX24"W C= 0.600
#3	Device 5	51.25'	12.0" W x 2.0" H Vert. Medium Flow 2"Hx12"W C= 0.600
#4	Device 5	52.80'	6.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#5	Primary	48.45'	24.0" Round 24" HDPE outlet L= 72.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 48.45' / 43.35' S= 0.0708 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Discarded OutFlow Max=0.04 cfs @ 6.90 hrs HW=47.41' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=1.80 cfs @ 12.28 hrs HW=50.70' TW=45.60' (Dynamic Tailwater)

↑ **5=24" HDPE outlet** (Passes 1.80 cfs of 16.90 cfs potential flow)

↑ **2=Low Orifice 4"HX24"W** (Orifice Controls 1.80 cfs @ 5.41 fps)

↑ **3=Medium Flow 2"Hx12"W** (Controls 0.00 cfs)

↑ **4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

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Type III 24-hr 010-YR Rainfall=4.76"

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Summary for Pond 3P: DMH-200

[57] Hint: Peaked at 45.61' (Flood elevation advised)

Inflow Area = 63,921 sf, 79.62% Impervious, Inflow Depth = 2.11" for 010-YR event
 Inflow = 2.56 cfs @ 12.31 hrs, Volume= 11,225 cf
 Outflow = 2.56 cfs @ 12.31 hrs, Volume= 11,225 cf, Atten= 0%, Lag= 0.0 min
 Primary = 2.56 cfs @ 12.31 hrs, Volume= 11,225 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Peak Elev= 45.61' @ 12.31 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	44.80'	15.0" Round Culvert L= 150.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 44.80' / 41.00' S= 0.0253 '/' Cc= 0.900 n= 0.012 Concrete pipe, finished, Flow Area= 1.23 sf

Primary OutFlow Max=2.55 cfs @ 12.31 hrs HW=45.61' TW=0.00' (Dynamic Tailwater)↑**1=Culvert** (Inlet Controls 2.55 cfs @ 3.06 fps)**Summary for Pond 4P: Top MC-3500**

ADS Stormtech MC4500 chamber system.

Exfiltration rate based on published Ksat value (23.2833um/s) for Hollis-Charlton fine sandy loam, converted to in/hr with a 4X factor of safety applied via discharge multiplier.

Note: Due to program limitations, 80 chambers are included in this model. 81 chambers are depicted on the project plan. This should make the hydraulic model more conservative.

Inflow Area = 21,985 sf, 67.17% Impervious, Inflow Depth = 3.65" for 010-YR event
 Inflow = 2.04 cfs @ 12.09 hrs, Volume= 6,678 cf
 Outflow = 0.79 cfs @ 12.33 hrs, Volume= 6,678 cf, Atten= 61%, Lag= 14.5 min
 Discarded = 0.03 cfs @ 9.05 hrs, Volume= 4,142 cf
 Primary = 0.76 cfs @ 12.33 hrs, Volume= 2,536 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Peak Elev= 54.06' @ 12.33 hrs Surf.Area= 1,807 sf Storage= 2,649 cf

Plug-Flow detention time= 404.8 min calculated for 6,674 cf (100% of inflow)

Center-of-Mass det. time= 405.3 min (1,197.7 - 792.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	51.75'	2,776 cf	37.08'W x 48.72'L x 5.75'H Field A 10,389 cf Overall - 3,448 cf Embedded = 6,941 cf x 40.0% Voids
#2A	52.75'	3,448 cf	ADS_StormTech MC-3500 d +Cap x 30 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 30 Chambers in 5 Rows Cap Storage= +14.9 cf x 2 x 5 rows = 149.0 cf
		6,224 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	51.75'	3.300 in/hr Exfiltration X 0.25 over Horizontal area Phase-In= 0.05'
#2	Device 5	53.75'	24.0" W x 2.0" H Vert. Low Orifice 4"HX24"W C= 0.600
#3	Device 5	55.65'	12.0" W x 2.0" H Vert. Medium Flow 2"Hx12"W C= 0.600
#4	Device 5	57.20'	6.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)
#5	Primary	52.85'	24.0" Round 24" HDPE outlet L= 72.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 52.85' / 47.75' S= 0.0708 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf

Discarded OutFlow Max=0.03 cfs @ 9.05 hrs HW=51.81' (Free Discharge)

↳ **1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.75 cfs @ 12.33 hrs HW=54.06' TW=45.60' (Dynamic Tailwater)

