DRAINAGE REPORT

For

WP East Acquisitions LLC

PROPOSED 308-UNIT
RESIDENTIAL DEVELOPMENT

86 Orchard Hill Park Drive
Leominster, Massachusetts
Worcester County

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BOHLER

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I. EXECUTIVE SUMMARY

This report examines the changes in drainage that can be expected as the result of the development of a proposed 308-unit residential development at 86 Orchard Hill Park Drive in the City of Leominster, Massachusetts. The site, which contains approximately 17.95± acres of land, is undeveloped consisting of wooded areas and wetlands.

The proposed project includes the construction of a new residential development which is anticipated to included nine (9) new apartment buildings and amenities with new paved parking areas, landscaping, storm water management components and associated utilities. This report addresses a comparative analysis of the pre- and post-development site runoff conditions. Additionally, this report provides calculations documenting the design of the proposed stormwater conveyance/management system as illustrated within the accompanying Site Development Plans prepared by Bohler. The project will also provide erosion and sedimentation controls during the demolition and construction periods, as well as long term stabilization of the site.

For the purposes of this analysis the pre- and post-development drainage conditions were analyzed at two (2) "design points" where stormwater runoff currently drains to under existing conditions. These design points are described in further detail in **Section II** below. A summary of the existing and proposed conditions peak runoff rates and volumes for the 2-, 10-, 25-, and 100-year storms can be found in **Table 1.1** below. In addition, the project has been designed to meet or exceed the Stormwater Management Standards as detailed herein.

Table 1.1: Design Point Peak Runoff Rate Summary

Point of Analysis	2-Year Storm			10-Year Storm			25-Year Storm			100-Year Storm		
	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ
DP1	7.02	6.46	**-0.56**	13.42	11.20	**-2.22**	17.54	14.81	**-2.73**	23.96	22.18	**-1.78**
DP2	9.32	8.43	**-0.89**	22.23	16.24	**-5.99**	31.16	21.14	**-10.02**	45.61	43.82	**-1.79**

**Flows are represented in cubic feet per second (cfs)*

II. EXISTING SITE CONDITIONS

Existing Site Description

The subject property is located to the west of the existing Orchard Hill Park retail development and has a total lot area of 19.95± acres of undeveloped land. Most of the site consists of dense woodland with existing wetlands along the eastern property line extending from the northern portion of the site down to the southern property line along Havard Street.

On-Site Soil Information

Soils within the analyzed area consist of the following as classified by the Natural Resource Conservation Service (NRCS):

Table 2.1: Existing Soil Information

Soil Unit Symbol	Soil Name / Description	Hydrologic Soil Group (HSG)
71B	Ridgebury fine sandy loam (extremely stony)	D
73A	Whitman fine sandy loam	D
305B	Paxton fine sandy loam	C
306B/C	Paxton fine sandy loam (Very stony)	C
312B	Woodbridge fine sandy loam (Extremely stony)	C/D
421B	Canton fine sandy loam (Very stony)	B
422C	Canton fine sandy loam (Extremely stony)	B

Existing Collection and Conveyance

The northern portions of the site drain to the east into the existing wetland and into the Orchard Hill Park Drive municipal drainage system. The southern portions of the site drain to the east into the existing wetland and into the Harvard Street municipal drainage system. Slopes on the site range from 2%-30% with on-site elevations ranging from 416 adjacent to Orchard Hill Park Drive to 492 at the western most point of the property adjacent to the existing residential area.

Existing Watersheds and Design Point Information

For the purposes of this analysis, the pre- and post-development drainage conditions were analyzed at two (2) “design points” as described below where stormwater runoff currently drains to under existing conditions. The existing site was subdivided into two (2) separate sub catchments, as described below, to analyze existing and proposed flow rates at each design point. The minimum time of concentration for all proposed areas is calculated as 6 minutes (0.1 hr).

Design Point #1 (DP1) is the southwest wetland adjacent to Harvard Street. Under existing conditions, this design point receives stormwater flows from approximately 6.0 acres of land, designated as watershed “EX1”. Refer to Table 2.1 below for additional detail.

Design Point #2 (DP2) is the existing wetland along the eastern most point of the property adjacent to Orchard Hill Park Drive. Under existing conditions, this design point receives

stormwater flows from approximately 13.4 acres of land, designated as watershed “EX2”. Refer to Table 2.1 below for additional detail.

Table 2.2: Existing Sub-Catchment Summary

Sub-catchment Name	Total Area (acres)	Cover Description	Curve Number (CN)	Time of Concentration (Tc, minutes)
EX1.1	6.0±	Wetlands, wooded area	83	21.8
EX2.1	13.4±	Wetlands, wooded area	73	19.0

Refer to **Table 1.1, and 5.1** for the existing conditions peak rates of runoff. Refer to **Appendix D** and the Drainage Area Maps in the appendices of this report for a graphical representation of the existing drainage areas.

III. PROPOSED SITE CONDITIONS

Proposed Development Description

The proposed project consists of the construction of nine (9) new residential apartments with associated amenities, paved parking areas, landscaping, utilities, and stormwater management systems. The site has been designed to drain to deep-sump, hooded catch basins and/or bioretention areas before entering either a subsurface detention basin, above ground infiltration basin, or one of two above ground bioretention basins. Pretreatment of stormwater runoff prior to infiltration is achieved by combination of the deep-sump, hooded catch basins and proprietary treatment units prior to discharge into the proposed basins. Rooftop runoff has been designed to flow to the basins as well.

Proposed Development Collection and Conveyance

Deep sump hooded catch basins are proposed to collect and route runoff from the paved parking areas to the proposed surface and underground basins. Pipes have been designed for the 25-year storm using Storm Sewers by Hydraflow Software/Rational Method. Pipe, inlet, and outlet protection sizing calculations are included in **Appendix F**.

The best management practices (BMPs) incorporated into the proposed stormwater management system have been designed to meet, or exceed, the standards set forth in the Massachusetts Department of Environmental Protection Stormwater Handbook standards. Refer to **Section V** for additional information.

Proposed Watersheds and Design Point Information

The project has been designed to maintain existing drainage watersheds to the greatest extent possible, with the same design points described in **Section II** above. The site was subdivided into ten (10) separate sub catchments for the proposed conditions as described below. The minimum time of concentration for all proposed areas is calculated as 6 minutes (0.1 hr).

Under proposed conditions DP#1 receives stormwater flows from approximately 5.9 acres of land, designated as watershed “PD1”, “PD2”. “PD3”, and “PD4”. Refer to Table 3.1 below for additional detail.

Under proposed conditions DP#2 receives stormwater flows from approximately 13.5 acres of land, designated as watershed “PD5”, “PD6”, “PD7”, “PD8”, “PD9”, and “PD10”. Refer to Table 3.1 below for additional detail.

Table 3.1: Proposed Sub-catchment Summary

Sub-catchment Name	Total Area (acres)	Cover Description	Curve Number (CN)	Time of Concentration (Tc, minutes)	Hydrologic Routing
PD1	4.2±	Paved parking, grass, woods, wetlands	87	21.8	DP#1
PD2	0.6±	Rooftops, paved parking, grass, basin bottom	90	6.0	Basin #1 / DP#1
PD3	0.5±	Rooftops, paved parking, grass, rooftops	96	6.0	Basin #2 / DP#1
PD4	0.6±	Paved parking, grass, basin bottom	91	6.0	Basin #3 / DP#1
PD5	1.8±	Rooftops, paved parking, grass, woods	88	6.0	Basin #4 / DP#2
PD6	1.9±	Rooftops, paved parking, grass	91	6.0	Basin #5 / DP#2
PD7	1.6±	Rooftops, paved parking, grass, woods	91	6.0	Basin #6 / DP#2
PD8	2.5±	Rooftops, paved parking, grass, woods	85	6.0	Basin #7 / DP#2
PD9	1.5±	Rooftops, paved parking, grass, basin bottom	91	6.0	Basin #8 / DP#2
PD10	4.3±	Rooftops, paved parking, grass, woods, wetlands	85	15.7	DP#2

Refer to **Table 1.1 and 6.1** for the calculated proposed conditions peak rates of runoff. For additional hydrologic information, refer to **Appendix D** and the Drainage Area Maps in the appendices of this report for a graphical representation of the proposed drainage areas.

IV. METHODOLOGY

Peak Flow Calculations

Methodology utilized to design the proposed stormwater management system includes compliance with the guidelines set forth in the latest edition of the Massachusetts DEP Stormwater Handbook. The pre- and post-development runoff rates being discharged from the site were computed using the HydroCAD computer program. The drainage area and outlet information were entered into the program, which routes storm flows based on NRCS TR-20 and TR-55 methods. The other components of the model were determined following standard NRCS procedures for Curve Numbers (CNs) and times of concentrations documented in the appendices of this report. The rainfall data utilized and listed below in table 4.1 below for stormwater calculations is based on NOAA. Refer to **Appendix F** for more information

Table 4.1: Leominster, MA NOAA Rainfall Intensities

Frequency	2 year	10 year	25 year	100 year
Rainfall* (inches)	3.12	4.74	5.75	7.31

Values derived from NOAA ATLAS on 03/05/2025

The proposed stormwater management as designed will provide a decrease in peak rates of runoff from the proposed facility for the 2-, 10-, 25- and 100-year design storm events. Additionally, the proposed project meets, or exceeds, the MADEP Stormwater Management standards. Compliance with these standards is described further below.

V. STORMWATER MANAGEMENT STANDARDS

Standard #1: No New Untreated Discharges

The project has been designed so that proposed impervious areas shall be collected and passed through the proposed drainage system for treatment prior to discharge.

Standard #2: Peak Rate Attenuation

As outlined in **Table 1.1** and **Table 6.1**, the development of the site and the proposed stormwater management system, have been designed so that post-development peak rates of runoff are below pre-development conditions for the 2-, 10-, 25- and 100-year storm events at all design points.

Standard #3: Recharge

The stormwater runoff from the project will be collected and diverted to an above bioretention basin, an underground detention basin, or a proposed infiltration basin. The project as proposed will involve the creation of 331,753 square feet of new impervious area. The southern portion of the site consisting entirely of C and D soils. Accordingly, recharge is not practical on the south side of the site and is collected and diverted to the detention and bioretention basins. The impervious area within the northern portion of the site consisting of B, C and D soils and portions of runoff from these areas will be diverted to a proposed infiltration basin which will provide the requisite groundwater recharge. The project proposes 117,873 square feet of new impervious area within the northern portion of the site and is required to infiltrate 2,650 cubic feet of stormwater as defined in Stormwater Standard 3. The proposed infiltration basin will provide 2,836 cubic feet of volume below the lowest outlet for groundwater recharge. Refer to **Appendix F** of this report for calculations documenting required and provided recharge volumes.

The DEP Stormwater Standards require that the infiltration BMP drains completely within 72 hours of the end of the storm event. Calculations showing that the proposed infiltration basin will drain within 71.4 hours are included in **Appendix F** of this report.

A four (4) foot separation to estimated seasonal high groundwater is provided and a groundwater mounding analysis is not required.

Standard #4: Water Quality

Water quality treatment is provided via a combination of some of the following: deep sump catch basins, water quality units, filtered bioretention, extended dry detention basins, and an infiltration basin. TSS removal calculations are included in **Appendix F** of this report. The project as proposed will involve the creation of 331,753 square feet of new impervious area and is required to treat 27,646 cubic feet of water quality volume as defined in Stormwater Standard 4. The proposed methods of treatment provide 90,279 cubic feet of water quality volume below the lowest outlet for water quality treatment. Refer to **Appendix F** of this report for calculations documenting required and provided water quality volumes.

Standard #5: Land Use with Higher Potential Pollutant Loads

The proposed project involves “Land Uses with Higher Potential Pollutant Loads”. Accordingly, the stormwater management system includes an oil-grit separator (Stormceptor unit) prior to discharge. In addition, the project will provide 88% TSS removal prior to infiltration and treat the 1.0 in water quality depth, as further illustrated in **Appendix E** of this report.

Standard #6: Critical Areas

Not applicable for this project.

Standard #7: Redevelopment

Not applicable for this project.

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

The proposed project will provide construction period erosion and sedimentation controls as indicated within the site plan set provided for this project. This includes a proposed construction exit, protection for stormwater inlets, protection around temporary material stock piles and various other techniques as outlined on the erosion and sediment control sheets. Additionally, the project

is required to file a Notice of Intent with the US EPA and implement a Stormwater Pollution Prevention Plan (SWPPP) during the construction period. The SWPPP will be prepared prior to the start of construction and will be implemented by the site contractor under the guidance and responsibility of the project's proponent. Refer to **Appendix H**.

Standard #9: Operation and Maintenance Plan (O&M Plan)

An Operation and Maintenance (O&M) Plan for this site has been prepared and is included in **Appendix G** of this report. The O&M Plan outlines procedures and time tables for the long term operation and maintenance of the proposed site stormwater management system, including initial inspections upon completion of construction, and periodic monitoring of the system components, in accordance with established practices and the manufacturer's recommendations. The O&M Plan includes a list of responsible parties.

Standard #10: Prohibition of Illicit Discharges

The proposed stormwater system will only convey allowable non-stormwater discharges (firefighting waters, irrigation, air conditioning condensates, etc.) and will not contain any illicit discharges from prohibited sources. An Illicit Discharge Statement is included in **Appendix G** of this report.

VI. SUMMARY

In summary, the proposed stormwater management system illustrated on the drawings prepared by Bohler results in a reduction in peak rates of runoff from the subject site when compared to pre-development conditions for the 2-, 10-, 25- and 100-year storm frequencies. In addition, the proposed best management practices will result in an effective removal of total suspended solids from the post-development runoff. The pre-development versus post-development stormwater discharge comparison is contained in **Table 6.1** below:

Table 6.1: Design Point Peak Runoff Rate Summary

Point of Analysis	2-Year Storm			10-Year Storm			25-Year Storm			100-Year Storm		
	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ
DP1	7.02	6.46	**-0.56**	13.42	11.20	**-2.22**	17.54	14.81	**-2.73**	23.96	22.18	**-1.78**
DP2	9.32	8.43	**-0.89**	22.23	16.24	**-5.99**	31.16	21.14	**-10.02**	45.61	43.82	**-1.79**

**Flows are represented in cubic feet per second (cfs)*

As outlined in the table above, the proposed stormwater management system as designed will provide a decrease in peak rates of runoff from the proposed facility for the 2-, 10-, 25- and 100-year storm events. Additionally, the project meets or exceeds the MADEP Stormwater Management Standards as described further herein.

