ALLEN & MAJOR ASSOCIATES, INC.

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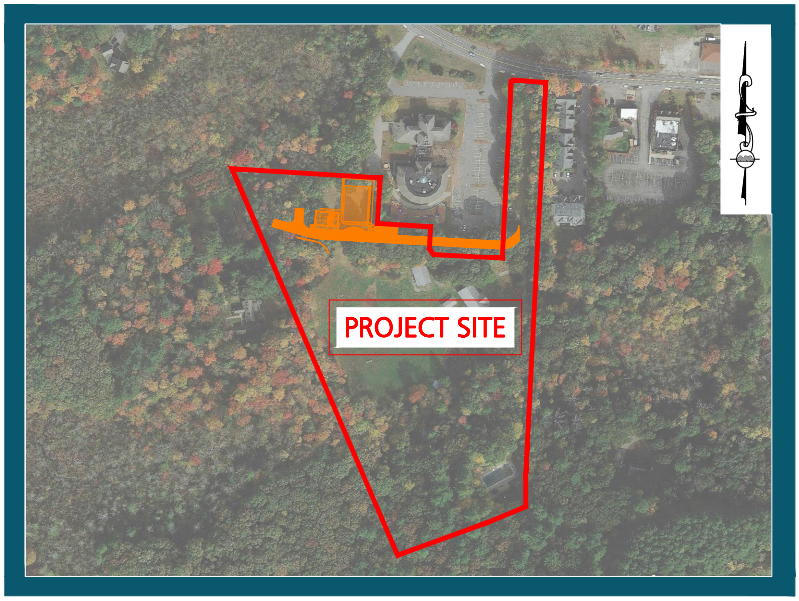


CAMP CHICKAMI DRAINAGE REPORT

139 BOSTON POST ROAD
WAYLAND, MASSACHUSETTS

DATE PREPARED:
NOVEMBER 10, 2021

APPLICANT:
WEST SUBURBAN YMCA
276 CHURCH STREET
NEWTON, MA 02458

PREPARED BY:
ALLEN & MAJOR ASSOCIATES, INC.
400 HARVEY ROAD, SUITE D
MANCHESTER, NH 03103

A&M PROJECT NO. : 2562-01

ALLEN & MAJOR ASSOCIATES, INC.

November 10, 2021

Sarkis Sarkisian
Town Planner
41 Cochituate Road
Wayland, MA 01778

RE: Camp Chickami
Drainage Report
139 Boston Post Road
Wayland, MA 01778

Dear Mr. Sarkisian,

On behalf of our Client, West Suburban YMCA, Allen & Major Associates (A&M) is pleased to provide this letter summarizing the drainage design for the proposed work to enhance the existing Camp Chickami. This letter will summarize how the proposed stormwater management system meets all Massachusetts stormwater performance standards and mitigates stormwater runoff from pre to post conditions.

Existing Conditions

The site is located on the eastern side of the Town of Wayland south of Boston Post Road (MA Route 20). It is accessed through an existing gravel driveway (Chickami Road) that leads to the majority of the lot located behind Temple Shir Tikva. The lot is identified on Town tax Map 29, as Lot 42. Elevations onsite range from elevation 160± at the southwest portion along the rear property line to elevation 125± leading into Pine Brook. Pine Brook and the surrounding wetlands are located within the centralized portion of the site. Stormwater flows to this area as the site's topography pitches from the southern boundary to the north and northern boundary to the south. The majority of the stormwater from the site discharges to various wetland locations leading to Pine Brook. A review of the NRCS soil report for Middlesex County indicates that the majority of soils onsite are considered various types loamy sand which have a Hydrologic Soil Group rating of an "A", see a copy of the NRCS soil report within the appendix of this report. A copy of the Existing Watershed Plan used for stormwater calculations is included herewith.

Proposed Conditions

The project proposes to add a multi-use camp building, tent, and associated septic system to the existing Camp Chickami. A permeable gravel driveway will also be constructed that will connect the existing Chickami Road to the proposed development area for emergency vehicle access. This driveway will be constructed out of EZ roll gravel pavers with the shoulders being constructed from EZ roll grass pavers. These systems are able to withstand AASHTO H-20 loading, providing adequate structural integrity for both emergency and passenger vehicles. The pavers are designed to act as a permeable surface with 8 inches of #57 stone with 40% voids beneath them that enable the stormwater to be stored and

infiltrated. Using the EZ roll paver systems, stormwater runoff is mitigated from pre to post conditions accounting for the additional impervious areas proposed on site. The proposed work will result in an additional 3,190± square feet of impervious area on site that will be compensated for as the proposed system can store and infiltrate all of the design storm events. The design infiltration rate used for calculations was 10 in/hr. which includes a factor of safety of 2 applied.

Runoff flows were estimated for both pre and post development conditions using HydroCAD 10.1-6a software, at three specific "Study Points" (SP-1 & SP-2). Study Point 1 represents the flows that will discharge from the northwestern corner of the parcel toward Hayward Brook and surrounding wetland. Study Point 2 represents the stormwater flows that will flow to the existing wetlands that surround and discharge to Pine Brook. The table below shows that the project causes a reduction in the peak rate of runoff and volume of stormwater leaving the site at the two Study Points. Copies of the HydroCAD worksheets and Watershed Plans used for design calculations are included herewith.

STUDY POINT #1 (flow toward Hayward Brook)				
	1" Storm	2-Year	10-Year	100-Year
Existing Flow (CFS)	0.00	0.08	0.53	2.20
Proposed Flow (CFS)	0.00	0.00	0.01	0.30
Decrease (CFS)	**0.00**	**0.08**	**0.52**	**1.90**
Existing Volume (CF)	0	621	2,042	7,091
Proposed Volume (CF)	0	1	152	1,255
Decrease (CF)	**0**	**620**	**1,890**	**5,836**

STUDY POINT #2 (flow to Pine Brook)				
	1" Storm	2-Year	10-Year	100-Year
Existing Flow (CFS)	0.00	0.00	0.00	0.47
Proposed Flow (CFS)	0.00	0.00	0.00	0.23
Decrease (CFS)	**0.00**	**0.00**	**0.00**	**0.24**
Existing Volume (CF)	0	0	134	3,422
Proposed Volume (CF)	0	0	76	1,439
Decrease (CF)	**0**	**0**	**58**	**1,983**

The surface water drainage requirements of the Town of Wayland and the Stormwater Management Policy of the Massachusetts Department of Environmental Protection have been reviewed and met with the proposed design. The proposed project will introduce an

increase of the amount of impervious area onsite, however the proposed stormwater management system has been designed to mitigate stormwater runoff from the pre to post conditions. See below the Massachusetts Department of Environmental Protection performance standards that have been met regarding a new development project.

MA DEP Stormwater Performance Standards

The MA DEP Stormwater Management Policy was developed to improve water quality by implementing performance standards for storm water management. The intent is to implement the stormwater management standards through the review of Notice of Intent filings by the issuing authority (Conservation Commission or DEP). The following section outlines how the proposed Stormwater Management System meets the standards set forth by the Policy.

BMP's implemented in the design include:

- Pervious Pavers (EZ grass & gravel paver systems)

Stormwater Best Management Practices have been incorporated into the design of the project to mitigate stormwater runoff and aid groundwater recharge. An Operations and Maintenance Plan has been developed for the project, which addresses the long-term maintenance requirements of the proposed system.

Temporary erosion and sedimentation controls will be incorporated into the construction phase of the project. These temporary controls may include tubular sediment barriers, inlet sediment traps, slope stabilization, and stabilized construction entrances.

The Massachusetts Department of Environmental Protection has established ten (10) Stormwater Management Standards. A project that meets or exceeds the standards is presumed to satisfy the regulatory requirements regarding stormwater management. The Standards are enumerated below as well as descriptions and supporting calculations as to how the project will comply with the Standards:

1. *No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.*

   The proposed development will not introduce any new stormwater conveyances (e.g. outfalls) that discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth. There are no structural BMPs used in the design. All proposed systems have been designed to infiltrate and store the 100-year storm event.

2. *Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.*

The proposed development has been designed so that the post-development peak discharge rates do not exceed the pre-development peak discharge rates. See the peak flow rate table, above.

3. *Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.*

The existing annual recharge for the site will be approximated in the developed condition. Subsurface infiltration using permeable EZ roll grass and gravel pavers will be designed to meet this requirement. Additionally, the EZ roll paver systems achieve LEED design points, making it environmentally sensitive. The permeable infiltration system was designed using the Static Method per the MA DEP Stormwater Management Standards, Volume 3, Chapter 1. See the attachments enclosed for water quality/recharge calculations for the project site.

4. *Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This Standard is met when:*

    a. *Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;*
    b. *Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and*
    c. *Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*

The proposed stormwater management system is designed so that the 80% TSS removal standard is met for the project site. Standard #4 is met when stormwater best management practices are sized to capture and treat the required water quality volume and pretreatment is provided in accordance with the Massachusetts Stormwater Handbook. Standard #4 also requires that suitable source control measures are identified in the Long-Term Pollution Prevention Plan.

5. *For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater*

Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

The proposed development is not considered a source of higher potential pollutant loading.

6. *Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.*

The proposed project is not located within a critical area.

7. *A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.*

The proposed project is considered a new development project under the Stormwater Management Handbook guidelines as there is an increase in the amount of impervious area.

8. *A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.*

A plan to control construction-related impacts, including erosion, sedimentation and other pollutant sources during construction and land disturbance activities has been developed within the site development plan set, see Sheet C-101, "Site Preparation Plan".

9. *A long-term operation and maintenance plan shall be developed and implemented to ensure that stormwater management systems function as designed.*

A Long-Term Operation and Maintenance (O&M) Plan has been developed for the proposed stormwater management system and is included within this document. See the appendix of this report.

10. *All illicit discharges to the stormwater management system are prohibited.*

There are no expected illicit discharges to the stormwater management system.

See the appendix section for the Mass DEP Stormwater Checklist.

Summary

Through achieving all Massachusetts DEP stormwater performance standards and mitigating the proposed stormwater runoff from the existing condition of the site, the proposed development will have a positive impact for Camp Chickami and the surrounding area regarding stormwater management practices.

Very truly yours,

ALLEN & MAJOR ASSOCIATES, INC.

Brian Jones, P.E.
Senior Project Manager

Attachments:

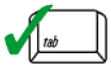
1. MA Stormwater Checklist
2. Long Term Pollution Prevention Plan
3. Operation & Maintenance Log
4. Existing Watershed Plan
5. Proposed Watershed Plan
6. Pre-Development HydroCAD Calculations
7. Post-Development HydroCAD Calculations
8. Extreme Precipitation Table
9. NRCS Soil Report
10. Camp Chickami Test Pit Logs
11. EZ Roll Permeable Paver Operation & Maintenance Brochure
12. MA Recharge Calculation
13. MA Water Quality Volume Calculation
14. MA TSS Removal Calculation

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

Checklist for Stormwater Report

A. Introduction

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A Stormwater Report must be submitted with the Notice of Intent permit application to document compliance with the Stormwater Management Standards. The following checklist is NOT a substitute for the Stormwater Report (which should provide more substantive and detailed information) but is offered here as a tool to help the applicant organize their Stormwater Management documentation for their Report and for the reviewer to assess this information in a consistent format. As noted in the Checklist, the Stormwater Report must contain the engineering computations and supporting information set forth in Volume 3 of the Massachusetts Stormwater Handbook. The Stormwater Report must be prepared and certified by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans are required to show existing and proposed conditions, identify all wetland resource areas, NRCS soil types, critical areas, Land Uses with Higher Potential Pollutant Loads (LUHPPL), and any areas on the site where infiltration rate is greater than 2.4 inches per hour. The Plans shall identify the drainage areas for both existing and proposed conditions at a scale that enables verification of supporting calculations.

As noted in the Checklist, the Stormwater Management Report shall document compliance with each of the Stormwater Management Standards as provided in the Massachusetts Stormwater Handbook. The soils evaluation and calculations shall be done using the methodologies set forth in Volume 3 of the Massachusetts Stormwater Handbook.

To ensure that the Stormwater Report is complete, applicants are required to fill in the Stormwater Report Checklist by checking the box to indicate that the specified information has been included in the Stormwater Report. If any of the information specified in the checklist has not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

[1] The Stormwater Report may also include the Illicit Discharge Compliance Statement required by Standard 10. If not included in the Stormwater Report, the Illicit Discharge Compliance Statement must be submitted prior to the discharge of stormwater runoff to the post-construction best management practices.

[2] For some complex projects, it may not be possible to include the Construction Period Erosion and Sedimentation Control Plan in the Stormwater Report. In that event, the issuing authority has the discretion to issue an Order of Conditions that approves the project and includes a condition requiring the proponent to submit the Construction Period Erosion and Sedimentation Control Plan before commencing any land disturbance activity on the site.

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

☐ No disturbance to any Wetland Resource Areas

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

☐ Reduced Impervious Area (Redevelopment Only)

☒ Minimizing disturbance to existing trees and shrubs

☐ LID Site Design Credit Requested:

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

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

☐ Bioretention Cells (includes Rain Gardens)

☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)

☐ Treebox Filter

☐ Water Quality Swale

☐ Grass Channel

☐ Green Roof

☒ Other (describe): EZ roll permeable grass & gravel pavers

Standard 1: No New Untreated Discharges

☒ No new untreated discharges

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☐ An Illicit Discharge Compliance Statement is attached;

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

Long-Term Pollution Prevention Plan

Standard #4 from the MassDEP Stormwater Management Handbook requires that a Long-Term Pollution Prevention Plan (LTPPP) be prepared and incorporated as part of the Operation and Maintenance Plan of the Stormwater Management System. The purpose of the LTPPP is to identify potential sources of pollution that may affect the quality of stormwater discharges, and to describe the implementation of practices to reduce the pollutants in stormwater discharges. The following items describe the source control and proper procedures of the LTPPP.

- Housekeeping
  The existing development has been designed to maintain a high level of water quality treatment for all stormwater discharge to the wetland areas. An Operation and Maintenance (O&M) plan has been prepared and is included in this section of the report. The owner (or its designee) is responsible for adherence to the O&M plan in a strict and complete manner.

- Storing of Materials & Water Products
  The trash and waste program for the site includes exterior dumpsters. There is a trash contractor used to pick up the waste material in the dumpsters. The stormwater drainage system has water quality inlets designed to capture trash and debris.

- Vehicle Washing
  Outdoor vehicle washing has the potential to result in high loads of nutrients, metals, and hydrocarbons during dry weather conditions, as the detergent-rich water used to wash the grime off the vehicle enters the stormwater drainage system. The existing development does not include any designated vehicle washing areas, nor is it expected that any vehicle washing will take place on-site.

- Spill Prevention & Response
  Sources of potential spill hazards include vehicle fluids, liquid fuels, pesticides, paints, solvents, and liquid cleaning products. The majority of the spill hazards would likely occur within the buildings and would not enter the stormwater drainage system. However, there are spill hazards from vehicle fluids or liquid fuels located outside of the buildings. These exterior spill hazards have the potential to enter the stormwater drainage system and are to be addressed as follows:

  1. Spill hazards of pesticides, paints, and solvents shall be remediated using the Manufacturers' recommended spill cleanup protocol.
  2. Vehicle fluids and liquid fuel spill shall be remediated according to the local and state regulations governing fuel spills.

3. The owner shall have the following equipment and materials on hand to address a spill clean-up: brooms, dust pans, mops, rags, gloves, absorptive material, sand, sawdust, plastic and metal trash containers.
4. All spills shall be cleaned up immediately after discovery.
5. Spills of toxic or hazardous material shall be reported, regardless of size, to the Massachusetts Department of Environmental Protection at (888) 304-1333.
6. Should a spill occur, the pollution prevention plan will be adjusted to include measures to prevent another spill of a similar nature. A description of the spill, along with the causes and cleanup measures will be included in the updated pollution prevention plan.

- Maintenance of Lawns, Gardens, and Other Landscaped Areas

  It should be recognized that this is a general guideline towards achieving high quality and well-groomed landscaped areas. The grounds staff/landscape contractor must recognize the shortcomings of a general maintenance plan such as this, and modify and/or augment it based on weekly, monthly, and yearly observations. In order to assure the highest quality conditions, the staff must also recognize and appreciate the need to be aware of the constantly changing conditions of the landscaping and be able to respond to them on a proactive basis. No trees shall be planted over the drain lines or recharge area, and that only shallow rooted plants and shrubs will be allowed.

  - Fertilizer

    Maintenance practices should be aimed at reducing environmental, mechanical and pest stresses to promote healthy and vigorous growth. When necessary, pest outbreaks should be treated with the most sensitive control measure available. Synthetic chemical controls should be used only as a last resort to organic and biological control methods. Fertilizer, synthetic chemical controls and pest management applications (when necessary) shall be performed only by licensed applicators in accordance with the manufacturer's label instructions when environmental conditions are conducive to controlled product application.

    Only slow-release organic fertilizers should be used in the planting and mulch areas to limit the amount of nutrients that could enter downstream resource areas. Fertilization of the planting and mulch areas will be performed within manufacturers labeling instructions and shall not exceed an NPK ration of 1:1:1 (i.e. Triple 10 fertilizer mix), considered a low nitrogen mixture. Fertilizers approved for the use under this O&M Plan are as follows:

Type: LESCO® 28-0-12 (Lawn Fertilizer)
MERIT® 0.2 Plus Turf Fertilizer
MOMENTUM™ Force Weed & Feed

- Suggested Aeration Program

  In-season aeration of lawn areas is good cultural practice, and is recommended whenever feasible. It should be accomplished with a solid thin tine aeration method to reduce disruption to the use of the area. The depth of solid tine aeration is similar to core type, but should be performed when the soil is somewhat drier for a greater overall effect.

  Depending on the intensity of use, it can be expected that all landscaped lawn areas will need aeration to reduce compaction at least once per year. The first operation should occur in late May following the spring season. Methods of reducing compaction will vary based on the nature of the compaction. Compaction on newly established landscaped areas is generally limited to the top 2-3" and can be alleviated using hollow core or thin tine aeration methods.

  The spring aeration should consist of two passes at opposite directions with 1/4" hollow core tines penetrating 3-5" into the soil profile. Aeration should occur when the soil is moist but not saturated. The soil cores should be shattered in place and dragged or swept back into the turf to control thatch. If desired the cores may also be removed and the area top-dressed with sand or sandy loam. If the area drains on average too slowly, the topdressing should contain a higher percentage of sand. If it is draining on average too quickly, the top dressing should contain a higher percentage of soil and organic matter.

- Landscape Maintenance Program Practices:
  - Lawn
    1. Mow a minimum of once a week in spring, to a height of 2" to 2 1/2" high. Mowing should be frequent enough so that no more than 1/3 of grass blade is removed at each mowing. The top growth supports the roots; the shorter the grass is cute, the less the roots will grow. Short cutting also dries out the soil and encourages weeds to germinate.
    2. Mow approximately once every two weeks from July 1st to August 15th depending on lawn growth.
    3. Mow on a ten-day cycle in fall, when growth is stimulated by cooler nights and increased moisture.

4. Do not remove grass clippings after mowing.
5. Keep mower blades sharp to prevent ragged cuts on grass leaves, which cause a brownish appearance and increase the chance for disease to enter a leaf.

- Shrubs
  1. Mulch not more than 3" depth with shredded pine or fir bark.
  2. Hand prune annually, immediately after blooming, to remove 1/3 of the above-ground biomass (older stems). Stem removals are to occur within 6" of the ground to open up shrub and maintain two-year wood (the blooming wood).
  3. Hand-prune evergreen shrubs only as needed to remove dead and damaged wood and to maintain the naturalistic form of the shrub. Never mechanically shear evergreen shrubs.
- Trees
  1. Provide aftercare of new tree plantings for the first three years.
  2. Do not fertilize trees, it artificially stimulates them (unless tree health warrants).
  3. Water once a week for the first year; twice a month for the second; once a month for the third year.
  4. Prune trees on a four-year cycle.
- Invasive Species
  1. Inform the Conservation Commission Agent prior to the removal of invasive species proposed either through hand work or through chemical removal.

- Storage and Use of Herbicides and Pesticides
  Integrated Pest Management is the combination of all methods (of pest control) which may prevent, reduce, suppress, eliminate, or repel an insect population. The main requirements necessary to support any pest population are food, shelter and water, and any upset of the balance of these will assist in controlling a pest population. Scientific pest management is the knowledgeable use of all pest control methods (sanitation, mechanical, chemical) to benefit mankind's health, welfare, comfort, property and food. A Pest Management Professional (PMP) should be retained who is licensed with the Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs, Department of Agricultural Resources.

The site manager will be provided with approved bulletin before entering into or renewing an agreement to apply pesticides for the control of indoor household or structural pests, refer to 333 CMR 13.08.

Before beginning each application, the applicator must post a Department approved notice on all of the entrances to the treated room or area. The applicator must leave such notices posted after the application. The notice will be posted at conspicuous point(s) of access to the area treated. The location and number of signs will be determined by the configuration of the area to be treated based on the applicator's best judgment. It is intended to give sufficient notice so that no one comes into an area being treated unaware that the applicator is working and pesticides are being applied. However, if the contracting entity does not want the signs posted, he/she may sign a Department approved waiver indicating this.

The applicator or employer will provide to any person upon their request the following information on previously conducted applications:

1. Name and phone number of pest control company;
2. Date and time of the application;
3. Name and license number of the applicator;
4. Target pests; and
5. Name and EPA Registration Number of pesticide products applied.