↳ **5=24" HDPE outlet** (Passes 0.75 cfs of 7.41 cfs potential flow)

↳ **2=Low Orifice 4"HX24"W** (Orifice Controls 0.75 cfs @ 2.26 fps)

↳ **3=Medium Flow 2"Hx12"W** (Controls 0.00 cfs)

↳ **4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 5P: CB-100

[57] Hint: Peaked at 56.50' (Flood elevation advised)

Inflow Area =	21,985 sf, 67.17% Impervious,	Inflow Depth =	3.65" for 010-YR event
Inflow =	2.04 cfs @ 12.09 hrs,	Volume=	6,678 cf
Outflow =	2.04 cfs @ 12.09 hrs,	Volume=	6,678 cf, Atten= 0%, Lag= 0.0 min
Primary =	2.04 cfs @ 12.09 hrs,	Volume=	6,678 cf
Secondary =	0.00 cfs @ 0.00 hrs,	Volume=	0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Peak Elev= 56.50' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	55.70'	12.0" Round Culvert L= 17.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 55.70' / 54.70' S= 0.0588 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Secondary	56.70'	12.0" Round 12" Overflow L= 39.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 56.70' / 54.70' S= 0.0513 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.99 cfs @ 12.09 hrs HW=56.48' TW=53.62' (Dynamic Tailwater)

↳ **1=Culvert** (Inlet Controls 1.99 cfs @ 3.01 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=55.70' TW=44.80' (Dynamic Tailwater)

↳ **2=12" Overflow** (Controls 0.00 cfs)

Summary for Pond 6P: CB-200

[57] Hint: Peaked at 51.73' (Flood elevation advised)

Inflow Area = 41,936 sf, 86.15% Impervious, Inflow Depth = 4.18" for 010-YR event
 Inflow = 4.25 cfs @ 12.09 hrs, Volume= 14,614 cf
 Outflow = 4.25 cfs @ 12.09 hrs, Volume= 14,614 cf, Atten= 0%, Lag= 0.0 min
 Primary = 4.25 cfs @ 12.09 hrs, Volume= 14,614 cf
 Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Peak Elev= 51.73' @ 12.09 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	50.60'	15.0" Round Culvert L= 17.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 50.60' / 49.60' S= 0.0588 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 1.23 sf
#2	Secondary	52.60'	12.0" Round 12" Overflow L= 39.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 52.60' / 50.60' S= 0.0513 '/' Cc= 0.900 n= 0.015 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=4.14 cfs @ 12.09 hrs HW=51.71' TW=50.24' (Dynamic Tailwater)
 ↳ **1=Culvert** (Inlet Controls 4.14 cfs @ 3.59 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=50.60' TW=44.80' (Dynamic Tailwater)
 ↳ **2=12" Overflow** (Controls 0.00 cfs)

Summary for Link Dp-1: Analysis Point

Inflow Area = 119,576 sf, 44.32% Impervious, Inflow Depth = 2.03" for 010-YR event
 Inflow = 4.37 cfs @ 12.12 hrs, Volume= 20,208 cf
 Primary = 4.37 cfs @ 12.12 hrs, Volume= 20,208 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Summary for Link Dp-2: Analysis Point

Inflow Area = 9,973 sf, 67.62% Impervious, Inflow Depth = 3.86" for 010-YR event
 Inflow = 0.96 cfs @ 12.09 hrs, Volume= 3,204 cf
 Primary = 0.96 cfs @ 12.09 hrs, Volume= 3,204 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