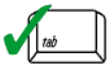
APPENDIX A: MASSACHUSETTS STORMWATER MANAGEMENT CHECKLIST

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): _____

Standard 1: No New Untreated Discharges

- ☒ No new untreated discharges
- ☒ Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- ☐ Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

☒ Site is comprised solely of C and D soils and/or bedrock at the land surface

☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000

☐ Solid Waste Landfill pursuant to 310 CMR 19.000

☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

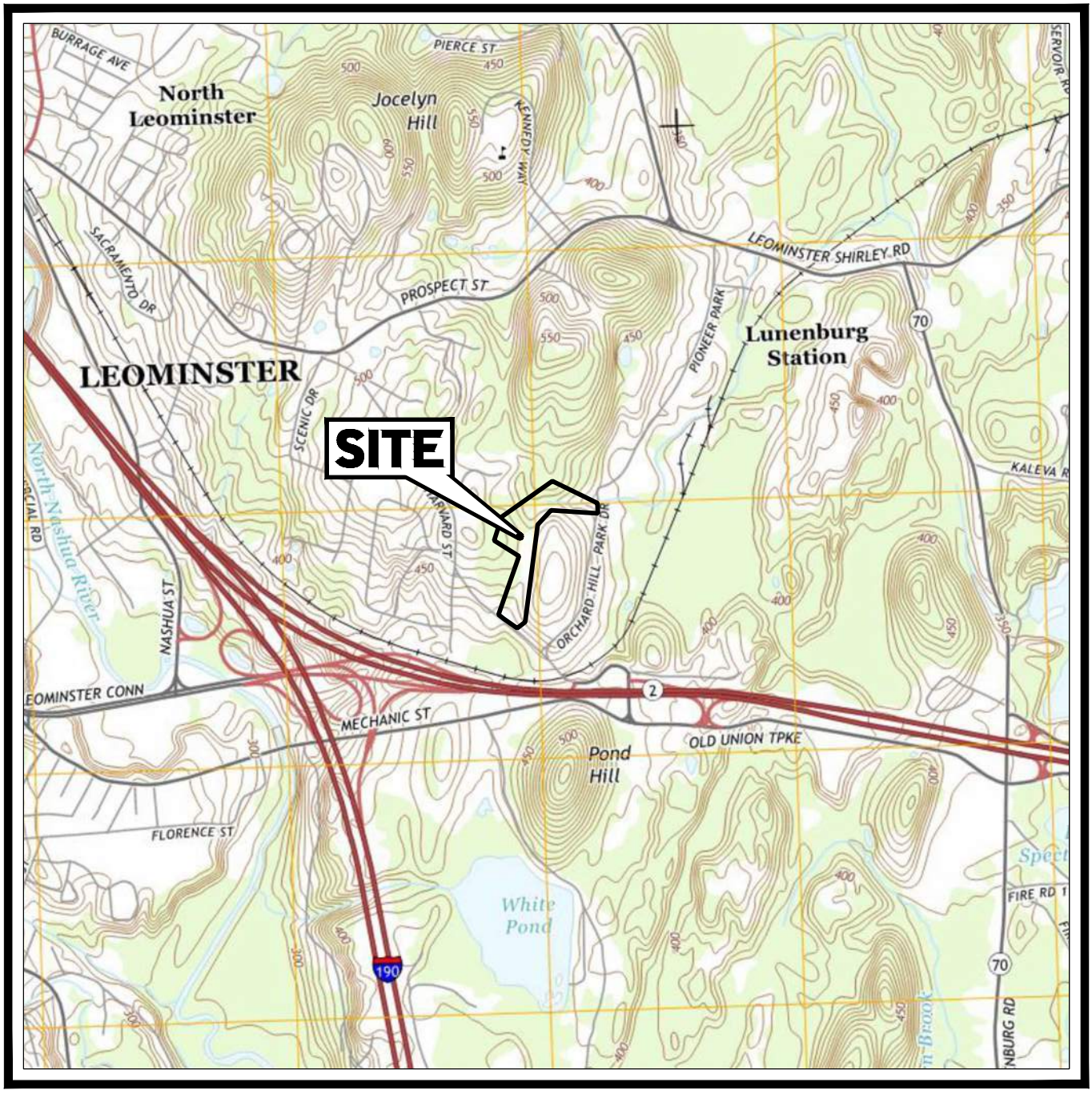
☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;

☐ An Illicit Discharge Compliance Statement is attached;

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

APPENDIX B: PROJECT LOCATION MAPS

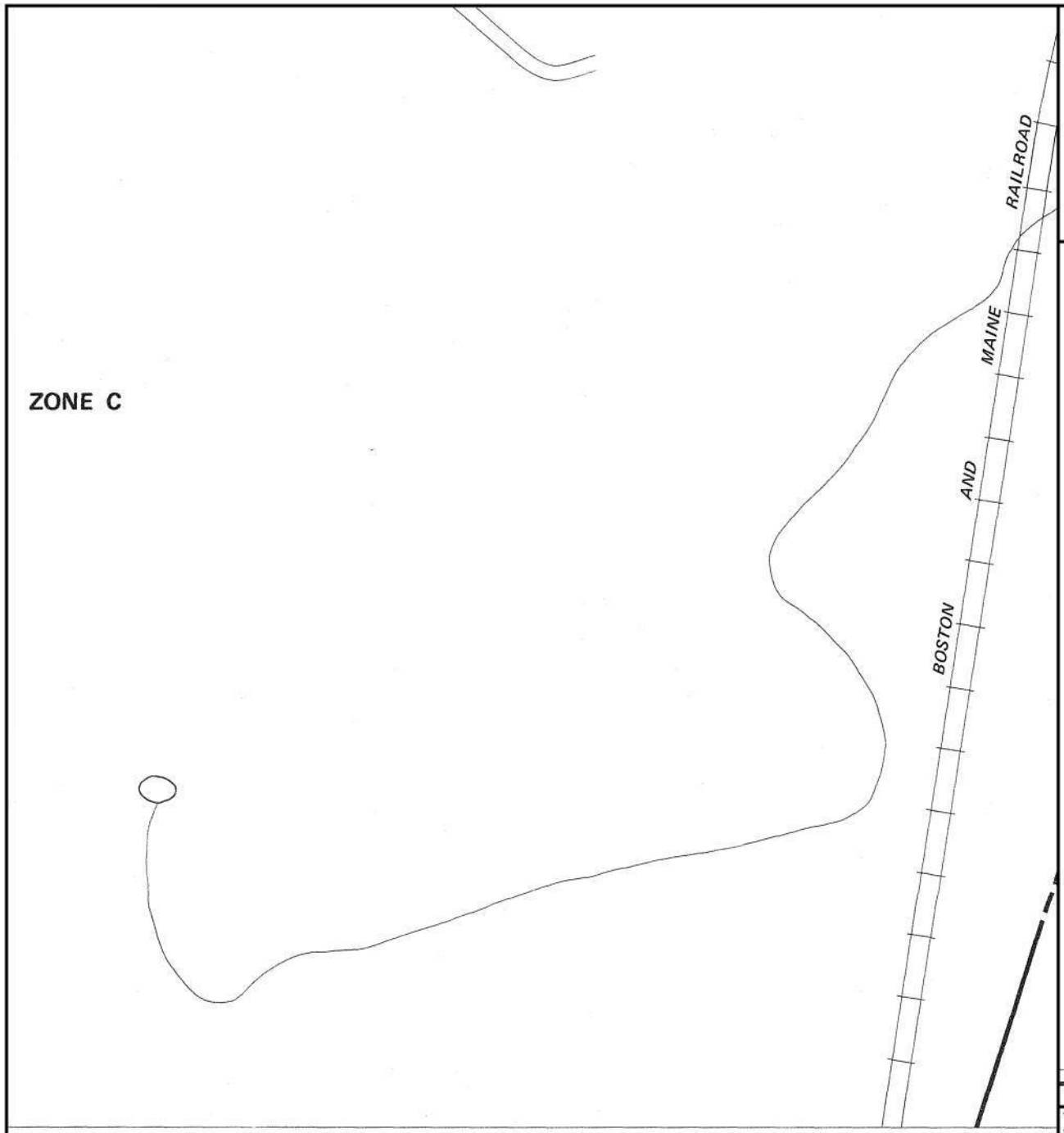
- *USGS MAP*
- *FEMA FIRMETTE*



USGS MAP

SCALE: 1" = 2,000'

SOURCE: USGS SHIRLEY QUADRANGLE



APPROXIMATE SCALE

400 0 400 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

CITY OF
LEOMINSTER,
MASSACHUSETTS
WORCESTER COUNTY

PANEL 4 OF 10
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
250314 0004 B

EFFECTIVE DATE:
SEPTEMBER 16, 1982

Federal Emergency Management Agency

APPENDIX C: SOIL AND WETLAND INFORMATION

- *NCRS CUSTOM SOIL RESOURCE REPORT*
- *REPORT OF GEOTECHNICAL INVESTIGATION*

Commonwealth of Massachusetts
City/Town of Leominster

Soil Suitability Assessment for Stormwater

A. Facility Information

WP Acquistions East, LLC
Owner Name

86 Orchard Hill Park Drive
Street Address

Map 386, Block 4, Lot 1C
Map/Lot #

Leominster
City

MA
State

01453
Zip Code

B. Site Information

2. Soil Survey — NRCS Web Soil Survey
Source

1. 312B
2. 71B
3. 421B
4. 306C
Soil Map Unit

1. Woodbridge Fine Sandy Loam
2. Ridgebury Fine Sandy Loam
3. Canton Fine Sandy Loam
4. Paxton Fine Sandy Loam
Soil Series

Drumlin
Landform

Potential High Groundwater, Potential Slow Permeability
Soil Limitations

Glacial Till
Soil Parent material

3. Surficial Geological Report — 2018
Year Published/Source

Thick Till
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:
Wetland Type

7. Current Water Resource Conditions (USGS): July 2025
Month/Day/ Year
Range: ☐ Above Normal ☐ Normal ☒ Below Normal

8. Other references reviewed:
(Zone II, IWPA, Zone A, EEA Data Portal, etc.)

Commonwealth of Massachusetts
City/Town of Leominster

Soil Suitability Assessment for Stormwater

C. On-Site Review

Deep Observation Hole Number: 725-1 (Hole #) | July 10, 2025 (Date) | 8:00 AM (Time) | 70° Rainy (Weather) | 42°31'42"N (Latitude) | 71°42'46"W (Longitude)

1. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Mostly Hardwoods (Vegetation) | Some Surface Stones & Stone Walls (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 5-10% (Slope (%))

Description of Location: See Attached Sketch

2. Soil Parent Material: Glacial Till | Drumlin (Landform) | See Attached Sketch (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body N/A feet | Drainage Way 95± feet | Wetlands 75± feet | Property Line 40± feet | Drinking Water Well N/A feet | Other N/A feet

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

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth to Weeping in Hole _____ Depth to 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			
0-12	A	Fine Sandy Loam	10YR 2/2		Cnc : Dpl:		5%	<2%	granular	friable	
12-24	Bw	Fine Sandy Loam	10YR 6/2	@18"	Cnc : Dpl:		5%	<2%	massive	friable	
24-33	C1	Loamy Fine Sand	2.5Y 6/1		Cnc : Dpl:		5%	10%	massive	friable	
33-84	C2	Fine Sandy Loam	2.5Y 7/1		Cnc : Dpl:		10%	5%	massive	firm	pockets of very fine sand and pockets of compacted silt
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of Leominster

Soil Suitability Assessment for Stormwater

C. On-Site Review

Deep Observation Hole Number: 725-2 (Hole #) | July 10, 2025 (Date) | 8:45 AM (Time) | 70° Rainy (Weather) | 42°31'42"N (Latitude) | 71°42'54"W (Longitude)

1. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Mostly Hardwoods (Vegetation) | Some Surface Stones & Stone Walls (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 5-10% (Slope (%))

Description of Location: See Attached Sketch

2. Soil Parent Material: Glacial Till | Drumlin (Landform) | See Attached Sketch (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body N/A feet | Drainage Way 85± feet | Wetlands 70± feet | Property Line >50 feet | Drinking Water Well N/A feet | Other N/A feet

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

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth to Weeping in Hole _____ Depth to 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			
0-6	A	Fine Sandy Loam	10YR 2/2		Cnc : Dpl:		<2%	<2%	granular	friable	
6-14	Bw	Loamy Fine Sand	10YR 5/6		Cnc : Dpl:		5%	<2%	massive	friable	
14-30	C1	Loamy Fine Sand	2.5Y 6/1	@26"	Cnc : Dpl:		5%	<2%	massive	friable	
30-96	C2	Fine Sandy Loam	2.5Y 6/2		Cnc : Dpl:		10%	5%	massive	firm	compacted pockets of silt
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of Leominster

Soil Suitability Assessment for Stormwater

D. Determination of High Groundwater Elevation

1. Method Used (Choose one):

	Obs. Hole # 725-1	Obs. Hole # 725-2
☒ Depth to soil redoximorphic features	18" inches	26" inches
☐ Depth to observed standing water in observation hole	_____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_____ Index Well Number

_____ Reading Date

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

Commonwealth of Massachusetts
City/Town of Leominster

Soil Suitability Assessment for Stormwater

C. On-Site Review

Deep Observation Hole Number: 725-3 (Hole #) | July 10, 2025 (Date) | 9:45 AM (Time) | 70° Rainy (Weather) | 42°31'28"N (Latitude) | 71°43'00"W (Longitude)

1. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Mostly Hardwoods (Vegetation) | Some Surface Stones & Stone Walls (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 5-10% (Slope (%))

Description of Location: See Attached Sketch

2. Soil Parent Material: Glacial Till | Drumlin (Landform) | See Attached Sketch (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body N/A feet | Drainage Way N/A feet | Wetlands 40± feet | Property Line >50 feet | Drinking Water Well N/A feet | Other N/A feet

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

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth to Weeping in Hole _____ Depth to 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			
0-12	A	Fine Sandy Loam	10YR 2/2		Cnc : Dpl:		<2%	<2%	granular	friable	
12-22	Bw	Fine Sandy Loam	10YR 5/6		Cnc : Dpl:		5%	<2%	massive	friable	
22-33	C1	Sandy Loam	2.5Y 6/3		Cnc : Dpl:		10%	<2%	massive	friable	
33-46	C2	Loamy Fine Sand	2.5Y 7/2	@38"	Cnc : Dpl:		10%	<2%	massive	friable	
46-84	C3	Fine Sandy Loam	2.5Y 5/2		Cnc : Dpl:		15%	10%	massive	firm	
84-96	C4	Silt Loam	2.5Y 6/2		Cnc : Dpl:		10%	5%	massive	firm	compacted pockets of silt

Additional Notes:

Commonwealth of Massachusetts
City/Town of Leominster

Soil Suitability Assessment for Stormwater

C. On-Site Review

Deep Observation Hole Number: 725-4 (Hole #) | July 10, 2025 (Date) | 10:15 AM (Time) | 70° Rainy (Weather) | 42°31'31"N (Latitude) | 71°42'58"W (Longitude)

1. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Mostly Hardwoods (Vegetation) | Some Surface Stones & Stone Walls (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 5-10% (Slope (%))

Description of Location: See Attached Sketch

2. Soil Parent Material: Glacial Till | Drumlin (Landform) | See Attached Sketch (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body N/A feet | Drainage Way N/A feet | Wetlands 40± feet | Property Line >50 feet | Drinking Water Well N/A feet | Other N/A feet

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

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth to Weeping in Hole _____ Depth to 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			
0-7	A	Fine Sandy Loam	10YR 2/2		Cnc : Dpl:		10%	10%	granular	friable	
7-24	Bw	Sandy Loam	10YR 5/6		Cnc : Dpl:		10%	10%	massive	friable	
24-46	C1	Loamy Fine Sand	2.5Y 7/2	@40"	Cnc : Dpl:		20%	20%	massive	friable	
46-96	C2	Fine Sandy Loam	2.5Y 6/2		Cnc : Dpl:		10%	10%	massive	firm	
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of Leominster

Soil Suitability Assessment for Stormwater

D. Determination of High Groundwater Elevation

1. Method Used (Choose one):

	Obs. Hole # 725-3	Obs. Hole # 725-4
☒ Depth to soil redoximorphic features	38" inches	40" inches
☐ Depth to observed standing water in observation hole	_____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_____ Index Well Number

_____ Reading Date

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

Commonwealth of Massachusetts
City/Town of Leominster

Soil Suitability Assessment for Stormwater

C. On-Site Review

Deep Observation Hole Number: 725-5 (Hole #) | July 10, 2025 (Date) | 11:15 AM (Time) | 70° Rainy (Weather) | 42°31'34"N (Latitude) | 71°42'58"W (Longitude)

1. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Mostly Hardwoods (Vegetation) | Some Surface Stones & Stone Walls (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 5-10% (Slope (%))

Description of Location: See Attached Sketch

2. Soil Parent Material: Glacial Till | Drumlin (Landform) | See Attached Sketch (Position on Landscape (SU, SH, BS, FS, TS, Plain))

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

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

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth to Weeping in Hole _____ Depth to 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			
0-8	A	Fine Sandy Loam	10YR 2/2		Cnc : Dpl:		<2%	<2%	granular	friable	
8-13	Bw	Sandy Loam	10YR 5/6		Cnc : Dpl:		<2%	<2%	massive	friable	
13-36	C1	Sandy Loam	2.5Y 6/3	@30"	Cnc : Dpl:		10%	10%	massive	firm	
36-84	C2	Fine Sandy Loam / Silt Loam	2.5Y 6/2		Cnc : Dpl:		10%	10%	massive	firm	compacted pockets of silt
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of Leominster

Soil Suitability Assessment for Stormwater

C. On-Site Review

Deep Observation Hole Number: 725-6 (Hole #) | July 10, 2025 (Date) | 12:00 PM (Time) | 70° Rainy (Weather) | 42°31'38"N (Latitude) | 71°42'58"W (Longitude)

1. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Mostly Hardwoods (Vegetation) | Some Surface Stones & Stone Walls (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 5-10% (Slope (%))

Description of Location: See Attached Sketch

2. Soil Parent Material: Glacial Till | Drumlin (Landform) | See Attached Sketch (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body N/A feet | Drainage Way N/A feet | Wetlands 90± feet | Property Line 100± feet | Drinking Water Well N/A feet | Other N/A feet

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

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth to Weeping in Hole _____ Depth to 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	A	Fine Sandy Loam	10YR 2/2		Cnc : Dpl:		5%	<2%	granular	friable	
4-14	Bw	Sandy Loam	10YR 5/6		Cnc : Dpl:		5%	<2%	massive	friable	
14-46	C1	Sandy Loam	2.5Y 6/3	@23"	Cnc : Dpl:		10%	10%	massive	firm	
46-84	C2	Fine Sandy Loam / Silt Loam	2.5Y 6/2		Cnc : Dpl:		10%	10%	massive	firm	compacted pockets of silt
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of Leominster

Soil Suitability Assessment for Stormwater

D. Determination of High Groundwater Elevation

1. Method Used (Choose one):

	Obs. Hole # 725-5	Obs. Hole # 725-6
☒ Depth to soil redoximorphic features	30" inches	23" inches
☐ Depth to observed standing water in observation hole	_____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_____ Index Well Number