- <u>Management of Deicing Chemicals and Snow</u>
  Snow will be stockpiled on site until the accumulated snow becomes a hazard to the daily operations of the site. It will be the responsibility of the snow removal contractor to properly dispose of transported snow according to MassDEP, Bureau of Resource Protection – Snow Disposal Guideline #BRPG01-01, governing the proper disposal of snow. It will be the responsibility of the snow removal contractor to follow these guidelines and all applicable laws and regulations

  The owner's maintenance staff (or its designee) will be responsible for the clearing of the sidewalk and building entrances. The owner may be required to use a de-icing agent such as potassium chloride to maintain a safe walking surface. If used, the de-icing agent for the walkways and building entrances will be kept within the storage rooms located within the building. If used, de-icing agents will not be stored outside. The owner's maintenance staff will limit the application of sand.

OPERATION AND MAINTENANCE PLAN SCHEDULE

2562-01

ALLEN & MAJOR ASSOCIATES, INC.

Project: Camp Chickami
Project Address: 139 Boston Post Road

Responsible for O&M Plan: West Suburban YMCA
Address: 276 Church St, Newton, MA 02458

All information within table is derived from Massachussetts Stormwater Handbook: Volume 2, Chapter 2

BMP CATEGORY	BMP OR MAINTENANCE ACTIVITY	SCHEDULE/ FREQUENCY	NOTES	INSPECTION PERFORMED	
				DATE:	BY:
OTHER BMPs	PERVIOUS PAVERS	Assess exfiltration capability at least once a year. Inspect for deterioration annually. Monitor if paving surface is draining properly as needed.	Monitor to ensure that the paving surface drains properly after storms. Inspect the surface annually for deterioration. If erosion is observed, add additional gravel and and or topsoil to achieve design grade.		
OTHER MAINTENANCE ACTIVITY	SNOW STORAGE	Clear and remove snow to approved storage locations as necessary to ensure systems are working properly and are protected from meltwater pollutants.	Carefully select snow disposal sites before winter. Avoid dumping removed snow in rivers, wetlands, and flood plains. It is also prohibited to dump snow in the gravel swales.		

LEGEND

- EXISTING WATERSHED
- SUBCATCHMENT LABEL (E-1)
- SUBCATCHMENT BOUNDARY
- FLOW DIRECTION

DIG SAFE

BEFORE YOU DIG
CALL 811 OR
1-888-DIG-SAFE
1-888-344-7233

PLAN NOTES:

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GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION

APPLICANT\OWNER:

WEST SUBURBAN YMCA
276 CHURCH STREET
NEWTON, MA 02458

PROJECT:

CAMP CHICKAMI
139 BOSTON POST ROAD
WAYLAND, MA

PROJECT NO.	2562-01	DATE:	11-10-21
SCALE:	1" = 40'	DWG. NAME:	C2562-01
DESIGNED BY:	JG	CHECKED BY:	BDJ

PREPARED BY:

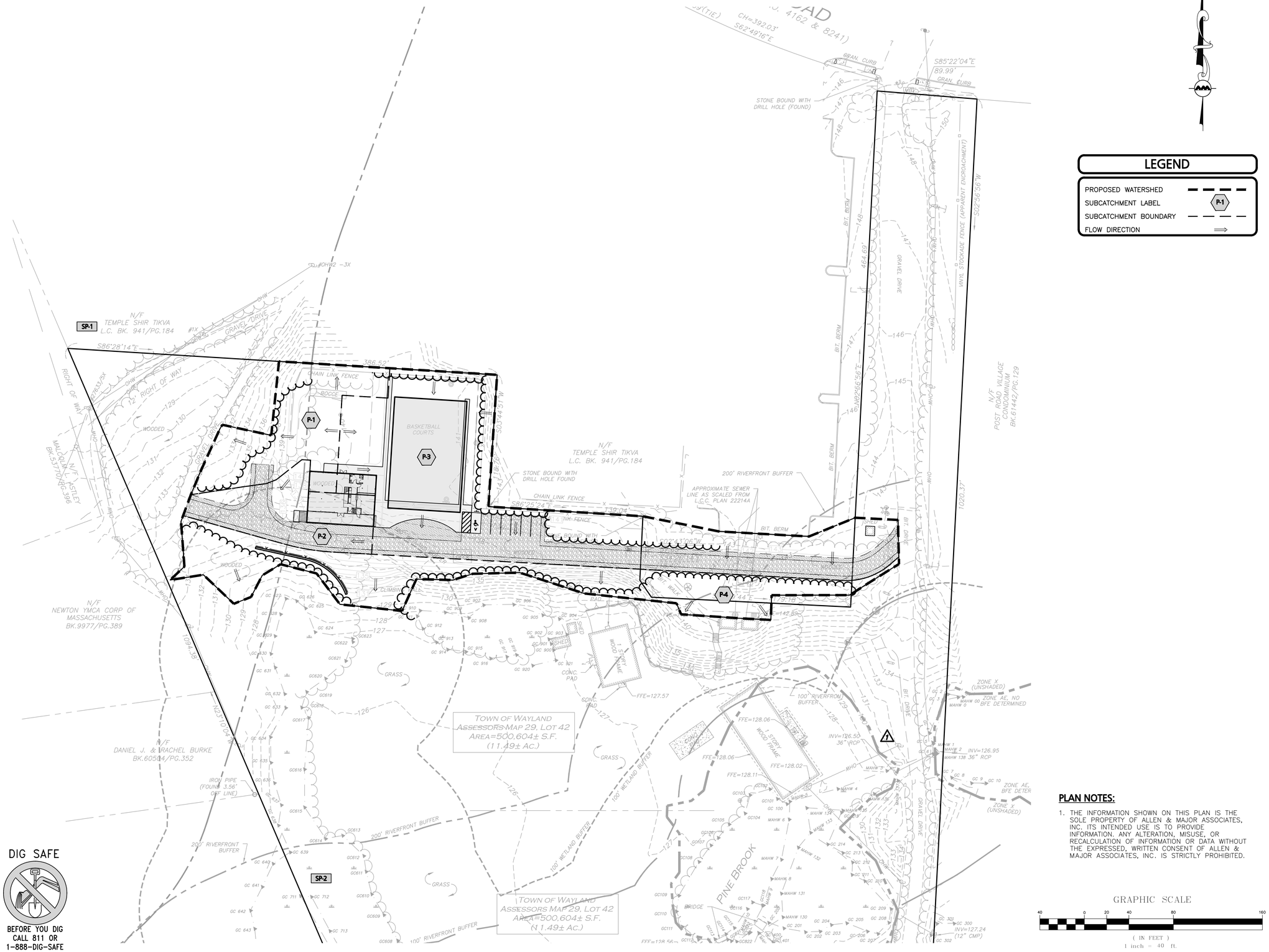
ALLEN & MAJOR ASSOCIATES, INC.
civil engineering ◆ land surveying
environmental consulting ◆ landscape architecture
www.allenmajor.com
100 COMMERCE WAY, SUITE 5
WOBURN MA 01801
TEL: (781) 935-6889
FAX: (781) 935-2896

WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

DRAWING TITLE: EXISTING WATERSHED PLAN

SHEET No. EWS-1

R:\PROJECTS\2562-01\CIVIL\DRAWINGS\CURRENT\C-2562-01_WATERSHED-EXISTING.DWG



LEGEND

- PROPOSED WATERSHED
- SUBCATCHMENT LABEL (P-1)
- SUBCATCHMENT BOUNDARY
- FLOW DIRECTION

PLAN NOTES:

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1-888-344-7233

R:\PROJECTS\2562-01\CIVIL\DRAWINGS\CURRENT\C-2562-01_WATERSHED-PROPOSED.DWG

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION

APPLICANT\OWNER:

WEST SUBURBAN YMCA
276 CHURCH STREET
NEWTON, MA 02458

PROJECT:

CAMP CHICKAMI
139 BOSTON POST ROAD
WAYLAND, MA

PROJECT NO.	2562-01	DATE:	11-10-21
SCALE:	1" = 40'	DWG. NAME:	C2562-01
DESIGNED BY:	JG	CHECKED BY:	BDJ

PREPARED BY:

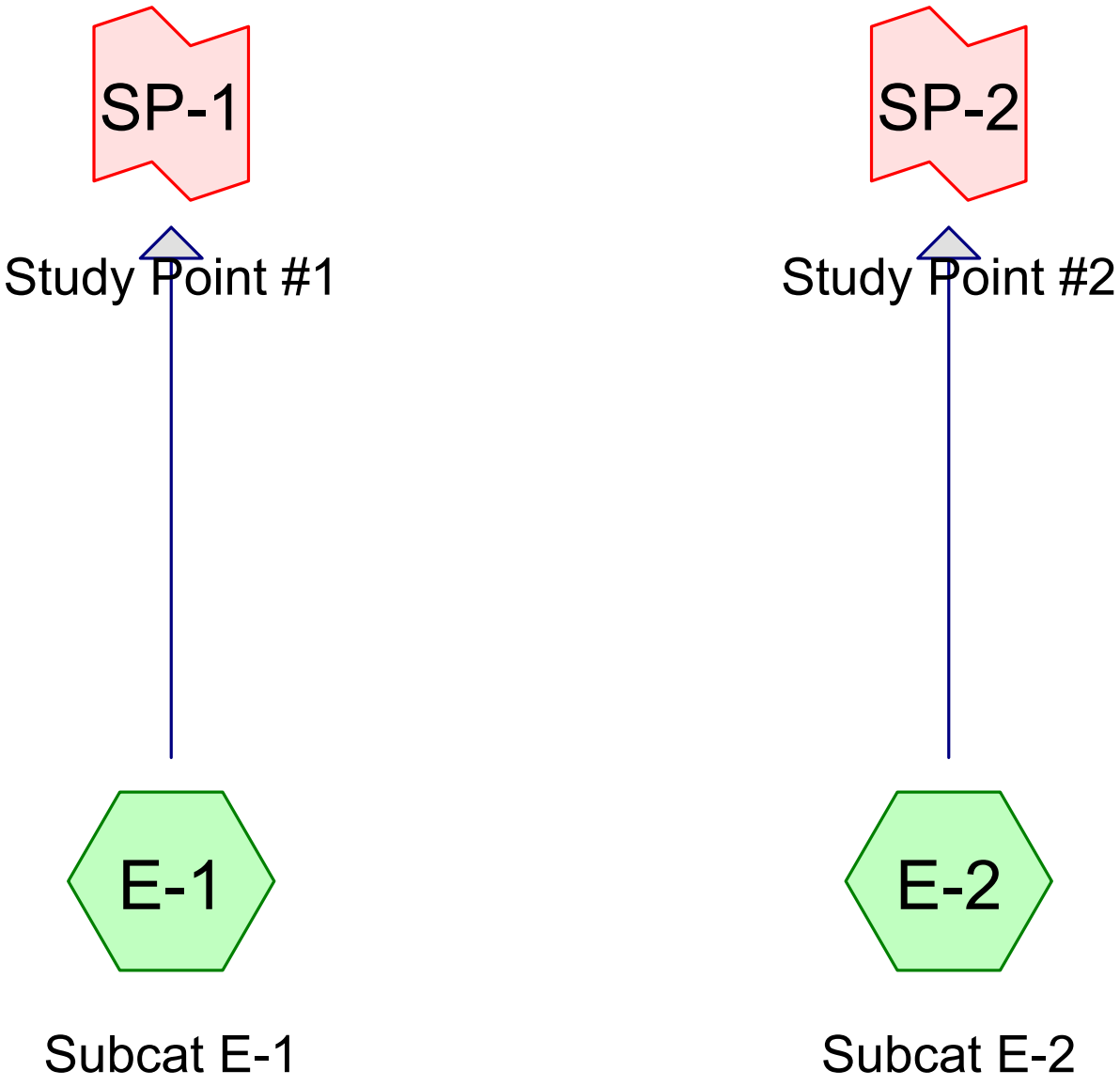
ALLEN & MAJOR ASSOCIATES, INC.
civil engineering ◆ land surveying
environmental consulting ◆ landscape architecture
www.allenmajor.com
100 COMMERCE WAY, SUITE 5
WOBURN MA 01801
TEL: (781) 935-6889
FAX: (781) 935-2896
WOBURN, MA ◆ LAKEVILLE, MA ◆ MANCHESTER, NH

DRAWING TITLE:

PROPOSED WATERSHED PLAN

SHEET No.

PWS-1



Subcat Reach Pond Link

Routing Diagram for 2562-01 - Existing HydroCAD
Prepared by Allen & Major Associates Inc., Printed 11/2/2021

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1" Storm	Type III 24-hr		Default	24.00	1	1.00	2
2	2-year	Type III 24-hr		Default	24.00	1	3.14	2
3	10-year	Type III 24-hr		Default	24.00	1	4.71	2
4	25-year	Type III 24-hr		Default	24.00	1	5.93	2
5	100-year	Type III 24-hr		Default	24.00	1	8.43	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
20,852	39	>75% Grass cover, Good, HSG A (E-1, E-2)
213	96	Gravel surface, HSG A (E-1)
70	98	Roofs, HSG A (E-2)
11,216	98	Unconnected pavement, HSG A (E-1, E-2)
40,924	30	Woods, Good, HSG A (E-1, E-2)
73,274	**43**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
73,274	HSG A	E-1, E-2
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
73,274		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatchment Numbers
20,852	0	0	0	0	20,852	>75% Grass cover, Good	E-1, E-2
213	0	0	0	0	213	Gravel surface	E-1
70	0	0	0	0	70	Roofs	E-2
11,216	0	0	0	0	11,216	Unconnected pavement	E-1, E-2
40,924	0	0	0	0	40,924	Woods, Good	E-1, E-2
73,274	**0**	**0**	**0**	**0**	**73,274**	**TOTAL AREA**	

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Subcat E-1 Runoff Area=25,694 sf 35.49% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=57 Runoff=0.00 cfs 0 cf

Subcatchment E-2: Subcat E-2 Runoff Area=47,580 sf 4.55% Impervious Runoff Depth=0.00"
Tc=6.0 min UI Adjusted CN=34 Runoff=0.00 cfs 0 cf

Link SP-1: Study Point #1 Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Link SP-2: Study Point #2 Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Total Runoff Area = 73,274 sf Runoff Volume = 0 cf Average Runoff Depth = 0.00"
84.60% Pervious = 61,988 sf 15.40% Impervious = 11,285 sf

Summary for Subcatchment E-1: Subcat E-1

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Link SP-1 : Study Point #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 1" Storm Rainfall=1.00"

Area (sf)	CN	Description
7,745	39	>75% Grass cover, Good, HSG A
213	96	Gravel surface, HSG A
9,119	98	Unconnected pavement, HSG A
8,617	30	Woods, Good, HSG A
25,694	57	Weighted Average
16,575		64.51% Pervious Area
9,119		35.49% Impervious Area
9,119		100.00% Unconnected

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

Summary for Subcatchment E-2: Subcat E-2

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Link SP-2 : Study Point #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 1" Storm Rainfall=1.00"

Area (sf)	CN	Adj	Description
13,107	39		>75% Grass cover, Good, HSG A
70	98		Roofs, HSG A
2,097	98		Unconnected pavement, HSG A
32,306	30		Woods, Good, HSG A
47,580	36	34	Weighted Average, UI Adjusted
45,413			95.45% Pervious Area
2,166			4.55% Impervious Area
2,097			96.79% Unconnected

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

Summary for Link SP-1: Study Point #1

Inflow Area = 25,694 sf, 35.49% Impervious, Inflow Depth = 0.00" for 1" Storm event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link SP-2: Study Point #2

Inflow Area = 47,580 sf, 4.55% Impervious, Inflow Depth = 0.00" for 1" Storm event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Subcat E-1 Runoff Area=25,694 sf 35.49% Impervious Runoff Depth=0.29"
Tc=6.0 min CN=57 Runoff=0.08 cfs 621 cf

Subcatchment E-2: Subcat E-2 Runoff Area=47,580 sf 4.55% Impervious Runoff Depth=0.00"
Tc=6.0 min UI Adjusted CN=34 Runoff=0.00 cfs 0 cf

Link SP-1: Study Point #1 Inflow=0.08 cfs 621 cf
Primary=0.08 cfs 621 cf

Link SP-2: Study Point #2 Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Total Runoff Area = 73,274 sf Runoff Volume = 621 cf Average Runoff Depth = 0.10"
84.60% Pervious = 61,988 sf 15.40% Impervious = 11,285 sf

Summary for Subcatchment E-1: Subcat E-1

Runoff = 0.08 cfs @ 12.29 hrs, Volume= 621 cf, Depth= 0.29"
Routed to Link SP-1 : Study Point #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.14"

Area (sf)	CN	Description
7,745	39	>75% Grass cover, Good, HSG A
213	96	Gravel surface, HSG A
9,119	98	Unconnected pavement, HSG A
8,617	30	Woods, Good, HSG A
25,694	57	Weighted Average
16,575		64.51% Pervious Area
9,119		35.49% Impervious Area
9,119		100.00% Unconnected

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

Summary for Subcatchment E-2: Subcat E-2

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Link SP-2 : Study Point #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.14"

Area (sf)	CN	Adj	Description
13,107	39		>75% Grass cover, Good, HSG A
70	98		Roofs, HSG A
2,097	98		Unconnected pavement, HSG A
32,306	30		Woods, Good, HSG A
47,580	36	34	Weighted Average, UI Adjusted
45,413			95.45% Pervious Area
2,166			4.55% Impervious Area
2,097			96.79% Unconnected

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

Summary for Link SP-1: Study Point #1

Inflow Area = 25,694 sf, 35.49% Impervious, Inflow Depth = 0.29" for 2-year event
Inflow = 0.08 cfs @ 12.29 hrs, Volume= 621 cf
Primary = 0.08 cfs @ 12.29 hrs, Volume= 621 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link SP-2: Study Point #2

Inflow Area = 47,580 sf, 4.55% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Subcat E-1 Runoff Area=25,694 sf 35.49% Impervious Runoff Depth=0.95"
Tc=6.0 min CN=57 Runoff=0.53 cfs 2,042 cf

Subcatchment E-2: Subcat E-2 Runoff Area=47,580 sf 4.55% Impervious Runoff Depth=0.03"
Tc=6.0 min UI Adjusted CN=34 Runoff=0.00 cfs 134 cf

Link SP-1: Study Point #1 Inflow=0.53 cfs 2,042 cf
Primary=0.53 cfs 2,042 cf

Link SP-2: Study Point #2 Inflow=0.00 cfs 134 cf
Primary=0.00 cfs 134 cf

Total Runoff Area = 73,274 sf Runoff Volume = 2,176 cf Average Runoff Depth = 0.36"
84.60% Pervious = 61,988 sf 15.40% Impervious = 11,285 sf

Summary for Subcatchment E-1: Subcat E-1

Runoff = 0.53 cfs @ 12.11 hrs, Volume= 2,042 cf, Depth= 0.95"
Routed to Link SP-1 : Study Point #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.71"

Area (sf)	CN	Description
7,745	39	>75% Grass cover, Good, HSG A
213	96	Gravel surface, HSG A
9,119	98	Unconnected pavement, HSG A
8,617	30	Woods, Good, HSG A
25,694	57	Weighted Average
16,575		64.51% Pervious Area
9,119		35.49% Impervious Area
9,119		100.00% Unconnected

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

Summary for Subcatchment E-2: Subcat E-2

Runoff = 0.00 cfs @ 17.10 hrs, Volume= 134 cf, Depth= 0.03"
Routed to Link SP-2 : Study Point #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.71"

Area (sf)	CN	Adj	Description
13,107	39		>75% Grass cover, Good, HSG A
70	98		Roofs, HSG A
2,097	98		Unconnected pavement, HSG A
32,306	30		Woods, Good, HSG A
47,580	36	34	Weighted Average, UI Adjusted
45,413			95.45% Pervious Area
2,166			4.55% Impervious Area
2,097			96.79% Unconnected

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

Summary for Link SP-1: Study Point #1

Inflow Area = 25,694 sf, 35.49% Impervious, Inflow Depth = 0.95" for 10-year event
Inflow = 0.53 cfs @ 12.11 hrs, Volume= 2,042 cf
Primary = 0.53 cfs @ 12.11 hrs, Volume= 2,042 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link SP-2: Study Point #2

Inflow Area = 47,580 sf, 4.55% Impervious, Inflow Depth = 0.03" for 10-year event
Inflow = 0.00 cfs @ 17.10 hrs, Volume= 134 cf
Primary = 0.00 cfs @ 17.10 hrs, Volume= 134 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Subcat E-1 Runoff Area=25,694 sf 35.49% Impervious Runoff Depth=1.63"
Tc=6.0 min CN=57 Runoff=1.02 cfs 3,498 cf

Subcatchment E-2: Subcat E-2 Runoff Area=47,580 sf 4.55% Impervious Runoff Depth=0.20"
Tc=6.0 min UI Adjusted CN=34 Runoff=0.03 cfs 775 cf

Link SP-1: Study Point #1 Inflow=1.02 cfs 3,498 cf
Primary=1.02 cfs 3,498 cf

Link SP-2: Study Point #2 Inflow=0.03 cfs 775 cf
Primary=0.03 cfs 775 cf

Total Runoff Area = 73,274 sf Runoff Volume = 4,273 cf Average Runoff Depth = 0.70"
84.60% Pervious = 61,988 sf 15.40% Impervious = 11,285 sf