2.4 Energy dissipation calculations (rip rap apron)

Culvert Report

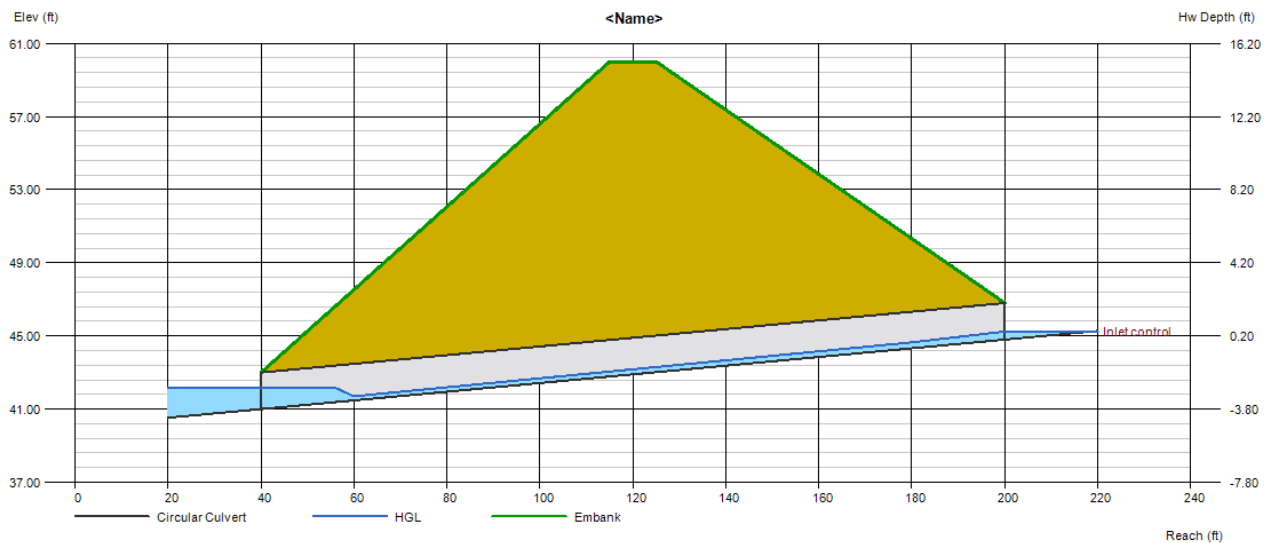
Circular Culvert

Invert Elev Dn (ft)	= 41.00
Pipe Length (ft)	= 160.00
Slope (%)	= 2.38
Invert Elev Up (ft)	= 44.80
Rise (in)	= 24.0
Shape	= Circular
Span (in)	= 24.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Square edge w/headwall (C)
Coeff. K,M,c,Y,k	= 0.0098, 2, 0.0398, 0.67, 0.5

Embankment	
Top Elevation (ft)	= 60.00
Top Width (ft)	= 10.00
Crest Width (ft)	= 0.00

Calculations	
Qmin (cfs)	= 1.00
Qmax (cfs)	= 6.50
Tailwater Elev (ft)	= (dc+D)/2

Highlighted	
Qtotal (cfs)	= 1.00
Qpipe (cfs)	= 1.00
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 0.52
Veloc Up (ft/s)	= 2.77
HGL Dn (ft)	= 42.17
HGL Up (ft)	= 45.14
Hw Elev (ft)	= 45.24
Hw/D (ft)	= 0.22
Flow Regime	= Inlet Control



2.5 Site specific soil survey

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CERTIFIED SOIL SCIENTIST * WETLAND SCIENTIST * LICENSED SITE EVALUATOR

October 25, 2020

**TEST PIT LOGS
TAX MAP 5 - LOTS 1-15 & 1-16
MAIN STREET
DURHAM, NEW HAMPSHIRE**

Test Pits Conducted: October 16, 2020
By: Joseph W. Noel
New Hampshire Certified Soil Scientist #017

Test Pit 1

1-0 inches partially decomposed organic matter
0-8 inches brown (10YR 4/3) very fine sandy loam, friable, granular
8-11 inches light olive brown (2.5Y 5/3) very fine sandy loam, friable, blocky
11-40 inches light yellowish brown (2.5Y 6/3) silt to silt loam, firm, massive, common prominent redox features

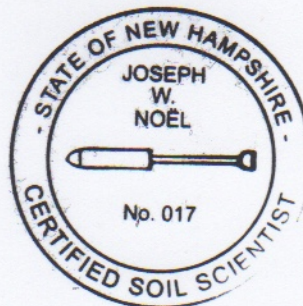
Seasonal High Water Table @ 11" (perched)
Observed Water Table none to 40"
Restrictive Horizon @ 11"
Bedrock none to 40"

Test Pit 2

1-0 inches partially decomposed organic matter
0-9 inches brown (10YR 4/3) very fine sandy loam, friable, granular
9-12 inches dark yellowish brown (10YR 4/4) very fine sandy loam, friable, blocky
12-22 inches light olive brown (2.5Y 5/3) silt loam, firm, blocky, common distinct redox features
22-48 inches olive gray (5Y 4/2) silt loam, very firm, blocky, common distinct redox features and manganese stains on ped faces

Seasonal High Water Table @ 12" (perched)
Observed Water Table none to 48"
Restrictive Horizon @ 12"
Bedrock none to 48"