_____ Reading Date

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

Commonwealth of Massachusetts
City/Town of Leominster

Soil Suitability Assessment for Stormwater

C. On-Site Review

Deep Observation Hole Number: 725-7 (Hole #) | July 10, 2025 (Date) | 12:30 PM (Time) | 70° Rainy (Weather) | 42°31'39"N (Latitude) | 71°42'57"W (Longitude)

1. Land Use: Woodland (e.g., woodland, agricultural field, vacant lot, etc.) | Mostly Hardwoods (Vegetation) | Some Surface Stones & Stone Walls (Surface Stones (e.g., cobbles, stones, boulders, etc.)) | 5-10% (Slope (%))

Description of Location: See Attached Sketch

2. Soil Parent Material: Glacial Till | Drumlin (Landform) | See Attached Sketch (Position on Landscape (SU, SH, BS, FS, TS, Plain))

3. Distances from: Open Water Body N/A feet | Drainage Way 135± feet | Wetlands 100± feet | Property Line 120± feet | Drinking Water Well N/A feet | Other N/A feet

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

5. Groundwater Observed: ☐ Yes ☒ No If yes: _____ Depth to Weeping in Hole _____ Depth to 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			
0-6	A	Fine Sandy Loam	10YR 2/2		Cnc : Dpl:		<2%	<2%	granular	friable	
6-24	Bw	Sandy Loam	10YR 5/6		Cnc : Dpl:		5%	<2%	massive	friable	
24-48	C1	Sandy Loam	2.5Y 6/3	@36"	Cnc : Dpl:		10%	5%	massive	firm	
48-84	C2	Fine Sandy Loam / Silt Loam	2.5Y 6/2		Cnc : Dpl:		10%	5%	massive	firm	compacted pockets of silt
					Cnc : Dpl:						
					Cnc : Dpl:						

Additional Notes:

Commonwealth of Massachusetts
City/Town of Leominster

Soil Suitability Assessment for Stormwater

D. Determination of High Groundwater Elevation

1. Method Used (Choose one):	Obs. Hole # 725-7	Obs. Hole # _____
☒ Depth to soil redoximorphic features	36" inches	_____ inches
☐ Depth to observed standing water in observation hole	_____ inches	_____ inches
☐ Depth to adjusted seasonal high groundwater (S_h) (USGS methodology)	_____ inches	_____ inches

_____ Index Well Number

_____ Reading Date

$S_h = S_c – [S_r \times (OW_c – OW_{max})/OW_r]$

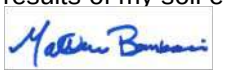
Obs. Hole/Well# _____ S_c _____ S_r _____ OW_c _____ OW_{max} _____ OW_r _____ S_h _____

Commonwealth of Massachusetts
City/Town of Leominster

Soil Suitability Assessment for Stormwater

F. Certification

I certify that I am currently approved by the Department of Environmental Protection pursuant to 310 CMR 15.017 to conduct soil evaluations and that the above analysis has been performed by me consistent with the required training, expertise and experience described in 310 CMR 15.017. I further certify that the results of my soil evaluation, as indicated in the attached Soil Evaluation Form, are accurate and in accordance with 310 CMR 15.100 through 15.107.



Signature of Soil Evaluator

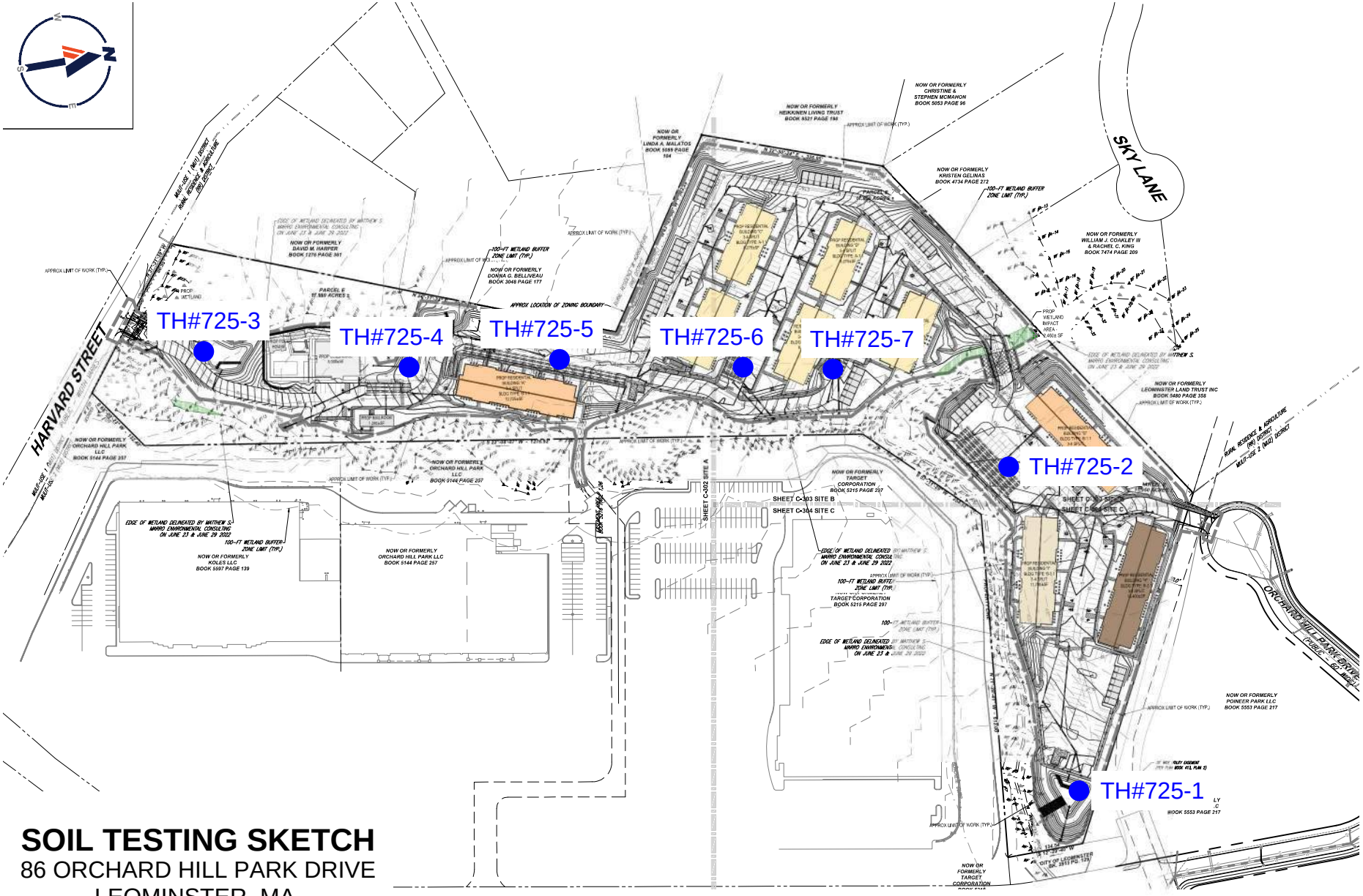
July 10, 2025

Date

Matthew Bombaci (SE #12732)

Typed or Printed Name of Soil Evaluator / License #

Field Diagrams: Use this area for field diagrams:



SOIL TESTING SKETCH

86 ORCHARD HILL PARK DRIVE
LEOMINSTER, MA
JULY 10, 2025
SCALE: 1"=250'

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 Worcester County, Massachusetts, Northeastern Part

March 10, 2025

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: 1:4,080 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Worcester County, Massachusetts, Northeastern Part
Survey Area Data: Version 19, Aug 27, 2024

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

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
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	9.2	22.2%
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	7.1	17.1%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	8.4	20.3%
306B	Paxton fine sandy loam, 0 to 8 percent slopes, very stony	4.7	11.3%
306C	Paxton fine sandy loam, 8 to 15 percent slopes, very stony	4.3	10.4%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	0.2	0.6%
312B	Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony	4.8	11.6%
421B	Canton fine sandy loam, 0 to 8 percent slopes, very stony	2.5	6.1%
422C	Canton fine sandy loam, 8 to 15 percent slopes, extremely stony	0.1	0.3%
Totals for Area of Interest		**41.3**	**100.0%**

Map Unit Descriptions

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

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

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a

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

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

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

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

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

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

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

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

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

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

Worcester County, Massachusetts, Northeastern Part

71B—Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w69c
Elevation: 0 to 1,290 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

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

Description of Ridgebury, Extremely Stony

Setting

Landform: Drumlins, depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 6 inches: fine sandy loam
Bw - 6 to 10 inches: sandy loam
Bg - 10 to 19 inches: gravelly sandy loam
Cd - 19 to 66 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 15 to 35 inches to densic material
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY009CT - Wet Till Depressions
Hydric soil rating: Yes

Minor Components

Woodbridge, extremely stony
Percent of map unit: 10 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Whitman, extremely stony
Percent of map unit: 8 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Paxton, extremely stony
Percent of map unit: 2 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Hydric soil rating: No

73A—Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony

Map Unit Setting
National map unit symbol: 2w695
Elevation: 0 to 1,580 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
Whitman, extremely stony, and similar soils: 81 percent
Minor components: 19 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Whitman, Extremely Stony

Setting
Landform: Drumlins, ground moraines, hills, drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave

Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oi - 0 to 1 inches: peat
A - 1 to 10 inches: fine sandy loam
Bg - 10 to 17 inches: gravelly fine sandy loam
Cdg - 17 to 61 inches: fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 7 to 38 inches to densic material
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: F144AY041MA - Very Wet Till Depressions
Hydric soil rating: Yes

Minor Components

Ridgebury, extremely stony

Percent of map unit: 10 percent
Landform: Drumlins, depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

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

Swansea

Percent of map unit: 3 percent
Landform: Marshes, bogs, swamps
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Woodbridge, extremely stony

Percent of map unit: 1 percent

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

305B—Paxton fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2t2qp
Elevation: 0 to 1,570 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Paxton

Setting

Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 8 inches: fine sandy loam
Bw1 - 8 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: fine sandy loam
Cd - 26 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 18 to 39 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)

Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Woodbridge

Percent of map unit: 9 percent
Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Ridgebury

Percent of map unit: 6 percent
Landform: Depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Toeslope, backslope, footslope
Landform position (three-dimensional): Base slope, head slope, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Charlton

Percent of map unit: 5 percent
Landform: Hills
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

306B—Paxton fine sandy loam, 0 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2w673
Elevation: 0 to 1,340 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Paxton, Very Stony

Setting

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 10 inches: fine sandy loam
Bw1 - 10 to 17 inches: fine sandy loam
Bw2 - 17 to 28 inches: fine sandy loam
Cd - 28 to 67 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Woodbridge, very stony

Percent of map unit: 8 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Ridgebury, very stony

Percent of map unit: 4 percent
Landform: Drumlins, drainageways, depressions, hills, ground moraines
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave

Across-slope shape: Concave
Hydric soil rating: Yes

Charlton, very stony

Percent of map unit: 3 percent
Landform: Hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

306C—Paxton fine sandy loam, 8 to 15 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2w677
Elevation: 0 to 1,330 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Paxton, Very Stony

Setting

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 10 inches: fine sandy loam
Bw1 - 10 to 17 inches: fine sandy loam
Bw2 - 17 to 28 inches: fine sandy loam
Cd - 28 to 67 inches: gravelly fine sandy loam

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Well drained
Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands
Hydric soil rating: No

Minor Components

Woodbridge, very stony

Percent of map unit: 8 percent
Landform: Hills, drumlins, ground moraines
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Charlton, very stony

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

Ridgebury, very stony

Percent of map unit: 2 percent
Landform: Drumlins, depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

310B—Woodbridge fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2t2ql
Elevation: 0 to 1,470 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F

Frost-free period: 140 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Woodbridge, fine sandy loam, and similar soils: 82 percent
Minor components: 18 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodbridge, Fine Sandy Loam

Setting

Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 18 inches: fine sandy loam
Bw2 - 18 to 30 inches: fine sandy loam
Cd - 30 to 65 inches: gravelly fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C/D
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Minor Components

Paxton

Percent of map unit: 10 percent
Landform: Drumlins, ground moraines, hills
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Ridgebury

Percent of map unit: 8 percent
Landform: Depressions, ground moraines, hills, drainageways
Landform position (two-dimensional): Toeslope, backslope, footslope
Landform position (three-dimensional): Base slope, head slope, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

312B—Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2t2qs
Elevation: 0 to 1,580 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

Woodbridge, extremely stony, and similar soils: 82 percent
Minor components: 18 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodbridge, Extremely Stony

Setting

Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

Oe - 0 to 2 inches: moderately decomposed plant material
A - 2 to 9 inches: fine sandy loam
Bw1 - 9 to 20 inches: fine sandy loam
Bw2 - 20 to 32 inches: fine sandy loam
Cd - 32 to 67 inches: gravelly fine sandy loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 20 to 43 inches to densic material
Drainage class: Moderately well drained
Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 19 to 27 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C/D
Ecological site: F144AY037MA - Moist Dense Till Uplands
Hydric soil rating: No

Minor Components

Paxton, extremely stony

Percent of map unit: 10 percent
Landform: Ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Linear, convex
Hydric soil rating: No

Ridgebury, extremely stony

Percent of map unit: 8 percent
Landform: Hills, drainageways, drumlins, depressions, ground moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

421B—Canton fine sandy loam, 0 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2w81l
Elevation: 0 to 1,180 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Canton, Very Stony

Setting

Landform: Moraines, hills, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 5 inches: fine sandy loam
Bw1 - 5 to 16 inches: fine sandy loam
Bw2 - 16 to 22 inches: gravelly fine sandy loam
2C - 22 to 67 inches: gravelly loamy sand

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Scituate, very stony

Percent of map unit: 9 percent
Landform: Hills, drumlins, ground moraines
Landform position (two-dimensional): Summit, backslope, footslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Montauk, very stony

Percent of map unit: 5 percent
Landform: Recessionial moraines, ground moraines, hills, drumlins
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest

Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Gloucester, very stony

Percent of map unit: 4 percent
Landform: Moraines, hills, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Swansea

Percent of map unit: 2 percent
Landform: Marshes, depressions, bogs, swamps, kettles
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

422C—Canton fine sandy loam, 8 to 15 percent slopes, extremely stony

Map Unit Setting

National map unit symbol: 2w815
Elevation: 0 to 1,310 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Canton, Extremely Stony

Setting

Landform: Moraines, hills, ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 5 inches: fine sandy loam
Bw1 - 5 to 16 inches: fine sandy loam
Bw2 - 16 to 22 inches: gravelly fine sandy loam

2C - 22 to 67 inches: gravelly loamy sand

Properties and qualities

Slope: 8 to 15 percent
Surface area covered with cobbles, stones or boulders: 9.0 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Scituate, extremely stony

Percent of map unit: 6 percent
Landform: Hills, drumlins, ground moraines
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Montauk, extremely stony

Percent of map unit: 5 percent
Landform: Recessionial moraines, ground moraines, hills, drumlins
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Charlton, extremely stony

Percent of map unit: 5 percent
Landform: Ridges, ground moraines, hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Hollis, extremely stony

Percent of map unit: 4 percent
Landform: Ridges, hills
Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Nose slope, side slope, crest
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Soil Information for All Uses

Soil Properties and Qualities

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

Soil Qualities and Features

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

Hydrologic Soil Group

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

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

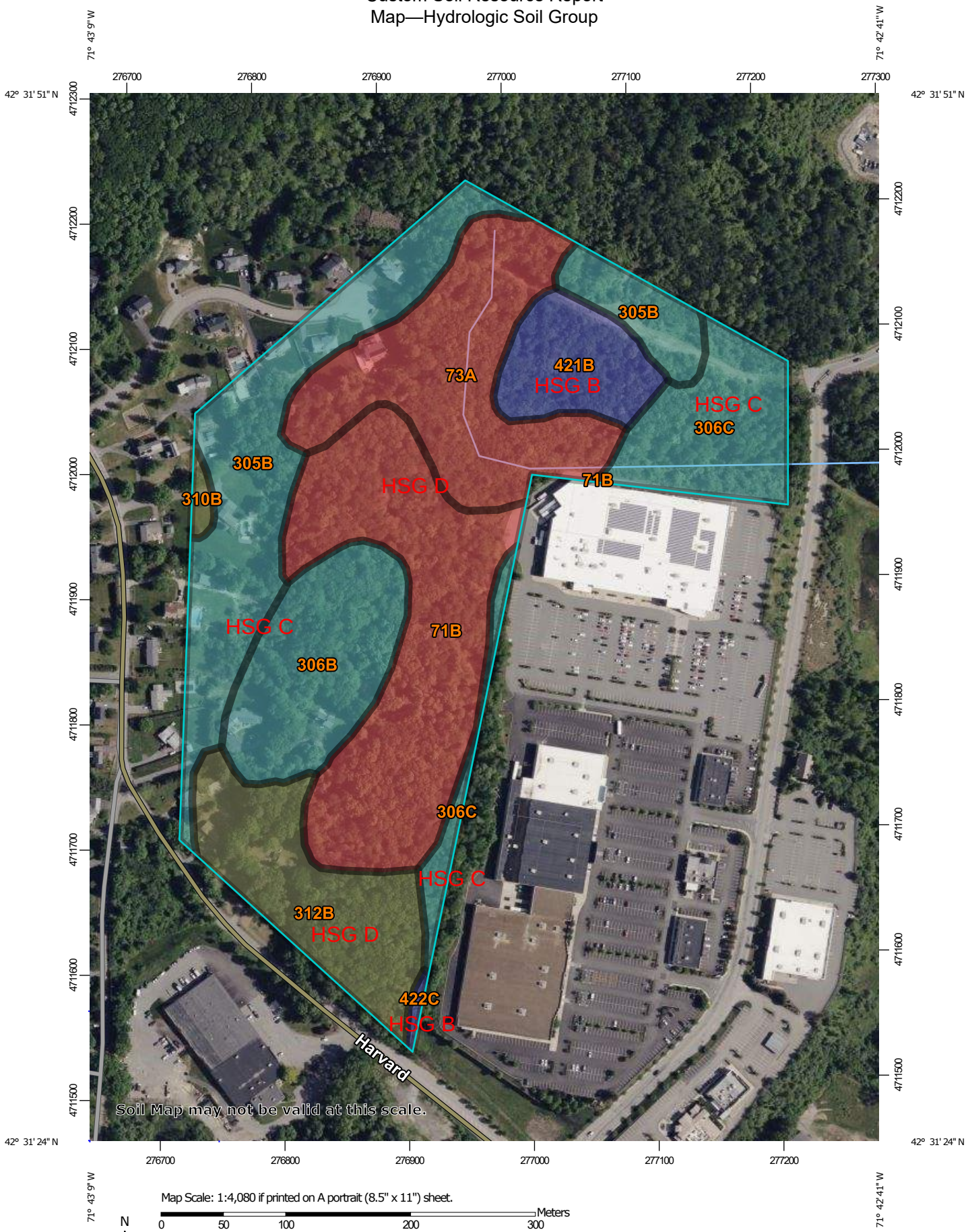
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

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

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.