Summary for Subcatchment E-1: Subcat E-1

Runoff = 1.02 cfs @ 12.10 hrs, Volume= 3,498 cf, Depth= 1.63"
Routed to Link SP-1 : Study Point #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=5.93"

Area (sf)	CN	Description
7,745	39	>75% Grass cover, Good, HSG A
213	96	Gravel surface, HSG A
9,119	98	Unconnected pavement, HSG A
8,617	30	Woods, Good, HSG A
25,694	57	Weighted Average
16,575		64.51% Pervious Area
9,119		35.49% Impervious Area
9,119		100.00% Unconnected

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

Summary for Subcatchment E-2: Subcat E-2

Runoff = 0.03 cfs @ 13.69 hrs, Volume= 775 cf, Depth= 0.20"
Routed to Link SP-2 : Study Point #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=5.93"

Area (sf)	CN	Adj	Description
13,107	39		>75% Grass cover, Good, HSG A
70	98		Roofs, HSG A
2,097	98		Unconnected pavement, HSG A
32,306	30		Woods, Good, HSG A
47,580	36	34	Weighted Average, UI Adjusted
45,413			95.45% Pervious Area
2,166			4.55% Impervious Area
2,097			96.79% Unconnected

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

Summary for Link SP-1: Study Point #1

Inflow Area = 25,694 sf, 35.49% Impervious, Inflow Depth = 1.63" for 25-year event
Inflow = 1.02 cfs @ 12.10 hrs, Volume= 3,498 cf
Primary = 1.02 cfs @ 12.10 hrs, Volume= 3,498 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link SP-2: Study Point #2

Inflow Area = 47,580 sf, 4.55% Impervious, Inflow Depth = 0.20" for 25-year event
Inflow = 0.03 cfs @ 13.69 hrs, Volume= 775 cf
Primary = 0.03 cfs @ 13.69 hrs, Volume= 775 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment E-1: Subcat E-1 Runoff Area=25,694 sf 35.49% Impervious Runoff Depth=3.31"
Tc=6.0 min CN=57 Runoff=2.20 cfs 7,091 cf

Subcatchment E-2: Subcat E-2 Runoff Area=47,580 sf 4.55% Impervious Runoff Depth=0.86"
Tc=6.0 min UI Adjusted CN=34 Runoff=0.47 cfs 3,422 cf

Link SP-1: Study Point #1 Inflow=2.20 cfs 7,091 cf
Primary=2.20 cfs 7,091 cf

Link SP-2: Study Point #2 Inflow=0.47 cfs 3,422 cf
Primary=0.47 cfs 3,422 cf

Total Runoff Area = 73,274 sf Runoff Volume = 10,513 cf Average Runoff Depth = 1.72"
84.60% Pervious = 61,988 sf 15.40% Impervious = 11,285 sf

Summary for Subcatchment E-1: Subcat E-1

Runoff = 2.20 cfs @ 12.10 hrs, Volume= 7,091 cf, Depth= 3.31"
Routed to Link SP-1 : Study Point #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.43"

Area (sf)	CN	Description
7,745	39	>75% Grass cover, Good, HSG A
213	96	Gravel surface, HSG A
9,119	98	Unconnected pavement, HSG A
8,617	30	Woods, Good, HSG A
25,694	57	Weighted Average
16,575		64.51% Pervious Area
9,119		35.49% Impervious Area
9,119		100.00% Unconnected

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

Summary for Subcatchment E-2: Subcat E-2

Runoff = 0.47 cfs @ 12.15 hrs, Volume= 3,422 cf, Depth= 0.86"
Routed to Link SP-2 : Study Point #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.43"

Area (sf)	CN	Adj	Description
13,107	39		>75% Grass cover, Good, HSG A
70	98		Roofs, HSG A
2,097	98		Unconnected pavement, HSG A
32,306	30		Woods, Good, HSG A
47,580	36	34	Weighted Average, UI Adjusted
45,413			95.45% Pervious Area
2,166			4.55% Impervious Area
2,097			96.79% Unconnected

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

Summary for Link SP-1: Study Point #1

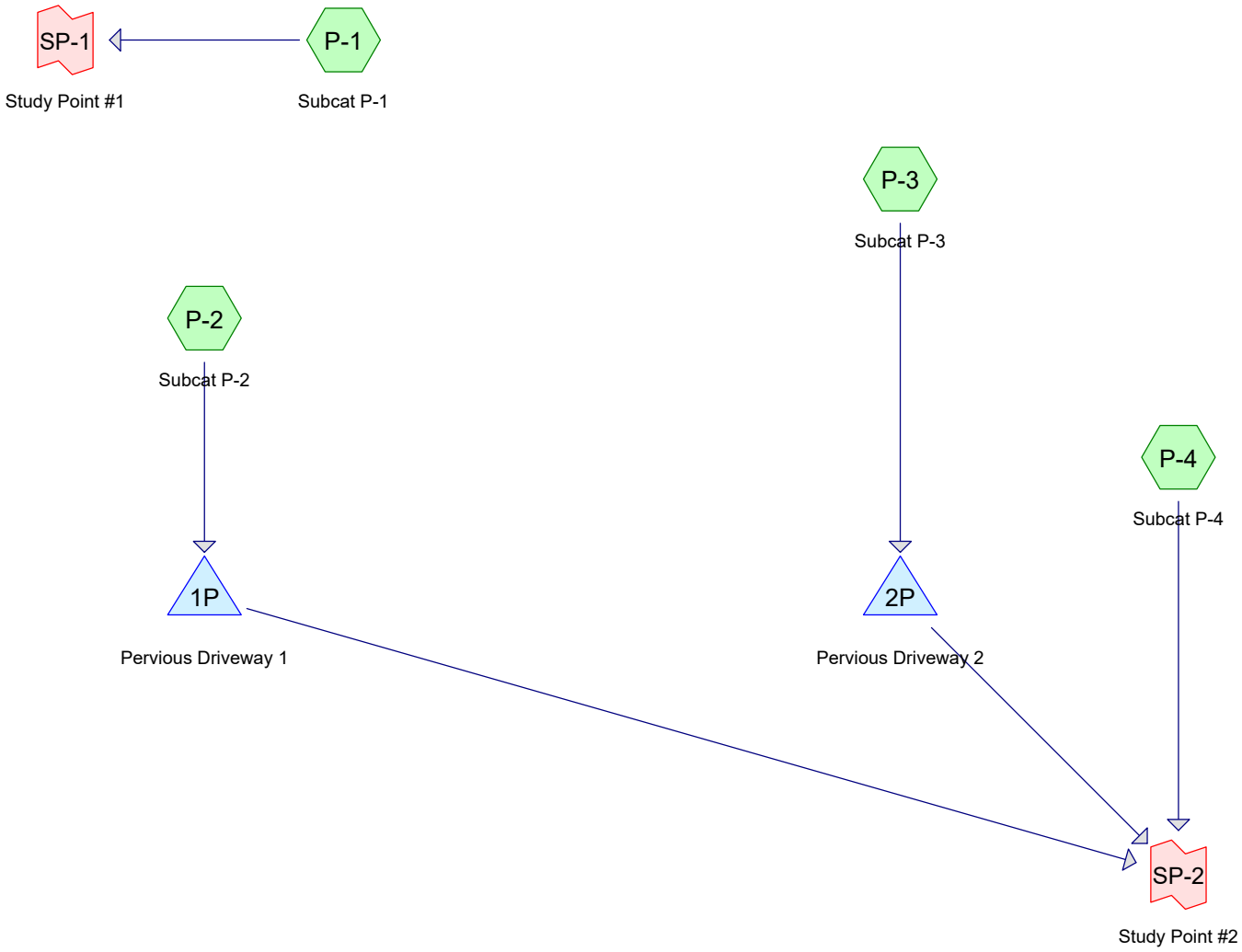
Inflow Area = 25,694 sf, 35.49% Impervious, Inflow Depth = 3.31" for 100-year event
Inflow = 2.20 cfs @ 12.10 hrs, Volume= 7,091 cf
Primary = 2.20 cfs @ 12.10 hrs, Volume= 7,091 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link SP-2: Study Point #2

Inflow Area = 47,580 sf, 4.55% Impervious, Inflow Depth = 0.86" for 100-year event
Inflow = 0.47 cfs @ 12.15 hrs, Volume= 3,422 cf
Primary = 0.47 cfs @ 12.15 hrs, Volume= 3,422 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs



Subcat Reach Pond Link

Routing Diagram for 2562-01 - Proposed HydroCAD
Prepared by Allen & Major Associates Inc., Printed 11/2/2021

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1" Storm	Type III 24-hr		Default	24.00	1	1.00	2
2	2-year	Type III 24-hr		Default	24.00	1	3.14	2
3	10-year	Type III 24-hr		Default	24.00	1	4.71	2
4	25-year	Type III 24-hr		Default	24.00	1	5.93	2
5	100-year	Type III 24-hr		Default	24.00	1	8.43	2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
32,163	39	>75% Grass cover, Good, HSG A (P-1, P-2, P-3, P-4)
10,197	98	Permeable Driveway, HSG A (P-1, P-2, P-3)
9,330	98	Roofs, HSG A (P-1, P-2, P-3)
5,359	98	Unconnected pavement, HSG A (P-1, P-2, P-3)
16,223	30	Woods, Good, HSG A (P-1, P-3, P-4)
73,273	**57**	**TOTAL AREA**

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
73,273	HSG A	P-1, P-2, P-3, P-4
0	HSG B	
0	HSG C	
0	HSG D	
0	Other	
73,273		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatchment Numbers
32,163	0	0	0	0	32,163	>75% Grass cover, Good	P-1, P-2, P-3, P-4
10,197	0	0	0	0	10,197	Permeable Driveway	P-1, P-2, P-3
9,330	0	0	0	0	9,330	Roofs	P-1, P-2, P-3
5,359	0	0	0	0	5,359	Unconnected pavement	P-1, P-2, P-3
16,223	0	0	0	0	16,223	Woods, Good	P-1, P-3, P-4
73,273	**0**	**0**	**0**	**0**	**73,273**	**TOTAL AREA**	

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: Subcat P-1 Runoff Area=10,433 sf 7.31% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=40 Runoff=0.00 cfs 0 cf

Subcatchment P-2: Subcat P-2 Runoff Area=8,100 sf 53.78% Impervious Runoff Depth=0.01"
Tc=6.0 min CN=71 Runoff=0.00 cfs 5 cf

Subcatchment P-3: Subcat P-3 Runoff Area=36,662 sf 53.92% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=70 Runoff=0.00 cfs 14 cf

Subcatchment P-4: Subcat P-4 Runoff Area=18,078 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=35 Runoff=0.00 cfs 0 cf

Pond 1P: Pervious Driveway 1 Peak Elev=134.33' Storage=0 cf Inflow=0.00 cfs 5 cf
Discarded=0.00 cfs 5 cf Primary=0.00 cfs 0 cf Outflow=0.00 cfs 5 cf

Pond 2P: Pervious Driveway 2 Peak Elev=139.83' Storage=0 cf Inflow=0.00 cfs 14 cf
Discarded=0.00 cfs 14 cf Primary=0.00 cfs 0 cf Outflow=0.00 cfs 14 cf

Link SP-1: Study Point #1 Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Link SP-2: Study Point #2 Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Total Runoff Area = 73,273 sf Runoff Volume = 19 cf Average Runoff Depth = 0.00"
66.04% Pervious = 48,387 sf 33.96% Impervious = 24,886 sf

Summary for Subcatchment P-1: Subcat P-1

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Link SP-1 : Study Point #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 1" Storm Rainfall=1.00"

	Area (sf)	CN	Description
	6,096	39	>75% Grass cover, Good, HSG A
	450	98	Roofs, HSG A
	99	98	Unconnected pavement, HSG A
*	214	98	Permeable Driveway, HSG A
	3,574	30	Woods, Good, HSG A
	10,433	40	Weighted Average
	9,670		92.69% Pervious Area
	763		7.31% Impervious Area
	99		12.98% Unconnected

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

Summary for Subcatchment P-2: Subcat P-2

Runoff = 0.00 cfs @ 16.98 hrs, Volume= 5 cf, Depth= 0.01"
Routed to Pond 1P : Pervious Driveway 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 1" Storm Rainfall=1.00"

	Area (sf)	CN	Description
	3,744	39	>75% Grass cover, Good, HSG A
	1,668	98	Roofs, HSG A
	50	98	Unconnected pavement, HSG A
*	2,638	98	Permeable Driveway, HSG A
	8,100	71	Weighted Average
	3,744		46.22% Pervious Area
	4,356		53.78% Impervious Area
	50		1.15% Unconnected

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

Summary for Subcatchment P-3: Subcat P-3

Runoff = 0.00 cfs @ 21.36 hrs, Volume= 14 cf, Depth= 0.00"
Routed to Pond 2P : Pervious Driveway 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 1" Storm Rainfall=1.00"

	Area (sf)	CN	Description
	12,311	39	>75% Grass cover, Good, HSG A
	7,212	98	Roofs, HSG A
	5,210	98	Unconnected pavement, HSG A
*	7,345	98	Permeable Driveway, HSG A
	4,584	30	Woods, Good, HSG A
	36,662	70	Weighted Average
	16,895		46.08% Pervious Area
	19,767		53.92% Impervious Area
	5,210		26.36% Unconnected

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

Summary for Subcatchment P-4: Subcat P-4

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Link SP-2 : Study Point #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 1" Storm Rainfall=1.00"

Area (sf)	CN	Description
10,012	39	>75% Grass cover, Good, HSG A
8,065	30	Woods, Good, HSG A
18,078	35	Weighted Average
18,078		100.00% Pervious Area

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

Summary for Pond 1P: Pervious Driveway 1

[92] Warning: Device #2 is above defined storage

Inflow Area = 8,100 sf, 53.78% Impervious, Inflow Depth = 0.01" for 1" Storm event
Inflow = 0.00 cfs @ 16.98 hrs, Volume= 5 cf
Outflow = 0.00 cfs @ 16.99 hrs, Volume= 5 cf, Atten= 0%, Lag= 0.3 min
Discarded = 0.00 cfs @ 16.99 hrs, Volume= 5 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link SP-2 : Study Point #2

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 134.33' @ 16.99 hrs Surf.Area= 2,813 sf Storage= 0 cf
Flood Elev= 135.00' Surf.Area= 2,813 sf Storage= 754 cf

Plug-Flow detention time= 0.3 min calculated for 5 cf (100% of inflow)
Center-of-Mass det. time= 0.3 min (1,157.9 - 1,157.6)

Volume	Invert	Avail.Storage	Storage Description
#1	134.33'	754 cf	**Custom Stage Data (Irregular)** Listed below 1,885 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
134.33	2,813	290.0	0	0	2,813
135.00	2,813	290.0	1,885	1,885	3,007

Device	Routing	Invert	Outlet Devices
#1	Discarded	134.33'	**10.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 130.67' Phase-In= 0.01'
#2	Primary	135.00'	**2.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=0.00 cfs @ 16.99 hrs HW=134.33' (Free Discharge)
↑**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=134.33' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P: Pervious Driveway 2

[92] Warning: Device #2 is above defined storage

Inflow Area = 36,662 sf, 53.92% Impervious, Inflow Depth = 0.00" for 1" Storm event
Inflow = 0.00 cfs @ 21.36 hrs, Volume= 14 cf
Outflow = 0.00 cfs @ 21.37 hrs, Volume= 14 cf, Atten= 0%, Lag= 0.4 min
Discarded = 0.00 cfs @ 21.37 hrs, Volume= 14 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link SP-2 : Study Point #2

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 139.83' @ 21.37 hrs Surf.Area= 11,741 sf Storage= 0 cf
Flood Elev= 140.50' Surf.Area= 11,741 sf Storage= 3,147 cf

Plug-Flow detention time= 0.3 min calculated for 14 cf (100% of inflow)
Center-of-Mass det. time= 0.3 min (1,203.9 - 1,203.6)

Volume	Invert	Avail.Storage	Storage Description
#1	139.83'	3,147 cf	**Custom Stage Data (Irregular)** Listed below 7,866 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
139.83	11,741	1,092.0	0	0	11,741
140.50	11,741	1,092.0	7,866	7,866	12,473

Device	Routing	Invert	Outlet Devices
#1	Discarded	139.83'	**10.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 129.33' Phase-In= 0.01'
#2	Primary	140.50'	**2.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=0.00 cfs @ 21.37 hrs HW=139.83' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=139.83' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link SP-1: Study Point #1

Inflow Area = 10,433 sf, 7.31% Impervious, Inflow Depth = 0.00" for 1" Storm event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link SP-2: Study Point #2

Inflow Area = 62,840 sf, 38.39% Impervious, Inflow Depth = 0.00" for 1" Storm event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: Subcat P-1 Runoff Area=10,433 sf 7.31% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=40 Runoff=0.00 cfs 1 cf

Subcatchment P-2: Subcat P-2 Runoff Area=8,100 sf 53.78% Impervious Runoff Depth=0.84"
Tc=6.0 min CN=71 Runoff=0.16 cfs 569 cf

Subcatchment P-3: Subcat P-3 Runoff Area=36,662 sf 53.92% Impervious Runoff Depth=0.79"
Tc=6.0 min CN=70 Runoff=0.69 cfs 2,424 cf

Subcatchment P-4: Subcat P-4 Runoff Area=18,078 sf 0.00% Impervious Runoff Depth=0.00"
Tc=6.0 min CN=35 Runoff=0.00 cfs 0 cf

Pond 1P: Pervious Driveway 1 Peak Elev=134.33' Storage=3 cf Inflow=0.16 cfs 569 cf
Discarded=0.16 cfs 569 cf Primary=0.00 cfs 0 cf Outflow=0.16 cfs 569 cf

Pond 2P: Pervious Driveway 2 Peak Elev=139.83' Storage=12 cf Inflow=0.69 cfs 2,424 cf
Discarded=0.69 cfs 2,424 cf Primary=0.00 cfs 0 cf Outflow=0.69 cfs 2,424 cf

Link SP-1: Study Point #1 Inflow=0.00 cfs 1 cf
Primary=0.00 cfs 1 cf

Link SP-2: Study Point #2 Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Total Runoff Area = 73,273 sf Runoff Volume = 2,994 cf Average Runoff Depth = 0.49"
66.04% Pervious = 48,387 sf 33.96% Impervious = 24,886 sf

Summary for Subcatchment P-1: Subcat P-1

Runoff = 0.00 cfs @ 24.00 hrs, Volume= 1 cf, Depth= 0.00"
Routed to Link SP-1 : Study Point #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.14"

	Area (sf)	CN	Description
	6,096	39	>75% Grass cover, Good, HSG A
	450	98	Roofs, HSG A
	99	98	Unconnected pavement, HSG A
*	214	98	Permeable Driveway, HSG A
	3,574	30	Woods, Good, HSG A
	10,433	40	Weighted Average
	9,670		92.69% Pervious Area
	763		7.31% Impervious Area
	99		12.98% Unconnected

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

Summary for Subcatchment P-2: Subcat P-2

Runoff = 0.16 cfs @ 12.10 hrs, Volume= 569 cf, Depth= 0.84"
Routed to Pond 1P : Pervious Driveway 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.14"

	Area (sf)	CN	Description
	3,744	39	>75% Grass cover, Good, HSG A
	1,668	98	Roofs, HSG A
	50	98	Unconnected pavement, HSG A
*	2,638	98	Permeable Driveway, HSG A
	8,100	71	Weighted Average
	3,744		46.22% Pervious Area
	4,356		53.78% Impervious Area
	50		1.15% Unconnected

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

Summary for Subcatchment P-3: Subcat P-3

Runoff = 0.69 cfs @ 12.10 hrs, Volume= 2,424 cf, Depth= 0.79"
Routed to Pond 2P : Pervious Driveway 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.14"

	Area (sf)	CN	Description
	12,311	39	>75% Grass cover, Good, HSG A
	7,212	98	Roofs, HSG A
	5,210	98	Unconnected pavement, HSG A
*	7,345	98	Permeable Driveway, HSG A
	4,584	30	Woods, Good, HSG A
	36,662	70	Weighted Average
	16,895		46.08% Pervious Area
	19,767		53.92% Impervious Area
	5,210		26.36% Unconnected

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

Summary for Subcatchment P-4: Subcat P-4

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"
Routed to Link SP-2 : Study Point #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Rainfall=3.14"

Area (sf)	CN	Description
10,012	39	>75% Grass cover, Good, HSG A
8,065	30	Woods, Good, HSG A
18,078	35	Weighted Average
18,078		100.00% Pervious Area

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

Summary for Pond 1P: Pervious Driveway 1

[92] Warning: Device #2 is above defined storage

Inflow Area = 8,100 sf, 53.78% Impervious, Inflow Depth = 0.84" for 2-year event
Inflow = 0.16 cfs @ 12.10 hrs, Volume= 569 cf
Outflow = 0.16 cfs @ 12.11 hrs, Volume= 569 cf, Atten= 0%, Lag= 0.3 min
Discarded = 0.16 cfs @ 12.11 hrs, Volume= 569 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link SP-2 : Study Point #2

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 134.33' @ 12.11 hrs Surf.Area= 2,813 sf Storage= 3 cf
Flood Elev= 135.00' Surf.Area= 2,813 sf Storage= 754 cf

Plug-Flow detention time= 0.3 min calculated for 568 cf (100% of inflow)
Center-of-Mass det. time= 0.3 min (873.9 - 873.6)

Volume	Invert	Avail.Storage	Storage Description
#1	134.33'	754 cf	**Custom Stage Data (Irregular)** Listed below 1,885 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
134.33	2,813	290.0	0	0	2,813
135.00	2,813	290.0	1,885	1,885	3,007