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Test Pit 3

1-0 inches partially decomposed organic matter
0-8 inches brown (10YR 4/3) very fine sandy loam, friable, granular
8-13 inches dark yellowish brown (10YR 4/4) very fine sandy loam, friable, blocky
13-43 inches light olive brown (2.5Y 5/3) silt loam, firm to very firm, massive, common prominent redox features

Seasonal High Water Table @ 13" (perched)

Observed Water Table none to 43"

Restrictive Horizon @ 13"

Bedrock none to 43"

Test Pit 4

1-0 inches partially decomposed organic matter
0-6 inches dark brown (10YR 3/3) very fine sandy loam, friable, granular
6-11 inches dark yellowish brown (10YR 4/4) very fine sandy loam, friable, blocky
11-40 inches light olive brown (2.5Y 5/3) silt loam, firm to very firm, massive, common prominent redox features

Seasonal High Water Table @ 11" (perched)

Observed Water Table none to 40"

Restrictive Horizon @ 11"

Bedrock none to 40"

Test Pit 5

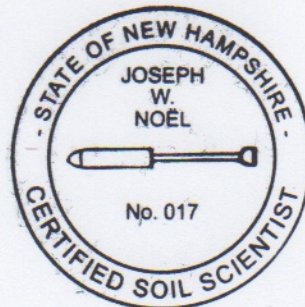
1-0 inches partially decomposed organic matter
0-8 inches very dark grayish brown (10YR 3/2) very fine sandy loam, friable, granular
8-13 inches dark yellowish brown (10YR 4/4) very fine sandy loam, friable, blocky
13-40 inches light olive brown (2.5Y 5/3) silt loam, firm to very firm, massive, common prominent redox features

Seasonal High Water Table @ 13" (perched)

Observed Water Table none to 40"

Restrictive Horizon @ 13"

Bedrock none to 40"



2.6 Inspection and maintenance manual

Frequency of Activities

The best time to perform inspections is during the onset of rain. To the extent practicable inspections should be timed to coincide with moderate storms that do not have the potential for severe (thunderstorms, etc.) precipitation. The frequency of inspection and maintenance will vary by intensity of use; however the recommended inspection frequency for each feature has been described in the protocol sheets to follow.

Maintenance frequencies will be determined based upon the results of the inspections and if specific maintenance thresholds are observed to have been crossed during inspections.

Records

A record of inspection and maintenance activities shall be recorded on the Inspection and Maintenance Log presented following. Records of Inspection and Maintenance Logs shall be made available upon request.

Control of Invasive Plants

Invasive plants are introduced, alien, or non-native plants, which have been moved by people from their native habitat to a new area. Some exotic plants are imported for human use such as landscaping, erosion control, or food crops. They also can arrive as "hitchhikers" among shipments of other plants, seeds, packing materials, or fresh produce. Some exotic plants become invasive and cause harm by:

- becoming weedy and overgrown;
- killing established shade trees;
- obstructing pipes and drainage systems;
- forming dense beds in water;
- lowering water levels in lakes, streams, and wetlands;
- destroying natural communities;
- promoting erosion on stream banks and hillsides; and
- resisting control except by hazardous chemical.

During maintenance activities, check for the presence of invasive plants and remove in a safe manner as described on the following pages. They should be controlled as described on the following pages.

CB- CATCH BASINS

(To include trench drains, drain manholes, and double catchbasins, and drop inlets)



Inspection Frequency:

Inspect 2 times per year (spring and fall-after leaf drop) unless otherwise described- maintain features as described below.

Maintenance Requirements:

- Remove debris from inlets grates.
- If an oily sheen or hydrocarbons are present on the water surface contact your supervisor
 - Skimming/absorbants should be used to remove to the material and disposed of in accordance with state and federal regulations.
- Remove accumulated sediment in sump if sediment has accumulated to $\frac{1}{2}$ sump depth or is within 1 foot below invert out of basin.
 - If sediment has accumulated to pipe invert out, check discharge end of pipe for sediment accumulations and remove sediment from pipe.
 - Note such conditions and increase inspection frequency if it is determined that the loads of sediment to the basin are consistently high.
 - Address source of sediment if possible.
- For drop inlets with no sump sediments will typically only accumulate if there is an obstruction in the downstream culvert and/or culvert outlet. Therefore where sediments are present in structure:
 - Inspect culvert and culvert outlet and remove debris and sediments.
- Do not dispose of catch basin cleanings in wetland areas or within 40 feet of wetland areas- refer to Appendix b; pages B-2 and B-4 in NH DES guidance document http://des.nh.gov/organization/divisions/water/stormwater/documents/nh_idde_sop.pdf to determine where catchbasin cleanings and street sweepings may be disposed of.