71° 43' 9" W
71° 42' 41" W
42° 31' 51" N
42° 31' 24" N
276700
276800
276900
277000
277100
277200
277300
4712300
4712200
4712100
4712000
4711900
4711800
4711700
4711600
4711500
305B
421B
HSG B
73A
HSG C
306C
305B
HSG D
71B
310B
HSG C
71B
306B
306C
HSG C
312B
HSG D
422C
HSG B
Harvard
Soil Map may not be valid at this scale.
Map Scale: 1:4,080 if printed on A portrait (8.5" x 11") sheet.
N
Meters
0 50 100 200 300
Feet
0 150 300 600 900
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 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Worcester County, Massachusetts, Northeastern Part
Survey Area Data: Version 19, Aug 27, 2024

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND	MAP INFORMATION
	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
71B	Ridgebury fine sandy loam, 3 to 8 percent slopes, extremely stony	D	9.2	22.2%
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	D	7.1	17.1%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	C	8.4	20.3%
306B	Paxton fine sandy loam, 0 to 8 percent slopes, very stony	C	4.7	11.3%
306C	Paxton fine sandy loam, 8 to 15 percent slopes, very stony	C	4.3	10.4%
310B	Woodbridge fine sandy loam, 3 to 8 percent slopes	C/D	0.2	0.6%
312B	Woodbridge fine sandy loam, 0 to 8 percent slopes, extremely stony	C/D	4.8	11.6%
421B	Canton fine sandy loam, 0 to 8 percent slopes, very stony	B	2.5	6.1%
422C	Canton fine sandy loam, 8 to 15 percent slopes, extremely stony	B	0.1	0.3%
Totals for Area of Interest			**41.3**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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PRELIMINARY GEOTECHNICAL REPORT
PROPOSED MULTI-FAMILY DEVELOPMENT
ORCHARD HILL PARK DRIVE
LEOMINSTER, MASSACHUSETTS

by
Haley & Aldrich, Inc.
Boston, Massachusetts

for
WP East Acquisitions, LLC
Lexington, Massachusetts

File No. 0212297
January 2025

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13 January 2025
File No. 0212297-000

WP East Acquisitions, LLC
1 Hartwell Place
Lexington, Massachusetts 02421

Attention: David Moore

Subject: Preliminary Geotechnical Report
Proposed Multi-Family Development
Orchard Hill Park Drive
Leominster, Massachusetts

Ladies and Gentlemen:

This letter report summarizes the results of a preliminary geotechnical investigation performed by Haley & Aldrich, Inc. (Haley & Aldrich) and provides preliminary geotechnical design recommendations and associated construction considerations for a proposed multi-family residential development project located at Orchard Hill Park Drive in Leominster, Massachusetts (the "site"). The work summarized in this memorandum was performed in accordance with our contract dated 19 November 2024.

The information presented in this report is intended for initial project planning and preliminary cost estimating purposes only. Final design recommendations and associated construction requirements will be developed during the final design phase of the project upon completion of final design explorations.

Introduction

SITE CONDITIONS

The project site is located along Orchard Hill Park Drive in Leominster, MA as shown on the attached Figure 1, Project Locus. The approximately 17.95-acre site is currently undeveloped and is completely forested with some wetland areas. The site is bordered to the south and east by a shopping plaza and to the north and west by single family residential properties along Harvard Street and Sky Lane. Site grades are variable throughout the property, and generally increase in both the easterly and westerly directions (from Orchard Hill Park Drive and Harvard Street). Grades at Orchard Hill Park Drive are approximately El. 416[1] and gradually climb to approximately El. 470 at the northeastern site limits; grades then drop to the west to a wetland area and intermittent brook at approximately El. 446. Grades along Harvard Street are at approximately El. 432 to El. 442 and climb gradually to a high point of El. 488 at the northwestern site limits.

[1] Elevations are in feet and reference the National Geodetic Vertical Datum (NGVD) of 1929.

PROPOSED DEVELOPMENT

Based on our review of the concept plan drawing prepared by Bohler 25 July 2024, we understand that the proposed development will consist of the construction of nine, three to four-story buildings with footprint areas ranging from approximately 9,000 to 15,000 square feet (sq ft). At-grade parking will surround the buildings, including several free-standing garages. A clubhouse/amenity building with pool is also planned at the southern end of the development. The concept plans provided are included in Appendix A. No below grade space is planned for this project.

Based on the available concept plans, we understand that the proposed buildings and site grading will generally be slopped/terraced to work with the existing topography and limit the extent of earthwork operations. The majority of the site buildings (with the exception of the clubhouse and Buildings H and I) are understood to be proposed with a partial basement level that spans the length of the building and benches into the existing grading. We expect that some areas of site development – particularly at the eastern portions of the site – will require the need for retaining walls with cuts and fills estimated up to about 15 feet (ft).

Subsurface Exploration Program

SUBSURFACE EXPLORATIONS

Haley & Aldrich conducted a subsurface exploration program consisting of eleven (11) test pits (designated HA24-TP1 through HA24-TP11) at the proposed project site. The test pits were excavated to depths ranging from 9.5 to 10.5 ft bgs. The test pits were performed by Earthworks Industries between 18 and 20 December 2024 and were observed in the field by a Haley & Aldrich geologist.

A summary of Haley & Aldrich's exploration data is shown on Table I. The approximate locations of the explorations relative to existing site conditions are shown on Figure 2, Site and Subsurface Exploration Location Plan. Logs and photographs of the test pits are provided in Appendix B.

GEOTECHNICAL LABORATORY TESTING

A total of four (4) soil samples obtained from the subsurface explorations program were tested for Sieve (ASTM International [ASTM] D422), and Modified Proctor (ASTM D1557) to aid in the classification of the soil and assess re-use potential of the materials. Results of the testing that was completed are attached as Appendix C.

Subsurface Conditions

SOIL AND BEDROCK CONDITIONS

Subsurface conditions encountered at the exploration locations consisted of the following stratigraphic units starting at the existing ground surface:

Subsurface Unit	Approx. Top of Stratum	Range in Thickness (ft)
Topsoil	El. 482 to El. 453	0.6 to 0.8
Loess	El. 481 to El. 452	0.7 to 1.4
Glacial Deposits	El. 480 to El. 451	>7.4 to >8.7 ft
Bedrock	Not Encountered	Not Encountered

Generalized descriptions of the units are as follows:

- Topsoil was encountered in all test pit explorations and generally consists of approximately 0.2-ft of brown, root-laden forest mat over an approximately 0.4 to 0.6-ft layer of ORGANIC SOIL with sand. We note that the topsoil was found to contain multiple boulders at/near ground surface elevation at the HA24-TP7 location.
- Loess (wind deposited material) was encountered below the Topsoil at all test pit locations and generally consists of SILT with sand and occasional cobbles. The Loess ranged in thickness from about 0.7 to 1.4-ft before transitioning to Glacial Deposits.
- Glacial Deposits (i.e., Glacial Till) were encountered below the Loess at each test boring location at depths ranging from 1.4 to 2.2-ft below existing site grades. The Glacial Deposits consists of approximately 3 to 4-ft silty SAND with gravel before typically transitioning to a sandy SILT with gravel. We note that at the HA24-TP2 location, the material was noted as having greater plasticity at a depth of about 5-ft into the deposit (El. 464.5) and was classified as an elastic SILT. The Glacial Deposits were not fully penetrated in the explorations. Cobbles and boulders were encountered frequently throughout the Glacial Deposits stratum.
- Bedrock was not encountered in the explorations.

As it relates to subsurface conditions within the general location of proposed buildings, refer to the summary table below:

Building ID	Approx. Existing Grades	Nearby H&A Test Pit ID	Generalized Conditions Exposed in Test Pits
Clubhouse	El. 460 to El. 467	HA24-TP1	Depth to Glacial = 1.8-ft (El. 463.2)
A	El. 468 to El. 473	HA24-TP2	Depth to Glacial = 2.0-ft (El. 469.5)
B	El. 470 to El. 481	HA23-TP3	Depth to Glacial = 1.7-ft (El. 475.3)
C	El. 477 to El. 483	HA24-TP4	Depth to Glacial = 1.4-ft (El. 480.1)
D	El. 472 to El. 466	HA24-TP5	Depth to Glacial = 1.5-ft (El. 468.5)
E	El. 469 to El. 460	HA24-TP6	Depth to Glacial = 1.8-ft (El. 465.2)
F	El. 462 to El. 450	HA24-TP7	Depth to Glacial = 2.2-ft (El. 454.8)
G	El. 465 to El. 470	HA24-TP8	Depth to Glacial = 2.0-ft (El. 460.5)
H	El. 471 to El. 458	HA24-TP10/11	Depth to Glacial = 1.8 to 2.0-ft (El. 458.0 to El. 467.2)
I	El. 466 to El. 442	HA24-TP9	Depth to Glacial = 1.6-ft (El. 450.9)

GROUNDWATER

The test pit explorations (which extended to depths ranging from 9.5 to 10.5 ft below existing site grades) were noted to be dry at the time of excavation. Likewise, the intermittent brook which bisects the site (as shown on the plan titled "Wetland Delineation Map" prepared by Whitman & Bingham Associates dated 4 March 2019) was also observed to be dry at the time of the recent test pit exploration activities; the ground surface elevation at the bottom of the brook is noted to be approximately El. 446. The wetland areas that run along the southern and eastern site perimeter were also observed to be dry during the explorations.

Site groundwater levels will fluctuate with seasonal precipitation among other factors, and as a result will differ from the conditions encountered during the explorations.

Preliminary Geotechnical Recommendations

The following preliminary geotechnical recommendations are based on the conceptual design of the project and the subsurface conditions encountered in the test borings. These preliminary geotechnical recommendations are in accordance with the 10th Edition of the Massachusetts State Building Code. The following recommendations are provided to aid with initial planning and preliminary cost estimating and are not intended for project final design.

BUILDING FOUNDATIONS

Based on the subsurface conditions encountered in the explorations, we recommend that the proposed buildings be supporting on spread footing foundations bearing on the Glacial Deposits or on compacted structural fill placed above the natural Glacial Deposits (following the removal and replacement of the existing Topsoil and Loess deposits within the zone of influence [ZOI] of the footings). The ZOI is defined as the zone beneath imaginary lines extending 2 ft laterally outward from the lower edges of footings and down a 1 horizontal to 1 vertical (1H:1V) splay to the top of the natural Glacial Deposits. Footings should bear at a depth of 4 ft below the lowest adjacent ground surface subject to freezing and a minimum of 18 inches (in.) below the top of adjacent ground floor slab at interior locations.

For initial planning, we recommend that footings be sized for a maximum allowable bearing pressure of 4 kips per square foot (ksf). Settlements of footings sized for this bearing pressure would be on the order of up to 1 in. total and ½ in. differential (over a distance of approximately 30 ft).

It is anticipated that the site will require cuts of up to approximately 13-ft and fill areas up to approximately 20-ft to allow for the proposed construction. The table below summarizes the anticipated range of cuts and fills per building location based upon our understanding of lowest finished floor slab elevations.

Building ID	Approx. Existing Grades	Assumed FFE (See Note)	Anticipated Cut (-) / Fill (+), ft
Clubhouse	El. 460 to El. 467	El. 465	-2.0 to +5.0
A	El. 468 to El. 473	El. 475 (West); El. 465 (East)	+3.0 to +5.0
B	El. 470 to El. 481	El. 485 (South); El. 475 (North)	-3.0 to +12.0
C	El. 477 to El. 483	El. 485 (South); El. 475 (North)	-5.0 to +5.0
D	El. 472 to El. 466	El. 475 (South); El. 465 (North)	-5.0 to +5.0
E	El. 469 to El. 460	El. 475 (South); El. 465 (North)	0 to +10.0
F	El. 462 to El. 450	El. 465 (South); El. 455 (North)	-5.0 to +10.0
G	El. 465 to El. 470	El. 455 (South); El. 465 (North)	-13.0 to +7.0
H	El. 471 to El. 458	El. 465	-6.0 to +7.0
I	El. 466 to El. 442	El. 462	-4.0 to +20.0

Notes:

1. Our understanding of finished floor elevation based on interpolation of spot grades provided on Concept Plans prepared by Bohler dated 25 July 2024.

In areas of the site requiring filling of more than 5 ft over existing site grades, Topsoil should be removed, but the existing Loess materials may stay in place as long as the material can be proof compacted to a stable condition prior to filling. In areas where filling will be between 0 to 5 ft, Topsoil should be removed and replaced prior to raising the site grades, and Loess deposits should be removed within the footing ZOI described above.

LOWEST LEVEL SLAB

The lowest level slabs of the residential buildings can be designed as conventional soil support slab-on-grades. We recommend that slabs bear on a minimum of 12-in. of ¾ in. crushed stone separated from underlying/adjacent soils using a geotextile filter fabric (6 oz per square yard minimum, needle-punched, non-woven). Slabs for garage buildings can bear on 8 in. of ¾ inch crushed stone or compacted granular fill. See radon mitigation section below for more details.

The existing Loess material is considered suitable to leave in place below slabs-on-grade following proof compaction with several passes of a large vibratory roller. We anticipate this risk would be low based on the quality and thickness of the Loess materials observed in the subsurface explorations. Existing Topsoil should be removed below slabs.

SEISMIC DESIGN CONSIDERATIONS

Based on the limited explorations conducted to-date and our understanding of area geology, the Seismic Site Class is considered to be a D. The soils at the site are not considered to be susceptible to liquefaction under the Building Code design level earthquake.

GROUNDWATER AND PERMANENT FOUNDATION DRAINAGE

Groundwater was not encountered in the recent test pit explorations and accordingly is not anticipated to be present in excavations conducted for this project. However, we note that given the silty nature of the site materials, we expect that ponding and intermittent stormwater may need to be managed during/following periods of precipitation.

Underslab drainage is not required for the proposed building and garages. A moisture vapor retarded membrane is recommended directly beneath the ground floor slabs in the residential buildings. In areas where a radon mitigation system (see below) will be installed, the membrane installed for the radon mitigation system will meet this requirement.

Perimeter drainage and waterproofing of below grade walls is recommended for the below grade portions of the buildings that will be benched into the existing slopes. The perimeter drainage should be designed to drain by gravity.

Drainage should be provided behind site retaining walls (with discharge direct to the site storm drain or via a series of weep holes along the base of the wall).