Device	Routing	Invert	Outlet Devices
#1	Discarded	134.33'	**10.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 130.67' Phase-In= 0.01'
#2	Primary	135.00'	**2.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=0.16 cfs @ 12.11 hrs HW=134.33' (Free Discharge)
1=Exfiltration (Controls 0.16 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=134.33' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 2P: Pervious Driveway 2

[92] Warning: Device #2 is above defined storage

Inflow Area = 36,662 sf, 53.92% Impervious, Inflow Depth = 0.79" for 2-year event
Inflow = 0.69 cfs @ 12.10 hrs, Volume= 2,424 cf
Outflow = 0.69 cfs @ 12.11 hrs, Volume= 2,424 cf, Atten= 0%, Lag= 0.3 min
Discarded = 0.69 cfs @ 12.11 hrs, Volume= 2,424 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link SP-2 : Study Point #2

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 139.83' @ 12.11 hrs Surf.Area= 11,741 sf Storage= 12 cf
Flood Elev= 140.50' Surf.Area= 11,741 sf Storage= 3,147 cf

Plug-Flow detention time= 0.3 min calculated for 2,421 cf (100% of inflow)
Center-of-Mass det. time= 0.3 min (877.5 - 877.2)

Volume	Invert	Avail.Storage	Storage Description
#1	139.83'	3,147 cf	**Custom Stage Data (Irregular)** Listed below 7,866 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
139.83	11,741	1,092.0	0	0	11,741
140.50	11,741	1,092.0	7,866	7,866	12,473

Device	Routing	Invert	Outlet Devices
#1	Discarded	139.83'	**10.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 129.33' Phase-In= 0.01'
#2	Primary	140.50'	**2.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=0.67 cfs @ 12.11 hrs HW=139.83' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.67 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=139.83' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link SP-1: Study Point #1

Inflow Area = 10,433 sf, 7.31% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.00 cfs @ 24.00 hrs, Volume= 1 cf
Primary = 0.00 cfs @ 24.00 hrs, Volume= 1 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link SP-2: Study Point #2

Inflow Area = 62,840 sf, 38.39% Impervious, Inflow Depth = 0.00" for 2-year event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: Subcat P-1 Runoff Area=10,433 sf 7.31% Impervious Runoff Depth=0.17"
Tc=6.0 min CN=40 Runoff=0.01 cfs 152 cf

Subcatchment P-2: Subcat P-2 Runoff Area=8,100 sf 53.78% Impervious Runoff Depth=1.90"
Tc=6.0 min CN=71 Runoff=0.40 cfs 1,282 cf

Subcatchment P-3: Subcat P-3 Runoff Area=36,662 sf 53.92% Impervious Runoff Depth=1.82"
Tc=6.0 min CN=70 Runoff=1.73 cfs 5,573 cf

Subcatchment P-4: Subcat P-4 Runoff Area=18,078 sf 0.00% Impervious Runoff Depth=0.05"
Tc=6.0 min CN=35 Runoff=0.00 cfs 76 cf

Pond 1P: Pervious Driveway 1 Peak Elev=134.34' Storage=7 cf Inflow=0.40 cfs 1,282 cf
Discarded=0.40 cfs 1,282 cf Primary=0.00 cfs 0 cf Outflow=0.40 cfs 1,282 cf

Pond 2P: Pervious Driveway 2 Peak Elev=139.84' Storage=30 cf Inflow=1.73 cfs 5,573 cf
Discarded=1.73 cfs 5,573 cf Primary=0.00 cfs 0 cf Outflow=1.73 cfs 5,573 cf

Link SP-1: Study Point #1 Inflow=0.01 cfs 152 cf
Primary=0.01 cfs 152 cf

Link SP-2: Study Point #2 Inflow=0.00 cfs 76 cf
Primary=0.00 cfs 76 cf

Total Runoff Area = 73,273 sf Runoff Volume = 7,083 cf Average Runoff Depth = 1.16"
66.04% Pervious = 48,387 sf 33.96% Impervious = 24,886 sf

Summary for Subcatchment P-1: Subcat P-1

Runoff = 0.01 cfs @ 12.50 hrs, Volume= 152 cf, Depth= 0.17"
Routed to Link SP-1 : Study Point #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.71"

	Area (sf)	CN	Description
	6,096	39	>75% Grass cover, Good, HSG A
	450	98	Roofs, HSG A
	99	98	Unconnected pavement, HSG A
*	214	98	Permeable Driveway, HSG A
	3,574	30	Woods, Good, HSG A
	10,433	40	Weighted Average
	9,670		92.69% Pervious Area
	763		7.31% Impervious Area
	99		12.98% Unconnected

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

Summary for Subcatchment P-2: Subcat P-2

Runoff = 0.40 cfs @ 12.10 hrs, Volume= 1,282 cf, Depth= 1.90"
Routed to Pond 1P : Pervious Driveway 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.71"

	Area (sf)	CN	Description
	3,744	39	>75% Grass cover, Good, HSG A
	1,668	98	Roofs, HSG A
	50	98	Unconnected pavement, HSG A
*	2,638	98	Permeable Driveway, HSG A
	8,100	71	Weighted Average
	3,744		46.22% Pervious Area
	4,356		53.78% Impervious Area
	50		1.15% Unconnected

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

Summary for Subcatchment P-3: Subcat P-3

Runoff = 1.73 cfs @ 12.10 hrs, Volume= 5,573 cf, Depth= 1.82"
Routed to Pond 2P : Pervious Driveway 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.71"

	Area (sf)	CN	Description
	12,311	39	>75% Grass cover, Good, HSG A
	7,212	98	Roofs, HSG A
	5,210	98	Unconnected pavement, HSG A
*	7,345	98	Permeable Driveway, HSG A
	4,584	30	Woods, Good, HSG A
	36,662	70	Weighted Average
	16,895		46.08% Pervious Area
	19,767		53.92% Impervious Area
	5,210		26.36% Unconnected

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

Summary for Subcatchment P-4: Subcat P-4

Runoff = 0.00 cfs @ 15.61 hrs, Volume= 76 cf, Depth= 0.05"
Routed to Link SP-2 : Study Point #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Rainfall=4.71"

Area (sf)	CN	Description
10,012	39	>75% Grass cover, Good, HSG A
8,065	30	Woods, Good, HSG A
18,078	35	Weighted Average
18,078		100.00% Pervious Area

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

Summary for Pond 1P: Pervious Driveway 1

[92] Warning: Device #2 is above defined storage

Inflow Area = 8,100 sf, 53.78% Impervious, Inflow Depth = 1.90" for 10-year event
Inflow = 0.40 cfs @ 12.10 hrs, Volume= 1,282 cf
Outflow = 0.40 cfs @ 12.10 hrs, Volume= 1,282 cf, Atten= 0%, Lag= 0.3 min
Discarded = 0.40 cfs @ 12.10 hrs, Volume= 1,282 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link SP-2 : Study Point #2

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 134.34' @ 12.10 hrs Surf.Area= 2,813 sf Storage= 7 cf
Flood Elev= 135.00' Surf.Area= 2,813 sf Storage= 754 cf

Plug-Flow detention time= 0.3 min calculated for 1,281 cf (100% of inflow)
Center-of-Mass det. time= 0.3 min (848.6 - 848.3)

Volume	Invert	Avail.Storage	Storage Description
#1	134.33'	754 cf	**Custom Stage Data (Irregular)** Listed below 1,885 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
134.33	2,813	290.0	0	0	2,813
135.00	2,813	290.0	1,885	1,885	3,007

Device	Routing	Invert	Outlet Devices
#1	Discarded	134.33'	**10.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 130.67' Phase-In= 0.01'
#2	Primary	135.00'	**2.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=0.40 cfs @ 12.10 hrs HW=134.34' (Free Discharge)
↑**1=Exfiltration** (Controls 0.40 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=134.33' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P: Pervious Driveway 2

[92] Warning: Device #2 is above defined storage
[88] Warning: Qout>Qin may require smaller dt or Finer Routing

Inflow Area = 36,662 sf, 53.92% Impervious, Inflow Depth = 1.82" for 10-year event
Inflow = 1.73 cfs @ 12.10 hrs, Volume= 5,573 cf
Outflow = 1.73 cfs @ 12.10 hrs, Volume= 5,573 cf, Atten= 0%, Lag= 0.3 min
Discarded = 1.73 cfs @ 12.10 hrs, Volume= 5,573 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link SP-2 : Study Point #2

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 139.84' @ 12.10 hrs Surf.Area= 11,741 sf Storage= 30 cf
Flood Elev= 140.50' Surf.Area= 11,741 sf Storage= 3,147 cf

Plug-Flow detention time= 0.3 min calculated for 5,565 cf (100% of inflow)
Center-of-Mass det. time= 0.3 min (851.2 - 850.9)

Volume	Invert	Avail.Storage	Storage Description
#1	139.83'	3,147 cf	**Custom Stage Data (Irregular)** Listed below 7,866 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
139.83	11,741	1,092.0	0	0	11,741
140.50	11,741	1,092.0	7,866	7,866	12,473

Device	Routing	Invert	Outlet Devices
#1	Discarded	139.83'	**10.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 129.33' Phase-In= 0.01'
#2	Primary	140.50'	**2.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=1.72 cfs @ 12.10 hrs HW=139.84' (Free Discharge)
↑**1=Exfiltration** (Controls 1.72 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=139.83' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link SP-1: Study Point #1

Inflow Area = 10,433 sf, 7.31% Impervious, Inflow Depth = 0.17" for 10-year event
Inflow = 0.01 cfs @ 12.50 hrs, Volume= 152 cf
Primary = 0.01 cfs @ 12.50 hrs, Volume= 152 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link SP-2: Study Point #2

Inflow Area = 62,840 sf, 38.39% Impervious, Inflow Depth = 0.01" for 10-year event
Inflow = 0.00 cfs @ 15.61 hrs, Volume= 76 cf
Primary = 0.00 cfs @ 15.61 hrs, Volume= 76 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: Subcat P-1 Runoff Area=10,433 sf 7.31% Impervious Runoff Depth=0.48"
Tc=6.0 min CN=40 Runoff=0.05 cfs 416 cf

Subcatchment P-2: Subcat P-2 Runoff Area=8,100 sf 53.78% Impervious Runoff Depth=2.84"
Tc=6.0 min CN=71 Runoff=0.61 cfs 1,919 cf

Subcatchment P-3: Subcat P-3 Runoff Area=36,662 sf 53.92% Impervious Runoff Depth=2.75"
Tc=6.0 min CN=70 Runoff=2.65 cfs 8,401 cf

Subcatchment P-4: Subcat P-4 Runoff Area=18,078 sf 0.00% Impervious Runoff Depth=0.24"
Tc=6.0 min CN=35 Runoff=0.02 cfs 356 cf

Pond 1P: Pervious Driveway 1 Peak Elev=134.34' Storage=13 cf Inflow=0.61 cfs 1,919 cf
Discarded=0.60 cfs 1,919 cf Primary=0.00 cfs 0 cf Outflow=0.60 cfs 1,919 cf

Pond 2P: Pervious Driveway 2 Peak Elev=139.84' Storage=60 cf Inflow=2.65 cfs 8,401 cf
Discarded=2.62 cfs 8,401 cf Primary=0.00 cfs 0 cf Outflow=2.62 cfs 8,401 cf

Link SP-1: Study Point #1 Inflow=0.05 cfs 416 cf
Primary=0.05 cfs 416 cf

Link SP-2: Study Point #2 Inflow=0.02 cfs 356 cf
Primary=0.02 cfs 356 cf

Total Runoff Area = 73,273 sf Runoff Volume = 11,092 cf Average Runoff Depth = 1.82"
66.04% Pervious = 48,387 sf 33.96% Impervious = 24,886 sf

Summary for Subcatchment P-1: Subcat P-1

Runoff = 0.05 cfs @ 12.33 hrs, Volume= 416 cf, Depth= 0.48"
Routed to Link SP-1 : Study Point #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=5.93"

	Area (sf)	CN	Description
	6,096	39	>75% Grass cover, Good, HSG A
	450	98	Roofs, HSG A
	99	98	Unconnected pavement, HSG A
*	214	98	Permeable Driveway, HSG A
	3,574	30	Woods, Good, HSG A
	10,433	40	Weighted Average
	9,670		92.69% Pervious Area
	763		7.31% Impervious Area
	99		12.98% Unconnected

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

Summary for Subcatchment P-2: Subcat P-2

Runoff = 0.61 cfs @ 12.09 hrs, Volume= 1,919 cf, Depth= 2.84"
Routed to Pond 1P : Pervious Driveway 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=5.93"

	Area (sf)	CN	Description
	3,744	39	>75% Grass cover, Good, HSG A
	1,668	98	Roofs, HSG A
	50	98	Unconnected pavement, HSG A
*	2,638	98	Permeable Driveway, HSG A
	8,100	71	Weighted Average
	3,744		46.22% Pervious Area
	4,356		53.78% Impervious Area
	50		1.15% Unconnected

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

Summary for Subcatchment P-3: Subcat P-3

Runoff = 2.65 cfs @ 12.10 hrs, Volume= 8,401 cf, Depth= 2.75"
Routed to Pond 2P : Pervious Driveway 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=5.93"

	Area (sf)	CN	Description
	12,311	39	>75% Grass cover, Good, HSG A
	7,212	98	Roofs, HSG A
	5,210	98	Unconnected pavement, HSG A
*	7,345	98	Permeable Driveway, HSG A
	4,584	30	Woods, Good, HSG A
	36,662	70	Weighted Average
	16,895		46.08% Pervious Area
	19,767		53.92% Impervious Area
	5,210		26.36% Unconnected

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

Summary for Subcatchment P-4: Subcat P-4

Runoff = 0.02 cfs @ 12.48 hrs, Volume= 356 cf, Depth= 0.24"
Routed to Link SP-2 : Study Point #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Rainfall=5.93"

Area (sf)	CN	Description
10,012	39	>75% Grass cover, Good, HSG A
8,065	30	Woods, Good, HSG A
18,078	35	Weighted Average
18,078		100.00% Pervious Area

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

Summary for Pond 1P: Pervious Driveway 1

[92] Warning: Device #2 is above defined storage

Inflow Area = 8,100 sf, 53.78% Impervious, Inflow Depth = 2.84" for 25-year event
Inflow = 0.61 cfs @ 12.09 hrs, Volume= 1,919 cf
Outflow = 0.60 cfs @ 12.10 hrs, Volume= 1,919 cf, Atten= 1%, Lag= 0.6 min
Discarded = 0.60 cfs @ 12.10 hrs, Volume= 1,919 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link SP-2 : Study Point #2

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 134.34' @ 12.10 hrs Surf.Area= 2,813 sf Storage= 13 cf
Flood Elev= 135.00' Surf.Area= 2,813 sf Storage= 754 cf

Plug-Flow detention time= 0.3 min calculated for 1,916 cf (100% of inflow)
Center-of-Mass det. time= 0.3 min (836.8 - 836.5)

Volume	Invert	Avail.Storage	Storage Description
#1	134.33'	754 cf	**Custom Stage Data (Irregular)** Listed below 1,885 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
134.33	2,813	290.0	0	0	2,813
135.00	2,813	290.0	1,885	1,885	3,007

Device	Routing	Invert	Outlet Devices
#1	Discarded	134.33'	**10.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 130.67' Phase-In= 0.01'
#2	Primary	135.00'	**2.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=0.65 cfs @ 12.10 hrs HW=134.34' (Free Discharge)
↑—**1=Exfiltration** (Controls 0.65 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=134.33' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P: Pervious Driveway 2

[92] Warning: Device #2 is above defined storage

Inflow Area = 36,662 sf, 53.92% Impervious, Inflow Depth = 2.75" for 25-year event
Inflow = 2.65 cfs @ 12.10 hrs, Volume= 8,401 cf
Outflow = 2.62 cfs @ 12.10 hrs, Volume= 8,401 cf, Atten= 1%, Lag= 0.6 min
Discarded = 2.62 cfs @ 12.10 hrs, Volume= 8,401 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link SP-2 : Study Point #2

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 139.84' @ 12.10 hrs Surf.Area= 11,741 sf Storage= 60 cf
Flood Elev= 140.50' Surf.Area= 11,741 sf Storage= 3,147 cf

Plug-Flow detention time= 0.3 min calculated for 8,389 cf (100% of inflow)
Center-of-Mass det. time= 0.3 min (839.1 - 838.8)

Volume	Invert	Avail.Storage	Storage Description
#1	139.83'	3,147 cf	**Custom Stage Data (Irregular)** Listed below 7,866 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
139.83	11,741	1,092.0	0	0	11,741
140.50	11,741	1,092.0	7,866	7,866	12,473

Device	Routing	Invert	Outlet Devices
#1	Discarded	139.83'	**10.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 129.33' Phase-In= 0.01'
#2	Primary	140.50'	**2.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=2.72 cfs @ 12.10 hrs HW=139.84' (Free Discharge)
↑—**1=Exfiltration** (Controls 2.72 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=139.83' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link SP-1: Study Point #1

Inflow Area = 10,433 sf, 7.31% Impervious, Inflow Depth = 0.48" for 25-year event
Inflow = 0.05 cfs @ 12.33 hrs, Volume= 416 cf
Primary = 0.05 cfs @ 12.33 hrs, Volume= 416 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link SP-2: Study Point #2

Inflow Area = 62,840 sf, 38.39% Impervious, Inflow Depth = 0.07" for 25-year event
Inflow = 0.02 cfs @ 12.48 hrs, Volume= 356 cf
Primary = 0.02 cfs @ 12.48 hrs, Volume= 356 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Time span=0.00-36.00 hrs, dt=0.05 hrs, 721 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment P-1: Subcat P-1 Runoff Area=10,433 sf 7.31% Impervious Runoff Depth=1.44"
Tc=6.0 min CN=40 Runoff=0.30 cfs 1,255 cf

Subcatchment P-2: Subcat P-2 Runoff Area=8,100 sf 53.78% Impervious Runoff Depth=4.95"
Tc=6.0 min CN=71 Runoff=1.06 cfs 3,344 cf

Subcatchment P-3: Subcat P-3 Runoff Area=36,662 sf 53.92% Impervious Runoff Depth=4.84"
Tc=6.0 min CN=70 Runoff=4.68 cfs 14,775 cf

Subcatchment P-4: Subcat P-4 Runoff Area=18,078 sf 0.00% Impervious Runoff Depth=0.95"
Tc=6.0 min CN=35 Runoff=0.23 cfs 1,439 cf

Pond 1P: Pervious Driveway 1 Peak Elev=134.48' Storage=168 cf Inflow=1.06 cfs 3,344 cf
Discarded=0.68 cfs 3,344 cf Primary=0.00 cfs 0 cf Outflow=0.68 cfs 3,344 cf

Pond 2P: Pervious Driveway 2 Peak Elev=140.02' Storage=882 cf Inflow=4.68 cfs 14,775 cf
Discarded=2.77 cfs 14,775 cf Primary=0.00 cfs 0 cf Outflow=2.77 cfs 14,775 cf

Link SP-1: Study Point #1 Inflow=0.30 cfs 1,255 cf
Primary=0.30 cfs 1,255 cf

Link SP-2: Study Point #2 Inflow=0.23 cfs 1,439 cf
Primary=0.23 cfs 1,439 cf

Total Runoff Area = 73,273 sf Runoff Volume = 20,813 cf Average Runoff Depth = 3.41"
66.04% Pervious = 48,387 sf 33.96% Impervious = 24,886 sf

Summary for Subcatchment P-1: Subcat P-1

Runoff = 0.30 cfs @ 12.12 hrs, Volume= 1,255 cf, Depth= 1.44"
Routed to Link SP-1 : Study Point #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.43"

	Area (sf)	CN	Description
	6,096	39	>75% Grass cover, Good, HSG A
	450	98	Roofs, HSG A
	99	98	Unconnected pavement, HSG A
*	214	98	Permeable Driveway, HSG A
	3,574	30	Woods, Good, HSG A
	10,433	40	Weighted Average
	9,670		92.69% Pervious Area
	763		7.31% Impervious Area
	99		12.98% Unconnected

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

Summary for Subcatchment P-2: Subcat P-2

Runoff = 1.06 cfs @ 12.09 hrs, Volume= 3,344 cf, Depth= 4.95"
Routed to Pond 1P : Pervious Driveway 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.43"

	Area (sf)	CN	Description
	3,744	39	>75% Grass cover, Good, HSG A
	1,668	98	Roofs, HSG A
	50	98	Unconnected pavement, HSG A
*	2,638	98	Permeable Driveway, HSG A
	8,100	71	Weighted Average
	3,744		46.22% Pervious Area
	4,356		53.78% Impervious Area
	50		1.15% Unconnected

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

Summary for Subcatchment P-3: Subcat P-3

Runoff = 4.68 cfs @ 12.09 hrs, Volume= 14,775 cf, Depth= 4.84"
Routed to Pond 2P : Pervious Driveway 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.43"

	Area (sf)	CN	Description
	12,311	39	>75% Grass cover, Good, HSG A
	7,212	98	Roofs, HSG A
	5,210	98	Unconnected pavement, HSG A
*	7,345	98	Permeable Driveway, HSG A
	4,584	30	Woods, Good, HSG A
	36,662	70	Weighted Average
	16,895		46.08% Pervious Area
	19,767		53.92% Impervious Area
	5,210		26.36% Unconnected