GS-GRASS SWALES

(Includes grass ditches, grass Pre-Treatment Swales, and grass Treatment Swales)



Inspection Frequency:

Inspect once per year unless otherwise described.

Grassed channels should be inspected for sediment accumulation, vegetation loss, and presence of invasive species. Maintain features as described below.

Maintenance Requirements:

- Repairs, including vegetation replacement, should be made based on inspection.
 - Grass Treatment Swales require a relatively flat swale floor (both laterally (side to side), and longitudinally (along their length)) to spread water across the swale floor and slow flows down to enable sediments to settle in the swale. This may create areas of standing water and associated dead spots in the grass.
 - Reseed such areas by scratching in seed and applying mulch matting for areas that exceed 4 ft. in diameter.
 - If reseeding does not work or water is seen ponding for more than 48 hours turf aeration of the swale floor may rejuvenate it.
 - Re-seed and rake out plugs created by aeration activities.
- Remove sediment and debris annually, or more frequently as warranted by inspection.
 - Leaves should be raked from swales to avoid smothering grass.
- Mow vegetated channels at least once a year to control establishment of woody vegetation.
 - It is recommended to cut grass no shorter than 4 inches.
 - Rake/collect grass clippings from swales.

ST- STORMTECH INFILTRATION CHAMBERS (To include stormtech isolator rows)



Photo Credit: Stormtech

Inspection Frequency:

Isolator Rows shall be inspected immediately after completion of the site construction and cleaned out if necessary. The typical inspection schedule after construction for the Isolator Rows is a minimum of twice a year (spring & fall) - maintain features as described below.

Inspection of the Isolator Row shall involve a visual check using either the inspection ports or the access manholes

Maintenance Requirements:

- If upon visual inspection of the Isolator Row, it is found that sediment has accumulated to an average depth exceeding 3 inches throughout the length of the Isolator Row, cleanout is required.
- Cleanout of the accumulated material in the Isolator Row should be accomplished by vacuum pumping.
- Cleanout should be performed during dry weather and care should be taken to avoid tearing the fabric in the Isolator Rows.
- A site maintenance log will be kept. This log will record the dates when maintenance tasks were completed, the person who completed the task, and any observations of malfunctions in components of the stormwater management system. Call 1-888-892-2694 to speak with a Technical representative or visit www.stormtech.com.

RR- RIP RAP OUTLET APRONS
(To include Rip Rap Channels/Swales)



Inspection Frequency:

Inspect once per year unless otherwise indicated or if apron is inlet to a stormwater Detention/treatment Pond or Bioretention Area (if so, see DP and BR, respectively). Maintain features as described below.

Maintenance Requirements:

- Remove debris accumulations if they redirect flow off of the apron or otherwise restrict flow or cause any backflow into the culvert outlet.
- Repair and replace gaps in stone coverage with stone of similar or larger size stone.
 - Refer to design plans for apron dimensions, stone size and any required geotextile underlayment.
 - Be careful not to extend apron into jurisdictional wetland areas or local wetland buffers.
- Ensure that any flared end sections are level to help spread water out onto apron. Re-level if needed.
- Ensure concrete or masonry headwalls are not undermined or have evidence of piping/voids; evidence that flow has bypassed culvert. If voids are found:
 - Check again during storms to determine what has caused voids and contact an engineer if water is flowing around/bypassing culvert.

2.7 References

Mays, Larry. *Stormwater Collection Systems Design Handbook*. McGraw-Hill. New York, NY. 2001

McCarthy, David. *Essentials of Soil Mechanics and Foundations: Sixth Edition*. Prentice Hall. Columbus, Ohio. 2002.

NHDES. *New Hampshire Stormwater Manual*. New Hampshire Department of Environmental Services. 2008.

NHDES. *New Hampshire Homeowner's Guide to Stormwater Management*. New Hampshire Department of Environmental Services. 2012

The UNH Stormwater Center, *The LID Stormwater Management Systems Demonstrate LID Stormwater Management Systems Demonstrate Superior Cold Climate Performance than Superior Cold Climate Performance than Conventional Stormwater Management Systems, UNH Stormwater Center, NEIWPC 2007 NPS Conference, Newport, RI, May 2007*

SECTION 3.0 PLANS

3.1 Design plans (unbound)

3.2 Pre- and post-development drainage area plans