RADON MITIGATION SYSTEM

According to the United States Environmental Protection Agency (EPA), the project is located in an area of Massachusetts which has an elevated risk of radon concentrations above recommended action levels (i.e., potential for concentrations above 4 picocuries per liter [pCi/L]). Accordingly, a radon mitigation system is a recommended beneath ground floor lobby/amenity areas attached to residential buildings, residential areas, as well as elevators and stairwells servicing residential floor levels.

A radon mitigation system typically consists of a 12-in.-thick layer of ¾ in. crushed stone below a vapor barrier under the lowest residential building slabs. Within the ¾ in. crushed stone layer are several suction pits that are vented to the exterior of the building, typically through the roof. The building design should include providing power to the roof area in the event the system needs to be activated with mechanical fans.

Radon mitigation is not considered necessary below non-continuously occupied areas including the garages and the clubhouse amenity building.

UTILITIES AND OTHER SITE IMPROVEMENTS

We recommend that the following considerations be incorporated into the preliminary design:

- Utilities below soil-supported slabs-on-grade within the building footprint may be earth-supported and installed using conventional methods.
- Site utilities can be supported in the natural Glacial Deposits or Fill/Loess Deposits. Oversized materials, if present at the subgrade level, should be removed to preclude a “hard spot” along the utility bottom that could damage or break the utility.

- Foundations for light pole bases, guard rails, small signs, and similar lightweight ancillary structures can be designed and installed using conventional methods.

  Detailed site grading is not known at this time, but based on the currently available concept plans it is anticipated that several retaining walls will be required to elevate site grades and mitigate impacts to surrounding wetland areas and to avoid interference with property line. Retaining walls are anticipated along the wetland boundary along the eastern/southern site perimeter roughly spanning between proposed Buildings A and I (with exception of the intermittent stream crossing that bisects the site), and potentially to the rear (north) of proposed Building H and to the rear (east) of proposed Building A. Note that we have performed an initial evaluation of global stability based upon our current understanding of site grading and the preliminary results indicate satisfactory factor of safety. This analysis will need to be reviewed and updated in the future pending final design grades and site/building configuration.

  The retaining walls may consist of gravity block walls or mechanically stabilized (grid reinforced) earth walls depending on the retained height and required surcharge loads. Positioning of grid reinforced walls relative to property lines and other site constraints should consider lengths of grid reinforcement and excavation requirements for installation of grid reinforcement. For initial planning, it should be assumed that grid reinforcement lengths may be on the order of one times the wall height (for walls with level backslope grades), and that excavation limits would extend to 1.5 times the wall height from the back of the grid reinforcement (where existing grades are flat).

- The existing near surface Glacial Deposits were noted to generally be sandy in nature. We anticipate that stormwater infiltration will be possible. See Appendix C for logs of the test pits for further details.

EARTHWORK, DEWATERING, AND REUSE OF EXCAVATED SOILS

Based on anticipated grading for the proposed construction and subsurface conditions encountered in the subsurface explorations, conventional earthwork procedures and equipment can be used. Because building excavations are anticipated to be above normal groundwater levels, temporary dewatering to allow for construction in the dry is not anticipated to be required with the exception of that necessary for controlling precipitation that falls on excavations and surface water runoff that collects in excavations. Localized dewatering may be required for locally deeper excavations or on an intermittent basis during periods of moderate to heavy precipitation or snow melt. In cut areas around the perimeter of the site, it is anticipated that water may seep from cut slopes during and following precipitation events as stormwater drains from adjacent higher areas.

The near surface natural Glacial Deposits appear consist primarily of granular materials and appear suitable for re-use as common fill and potentially as compacted structural fill. However, the existing Glacial Deposits are variable in nature in terms of the percentage of coarse to fine sand and fines (typically getting more cohesive with depth). Areas containing more well graded sands will be easier to re-use as structural fill. Materials noted to have higher fines or higher fine sand contents may be able to be re-used as structural fill, but may have difficulty being properly compacted if their moisture contents are too high or too low. For planning purposes, we recommend assuming the top approximately 4 ft of

the Glacial Deposits to be potentially suitable for structural fill applications, whereas the remainder of the Deposit – due to the higher anticipated fines content – to be assumed suitable for common fill. The lower Glacial Deposits will be more difficult to nearly impossible to place and compact if they become wet and disturbed.

The existing Loess deposits were noted to be primarily SILT but with variable quantities of sand and cobbles. The Loess materials can be re-used as common fill to raise site grades but may be more difficult to properly place and compact and will be susceptible to disturbance if they become wet.

The existing topsoil may be suitable for re-use in planned landscape areas pending review by the landscape architect.

We recommend the placement of 3 to 4 in. of crushed stone on prepared foundations subgrades (with geotextile filter fabric separation) to protect the subgrades from disturbance during placement of rebar and forms.

ADDITIONAL EXPLORATIONS AND TESTING

Once the final locations of buildings are selected, we recommend that a limited additional subsurface exploration program consisting of test borings be completed to confirm the recommended bearing pressures for foundations and retaining walls and to also gather additional soil samples in cut areas for testing for re-use. The types, numbers, and locations will depend on the final development layout, stormwater/wastewater infiltration locations, and proposed grading.

Closing

We appreciate the opportunity to provide geotechnical engineering services on this project. Please do not hesitate to call if you have any questions or comments.

Sincerely yours,
HALEY & ALDRICH, INC.

Lee S. Vanzler, P.E. (MA)
Program Manager

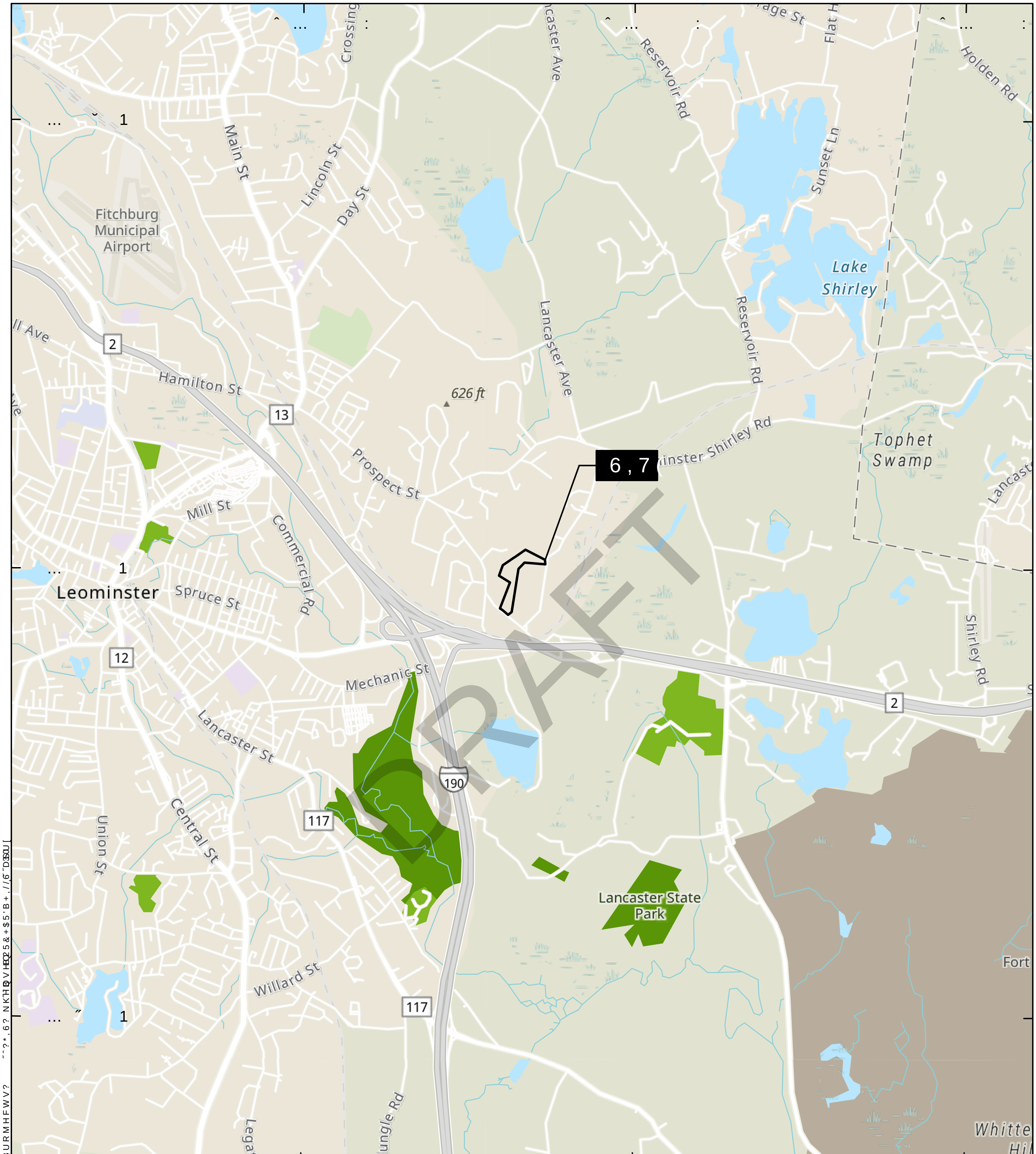
Michael J. Weaver, P.E. (MA)
Principal

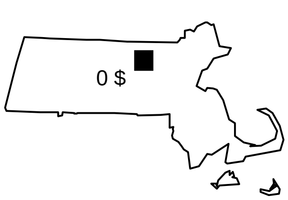
Enclosures:

- Figure 1 - Project Locus
- Figure 2 - Site and Subsurface Exploration Location Plan
- Table I – Summary of Haley & Aldrich Exploration Data
- Appendix A - Concept Plans dated 25 July 2024
- Appendix B - Logs and Photographs of Test Pits
- Appendix C - Geotechnical Laboratory Testing Results

https://haleyaldrich.sharepoint.com/sites/WoodPartners/Shared Documents/0212297.Orchard Hill Park Drive/Deliverables/Geotech Report/2025-0113-HAI-OrchardHillPark-Prelim Geotech Considerations-Df.docx

FIGURES





HALEY ALDRICH

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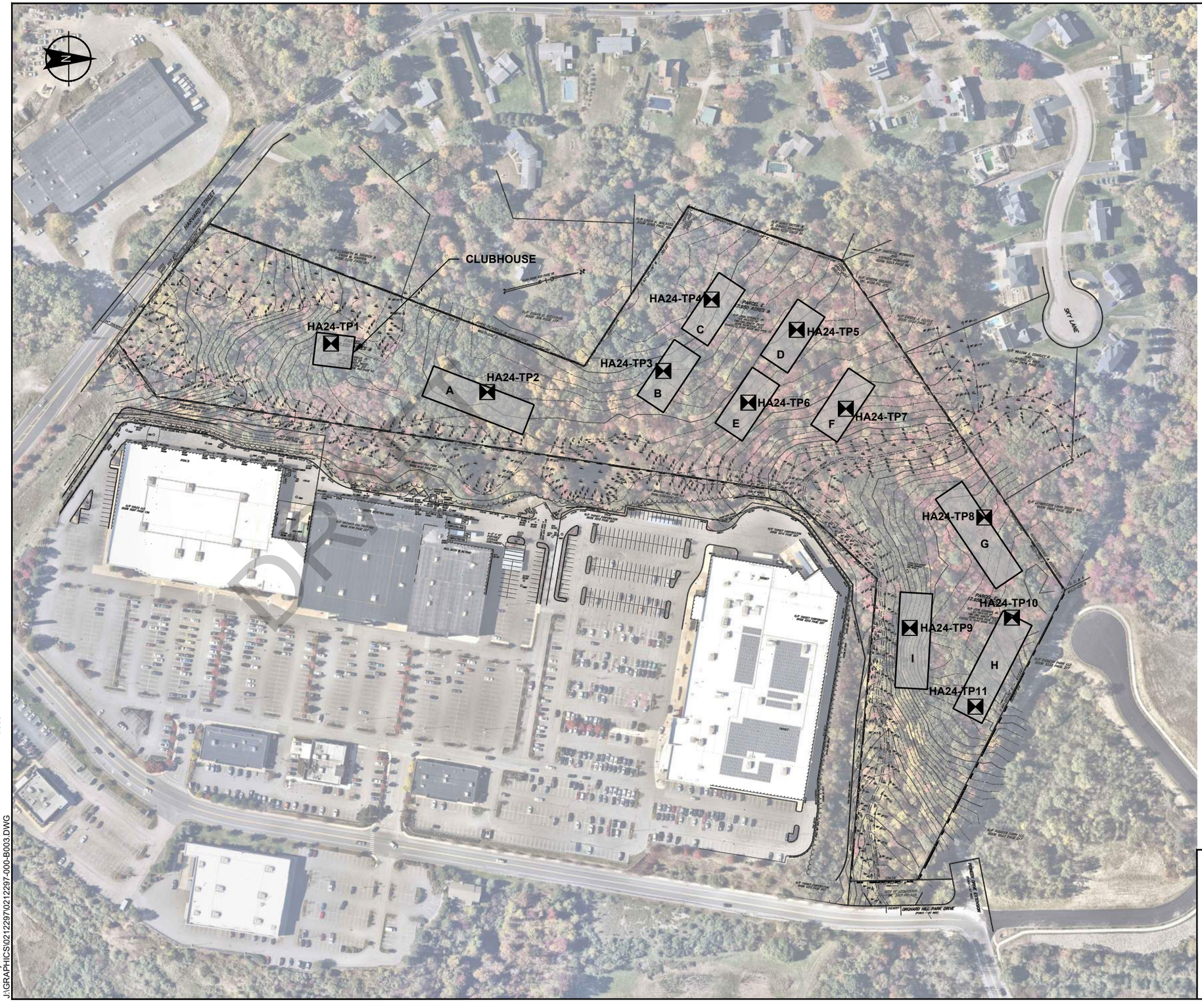

LEGEND

HA24-TP1 — DESIGNATION AND APPROXIMATE LOCATION OF TEST PIT CONDUCTED BY EARTHWORK INDUSTRIES AND MONITORED BY HALEY & ALDRICH BETWEEN 18 AND 20 DECEMBER 2024

APPROXIMATE LOCATION OF PROPOSED BUILDING

NOTES

1. IMAGE, DATED 11 OCTOBER 2024, TAKEN ELECTRONICALLY FROM NEARMAP.
2. VERTICAL ELEVATION CONTOURS TAKEN FROM PLAN TITLED "WETLAND DELINEATION MAP" PREPARED BY WHITMAN & BINGHAM ASSOCIATES, LLC AND DATED 21 MARCH 2019. ELEVATIONS ARE IN FEET AND REFERENCE THE NATIONAL GEODETIC VERTICAL DATUM (NGVD) OF 1929.
3. PROPOSED BUILDING LAYOUT TAKEN FROM PLAN TITLED "CONCEPT PLAN" PREPARED BY BOHLER AND DATED 25 JULY 2024.

0 200 400
SCALE IN FEET

HALEY ALDRICH

ORCHARD HILL PARK DRIVE
LEOMINSTER, MASSACHUSETTS

SITE AND SUBSURFACE EXPLORATION LOCATION PLAN

SCALE: AS SHOWN
JANUARY 2025

FIGURE 2

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TABLE

TABLE I
SUMMARY OF HALEY & ALDRICH EXPLORATION DATA
ORCHARD HILL PARK DRIVE
LEOMINSTER, MASSACHUSETTS
FILE NO.: 0212297

Exploration ID	Date Completed	Est. Ground Surface Elevation, ft (NGVD29)	Total Exploration Depth (ft)	Topsoil		Loess		Glacial Deposits	
				Top Elevation (ft)	Thickness (ft)	Top Elevation (ft)	Thickness (ft)	Top Elevation (ft)	Thickness (ft)
HA24-TP1	12/19/2024	465.0	10.5	465.0	0.6	464.4	1.2	463.2	BNE
HA24-TP2	12/19/2024	471.5	10.0	471.5	0.6	470.9	1.4	469.5	BNE
HA24-TP3	12/20/2024	477.0	9.5	477.0	0.6	476.4	1.1	475.3	BNE
HA24-TP4	12/20/2024	481.5	10.0	481.5	0.7	480.8	0.7	480.1	BNE
HA24-TP5	12/20/2024	470.0	9.5	470.0	0.7	469.3	0.8	468.5	BNE
HA24-TP6	12/20/2024	467.0	9.8	467.0	0.8	466.2	1.0	465.2	BNE
HA24-TP7	12/19/2024	457.0	10.0	457.0	0.8	456.2	1.4	454.8	BNE
HA24-TP8	12/18/2024	462.5	10.0	462.5	0.6	461.9	1.4	460.5	BNE
HA24-TP9	12/18/2024	452.5	9.0	452.5	0.6	451.9	1.0	450.9	BNE
HA24-TP10	12/18/2024	469.0	9.5	469.0	0.7	468.3	1.1	467.2	BNE
HA24-TP11	12/18/2024	460.0	10.0	460.0	0.6	459.4	1.4	458.0	BNE

NOTES:

1. Elevations are in feet and reference the National Geodetic Vertical Datum of 1929 (NGVD29). Surface elevations are estimated based on interpolation of surface grades provided on the plan titled "Wetland Delineation Map" prepared by Whitman & Bingham Associates, LLC dated 21 March 2019.
2. "-" = Not Encountered
3. BNE = Bottom of Soil Layer Not Encountered

APPENDIX A
Concept Plans dated 25 July 2024

Development Summary

Key	Description	Units Residential	Parking Ratio	Parking Spaces Required	Parking Spaces Provided	Ratio
A	Type B-1	42	1.58	66	116	
B	Type A-1	28	1.58	44	222	
C	Type A-1	28	1.58	44		
D	Type A-1	28	1.58	44		
E	Type A-1	28	1.58	44		
F	Type A-1	28	1.58	44		
G	Type B-1	42	1.58	66	168	
H	Type A-1	36	1.58	57		
I	Type B-3	42	1.58	66		
	Amenity					
TOTAL		302		486	506	1.68

BOHLER
SITE CIVIL AND CONSULTING ENGINEERING
LAND DEVELOPMENT
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
SUSTAINABLE DESIGN
PERMITTING SERVICES
TRANSPORTATION SERVICES

REVISIONS

REV	DATE	COMMENT	DRAWN BY / CHECKED BY

FOR CONCEPT PURPOSES ONLY

THIS DRAWING IS INTENDED FOR MUNICIPAL AND/OR AGENCY REVIEW AND APPROVAL. IT IS NOT INTENDED AS A CONSTRUCTION DOCUMENT UNLESS INDICATED OTHERWISE.