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

Summary for Subcatchment P-4: Subcat P-4

Runoff = 0.23 cfs @ 12.16 hrs, Volume= 1,439 cf, Depth= 0.95"
Routed to Link SP-2 : Study Point #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Rainfall=8.43"

Area (sf)	CN	Description
10,012	39	>75% Grass cover, Good, HSG A
8,065	30	Woods, Good, HSG A
18,078	35	Weighted Average
18,078		100.00% Pervious Area

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

Summary for Pond 1P: Pervious Driveway 1

[92] Warning: Device #2 is above defined storage

Inflow Area = 8,100 sf, 53.78% Impervious, Inflow Depth = 4.95" for 100-year event
Inflow = 1.06 cfs @ 12.09 hrs, Volume= 3,344 cf
Outflow = 0.68 cfs @ 12.20 hrs, Volume= 3,344 cf, Atten= 36%, Lag= 6.3 min
Discarded = 0.68 cfs @ 12.20 hrs, Volume= 3,344 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link SP-2 : Study Point #2

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 134.48' @ 12.20 hrs Surf.Area= 2,813 sf Storage= 168 cf
Flood Elev= 135.00' Surf.Area= 2,813 sf Storage= 754 cf

Plug-Flow detention time= 1.0 min calculated for 3,340 cf (100% of inflow)
Center-of-Mass det. time= 1.0 min (821.4 - 820.4)

Volume	Invert	Avail.Storage	Storage Description
#1	134.33'	754 cf	**Custom Stage Data (Irregular)** Listed below 1,885 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
134.33	2,813	290.0	0	0	2,813
135.00	2,813	290.0	1,885	1,885	3,007

Device	Routing	Invert	Outlet Devices
#1	Discarded	134.33'	**10.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 130.67' Phase-In= 0.01'
#2	Primary	135.00'	**2.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=0.68 cfs @ 12.20 hrs HW=134.48' (Free Discharge)
↑**1=Exfiltration** (Controls 0.68 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=134.33' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 2P: Pervious Driveway 2

[92] Warning: Device #2 is above defined storage
[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=2)

Inflow Area = 36,662 sf, 53.92% Impervious, Inflow Depth = 4.84" for 100-year event
Inflow = 4.68 cfs @ 12.09 hrs, Volume= 14,775 cf
Outflow = 2.77 cfs @ 12.21 hrs, Volume= 14,775 cf, Atten= 41%, Lag= 7.3 min
Discarded = 2.77 cfs @ 12.21 hrs, Volume= 14,775 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Link SP-2 : Study Point #2

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 140.02' @ 12.21 hrs Surf.Area= 11,741 sf Storage= 882 cf
Flood Elev= 140.50' Surf.Area= 11,741 sf Storage= 3,147 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 1.3 min (823.8 - 822.5)

Volume	Invert	Avail.Storage	Storage Description
#1	139.83'	3,147 cf	**Custom Stage Data (Irregular)** Listed below 7,866 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
139.83	11,741	1,092.0	0	0	11,741
140.50	11,741	1,092.0	7,866	7,866	12,473

Device	Routing	Invert	Outlet Devices
#1	Discarded	139.83'	**10.000 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 129.33' Phase-In= 0.01'
#2	Primary	140.50'	**2.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Discarded OutFlow Max=2.77 cfs @ 12.21 hrs HW=140.02' (Free Discharge)
↑**1=Exfiltration** (Controls 2.77 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=139.83' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link SP-1: Study Point #1

Inflow Area = 10,433 sf, 7.31% Impervious, Inflow Depth = 1.44" for 100-year event
Inflow = 0.30 cfs @ 12.12 hrs, Volume= 1,255 cf
Primary = 0.30 cfs @ 12.12 hrs, Volume= 1,255 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link SP-2: Study Point #2

Inflow Area = 62,840 sf, 38.39% Impervious, Inflow Depth = 0.27" for 100-year event
Inflow = 0.23 cfs @ 12.16 hrs, Volume= 1,439 cf
Primary = 0.23 cfs @ 12.16 hrs, Volume= 1,439 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Extreme Precipitation Tables

Northeast Regional Climate Center

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

Smoothing	Yes
State	Massachusetts
Location	
Longitude	71.347 degrees West
Latitude	42.359 degrees North
Elevation	0 feet
Date/Time	Mon, 19 Jul 2021 13:12:42 -0400

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.43	0.54	0.70	0.88	1.11	**1yr**	0.76	1.05	1.29	1.62	2.06	2.62	2.83	**1yr**	2.32	2.72	3.21	3.87	4.53	**1yr**
2yr	0.35	0.54	0.67	0.88	1.11	1.39	**2yr**	0.95	1.28	1.61	2.01	2.51	3.14	3.46	**2yr**	2.78	3.33	3.83	4.57	5.20	**2yr**
5yr	0.41	0.64	0.81	1.08	1.38	1.76	**5yr**	1.19	1.60	2.04	2.55	3.18	3.96	4.41	**5yr**	3.50	4.24	4.87	5.79	6.48	**5yr**
10yr	0.47	0.74	0.93	1.26	1.64	2.10	**10yr**	1.42	1.89	2.44	3.06	3.81	4.71	5.30	**10yr**	4.17	5.09	5.84	6.93	7.66	**10yr**
25yr	0.56	0.89	1.13	1.55	2.06	2.65	**25yr**	1.78	2.37	3.10	3.88	4.82	5.93	6.75	**25yr**	5.25	6.49	7.43	8.78	9.56	**25yr**
50yr	0.63	1.01	1.30	1.82	2.45	3.19	**50yr**	2.11	2.81	3.73	4.67	5.78	7.07	8.12	**50yr**	6.26	7.81	8.92	10.52	11.32	**50yr**
100yr	0.73	1.18	1.51	2.14	2.91	3.81	**100yr**	2.51	3.33	4.46	5.59	6.91	8.43	9.76	**100yr**	7.46	9.39	10.71	12.60	13.39	**100yr**
200yr	0.83	1.36	1.76	2.51	3.47	4.56	**200yr**	2.99	3.95	5.35	6.71	8.27	10.06	11.75	**200yr**	8.90	11.30	12.86	15.09	15.85	**200yr**
500yr	1.01	1.65	2.16	3.13	4.38	5.79	**500yr**	3.78	4.96	6.81	8.53	10.49	12.71	15.02	**500yr**	11.25	14.44	16.40	19.18	19.83	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.23	0.35	0.43	0.58	0.71	0.82	**1yr**	0.61	0.81	1.05	1.44	1.77	2.28	2.44	**1yr**	2.02	2.35	2.83	3.48	3.95	**1yr**
2yr	0.33	0.51	0.63	0.85	1.05	1.25	**2yr**	0.91	1.23	1.43	1.88	2.42	3.07	3.38	**2yr**	2.72	3.25	3.68	4.47	5.08	**2yr**
5yr	0.38	0.59	0.73	1.00	1.27	1.48	**5yr**	1.10	1.45	1.72	2.23	2.86	3.68	4.07	**5yr**	3.26	3.91	4.49	5.41	6.08	**5yr**
10yr	0.42	0.65	0.81	1.13	1.46	1.68	**10yr**	1.26	1.64	1.87	2.52	3.21	4.20	4.66	**10yr**	3.72	4.48	5.08	6.27	6.94	**10yr**
25yr	0.49	0.74	0.92	1.31	1.73	1.97	**25yr**	1.49	1.93	2.18	2.96	3.77	4.99	5.57	**25yr**	4.42	5.35	5.92	7.60	8.26	**25yr**
50yr	0.53	0.81	1.01	1.45	1.95	2.23	**50yr**	1.68	2.18	2.44	3.35	4.25	5.67	6.34	**50yr**	5.02	6.10	6.58	8.80	9.45	**50yr**
100yr	0.58	0.88	1.10	1.59	2.18	2.52	**100yr**	1.88	2.47	2.73	3.36	4.81	6.44	7.19	**100yr**	5.70	6.92	7.28	10.20	10.81	**100yr**
200yr	0.64	0.96	1.22	1.76	2.46	2.85	**200yr**	2.12	2.79	3.06	3.71	5.44	7.30	8.14	**200yr**	6.46	7.83	7.97	11.83	12.35	**200yr**
500yr	0.72	1.08	1.39	2.02	2.87	3.35	**500yr**	2.47	3.28	3.56	4.23	6.43	8.60	9.54	**500yr**	7.61	9.17	8.80	14.41	14.76	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.32	0.49	0.60	0.81	0.99	1.18	**1yr**	0.85	1.15	1.36	1.80	2.27	2.81	3.14	**1yr**	2.49	3.02	3.45	4.17	4.84	**1yr**
2yr	0.37	0.57	0.70	0.95	1.17	1.37	**2yr**	1.01	1.34	1.57	2.07	2.65	3.24	3.58	**2yr**	2.87	3.45	4.02	4.69	5.35	**2yr**
5yr	0.45	0.70	0.86	1.19	1.51	1.80	**5yr**	1.30	1.76	2.03	2.62	3.32	4.27	4.78	**5yr**	3.78	4.59	5.26	6.20	6.91	**5yr**
10yr	0.54	0.83	1.03	1.44	1.86	2.23	**10yr**	1.61	2.18	2.58	3.17	3.98	5.29	5.98	**10yr**	4.68	5.75	6.54	7.68	8.44	**10yr**
25yr	0.70	1.06	1.32	1.89	2.48	2.96	**25yr**	2.14	2.89	3.44	4.08	5.06	7.04	8.08	**25yr**	6.23	7.77	8.80	10.18	11.01	**25yr**
50yr	0.84	1.28	1.59	2.29	3.08	3.67	**50yr**	2.66	3.59	4.27	4.94	6.08	8.76	10.16	**50yr**	7.76	9.77	11.05	12.61	13.46	**50yr**
100yr	1.02	1.54	1.94	2.80	3.83	4.55	**100yr**	3.31	4.44	5.31	6.67	7.30	10.93	12.80	**100yr**	9.67	12.31	13.93	15.63	16.45	**100yr**
200yr	1.24	1.87	2.36	3.42	4.77	5.64	**200yr**	4.12	5.51	6.62	8.23	8.75	13.64	16.15	**200yr**	12.07	15.53	17.63	19.37	20.09	**200yr**
500yr	1.61	2.40	3.09	4.48	6.38	7.46	**500yr**	5.50	7.29	8.85	10.88	11.14	18.35	21.99	**500yr**	16.24	21.15	24.17	25.74	26.21	**500yr**

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Northeast Regional Climate Center

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 Middlesex County, Massachusetts

July 19, 2021

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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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

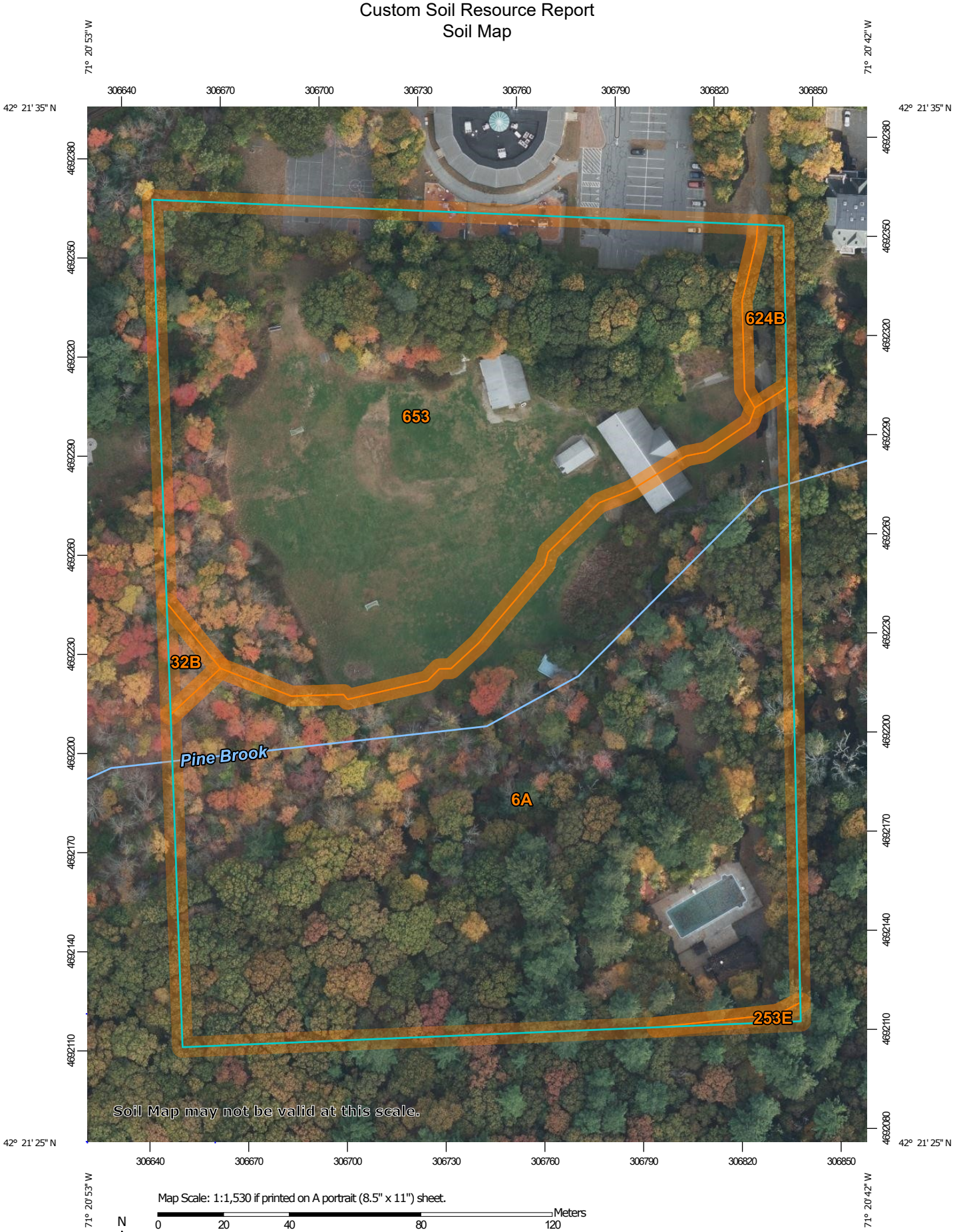
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

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



Map Scale: 1:1,530 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

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: Middlesex County, Massachusetts
Survey Area Data: Version 20, Jun 9, 2020

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

Date(s) aerial images were photographed: Oct 4, 2020—Oct 19, 2020

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
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	6.3	53.5%
32B	Wareham loamy fine sand, 0 to 5 percent slopes	0.1	0.6%
253E	Hinckley loamy sand, 25 to 35 percent slopes	0.0	0.2%
624B	Haven-Urban land complex, 0 to 8 percent slopes	0.2	1.3%
653	Udorthents, sandy	5.2	44.5%
Totals for Area of Interest		**11.7**	**100.0%**

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

Middlesex County, Massachusetts

6A—Scarboro mucky fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2svky
Elevation: 0 to 1,320 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Scarboro and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Scarboro

Setting

Landform: Outwash terraces, outwash deltas, drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Sandy glaciofluvial deposits derived from schist and/or sandy glaciofluvial deposits derived from gneiss and/or sandy glaciofluvial deposits derived from granite

Typical profile

Oe - 0 to 3 inches: mucky peat
A - 3 to 11 inches: mucky fine sandy loam
Cg1 - 11 to 21 inches: sand
Cg2 - 21 to 65 inches: gravelly coarse sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (1.42 to 14.17 in/hr)
Depth to water table: About 0 to 2 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: F144AY031MA - Very Wet Outwash
Hydric soil rating: Yes

Minor Components

Swansea

Percent of map unit: 10 percent
Landform: Swamps, bogs
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Walpole

Percent of map unit: 5 percent
Landform: Depressions, deltas, outwash plains, depressions, outwash terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip, talf
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Wareham

Percent of map unit: 5 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

32B—Wareham loamy fine sand, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: vqnd
Elevation: 0 to 2,100 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Wareham and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wareham

Setting

Landform: Depressions, deltas, terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 10 inches: loamy fine sand
H2 - 10 to 24 inches: loamy sand
H3 - 24 to 34 inches: stratified sand to fine sand
H4 - 34 to 65 inches: stratified coarse sand to sand

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: About 6 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A/D
Ecological site: F144AY028MA - Wet Outwash
Hydric soil rating: Yes

Minor Components

Sudbury

Percent of map unit: 10 percent
Landform: Plains, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Scarboro

Percent of map unit: 5 percent
Landform: Terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Deerfield

Percent of map unit: 5 percent
Landform: Deltas, stream terraces, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

253E—Hinckley loamy sand, 25 to 35 percent slopes

Map Unit Setting

National map unit symbol: 2svmf
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: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Hinckley

Setting

Landform: Outwash plains, kames, eskers, moraines, outwash terraces, outwash deltas, kame terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, riser
Down-slope shape: Convex, linear, concave
Across-slope shape: Linear, convex, concave
Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 8 inches: loamy sand
Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 25 to 35 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 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: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 10 percent
Landform: Outwash plains, outwash terraces, outwash deltas, kames, eskers, moraines, kame terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, riser
Down-slope shape: Convex, linear, concave
Across-slope shape: Linear, convex, concave
Hydric soil rating: No

Merrimac

Percent of map unit: 3 percent
Landform: Eskers, moraines, outwash plains, kames, outwash terraces, kame terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope, head slope, nose slope, crest, riser
Down-slope shape: Linear, convex, concave
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Sudbury

Percent of map unit: 2 percent
Landform: Outwash terraces, kame terraces, outwash plains, moraines, outwash deltas
Landform position (two-dimensional): Backslope, footslope, toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Hydric soil rating: No

624B—Haven-Urban land complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9956
Elevation: 0 to 1,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Haven and similar soils: 45 percent
Urban land: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Haven

Setting

Landform: Terraces, plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Friable loamy eolian deposits over loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 2 inches: silt loam
H2 - 2 to 20 inches: silt loam
H3 - 20 to 32 inches: very fine sandy loam
H4 - 32 to 65 inches: stratified coarse sand to sand to fine sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 18 to 36 inches to strongly contrasting textural stratification
Drainage class: Well drained
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 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A
Ecological site: F144AY023CT - Well Drained Outwash
Hydric soil rating: No

Description of Urban Land

Setting

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Excavated and filled land

Minor Components

Tisbury

Percent of map unit: 10 percent
Landform: Plains, terraces

Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: No

Merrimac

Percent of map unit: 5 percent
Landform: Plains, terraces
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Eskers, ridges, terraces
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

653—Udorthents, sandy

Map Unit Setting

National map unit symbol: vr1k
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Udorthents, Sandy

Setting

Parent material: Loamy alluvium and/or sandy glaciofluvial deposits and/or loamy glaciolacustrine deposits and/or loamy marine deposits and/or loamy basal till and/or loamy lodgment till

Properties and qualities

Slope: 0 to 25 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None

Minor Components

Udorthents, loamy
Percent of map unit: 5 percent
Hydric soil rating: No

Urban land
Percent of map unit: 5 percent
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear

Unnamed
Percent of map unit: 5 percent

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 Physical Properties

Soil Physical Properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

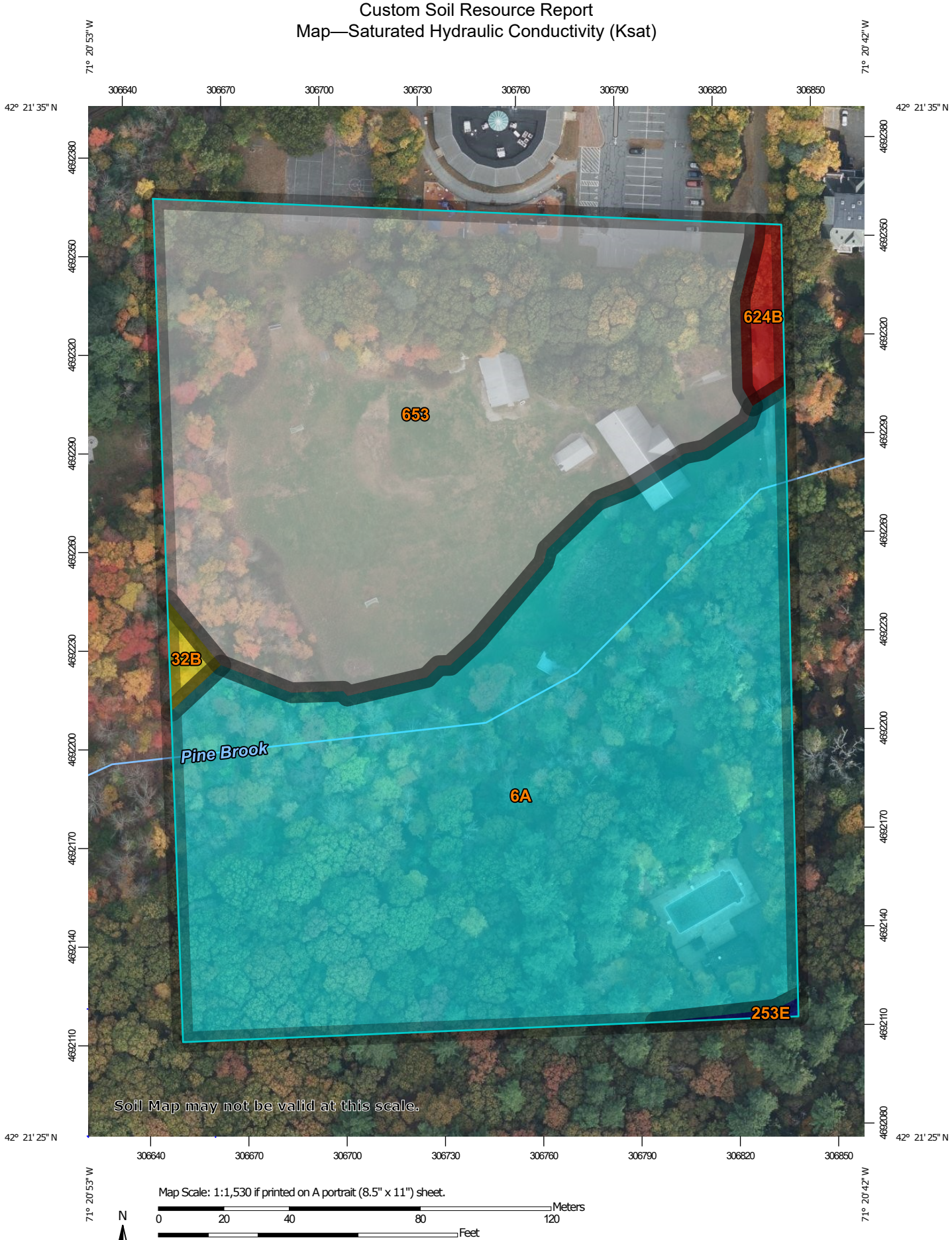
Saturated Hydraulic Conductivity (Ksat)

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits.