PROJECT No.:	MAA240279.00
DRAWN BY:	KME
CHECKED BY:	MKB
DATE:	07/25/2024
CAD I.D.:	MAA240279-X-TTLB-SUBD

PROJECT:

ORCHARD HILL PARK DRIVE

FOR

WOOD PARTNERS

MAP: 369, BLOCK: 1, LOT: 2,3,4
PIONEER DRIVE,
TOWN OF LEOMINSTER ,
WORCESTER COUNTY,
MASSACHUSETTS

BOHLER
352 TURNPIKE ROAD
SOUTHBOROUGH, MA 01772
Phone: (508) 480-9900
www.BohlerEngineering.com

SHEET TITLE:

CONCEPT PLAN

SHEET NUMBER:

1 of 1

ORG. DATE - 05/08/2024

P:\2024\MAA240279.00\CAD\DRAWINGS\PLAN SETS\CIVIL SITE PLANS\MAA240279.00-EXST-ISA-----LAYOUT: C-202-PLOT PLAN GRAD

APPENDIX B
Logs and Photographs of Test Pits

HALEY ALDRICH

TEST PIT LOG

Test Pit No. HA24-TP1

Project	ORCHARD HILL PARK DRIVE	**File No.**	0212297-000
Location	LEOMINSTER, MA	**H&A Rep**	D. Warren
Client	WP EAST ACQUISITIONS, LLC	**Date**	12/19/2024
Contractor	EARTHWORK INDUSTRIES, INC.	**Weather**	Sunny, 40s
Equipment Used	Doosan DX-85 1 cu. yd excavator		

Ground El.: 465.0 (est.) **El. Datum:** NAVD 88 | **Location:** See Plan | **Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample Data/ PID Readings (ppm)	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0	ND	464.8		-BROWN ROOTY FOREST MAT-										
		0.2	OL/ OH	Brown ORGANIC SOIL with sand (OL/OH), mps= 0.25 in., no structure, no odor, moist					20	80				
	ND	464.4	ML	-TOPSOIL-	5				20	75				
		0.6		Orange brown SILT with sand (ML), mps= 3 in., no structure, no odor, moist, trace gravel										
	ND	463.2		-LOESS-										
2		1.8	SM	Light brown silty SAND with gravel (SM), mps= 3 in., no structure, no odor, dry, 15% cobbles, mps= 10 in.	10	15	5	5	50	15				
				-GLACIAL TILL-										
4														
6	S2		ML	Gray sandy SILT with gravel (ML), mps= 3 in., well bonded in-situ, moist, 10% cobbles mps= 10 in.	10	10	5	5	20	50				
8														
10		454.5												
		10.5		BOTTOM OF EXPLORATION 10.5 FT										

Obstructions:

Remarks:

Field Tests

Dilatancy R - Rapid S - Slow N - None
Toughness L - Low M - Medium H - High
Plasticity N - Nonplastic L - Low M - Medium H - High
Dry Strength N - None L - Low M - Medium H - High V - Very High

Standing Water in Completed Pit

at depth NE ft
measured after - hours elapsed

Boulders

Diameter (in.)	Number	Approx. Vol. (cu.ft)
12 to 24	-	= -
over 24	-	= -

Test Pit Dimensions (ft)

Pit Length x Width (ft) 15 x 4
Pit Depth (ft) 10.5

NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST PIT LOG

Test Pit No. HA24-TP10

Project	**ORCHARD HILL PARK DRIVE**	**File No.**	0212297-000
Location	LEOMINSTER, MA	**H&A Rep**	D. Warren
Client	WP EAST ACQUISITIONS, LLC	**Date**	12/18/2024
Contractor	EARTHWORK INDUSTRIES, INC.	**Weather**	Sunny, 40s
Equipment Used	Doosan DX-85 1 cu. yd excavator		

Ground El.: 469.0 (est.) **El. Datum:** NAVD 88 | **Location:** See Plan | **Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample Data/ PID Readings (ppm)	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0	ND	468.8		-BROWN ROOTY FOREST MAT-										
		0.2	OL/ OH	Brown ORGANIC SOIL with sand (OL/OH), mps< 1mm, no structure, no odor, moist					20	80				
	ND	468.3		-TOPSOIL-										
		0.7	ML	Orange-brown SILT with sand (ML), mps< 1mm, no structure, no odor -LOESS-					15	85				
2	ND	467.2												
		1.8	SM/ML	Gray-brown silty SAND to sandy SILT with gravel (SM/ML), mps= 3 in., moderately to well bonded in-situ, moist, 10% cobbles mps= 10 in., occasional boulders mps= 24 in. Note: Material becoming siltier with depth.	10	10	5	5	35	35				
4														
6														
8														
		459.5												
		9.5		BOTTOM OF EXPLORATION 9.5 FT										

Obstructions:

Remarks:

Field Tests

Dilatancy R - Rapid S - Slow N - None
Toughness L - Low M - Medium H - High
Plasticity N - Nonplastic L - Low M - Medium H - High
Dry Strength N - None L - Low M - Medium H - High V - Very High

Standing Water in Completed Pit

at depth NE ft
measured after - hours elapsed

Boulders

Diameter (in.)	Number		Approx. Vol. (cu.ft)
12 to 24	3	=	12
over 24	-	=	-

Test Pit Dimensions (ft)

Pit Length x Width (ft) 11 x 3.5
Pit Depth (ft) 9.5

NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST PIT LOG

Test Pit No. HA24-TP11

Project	**ORCHARD HILL PARK DRIVE**	**File No.**	0212297-000
Location	LEOMINSTER, MA	**H&A Rep**	D. Warren
Client	WP EAST ACQUISITIONS, LLC	**Date**	12/18/2024
Contractor	EARTHWORK INDUSTRIES, INC.	**Weather**	Sunny, 40s
Equipment Used	Doosan DX-85 1 cu. yd excavator		

Ground El.: 460.0 (est.) **El. Datum:** NAVD 88 | **Location:** See Plan | **Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample Data/ PID Readings (ppm)	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0	ND	459.8 0.2		-BROWN ROOTY FOREST MAT-										
	ND	459.4 0.6	OL/ OH	Brown sandy ORGANIC SOIL (OL/OH), mps< 1mm, no structure, no odor, moist, 30% roots					30	70				
			ML	-TOPSOIL- Orange-brown SILT with sand (ML), mps< 1mm, no structure, no odor, moist, occasional cobbles mps= 6 in. -LOESS-										
2	ND	458.0 2.0	SM	Light gray-tan silty SAND with gravel (SM), mps= 3 in., well bonded in-situ, dry, 10% cobbles and boulders mps= 18 in. -GLACIAL TILL-	10	15	5	5	45	20				
4														
6	ND		SM/ML	Light brown silty SAND to sandy SILT with gravel (SM/ML), mps= 3 in., well bonded in-situ, dry, 20% cobbles and boulders mps= 24 in. Note: Materail becoming siltier with depth	10	10	5	5	35	35				
8														
10		450.0 10.0		BOTTOM OF EXPLORATION 10.0 FT										

Obstructions:

Remarks:

Field Tests

Dilatancy R - Rapid S - Slow N - None
Toughness L - Low M - Medium H - High
Plasticity N - Nonplastic L - Low M - Medium H - High
Dry Strength N - None L - Low M - Medium H - High V - Very High

Standing Water in Completed Pit

at depth NE ft
measured after - hours elapsed

Boulders

Diameter (in.)	Number	Approx. Vol. (cu.ft)
12 to 24	5	= 20
over 24	-	= -

Test Pit Dimensions (ft)

Pit Length x Width (ft) 14 x 3.5
Pit Depth (ft) 10.0

NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

TEST PIT LOG

Test Pit No. HA24-TP2

Project	ORCHARD HILL PARK DRIVE	**File No.**	0212297-000
Location	LEOMINSTER, MA	**H&A Rep**	D. Warren
Client	WP EAST ACQUISITIONS, LLC	**Date**	12/19/2024
Contractor	EARTHWORK INDUSTRIES, INC.	**Weather**	Sunny, 40s
Equipment Used	Doosan DX-85 1 cu. yd excavator		

Ground El.: 471.5 (est.) **El. Datum:** NAVD 88 | **Location:** See Plan | **Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample Data/ PID Readings (ppm)	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0	ND	471.3 0.2		-BROWN ROOTY FOREST MAT-										
	ND	470.9 0.6	OL/ OH	Brown ORGANIC SOIL with sand (OL/OH), mps= 0.25 in., no structure, no odor			5	5	10	80				
			ML	-TOPSOIL-				5	15	80				
				Yellow-brown SILT with sand (ML), mps= 0.25 in., no structure, no odor, moist, occasional cobbles, mps= 10 in. -LOESS-										
2	ND	469.5 2.0	SM	Light brown silty SAND with gravel (SM), mps= 3 in., no structure, no odor, moist, 15% cobbles mps= 18 in. -GLACIAL TILL-	10	10	5	5	50	20				
4														
	ND		ML	Brown sandy SILT with gravel (ML), mps= 3 in., well bonded in-situ, moist, 10% cobbles mps= 10 in.	10	10	5	5	20	50				
6														
	ND		MH	Gray gravelly elastic SILT with sand (MH), mps= 3 in., well bonded in-situ, moist, 15% cobbles and boulders mps= 15 in.	15	15	5		15	50				
8														
10		461.5 10.0		BOTTOM OF EXPLORATION 10.0 FT										

Obstructions:

Remarks: Several large surface boulders within 50 ft radius of pit, mps estimated 48 in.

Field Tests

Dilatancy	R - Rapid S - Slow N - None
Toughness	L - Low M - Medium H - High
Plasticity	N - Nonplastic L - Low M - Medium H - High
Dry Strength	N - None L - Low M - Medium H - High V - Very High

Standing Water in Completed Pit

at depth	NE	ft
measured after	-	hours elapsed

Boulders

Diameter (in.)	Number		Approx. Vol. (cu.ft)
12 to 24	8	=	30
over 24	1	=	30

Test Pit Dimensions (ft)

Pit Length x Width (ft)	15 x 4
Pit Depth (ft)	10.0

NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST PIT LOG

Test Pit No. HA24-TP3

Project	ORCHARD HILL PARK DRIVE	**File No.**	0212297-000
Location	LEOMINSTER, MA	**H&A Rep**	J. Shaw
Client	WP EAST ACQUISITIONS, LLC	**Date**	12/20/2024
Contractor	EARTHWORK INDUSTRIES, INC.	**Weather**	Cloudy, light snow, 28
Equipment Used	Doosan DX-85 1 cu. yd excavator		

Ground El.: 477.0 (est.) **El. Datum:** NAVD 88 | **Location:** See Plan | **Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample Data/ PID Readings (ppm)	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0	ND	476.8 0.2		-BROWN ROOTY FOREST MAT-										
	ND	476.4 0.6	OL/ OH	Brown sandy ORGANIC SOIL (OL/OH), mps= 0.25 in., no structure, no odor, moist			5	5	25	65				
			ML	-TOPSOIL-					25	75				
				Orange-brown SILT with sand (ML), mps= 1mm, no structure, no odor, moist										
	ND	475.3 1.7		-LOESS-										
2			SM	Gray-brown silty SAND with gravel (SM), mps= 3 in., no structure, no odor, moist, occasional cobbles mps= 6 in.	10	15	5	5	45	20				
				-GLACIAL TILL-										
4	ND		ML	Gray sandy SILT with gravel (ML), mps= 0.5 in., well bonded in-situ, no odor, moist, 10% cobbles, mps= 8 in.	10	10	5	5	20	50				
6	ND		ML	Similar to above, except dark gray-brown	10	10	5	5	20	50				
8		467.5 9.5		BOTTOM OF EXPLORATION 9.5 FT										

Obstructions:

Remarks:

Field Tests

Dilatancy R - Rapid S - Slow N - None
Toughness L - Low M - Medium H - High
Plasticity N - Nonplastic L - Low M - Medium H - High
Dry Strength N - None L - Low M - Medium H - High V - Very High

Standing Water in Completed Pit

at depth NE ft
measured after - hours elapsed

Boulders

Diameter (in.)	Number	Approx. Vol. (cu.ft)
12 to 24	-	= -
over 24	-	= -

Test Pit Dimensions (ft)

Pit Length x Width (ft)
Pit Depth (ft) 9.5

NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST PIT LOG

Test Pit No. HA24-TP4

Project	ORCHARD HILL PARK DRIVE	**File No.**	0212297-000
Location	LEOMINSTER, MA	**H&A Rep**	J. Shaw
Client	WP EAST ACQUISITIONS, LLC	**Date**	12/20/2024
Contractor	EARTHWORK INDUSTRIES, INC.	**Weather**	Cloudy, light snow, 28
Equipment Used	Doosan DX-85 1 cu. yd excavator		

Ground El.: 481.5 (est.) **El. Datum:** NAVD 88 | **Location:** See Plan | **Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample Data/ PID Readings (ppm)	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0		481.3		-BROWN ROOTY FOREST MAT-										
		0.2	OL/ OH	Brown ORGANIC SOIL with sand (OL/OH), mps= 0.25 in., no structure, no odor, moist			5	5	10	80				
	ND	480.8												
		0.7	ML	-TOPSOIL-					20	80				
				Orange-brown SILT with sand (ML), mps= 0.25 in., no structure, no odor, moist, occasional cobbles mps= 6 in.										
2				-LOESS-										
	ND	479.3												
		2.2	SM	Light brown silty SAND with gravel (SM), mps= 4 in., no structure, no odor, moist, occasional cobbles mps= 8 in.	10	10	5	5	50	20				
				-GLACIAL TILL-										
4														
6														
	ND		ML	Gray sandy SILT with gravel (ML), mps= 4 in., well bonded in-situ, no odor, moist, 10% cobbles mps= 6 in.	10	15	5	10	10	50				
8														
10		471.5												
		10.0		BOTTOM OF EXPLORATION 10.0 FT										

Obstructions:

Remarks:

Field Tests

Dilatancy R - Rapid S - Slow N - None
Toughness L - Low M - Medium H - High
Plasticity N - Nonplastic L - Low M - Medium H - High
Dry Strength N - None L - Low M - Medium H - High V - Very High

Standing Water in Completed Pit

at depth NE ft
measured after - hours elapsed

Boulders

Diameter (in.)	Number	Approx. Vol. (cu.ft)
12 to 24	-	= -
over 24	-	= -

Test Pit Dimensions (ft)

Pit Length x Width (ft)
Pit Depth (ft) 10.0

NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

TEST PIT LOG

Test Pit No. HA24-TP5

Project	ORCHARD HILL PARK DRIVE	**File No.**	0212297-000
Location	LEOMINSTER, MA	**H&A Rep**	J. Shaw
Client	WP EAST ACQUISITIONS, LLC	**Date**	12/20/2024
Contractor	EARTHWORK INDUSTRIES, INC.	**Weather**	Cloudy, light snow, 28
Equipment Used	Doosan DX-85 1 cu. yd excavator		

Ground El.: 470.0 (est.) **El. Datum:** NAVD 88 | **Location:** See Plan | **Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample Data/ PID Readings (ppm)	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0	ND	469.8		-BROWN ROOTY FOREST MAT-										
		0.2	OL/ OH	Brown sandy ORGANIC SOIL (OL/OH), mps= 0.25 in., no structure, no odor, moist			5	5	20	70				
		469.3		-TOPSOIL-										
		0.7	ML	Orange-brown SILT with sand (ML), mps< 1mm, no structure, no odor, moist					20	80				
		468.5		-LOESS-										
		1.5	SM	Note: Numerous cobbles and boulders at or near ground surface, mps= 18 in.	10	15	5	5	45	20				
2				Gray-brown silty SAND with gravel (SM), mps= 3 in., occasional cobbles mps= 8 in.										
				-GLACIAL TILL-										
4	S1		ML	Gray sandy SILT with gravel (ML), mps= 3 in., well bonded in-situ, moist, 10% cobbles mps= 10 in.	10	15		5	20	50				
6														
8														
		460.5												
		9.5		BOTTOM OF EXPLORATION 9.5 FT										

Obstructions:

Remarks:

Field Tests

Dilatancy	R - Rapid S - Slow N - None
Toughness	L - Low M - Medium H - High
Plasticity	N - Nonplastic L - Low M - Medium H - High
Dry Strength	N - None L - Low M - Medium H - High V - Very High

Standing Water in Completed Pit

at depth	NE	ft
measured after	-	hours elapsed

Boulders

Diameter (in.)	Number	Approx. Vol. (cu.ft)
12 to 24	-	= -
over 24	-	= -

Test Pit Dimensions (ft)

Pit Length x Width (ft)	15 x 4
Pit Depth (ft)	9.5

NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST PIT LOG

Test Pit No. HA24-TP6

Project	ORCHARD HILL PARK DRIVE	**File No.**	0212297-000
Location	LEOMINSTER, MA	**H&A Rep**	J. Shaw
Client	WP EAST ACQUISITIONS, LLC	**Date**	12/20/2024
Contractor	EARTHWORK INDUSTRIES, INC.	**Weather**	Cloudy, light snow, 28
Equipment Used	Doosan DX-85 1 cu. yd excavator		

Ground El.: 467.0 (est.) **El. Datum:** NAVD 88 | **Location:** See Plan | **Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample Data/ PID Readings (ppm)	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0	ND	466.8		-BROWN ROOTY FOREST MAT-										
		0.2	OL/ OH	Brown sandy ORGANIC SOIL (OL/OH), mps= 2 in., no structure, no odor, moist	5	5			15	75				
	ND	466.2		-TOPSOIL-										
		0.8	ML	Orange-brown SILT with sand (ML), mps= 0.4 in., no structure, no odor, moist, 25% cobbles mps= 10 in.	5	5			15	75				
				-LOESS-										
	ND	465.2												
2		1.8	SM	Gray-brown silty SAND with gravel (SM), mps= 5 in., no structure, no odor, moist, 25% cobbles mps= 8 in.	10	15	5	10	45	15				
				-GLACIAL TILL-										
4														
	ND													
6			SM	Gray sandy SILT with gravel (SM), mps= 3 in., well bonded in-situ, no odor, moist, 10% cobbles mps= 6 in.	10	10	5	5	20	50				
8														
		457.2												
		9.8		BOTTOM OF EXPLORATION 9.8 FT										

Obstructions:

Remarks:

Field Tests

Dilatancy R - Rapid S - Slow N - None
Toughness L - Low M - Medium H - High
Plasticity N - Nonplastic L - Low M - Medium H - High
Dry Strength N - None L - Low M - Medium H - High V - Very High

Standing Water in Completed Pit

at depth NE ft
measured after - hours elapsed

Boulders

Diameter (in.)	Number	Approx. Vol. (cu.ft)
12 to 24	-	= -
over 24	-	= -

Test Pit Dimensions (ft)

Pit Length x Width (ft)
Pit Depth (ft) 9.8

NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST PIT LOG

Test Pit No. HA24-TP7

Project	ORCHARD HILL PARK DRIVE	**File No.**	0212297-000
Location	LEOMINSTER, MA	**H&A Rep**	D. Warren
Client	WP EAST ACQUISITIONS, LLC	**Date**	12/19/2024
Contractor	EARTHWORK INDUSTRIES, INC.	**Weather**	Overcast, 30s
Equipment Used	Doosan DX-85 1 cu. yd excavator		

Ground El.: 457.0 (est.) **El. Datum:** NAVD 88 | **Location:** See Plan | **Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample Data/ PID Readings (ppm)	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0	ND	456.8		-BROWN ROOTY FOREST MAT-										
		0.2	OL/ OH	Brown ORGANIC SOIL with sand (OL/OH), mps= 2 in., no structure, no odor, moist, trace gravel	5	5			15	75				
	ND	456.2		-TOPSOIL-										
		0.8	ML	Orange-brown SILT with sand (ML), mps= 3 in., trace gravel -LOESS-	5	5			15	75				
2		454.8												
		2.2												
	ND		SM	Gray-brown silty SAND with gravel (SM), mps= 5 in., no structure, no odor, dry, 25% cobbles mps= 10 in.	10	15	5	5	50	15				
4				-GLACIAL TILL-										
	ND		ML	Gray sandy SILT with gravel (ML), mps= 3 in., well bonded in-situ, moist, 15% cobbles and boulders mps= 24 in.	10	10	5	5	20	50				
6														
8														
10		447.0		BOTTOM OF EXPLORATION 10.0 FT										
		10.0												

Obstructions:

Remarks: Multiple boulders at/near ground surface, mps= approximately 30 in.

Field Tests

Dilatancy	R - Rapid S - Slow N - None
Toughness	L - Low M - Medium H - High
Plasticity	N - Nonplastic L - Low M - Medium H - High
Dry Strength	N - None L - Low M - Medium H - High V - Very High

Standing Water in Completed Pit

at depth	NE	ft
measured after	-	hours elapsed

Boulders

Diameter (in.)	Number		Approx. Vol. (cu.ft)
12 to 24	12	=	50
over 24	5	=	50

Test Pit Dimensions (ft)

Pit Length x Width (ft)	15 x 10
Pit Depth (ft)	10.0

NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST PIT LOG

Test Pit No. HA24-TP8

Project	ORCHARD HILL PARK DRIVE	**File No.**	0212297-000
Location	LEOMINSTER, MA	**H&A Rep**	D. Warren
Client	WP EAST ACQUISITIONS, LLC	**Date**	12/18/2024
Contractor	EARTHWORK INDUSTRIES, INC.	**Weather**	Sunny, 40s
Equipment Used	Doosan DX-85 1 cu. yd excavator		

Ground El.: 462.5 (est.) **El. Datum:** NAVD 88 | **Location:** See Plan | **Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample Data/ PID Readings (ppm)	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0		462.3		-BROWN ROOTY FOREST MAT-										
		0.2	OL/ OH	Brown sandy ORGANIC SOIL (OL/OH), mps< 1mm, no structure, no odor, moist					30	70				
		461.9		-TOPSOIL-										
		0.6	ML	Orange-brown SILT with sand (ML), mps= 0.25 in., no structure, no odor, moist			5	5	15	75				
				-LOESS-										
2		460.5												
		2.0	SM	Light gray-brown silty SAND with gravel (SM), mps= 3 in., no structure, no odor, dry, 20% cobbles and boulders mps= 30 in. Note: Two 30-in. boulders in top 3 ft of glacial till	10	10	5	10	45	20				
				-GLACIAL TILL-										
4														
6			ML	Brown sandy SILT with gravel (ML), mps= 3 in., well bonded in-situ, moist, 20% cobbles and boulders mps= 20 in.	10	10	5	5	20	50				
8														
10		452.5												
		10.0		BOTTOM OF EXPLORATION 10.0 FT										

Obstructions:

Remarks:

Field Tests

Dilatancy	R - Rapid S - Slow N - None
Toughness	L - Low M - Medium H - High
Plasticity	N - Nonplastic L - Low M - Medium H - High
Dry Strength	N - None L - Low M - Medium H - High V - Very High

Standing Water in Completed Pit

at depth	NE	ft
measured after	-	hours elapsed

Boulders

Diameter (in.)	Number		Approx. Vol. (cu.ft)
12 to 24	8	=	45
over 24	2	=	30

Test Pit Dimensions (ft)

Pit Length x Width (ft)	15 x 3.5
Pit Depth (ft)	10.0

NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST PIT LOG

Test Pit No. HA24-TP9

Project	ORCHARD HILL PARK DRIVE	**File No.**	0212297-000
Location	LEOMINSTER, MA	**H&A Rep**	D. Warren
Client	WP EAST ACQUISITIONS, LLC	**Date**	12/18/2024
Contractor	EARTHWORK INDUSTRIES, INC.	**Weather**	Sunny, 40s
Equipment Used	Doosan DX-85 1 cu. yd excavator		

Ground El.: 452.5 (est.) **El. Datum:** NAVD 88 | **Location:** See Plan | **Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample Data/ PID Readings (ppm)	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Tests Dilatancy	Toughness	Plasticity	Strength
0	ND	452.3 0.2		-BROWN ROOTY FOREST MAT-										
	ND	451.9 0.6	OL/ OH	Brown sandy ORGANIC SOIL (OL/OH), mps= 0.25 in., no structure, no odor, moist, 20% roots			5	5	20	70				
			ML	-TOPSOIL- Orange brown SILT with sand (ML), mps< 1mm, no structure, no odor, moist, occasional cobbles mps= 6 in.					20	80				
	ND	450.9 1.6		-LOESS-										
2			SM	Light brown silty SAND with gravel (SM), mps= 3 in., no structure, no odor, dry, 20% cobbles/boulders mps= 24 in. -GLACIAL TILL-	10	15	5	5	45	20				
4	ND		ML	Gray-brown sandy SILT with gravel (ML), mps= 3 in., well bonded in-situ, moist, 15% cobbles and boulders mps= 24 in.	10	10	5	5	20	50				
6														
8		443.5 9.0		BOTTOM OF EXPLORATION 9.5 FT										

Obstructions:

Remarks:

Field Tests

Dilatancy R - Rapid S - Slow N - None
Toughness L - Low M - Medium H - High
Plasticity N - Nonplastic L - Low M - Medium H - High
Dry Strength N - None L - Low M - Medium H - High V - Very High

Standing Water in Completed Pit

at depth NE ft
measured after - hours elapsed

Boulders

Diameter (in.)	Number	Approx. Vol. (cu.ft)
12 to 24	-	= -
over 24	-	= -

Test Pit Dimensions (ft)

Pit Length x Width (ft) 15 x 9
Pit Depth (ft) 9.0

NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.

ORCHARD HILL PARK DRIVE – TEST PIT EXPLORATIONS
LEOMINSTER, MASSACUSSETTS
File No. 0212297
Date Photographs Taken: 18 to 20 December 2024

Photo 1: HA24-TP1

Photo 2: HA24-TP1

Photo 3: HA24-TP2

Photo 4: HA24-TP2

Photo 5: HA24-TP3

Photo 6: HA24-TP3

Photo 7: HA24-TP4

Photo 8: HA24-TP4

Photo 9: HA24-TP5

Photo 10: HA24-TP5

Photo 11: HA24-TP6

Photo 12: HA24-TP6

Photo 13: HA24-TP7

Photo 14: HA24-TP7

Photo 15: HA24-TP8

Photo 16: HA24-TP8

Photo 17: HA24-TP9

Photo 18: HA24-TP9

Photo 19: HA24-TP10

Photo 20: HA24-TP10

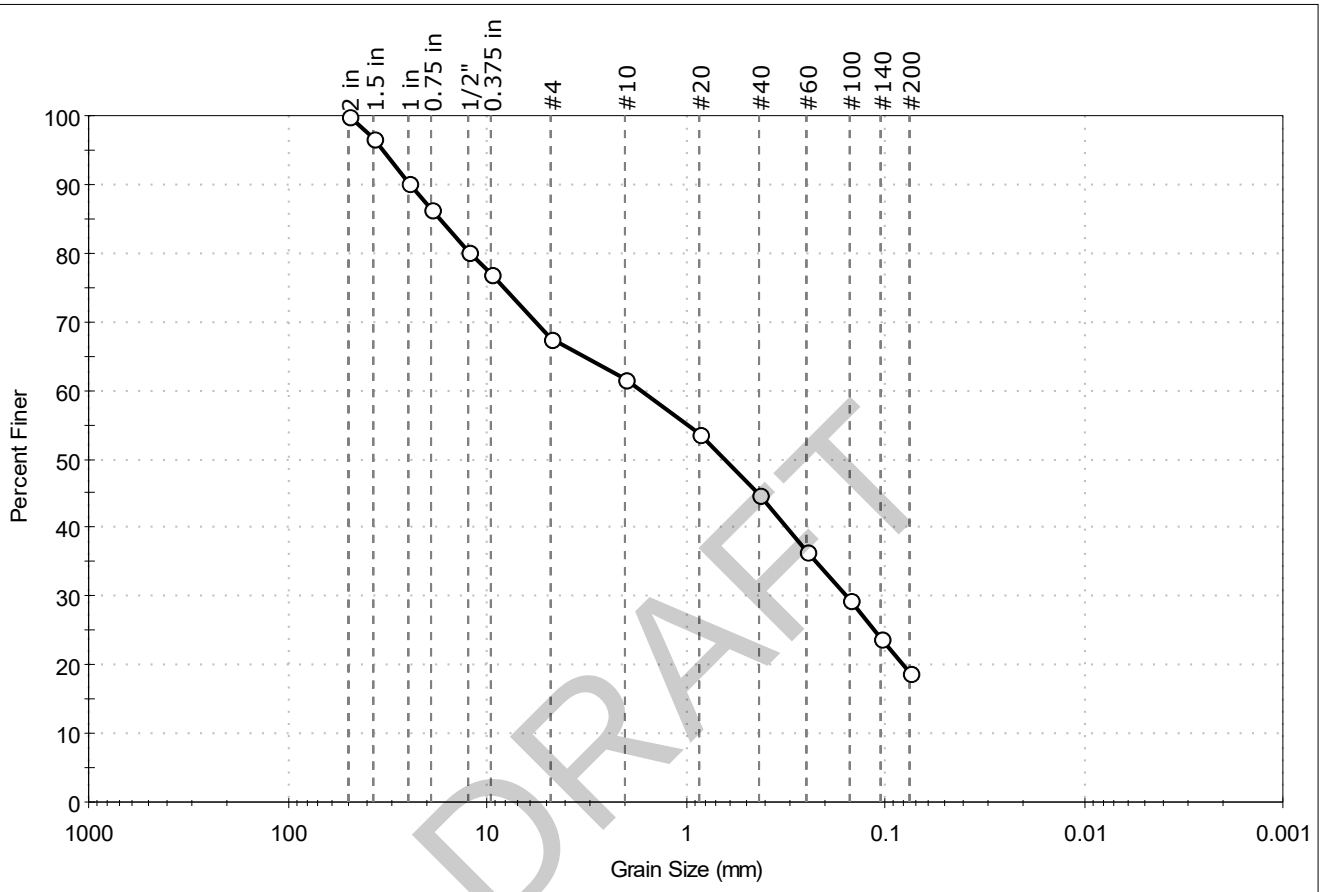
Photo 21: HA24-TP11

Photo 22: HA24-TP11

APPENDIX C
Geotechnical Laboratory Testing Results

Client:	Haley & Aldrich, Inc.				
Project:	Orchard Hill Park				
Location:	Leominster, MA			Project No:	GTX-320387
Boring ID:	HA24-TP1	Sample Type:	Bag	Tested By:	ajl
Sample ID:	S1	Test Date:	01/09/25	Checked By:	jsc
Depth :	2.0-6.0 ft	Test Id:	799630		
Test Comment:	---				
Visual Description:	Moist, light olive brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	32.3	48.7	19.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
2 in	50.00	100		
1.5 in	37.50	97		
1 in	25.00	90		
0.75 in	19.00	86		
1/2"	12.50	80		
0.375 in	9.50	77		
#4	4.75	68		
#10	2.00	62		
#20	0.85	54		
#40	0.42	45		
#60	0.25	37		
#100	0.15	29		
#140	0.11	24		
#200	0.075	19		

Coefficients

D_{85} = 17.3548 mm	D_{30} = 0.1563 mm
D_{60} = 1.6784 mm	D_{15} = N/A
D_{50} = 0.6388 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