Custom Soil Resource Report
Map—Saturated Hydraulic Conductivity (Ksat)



Map Scale: 1:1,530 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- <= 69.0031
- > 69.0031 and <= 91.7400
- > 91.7400 and <= 93.3333
- > 93.3333 and <= 100.0000
- Not rated or not available

Soil Rating Lines

- <= 69.0031
- > 69.0031 and <= 91.7400
- > 91.7400 and <= 93.3333
- > 93.3333 and <= 100.0000
- Not rated or not available

Soil Rating Points

- <= 69.0031
- > 69.0031 and <= 91.7400
- > 91.7400 and <= 93.3333
- > 93.3333 and <= 100.0000
- 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 1:25,000.

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: Middlesex County, Massachusetts
Survey Area Data: Version 20, Jun 9, 2020

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

Date(s) aerial images were photographed: Oct 4, 2020—Oct 19, 2020

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—Saturated Hydraulic Conductivity (Ksat)

Map unit symbol	Map unit name	Rating (micrometers per second)	Acres in AOI	Percent of AOI
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	93.3333	6.3	53.5%
32B	Wareham loamy fine sand, 0 to 5 percent slopes	91.7400	0.1	0.6%
253E	Hinckley loamy sand, 25 to 35 percent slopes	100.0000	0.0	0.2%
624B	Haven-Urban land complex, 0 to 8 percent slopes	69.0031	0.2	1.3%
653	Udorthents, sandy		5.2	44.5%
Totals for Area of Interest			**11.7**	**100.0%**

Rating Options—Saturated Hydraulic Conductivity (Ksat)

Units of Measure: micrometers per second

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Fastest

Interpret Nulls as Zero: No

Layer Options (Horizon Aggregation Method): Depth Range (Weighted Average)

Top Depth: 12

Bottom Depth: 120

Units of Measure: Centimeters

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:

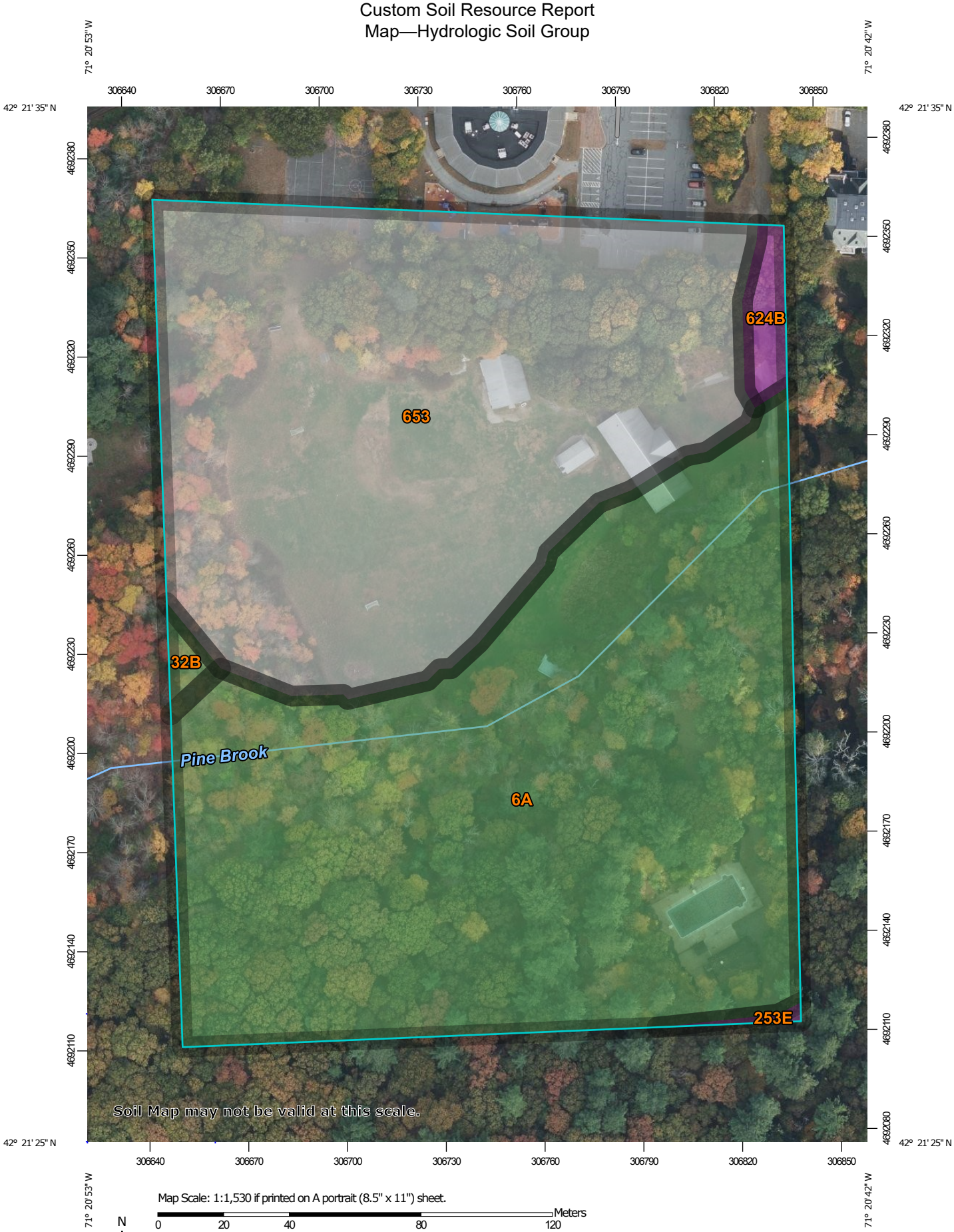
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

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.

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.



Map Scale: 1:1,530 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 20 40 80 120

Feet
0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil 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 1:25,000.

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

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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: Middlesex County, Massachusetts
Survey Area Data: Version 20, Jun 9, 2020

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

Date(s) aerial images were photographed: Oct 4, 2020—Oct 19, 2020

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
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	A/D	6.3	53.5%
32B	Wareham loamy fine sand, 0 to 5 percent slopes	A/D	0.1	0.6%
253E	Hinckley loamy sand, 25 to 35 percent slopes	A	0.0	0.2%
624B	Haven-Urban land complex, 0 to 8 percent slopes	A	0.2	1.3%
653	Udorthents, sandy		5.2	44.5%
Totals for Area of Interest			**11.7**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

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Commonwealth of Massachusetts
City/Town of Wayland

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

A. Facility Information

West Suburban YMCA - Camp Chickami
Owner Name

139 Boston Post Road
Street Address

Map 29 / Lot 42
Map/Lot #

Wayland
City

MA
State

01778
Zip Code

B. Site Information

1. (Check one) ☒ New Construction ☐ Upgrade ☐ Repair

2. Soil Survey Available? ☒ Yes ☐ No If yes: USDA NRCS (Source) 310C (Soil Map Unit)

Udorthents, sandy (653)
Soil Name

None listed
Soil Limitations

Glacial Outwash
Soil Parent material

Proglacial Outwash
Landform

3. Surficial Geological Report Available? ☐ Yes ☒ No If yes: (Year Published/Source) (Map Unit)

Description of Geologic Map Unit:

4. Flood Rate Insurance Map Within a regulatory floodway? ☐ Yes ☒ No

5. Within a velocity zone? ☐ Yes ☒ No

6. Within a Mapped Wetland Area? ☐ Yes ☒ No If yes, MassGIS Wetland Data Layer: N/A (Wetland Type)

7. Current Water Resource Conditions (USGS): April (Month/Day/ Year) Range: ☐ Above Normal ☐ Normal ☒ Below Normal

8. Other references reviewed: Topographic survey and wetland delineation performed by Allen & Major Associates, September 2020

Commonwealth of Massachusetts
City/Town of Wayland

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP1 (Hole #) | 04-26-21 (Date) | 10:30 a.m. (Time) | Clear, 45 degrees (Weather) | 42.359609 (Latitude) | -71.347257 (Longitude:)

1. Land Use: YMCA Camp facility (e.g., woodland, agricultural field, vacant lot, etc.) | grass (Vegetation) | none (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 2% (Slope (%))

Description of Location:

2. Soil Parent Material: Glacial Outwash | Proglacial outwash (Landform) | (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >200 feet | Drainage Way >100 feet | Wetlands >100 feet | Property Line 55 feet | Drinking Water Well >100 feet | Other _____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: None Depth Weeping from Pit | None Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-29"	HTM	-	-	-	-	-	-	-	-	Dry	
29-36"	Ab	Sandy Loam	10YR 3/3	-	-	-	-	-	Massive Friable	Dry	
36-42"	Bw	Fine Loamy Sand	2.5YR 5/6	-	-	-	-	-	Massive Friable	Dry	-
42-120"	C	Fine Loamy Sand	2.5Y 5/4	80"	2.5YR 5/6 2.5Y 7/4	5%	-	-	Massive Friable	Dry to Moist	One lense of coarse sand around 100" depth

Additional Notes:
HTM (Fill layer) is consistent with C-horizon. On-site material may have been used to level the grade.

Commonwealth of Massachusetts
City/Town of Wayland

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP2 (Hole #) | 04-26-21 (Date) | 10:45 a.m. (Time) | Clear, 45 degrees (Weather) | 42.359609 (Latitude) | -71.347257 (Longitude:)

1. Land Use: YMCA Camp facility (e.g., woodland, agricultural field, vacant lot, etc.) | paved (Vegetation) | none (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 2% (Slope (%))

Description of Location: See attached sketch

2. Soil Parent Material: Glacial Outwash | Proglacial Outwash (Landform) | (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >200 feet | Drainage Way >100 feet | Wetlands >100 feet | Property Line 50 feet | Drinking Water Well >100 feet | Other _____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: None Depth Weeping from Pit | None Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-20"	HTM	-	-	-	-	-	-	-	-	Dry	
20-124"	C	Fine Loamy Sand	2.5Y 5/4	84"	2.5YR 5/6 2.5Y 7/4	5%	-	-	Massive Friable	Dry to Moist	

Additional Notes:
HTM (Fill layer) consisted of pavement gravel base placed directly on the C-horizon

Commonwealth of Massachusetts
City/Town of Wayland

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP3 (Hole #) | 10-19-21 (Date) | 9:45 a.m. (Time) | Clear, 50 degrees (Weather) | 42.359704 (Latitude) | -71.347538 (Longitude:)

1. Land Use: YMCA Camp facility (e.g., woodland, agricultural field, vacant lot, etc.) | grass (Vegetation) | none (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 2% (Slope (%))

Description of Location:

2. Soil Parent Material: Glacial Outwash | Landform: Proglacial outwash | Position on Landscape (SU, SH, BS, FS, TS):

3. Distances from: Open Water Body >200 feet | Drainage Way >100 feet | Wetlands >100 feet | Property Line 20 feet | Drinking Water Well >100 feet | Other _____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: None Depth Weeping from Pit | None Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-4"	HTM	-	-	-	-	-	-	-	-	Dry	-
4-9"	Bw	Fine Loamy Sand	10YR 4/3	-	-	-	-	-	Massive Friable	Dry	-
9-132"	C	Fine Loamy Sand	2.5YR 5/4	84"	5YR 5/8 2.5Y 7/3	5%	-	-	Massive Friable	Dry to Moist	-

Additional Notes:
HTM (Fill layer) is from the bocci ball court.

Commonwealth of Massachusetts
City/Town of Wayland

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP4 (Hole #) | 10-19-21 (Date) | 10:15 a.m. (Time) | Clear, 45 degrees (Weather) | 42.359387 (Latitude) | -71.346947 (Longitude:)

1. Land Use: YMCA Camp facility (e.g., woodland, agricultural field, vacant lot, etc.) | wooded (Vegetation) | none (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 2% (Slope (%))

Description of Location:

2. Soil Parent Material: Glacial Outwash | Proglacial outwash (Landform) | (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >200 feet | Drainage Way >100 feet | Wetlands >70 feet | Property Line 15 feet | Drinking Water Well >100 feet | Other _____ feet

4. Unsuitable Materials Present: ☒ Yes ☐ No If Yes: ☐ Disturbed Soil ☒ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: None Depth Weeping from Pit | None Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-4"	HTM	-	-	-	-	-	-	-	-	Dry	
4-8"	Bw	Fine Loamy Sand	10YR 3/3	-	-	-	-	-	Massive Friable	Dry	
8-116"	C	Fine Loamy Sand	2.5YR 5/4	-	-	-	-	5%	Massive Friable	Dry	-

Additional Notes:
Test pit performed for stormwater management, no perc test was performed.

Commonwealth of Massachusetts
City/Town of Wayland

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

C. On-Site Review (*minimum of two holes required at every proposed primary and reserve disposal area)*

Deep Observation Hole Number: TP5 (Hole #) | 10-19-21 (Date) | 10:45 a.m. (Time) | Clear, 45 degrees (Weather) | 42.359322 (Latitude) | -71.347923 (Longitude:)

1. Land Use: YMCA Camp facility (e.g., woodland, agricultural field, vacant lot, etc.) | wooded (Vegetation) | few (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 2% (Slope (%))

Description of Location: See attached sketch

2. Soil Parent Material: Glacial Outwash | Proglacial Outwash (Landform) | (Position on Landscape (SU, SH, BS, FS, TS))

3. Distances from: Open Water Body >200 feet | Drainage Way >100 feet | Wetlands >75 feet
Property Line 75 feet | Drinking Water Well >100 feet | Other _____ feet

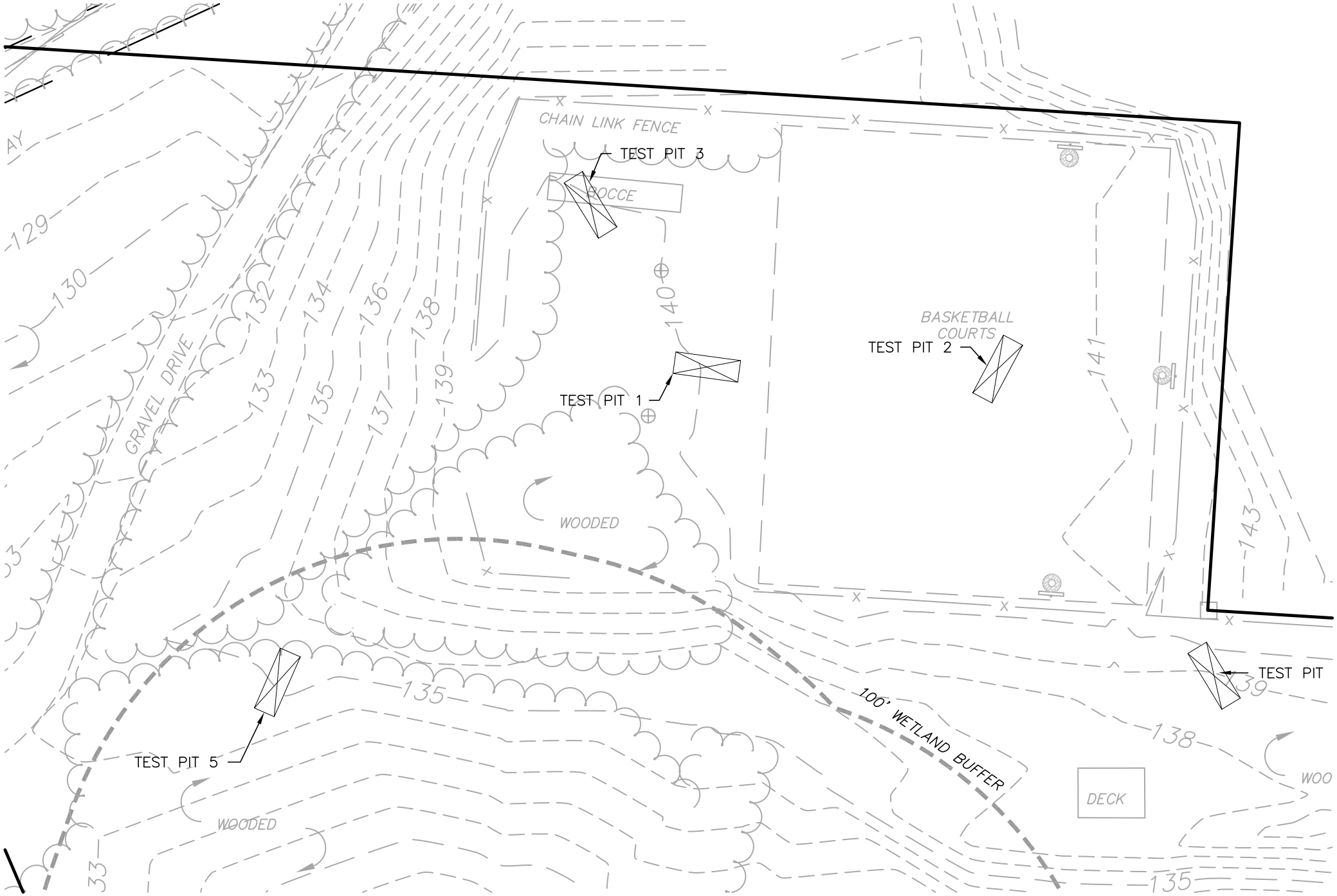
4. Unsuitable Materials Present: ☐ Yes ☒ No If Yes: ☐ Disturbed Soil ☐ Fill Material ☐ Weathered/Fractured Rock ☐ Bedrock

5. Groundwater Observed: ☐ Yes ☒ No If yes: None Depth Weeping from Pit | None Depth Standing Water in Hole

Soil Log

Depth (in)	Soil Horizon /Layer	Soil Texture (USDA)	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features			Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
				Depth	Color	Percent	Gravel	Cobbles & Stones			
0-2"	A	Fine Loamy Sand	7.5YR 3/3	-	-	-	-	-	Massive Friable	Dry	
2-12"	Bw	Fine Loamy Sand	7.5YR 3/4	-	-	-	-	-	Massive Friable	Dry	
12-96"	C	Fine Loamy Sand	2.5Y 5/4	52"	5YR 5/8 2.5Y7/3	5%	-	-	Massive Friable	Dry to Moist	

Additional Notes:
Test pit performed for stormwater management, no perc test was performed.


CHAIN LINK FENCE
TEST PIT 3
BOCCE
BASKETBALL COURTS
TEST PIT 2
TEST PIT 1
GRAVEL DRIVE
WOODED
TEST PIT 5
TEST PIT
100' WETLAND BUFFER
DECK
WOODED
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NDS®
We put water in its place

Permeable Pavers

High performance alternative to traditional paving

Greatest Compressive Strength in the Industry!

- Tufftrack™ Grass Paver
- EZ Roll™ Grass Paver
- EZ Roll™ Gravel Paver

ndspro.com

MADE IN USA

What are Permeable Pavers?

NDS Permeable Pavers provide a high-performing alternative to traditional paving methods.

Creating a strong and durable grass or gravel surface that can support heavy vehicles, they maintain permeable surface areas, eliminating or reducing stormwater runoff.

Benefits

Stormwater Management. A sustainable solution that reduces impervious area, volume of runoff, and size of downstream BMPs.

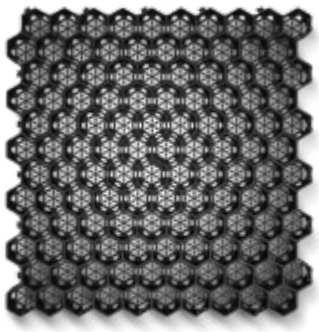
High Structural Strength. Offering a high load bearing capacity, NDS Permeable Pavers feature hexagonal cells that connect to form a flexible grid capable of handling significant structural loads.

Enhanced Aesthetics. Grass or gravel surfaces blend with surrounding natural surface.

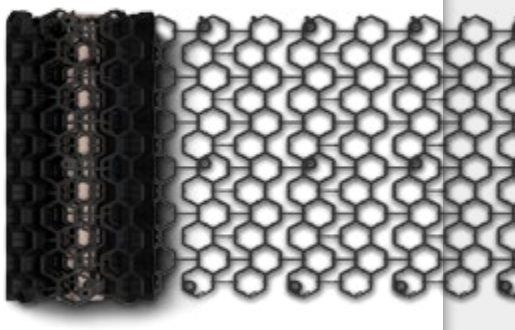
Easy Installation. EZ Roll™ Products come in large rolls that are easily placed and clipped together. Tuffttrack™ features an integrated easy assemble clip that greatly reduces installation time.

Environmentally Friendly. NDS permeable pavers can help contribute to LEED credits and are made of recycled plastic.

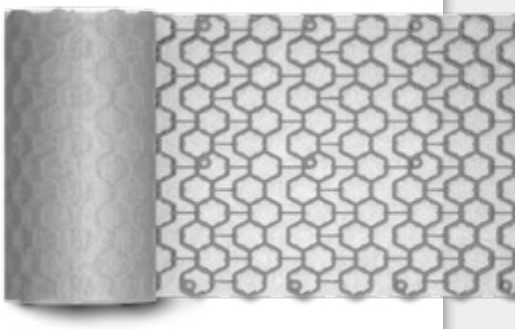
Tufftrack™
Grass Paver



EZ Roll™
Grass Paver



EZ Roll™
Gravel Paver

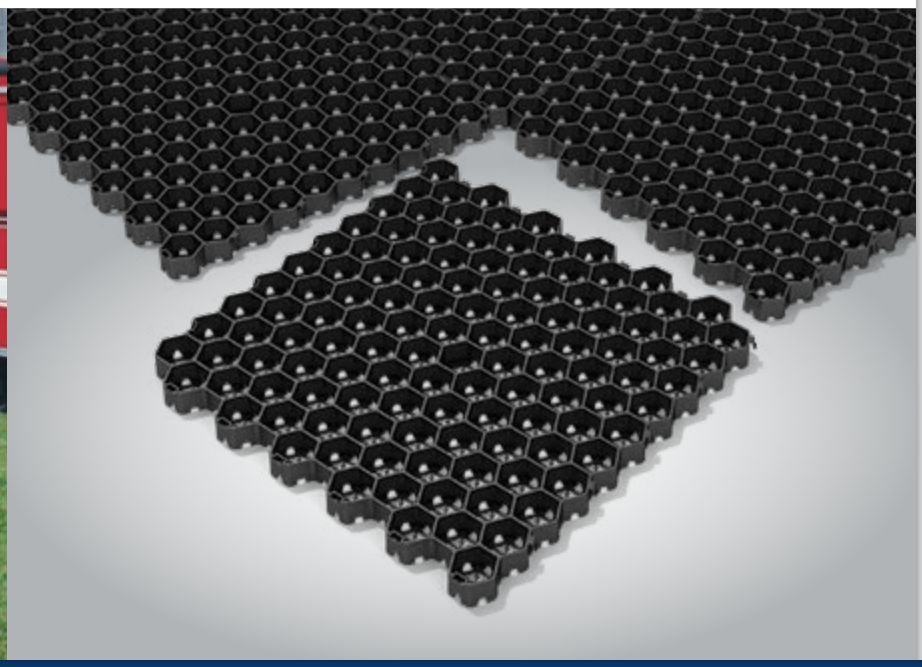


Tufftrack™ Grass Pavers

A turf reinforcement, load transferring paving system designed to be placed directly on a lightly compacted planting base which is installed over an engineer specified compacted road base.

It can also be used for light load applications without road base by simply compacting the planting base per engineer specification. This system is designed to transfer vehicle weight directly to the supportive base course and prevent soil compaction. The web of interconnected honeycomb cells provides resistance from vehicular load as well as lateral containment that prevents the soil compaction that would inhibit healthy root growth. This system also provides a porous condition that allows rapid absorption and movement of stormwater. Tufftrack Grass Pavers can be infilled with soil per specification. Tufftrack Pavers have a compressive strength of 86,563 lbs. in an empty condition; 400,000 lbs. when filled with native top soil. The Tufftrack Grass Paver system has been used and accepted across the country for a wide variety of projects including emergency vehicle access purposes.

Additional information, details, and specifications can be found at
http://www.ndspro.com/permeable-pavers/grass-pavers/tufftrack-grass-pavers
For further technical support or assistance, contact: techservice@ndspro.com

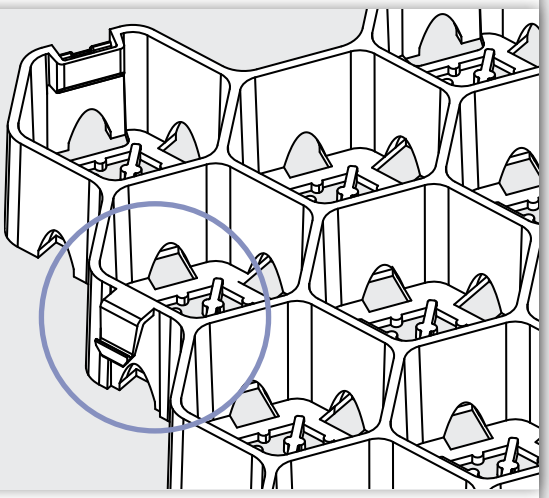


Design Theory

Tufftrack™ Grass Paver has unique Tongue and Groove clips
that minimize the paver mat separation and make for quick installation

The Tufftrack™ Grass Paver's secure locking clips prevent paver displacement or mat failure that could result from traffic load movement or changing ground conditions

The Tufftrack™ system has a high compressive strength bare product,
meaning that Tufftrack does not rely on the fill material for load carrying



Recommended Use

Light Loads:
Golf Cart Paths
Jogging Tracks
Bike Paths
ATV Paths
Equestrian Parks
Trail Reinforcements
Runoff Areas

Medium Loads:
Roadway Shoulders
Residential Driveways
Parking Lots
Overflow Parking Area
Truck & Cart Wash-Down Areas
RV and Boat Access

Heavy Loads/Fire Lane:
Fire Lanes
Emergency Vehicle Access Roads
Service Vehicle Utility Roads
Truck Maintenance and Equipment Yards
Construction Entrance Soil Stabilization
Consult NDS Design Worx during design phase when the intended use is semi trucks with trailers

Non-load Applications:
Erosion Control on Slopes (staking recommended)
Erosion Control in Swales (staking recommended)

Not Recommended for the Following:
Traffic on slopes exceeding a 10% grade
To support tread driven vehicles

The Tufftrack™ Grass Paver from NDS is the latest and most advanced product of its type on the market. NDS has used its years of experience in the landscaping industry to create a product with all of the most desirable features.

The Tufftrack Grass Paver has a combined series of 120 nested hexagonal cells per paver cell with 12 connecting clips. This unique combination provides superior stability and durability.

Product Specifications

Material. 100% recycled Polyolefin plastic (50% pre-consumer 50% post-consumer). Polyolefin is rugged, flexible and ideally suited for outside exposure and longevity. NDS uses UV inhibitors in the polymer structure to prevent breakdown in the strength of the paver.

Manufacturing. Manufactured in the USA: Lindsay, CA.

Recyclability. 100% recyclable.
Please recycle whenever possible.

Paver Size. Each 24" x 24" x 1½" panel contains 120, 2½" nested hexagonal cells. Each cell has 6 arched cutouts at its base.

Weight Per Unit. 4.0 pounds per 24" x 24" section.

Paver Details. The top surface of the hexagonal cell walls is smooth and devoid of notches or grooves.

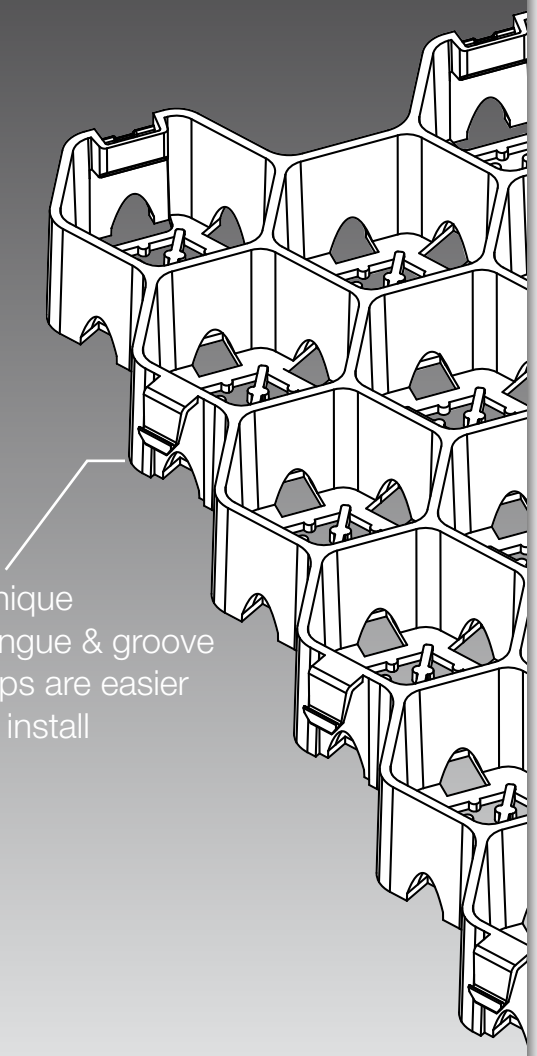
Assembly Mechanism. Each Paver section includes 10 sturdy Tongue and Groove locks per panel, which provide secure connection between panels.

Chemical Resistance. Tufftrack™ Pavers have superior chemical resistance and are totally inert.

Compressive Strength (Empty Pavers): 86,563 lbs.
Compressive Strength (Native Soil filled Pavers): 400,000 lbs.

Unique Product Features. Tufftrack™ Pavers have features found in no other grass paver product in the industry. Tufftrack features a unique domed opening at the base of each hexagonal cell wall. This promotes a greater flow of water, oxygen and nutrients. Additionally, the slot opening allows root penetration to the soil below the paver and allows roots to grow between cells, promoting healthier grass. In areas where drainage is critical, Tufftrack increases water runoff capabilities. The Tongue and Groove latching system is another unique feature which provides exceptional stability, longevity, and ease of assembly.

Empty cells have compressive strength of 86,563 lbs.



Unique tongue & groove clips are easier to install

Dare to Compare

Tufftrack™ Grass Pavers are **25% STRONGER** than the competition

Compare the strength of NDS Permeable Pavers to the competition below.

Panel Pavers	Max Load Unfilled (lbs.)	Area (sq. in.)	Max Load (PSI)
NDS Tufftrack™ TT24	86,563	144	601
TrueGrid Pro Plus™	64,361	144	447
TrueGrid Eco™	53,797	144	374
Presto GEOPAVE®	35,682	144	248
Presto GEOBLOCK® 5150	35,220	144	245
AirPave Grass Paver	23,910	144	166

NDS Max load filled cells: 400,000 lbs. (soil)

Pro Plus™ and Eco™ are trademarks of TrueGrid® Pavers. Presto GEOBLOCK® and GEOPAVE® are registered trademarks of Reynolds Presto Products, Inc.

Case Studies – Tufftrack™ Grass Pavers

Union High School

Tulsa, OK

Emergency vehicle lane

When the Tulsa Independent School District prepared to open a new school, the design team needed to incorporate emergency vehicle access roads leading up to the building and athletic facilities. The Tufftrack® Grass Paver was selected for its high compressive strength of 81,744 psf and the flexibility either to sod or seed the area immediately following the 8,000 square foot installation.

Hilton Garden Inn

Elk Grove, CA

Emergency access lane

An emergency access lane needed to be added along the side of the property, but due to the large width of the lane and proximity to the hotel, the owners wanted a solution that would be aesthetically pleasing as well as functional. Tufftrack® Grass Pavers were selected and installed. Twelve years later the site was revisited and inspected. The Tufftrack® base is virtually indistinguishable from the rest of the landscape. The result was, and still is, a highly functional fire lane that can be enjoyed by their guests when not in use.

Installation As Easy As 1-2-3

1

Lay it out

Lay panels out in square or offset pattern over prepared base to cover entire area

2

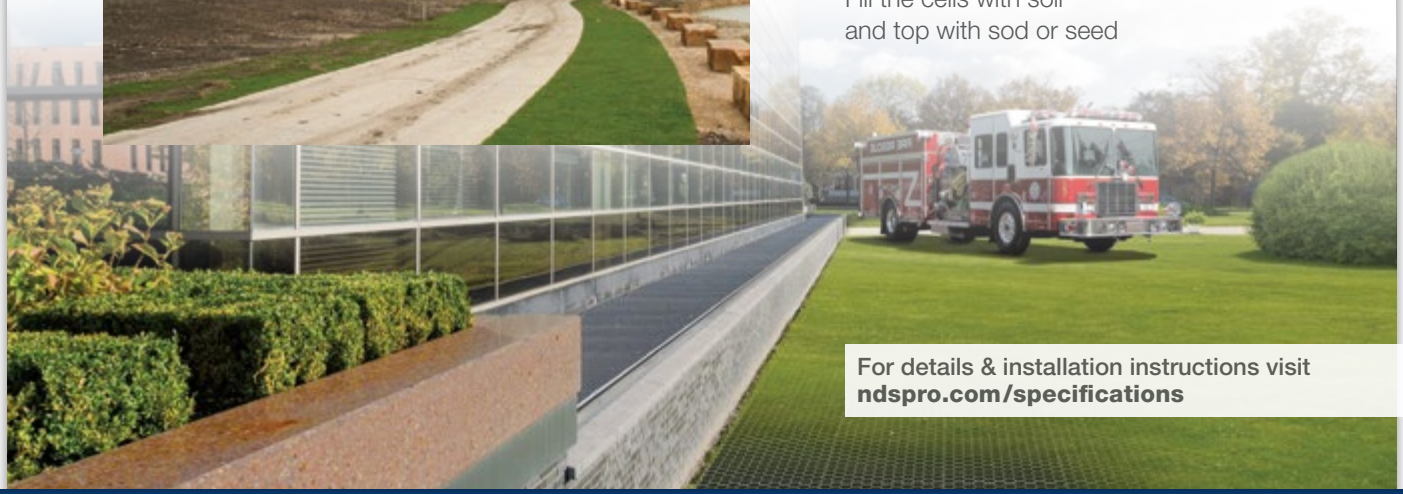
Clip it together

Tongue-and-groove latching system connects easily without special tools to create an integral paver mat

3

Add soil infill

Fill the cells with soil and top with sod or seed



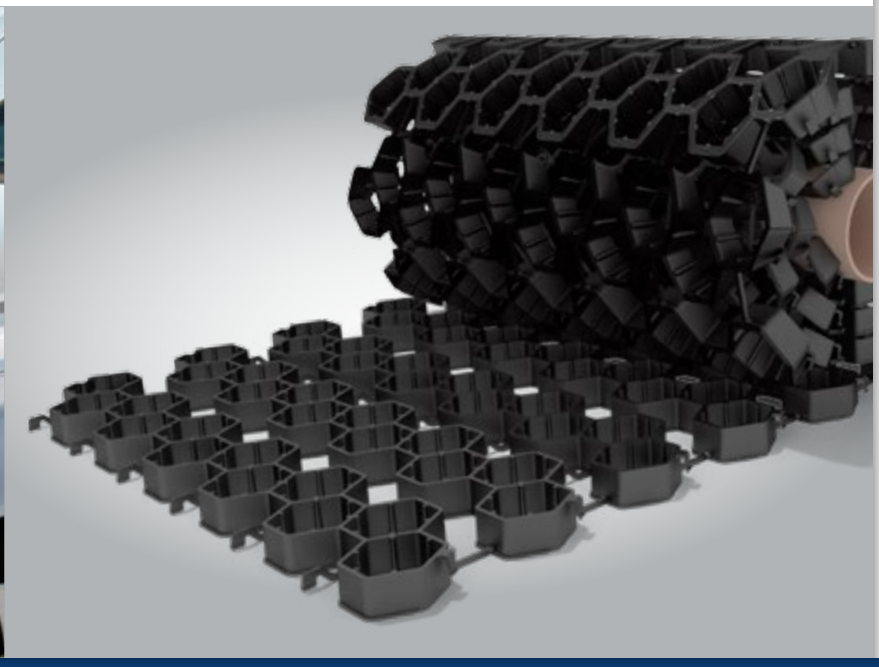
For details & installation instructions visit **ndspro.com/specifications**

EZ Roll™ Grass Pavers

A turf reinforcement, load transferring paving system designed to be placed directly on an engineer specified compacted road base.

This system is designed to transfer vehicle weight directly to the supportive base course and prevent soil compaction. The web of interconnected honeycomb cells provides resistance from vehicular load as well as lateral containment that prevents the soil compaction that would inhibit healthy root growth. This system also provides a porous condition that allows rapid absorption of stormwater. EZ Roll™ Grass Pavers have a compressive strength of 53,683 lbs. in an empty condition and greater than 400,000 lbs. when filled with native top soil. The EZ Roll™ Grass Paver system has been used and accepted across the country for a wide variety of projects including emergency vehicle access purposes.

Additional information, details, and specifications can be found at
http://www.ndspro.com/permeable-pavers/grass-pavers/ez-roll-grass-pavers
For further technical support or assistance, contact: techservice@ndspro.com

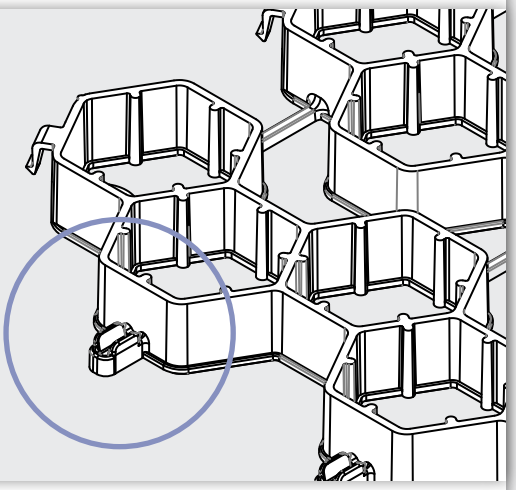


Design Theory

The EZ Roll™ Grass Paver comes in pre-assembled rolls, which means it is easy to roll out, decreasing installation time and increasing efficiency.

EZ Roll™ Grass Paver has been tested for compressive strength at 53,683 lbs. bare product, meaning that EZ Roll™ does not rely on the fill material for load carrying.

Connections between rows of EZ Roll™ are secure due to unique side-to-side and end-to-end clips that minimize the paver mat movement and separation due to lateral and horizontal pressure. These sturdy locking clips prevent paver displacement or mat failure that could result from traffic load movement or changing ground conditions.



Recommended Use

Light Loads:
Golf Cart Paths
Jogging Tracks
Bike Paths
ATV Paths
Equestrian Parks
Trail Reinforcements
Runoff Areas

Medium Loads (occassional traffic):
Roadway Shoulders
Overflow Parking Area
Truck & Cart Wash-Down Areas
RV and Boat Access

Heavy Loads/Fire Lane (occassional traffic):
Emergency Vehicle Access Roads
Service Vehicle Utility Roads

Non-load Applications:
Erosion Control on Slopes (staking recommended)
Erosion Control in Swales (staking recommended)
Semi-Trucks with Trailers

Not Recommended for the Following:
Traffic on slopes exceeding a 10% grade
To support tread driven vehicles
Frequent use traffic, since grass will not have time to recover

The EZ Roll™ Grass Pavers from NDS is the latest and most advanced product of its type on the market. NDS has used its years of experience in the landscaping industry to create a product with all of the most desirable features.

Product Specifications

Material. 100% recycled HDPE plastic (50% pre-consumer 50% post-consumer). HDPE is rugged, flexible and ideally suited for outside exposure and longevity. NDS uses UV inhibitors in the polymer structure to prevent breakdown in the strength of the paver.

Manufacturing. Manufactured in Lindsay, CA.

Recyclability. 100% recyclable. Please recycle whenever possible.

Paver Size. Each 24" x 24" panel contains 72, 2¼" nested hexagonal cells. Panels are integrated with crosslinks and clips to form rolls. Part No. EZ4X24 has dimensions of 4' x 24' per roll and EZ4X150 has dimensions of 4' x 150'. Custom size rolls available upon request.

Paver Details. The top surface of the hexagonal cell walls is smooth and devoid of notches or grooves. The bottom surface of the paver mat has over 80% open area for increased permeability.

Chemical Resistance. EZ Roll™ Pavers have superior chemical resistance and are totally inert.

Compressive Strength (Empty Cells). 53,683 lbs.
Compressive Strength (Native Soil filled Pavers): 400,000 lbs.

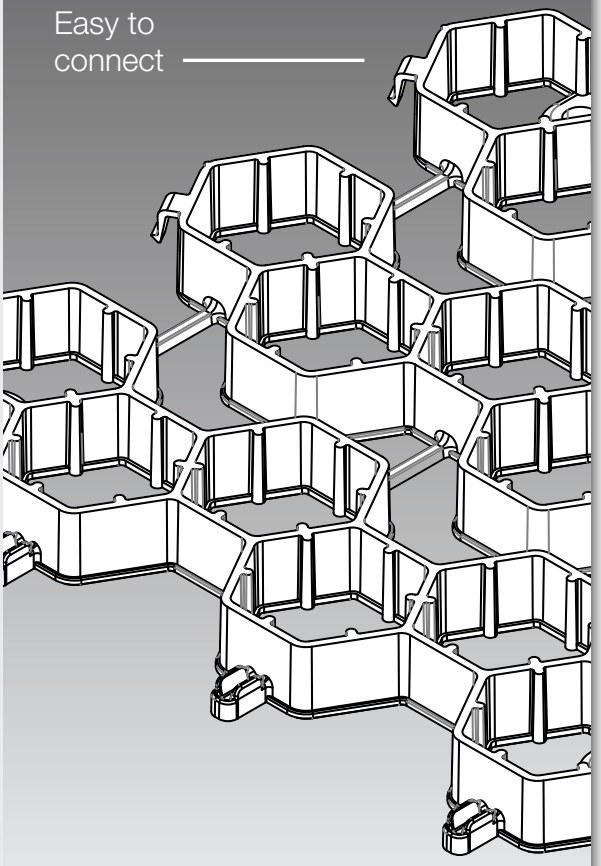
Unique Product Features. EZ Roll™ Pavers feature an easy to install top down locking feature. This locking mechanism allows pavers to be installed quickly and easily.

Empty cells have a compressive strength of

53,683 lbs.

Product ships in large rolls for easy rollout

Easy to connect



Dare to Compare

EZ Roll™ Grass Pavers are **25% STRONGER** than the competition

Compare the strength of NDS Permeable Pavers to the competition below.

Roll Pavers	Max Load Unfilled (lbs.)	Area (sq. in.)	Max Load (PSI)
NDS EZ Roll™	53,683	144	373
ISI GrassPave²	40,623	144	282

NDS Max load for soil-filled cells is 400,000 lbs.

ISI GrassPave² is a registered trademark of Invisible Structures Inc.

Case Studies – EZ Roll™ Grass Pavers

Trump Taj Mahal Casino Resort

Atlantic City, NJ

Fire lane and maintenance access

Access to the building facade was needed for maintenance and to allow access for emergency vehicles. EZ Roll™ was chosen for its strength and flexibility, but also for its aesthetic advantages. The ability to sod directly on top of the product reduced the time needed to seed and wait for growth, while keeping up appearances at the busy casino.

Keller High School

White Settlement, TX

Overflow parking

A new school needed additional parking for their football program and looked to covert a former cow pasture they owned across the street. The solution had to be aesthetically pleasing, cost-effective and demonstrate to the community an ongoing commitment to supporting the environment. The 150,000 sq. ft. project was installed in just 10 days.

Installation As Easy As 1-2-3

1

Roll it out

Manufactured in pre-assembled rolls for fast and easy installation over prepared base

2

Clip it together

Lateral snap-lock system allows rolls to be connected without any special tools

3

Use suitable soil infill and top with sod or seed per local standards

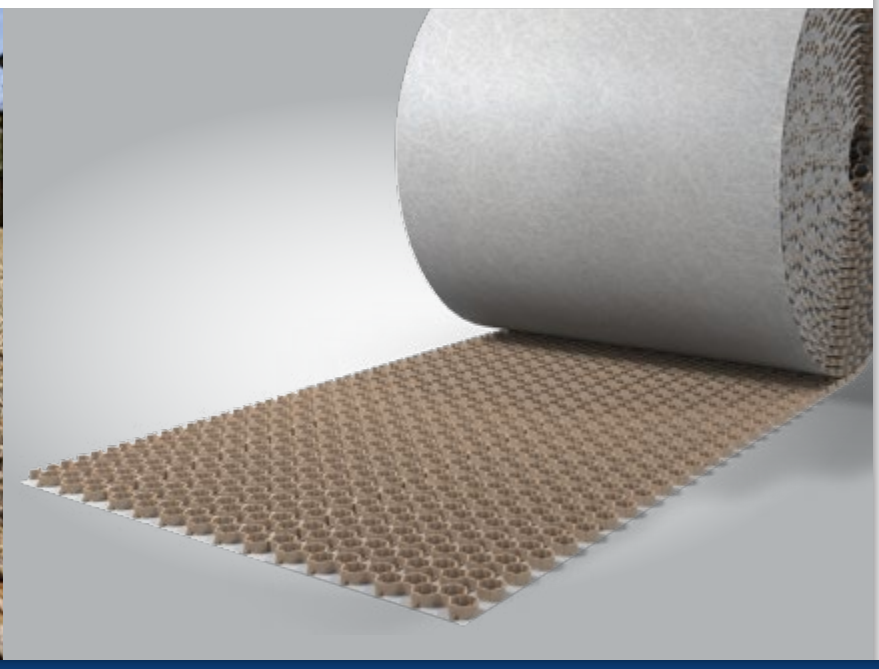
For details & installation instructions visit **ndspro.com/specifications**

EZ Roll™ Gravel Pavers

A turf reinforcement, load transferring paving system designed to be placed directly on an engineer specified compacted road base.

This system is designed to transfer vehicle weight directly to the supportive base course and prevent soil compaction. The web of interconnected honeycomb cells provides resistance from vehicular load as well as lateral containment that prevents soil compaction. This system also provides a porous condition that allows rapid absorption of stormwater. EZ Roll™ Gravel Pavers have a compressive strength of 53,683 lbs. in an empty condition and greater than 500,000 lbs. when filled with gravel. The EZ Roll™ Gravel Paver system has been used and accepted across the country for a wide variety of projects including emergency vehicle access purposes.

Additional information, details, and specifications can be found at
http://www.ndspro.com/permeable-pavers/Gravel-pavers/ez-roll-gravel-pavers
For further technical support or assistance, contact: techservice@ndspro.com

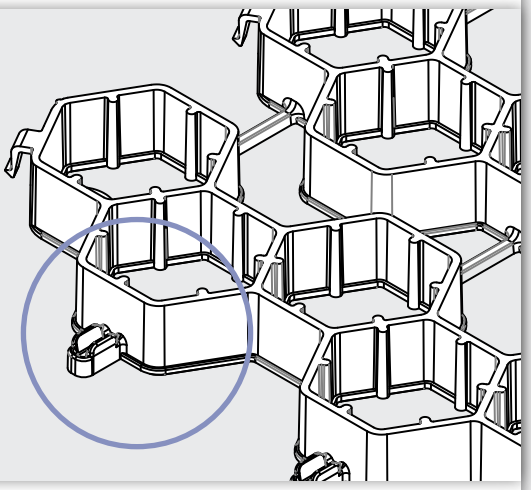


Design Theory

The EZ Roll™ Gravel Paver comes in pre-assembled rolls, which means it is easy to roll out, decreasing installation time and increasing efficiency.

EZ Roll™ Gravel has been tested for compressive strength at 53,683 lbs. bare product, meaning that EZ Roll™ does not rely on the fill material for load carrying.

Connections between rows of EZ Roll™ are secure due to unique side-to-side and end-to-end clips that minimize the paver mat movement and separation due to lateral and horizontal pressure. These sturdy locking clips prevent paver displacement or mat failure that could result from traffic load movement or changing ground conditions.



Recommended Use

Light Loads:
Golf Cart Paths
Jogging Tracks
Bike Paths
ATV Paths
Equestrian Parks
Trail Reinforcements

Medium Loads:
Roadway Shoulders
Residential Driveways
Parking Lots
Overflow Parking Area
Truck & Cart Wash-Down Areas
RV and Boat Access

Heavy Loads/Fire Lane:
Emergency Vehicle Access Roads
Service Vehicle Utility Roads
Equipment Yards
Consult NDS Design Worx during design phase when the intended use is semi trucks with trailers

Non-load Applications:
Erosion Control on Slopes (staking recommended)
Erosion Control in Swales (staking recommended)

Not Recommended for the Following:
Traffic on slopes exceeding a 10% grade
To support tread driven vehicles

The EZ Roll™ Gravel Pavers from NDS is the latest and most advanced product of its type on the market. NDS has used its years of experience in the landscaping industry to create a product with all of the most desirable features.

Product Specifications

Material. 100% recycled HDPE plastic (50% pre-consumer 50% post-consumer). HDPE is rugged, flexible and ideally suited for outside exposure and longevity. NDS uses UV inhibitors in the polymer structure to prevent breakdown in the strength of the paver.

Color. EZ Roll™ Gravel is available in tan, black, brick red, and gray to provide design flexibility.

Manufacturing. Manufactured in Lindsay, CA.

Recyclability. 100% recyclable. Please recycle whenever possible.

Paver Size. Panels are integrated with crosslinks and clips to form rolls. Part No. EZ4X150 has dimensions of 4' x 150' per roll. Custom size rolls available upon request.

Paver Details. The top surface of the hexagonal cell walls is smooth and devoid of notches or grooves. The bottom surface of the paver mat has over 80% open area for increased permeability.

Chemical Resistance. EZ Roll™ Pavers have superior chemical resistance and are totally inert.

Compressive Strength (Empty Cells): 53,683 lbs.
Compressive Strength (Gravel-Filled Pavers): 500,000 lbs.

Unique Product Features. EZ Roll™ Pavers feature an easy to install top down locking feature. This locking mechanism allows pavers to be installed quickly and easily.

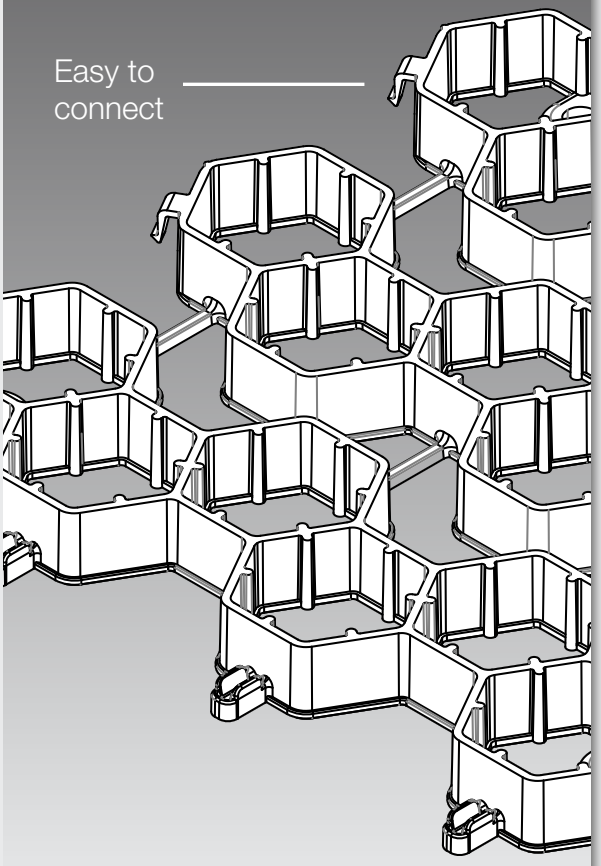
Our fabric is fused to the paver using a proprietary heat-and-pressure-fusion process that is permanent!

Empty cells have a compressive strength of

53,683 lbs.

Product ships in large rolls for easy rollout

Easy to connect



Dare to Compare

EZ Roll™ Gravel Pavers are **25% STRONGER** than the competition

Compare the strength of NDS Permeable Pavers to the competition below.

Roll Pavers	Max Load Unfilled (lbs.)	Area (sq. in.)	Max Load (PSI)
NDS EZ Roll™	53,683	144	373
ISI GravelPave²	35,682	144	248

NDS Max load for gravel-filled cells is 500,000 lbs.

ISI GravelPave² is a registered trademark of Invisible Structures Inc.

Case Studies – EZ Roll™ Gravel Pavers

Dallas Arboretum

Dallas, Texas

Daily parking

The arboretum is a high-profile facility in Dallas that generates critical tourism and income to the area. The busy arboretum needed additional parking to accommodate a predicted rise in traffic volume over the next decade and wanted something that would blend in with the natural surroundings while handling heavy amounts of traffic. They also wanted a permeable solution that could mitigate stormwater runoff. EZ Roll™ Gravel pavers were selected for their strength, durability and ease of installation. The project was completed in two phases totaling 185,000 square feet.

Gastonia Readiness Center

Gastonia, NC

Parking and heavy vehicle access

An Army facility, the Gastonia Readiness Center was adding two separate buildings for soldiers and equipment along with a new parking lot for forty vehicles. The new 16,000 sq. ft. lot needed to supply daily parking, but also function as an emergency access lane capable of supporting the weight of National Guard military vehicles. EZ Roll™ Gravel was selected for its strength, permeability and overall aesthetics.

Installation As Easy As 1-2-3

1

Roll it out

Manufactured in pre-assembled rolls for fast and easy installation over prepared base

2

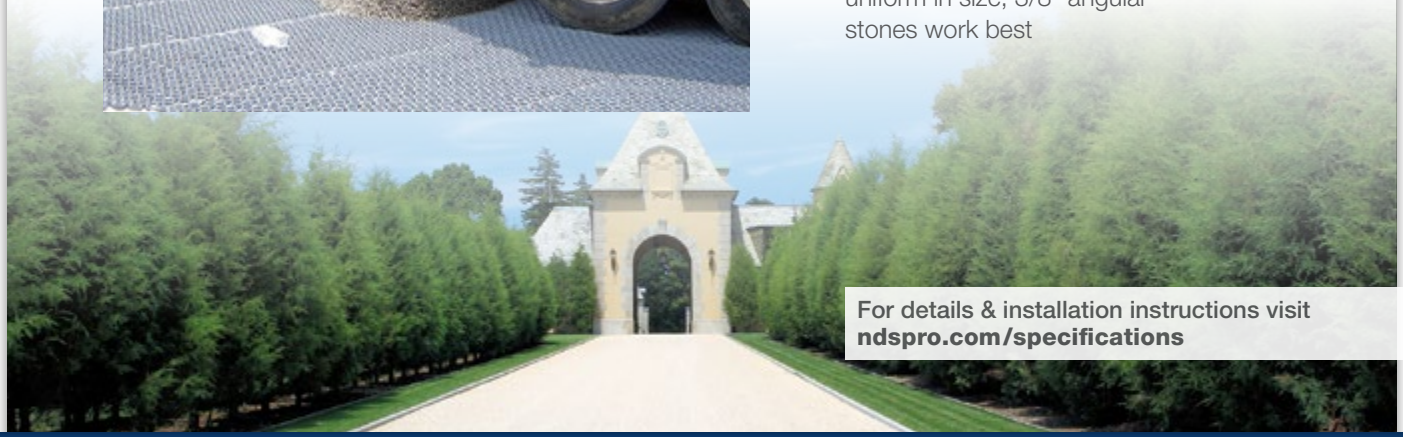
Clip it together

Lateral snap-lock system allows rolls to be connected without any special tools

3

Fill with gravel

Use clean gravel that is uniform in size, 3/8" angular stones work best



For details & installation instructions visit **ndspro.com/specifications**

Contribution to LEED

EZ Roll™ and Tufftrack™ Pavers can be used in a number of categories that contribute points to LEED certification according to LEED v3.

Category: Sustainable Sites

Credit 5.1 Site Development – Protect or Restore Habitat (1 credit):
Conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity.

- To attain this credit, all site disturbances during construction must be limited to within a certain distance from the building perimeter. Use of EZ Roll™ and Tufftrack™ extends the allowed area of site disturbance from 10 ft. to 25 ft., thus providing more area to work during construction.
- EZ Roll™ and Tufftrack™ seeded with native plants in place of asphalt or other non-pervious surfaces will contribute to the overall percentage of habitat restored.
- For projects that qualify for 5.2 (below), use of EZ Roll™ and Tufftrack™ Pavers on a vegetated roof with native or adapted plants can contribute to overall percentage of habitat restored or protected.

Credit 5.2 Site Development – Maximize Open Space (1 credit):
Provide a high ratio of open space to development footprint to promote biodiversity.

- Application of EZ Roll™ and Tufftrack™ provides vegetated open space that will contribute to the open space requirements.
- Use of EZ Roll™ and Tufftrack™ on a vegetated roof can contribute to credit compliance.

Credit 6.1 Stormwater Design – Quantity Control (1 credit):
Limit disruption of natural water hydrology by reducing impervious cover, increasing on-site infiltration, reducing or eliminating pollution from stormwater runoff, and eliminating contaminants.

- EZ Roll™ and Tufftrack™ can be utilized as part of a stormwater management plan as it reduces impervious cover, increases on-site infiltration, and reduces pollution from stormwater runoff.
- EZ Roll™ and Tufftrack™ can be used to maintain a vegetated roof, which will minimize impervious surface area onsite.

Credit 6.2 Stormwater Design – Quality Control (1 credit):
To limit disruption and pollution of natural water flows by managing stormwater runoff.

- EZ Roll™ and Tufftrack™ can be utilized as part of a stormwater management plan as it reduces impervious cover, increases on-site infiltration, and reduces pollution from stormwater runoff.

Credit 7.1 Heat Island Effect – Nonroof (1 credit):
To reduce heat islands to minimize impacts on microclimates and human and wildlife habitats.

- As open grid pavement systems, the use of EZ Roll™ and Tufftrack™ reduces heat absorption and contributes to the overall hardscaped area calculation for this credit.

Credit 7.2 Heat Island Effect – Roof (1 credit):
To reduce heat islands to minimize impacts on microclimates and human and wildlife habitats.

- EZ Roll™ and Tufftrack™ utilized on a vegetated roof can reduce heat absorption.

Category: Materials and Resources

Credit 4.1 Recycled Content: 10% (post-consumer + ½ pre-consumer) (1 credit):
Increase demand for the building products that incorporate recycled content materials, thereby reducing impacts resulting from extraction and processing of virgin materials.

- EZ Roll™ and Tufftrack™ is made from 100% recycled HPPE (approximate blend is 50% post-consumer, 50% pre-consumer material). Utilization of this product will increase the proportion of materials used on site that are recycled, and can contribute towards attainment of this credit.

Credit 4.2 Recycled Content: 20% (post-consumer + ½ pre-consumer) (1 credit):
Increase demand for the building products that incorporate recycled content materials, thereby reducing impacts resulting from extraction and processing of virgin materials.

- As cited in credit 4.1 (above), utilizing EZ Roll™ and Tufftrack™ can contribute to the attainment of this credit, if used in a larger proportion on site relative to the proportion of materials that are not recycled.

NOTES

Permeable Pavers

Reinforced Turf & Gravel Systems

High Performing. Proven Durability. Easy Installation.

Tufftrack™
Grass Paver

EZ Roll™
Grass Paver

EZ Roll™
Gravel Paver

NDS®
We put water in its place

Visit **ndspro.com** for specs, detail drawings and case studies

NDS Customer Service
851 N. Harvard Ave., Lindsay, CA 93247
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Fax: 800.726.1998 · 559.562.4488

ALLEN & MAJOR ASSOCIATES, INC.

Project No.	2562-01	**Sheet**	1 of 1
Project Description	Camp Chickami		
	Wayland, MA		
Calculated By	JG	**Date**	10/29/21
Checked By	BDJ		

Standard # 3: Groundwater Recharge

Proposed recharge system: Permeable Paver Systems

In accordance with *MADEP – Volume 2, Technical Guide for Compliance with Massachusetts Stormwater Management Standards, dated January 2008*

A soils require a Volume to recharge of	**0.60**	**inches**
B soils require a Volume to recharge of	**0.35**	**inches**
C soils require a Volume to recharge of	**0.25**	**inches**
D soils require a Volume to recharge of	**0.10**	**inches**

Impervious area within: A-soils =	3,190	sf	Weighted Groundwater Recharge Depth	=	**0.60**	**in**
Impervious area within: B-soils =	0	sf				
Impervious area within: C-soils =	0	sf				
Impervious area within: D-soils =	0	sf				

Total Site Volume required to be recharged =

3,190 sf x 1" / 12 x 0.60 in = **160** **cf**

Site volume recharge provided by = Volume of Pervious Driveway 1 & 2

Storage Volume of Pervious Driveway 1 = 743 c.f.

Storage Volume of Pervious Driveway 2 = 3,100 c.f.

= **3,843** c.f. Total Volume Recharged > **160** **cf** (OK)

Allen & Major Associates, Inc.		Computation Sheet
Title	***Water Quality Volume Calculation***	By: JG
Project	*Camp Chickami*	Chk'd: BDJ
Location	139 Boston Post Road, Wayland, MA	
Date	11/2/21	

Stormwater Water Quality Volume Table

Impervious Area *= Pavement & Rooftop Area On-Site*

A_{WQ} *= Required Water Quality Treatment Volume, expressed in* ft^3

D_{WQ} *= Water Quality Depth*

A_{IMP} *= Impervious Area*

				Water Quality Volume Required	
Watershed (Pond 1)	**Area (Sq. Ft.)**	**Landscaped**	**Impervious Area (SF)** **HSG A (F=.6)**	D_{WQ} *(Inch)*	A_{WQ}
P-1	10,433	9,884	549	0.5	23
P-2	8,100	6,382	1,718	0.5	72
P-3	36,662	24,240	12,422	0.5	518
P-4	18,077	18,077	0	0.5	0
Total	**73,272**	**58,583**	**14,689**		**612**

ALLEN & MAJOR ASSOCIATES, INC.

Project No.	2562-01	**Sheet**	1
Project Description	Camp Chickami		
	Wayland, MA		
Calculated By	JG	**Date**	10/29/21
Checked By	BDJ		

These calculations provide the TSS removal rate of the stormwater management system for runoff directed to the pervious gravel driveway

Stormwater Management BMP	TSS Removal rate
Pervious Driveway	80%

Average Annual Load	=	100%	
Pervious Driveway	=	80%	Removal Rate
		20%	TSS Load Remains

Percentage of TSS Remaining	-	Initial TSS Load	=	Final TSS Removal Rate
100%	-	20.0%	=	80.0%

For this drainage area, this system as designed will remove an estimated
80% of the annual TSS load and therefore will meet the TSS removal standard.