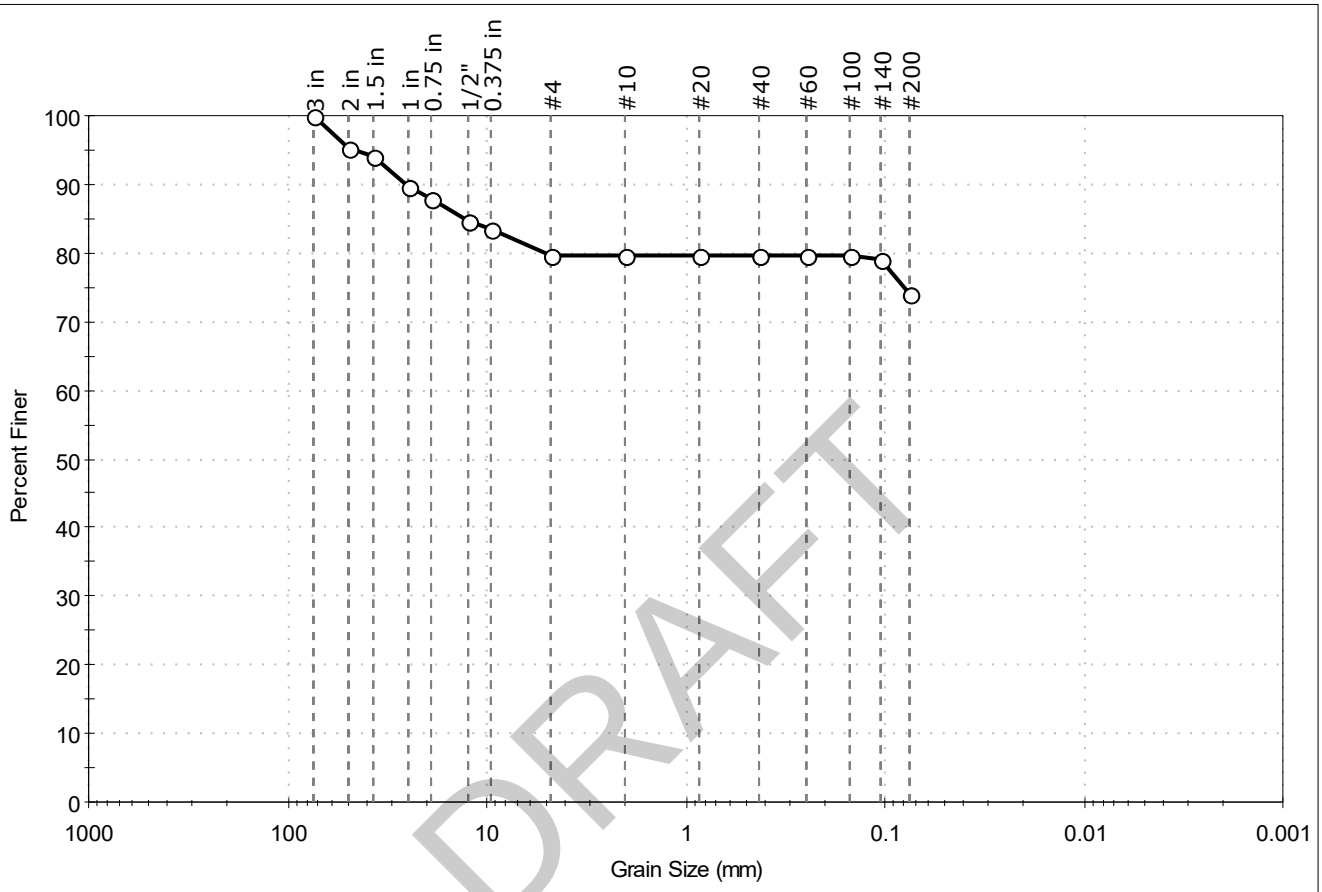
Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	Haley & Aldrich, Inc.				
Project:	Orchard Hill Park				
Location:	Leominster, MA			Project No:	GTX-320387
Boring ID:	HA24-TP1	Sample Type:	Bag	Tested By:	ajl
Sample ID:	S2	Test Date:	01/09/25	Checked By:	jsc
Depth :	6.0-10.0 ft	Test Id:	799631		
Test Comment:	---				
Visual Description:	Moist, light olive brown silt with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	20.4	5.7	73.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3 in	75.00	100		
2 in	50.00	95		
1.5 in	37.50	94		
1 in	25.00	90		
0.75 in	19.00	88		
1/2"	12.50	85		
0.375 in	9.50	84		
#4	4.75	80		
#10	2.00	80		
#20	0.85	80		
#40	0.42	80		
#60	0.25	80		
#100	0.15	80		
#140	0.11	79		
#200	0.075	74		

Coefficients

D_{85} = 13.2621 mm	D_{30} = N/A
D_{60} = N/A	D_{15} = N/A
D_{50} = N/A	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

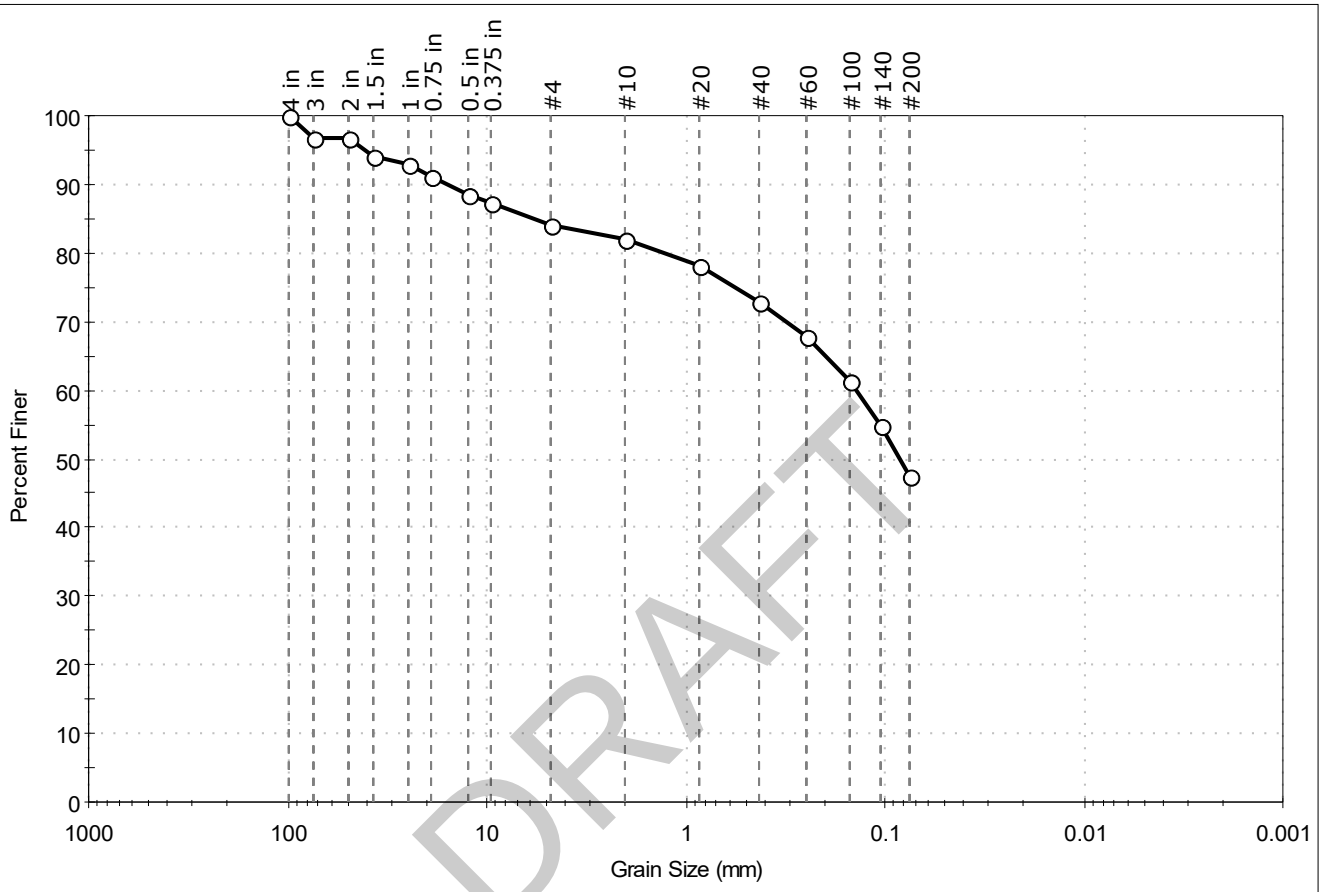
Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	Haley & Aldrich, Inc.				
Project:	Orchard Hill Park				
Location:	Leominster, MA			Project No:	GTX-320387
Boring ID:	HA24-TP5	Sample Type:	Bag	Tested By:	ajl
Sample ID:	S1	Test Date:	01/10/25	Checked By:	jsc
Depth :	4.0-9.5 ft	Test Id:	799632		
Test Comment:	---				
Visual Description:	Moist, dark olive brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
3.3	12.7	36.5	47.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
4 in	100.00	100		
3 in	75.00	97		
2 in	50.00	97		
1.5 in	37.50	94		
1 in	25.00	93		
0.75 in	19.00	91		
0.5 in	12.50	89		
0.375 in	9.50	87		
#4	4.75	84		
#10	2.00	82		
#20	0.85	78		
#40	0.42	73		
#60	0.25	68		
#100	0.15	61		
#140	0.11	55		
#200	0.075	47		

Coefficients

D_{85} = 5.9346 mm D_{30} = N/A

D_{60} = 0.1392 mm D_{15} = N/A

D_{50} = 0.0843 mm D_{10} = N/A

C_u = N/A C_c = N/A

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

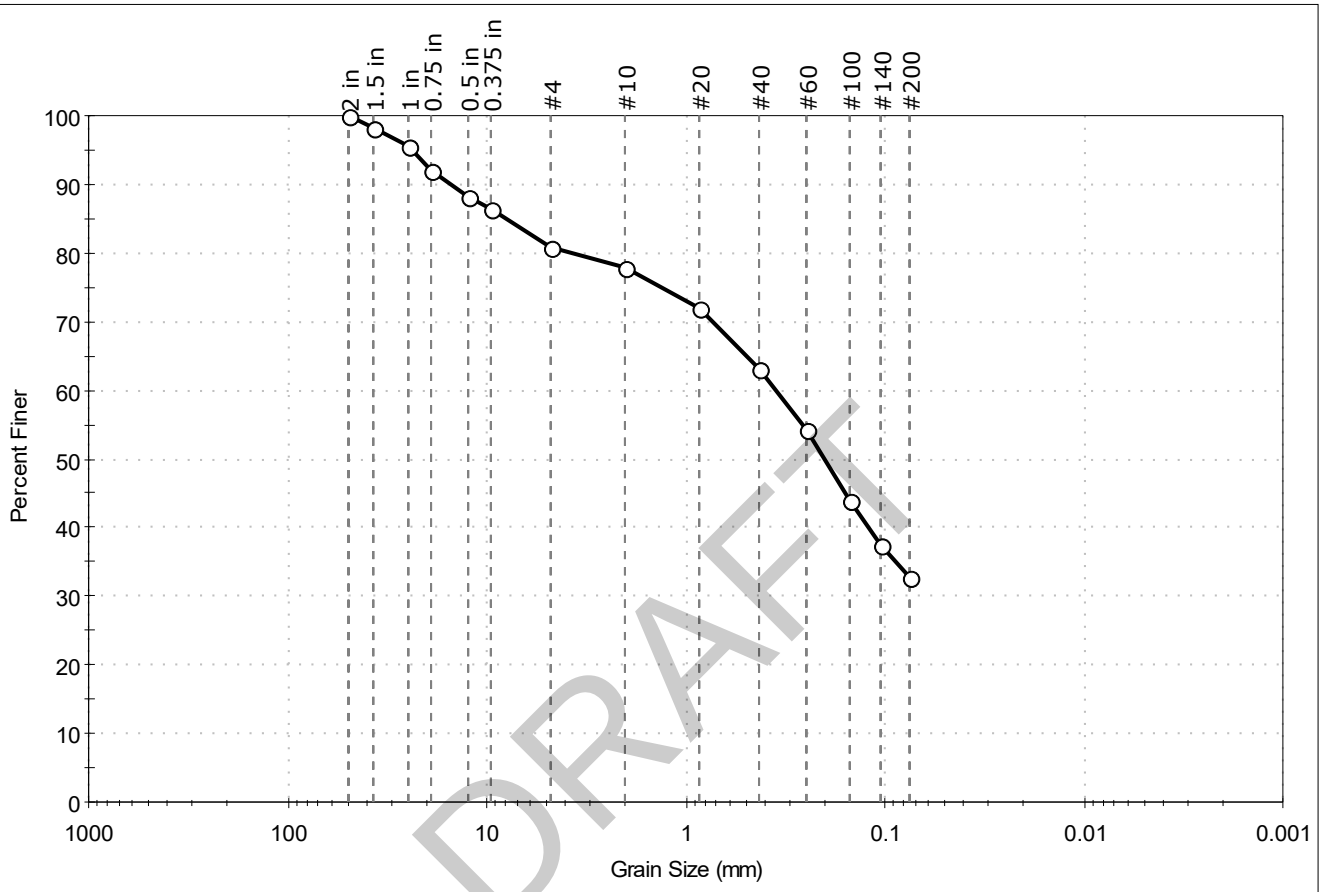
Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	Haley & Aldrich, Inc.				
Project:	Orchard Hill Park				
Location:	Leominster, MA			Project No:	GTX-320387
Boring ID:	HA24-TP10	Sample Type:	Bag	Tested By:	ajl
Sample ID:	S1	Test Date:	01/10/25	Checked By:	jsc
Depth :	3.0-9.0 ft	Test Id:	799633		
Test Comment:	---				
Visual Description:	Moist, light olive brown silty sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	19.3	47.8	32.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
2 in	50.00	100		
1.5 in	37.50	98		
1 in	25.00	96		
0.75 in	19.00	92		
0.5 in	12.50	88		
0.375 in	9.50	86		
#4	4.75	81		
#10	2.00	78		
#20	0.85	72		
#40	0.42	63		
#60	0.25	54		
#100	0.15	44		
#140	0.11	38		
#200	0.075	33		

Coefficients

D_{85} = 8.0353 mm	D_{30} = N/A
D_{60} = 0.3519 mm	D_{15} = N/A
D_{50} = 0.2030 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

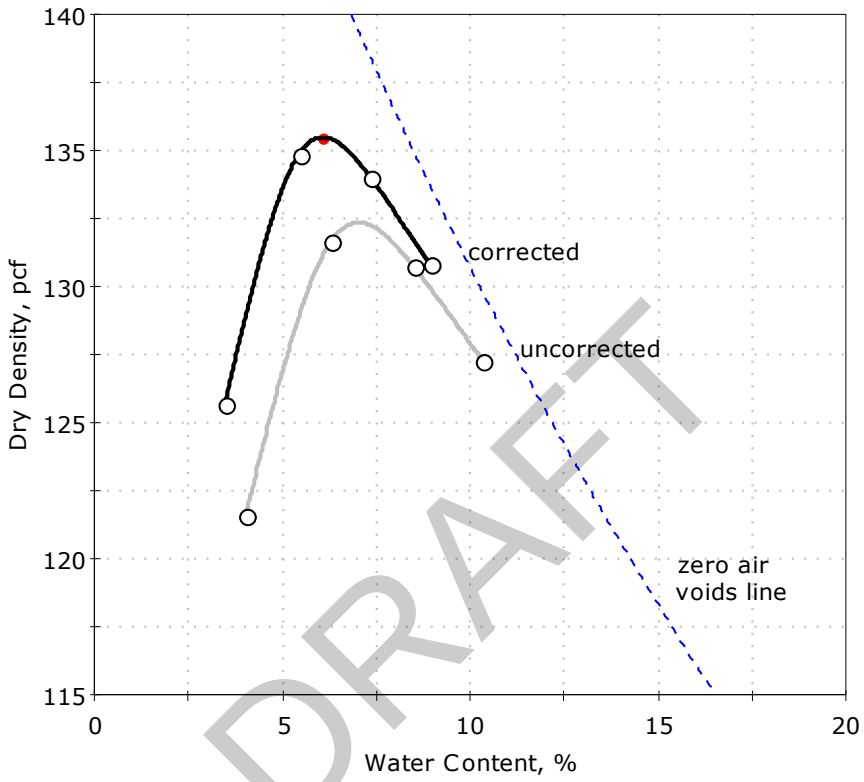
Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	Haley & Aldrich, Inc.				
Project:	Orchard Hill Park				
Location:	Leominster, MA			Project No:	GTX-320387
Boring ID:	HA24-TP1	Sample Type:	Bag	Tested By:	cwd
Sample ID:	S1	Test Date:	01/10/25	Checked By:	jsc
Depth :	2.0-6.0 ft	Test Id:	799634		
Test Comment:	---				
Visual Description:	Moist, light olive brown silty sand with gravel				
Sample Comment:	---				

Compaction Report - ASTM D1557



Data Points	Point 1	Point 2	Point 3	Point 4
Dry density, pcf	121.6	131.7	130.7	127.2
Moisture Content, %	4.0	6.3	8.5	10.3

Method : C

Preparation : DRY

As received Moisture :7 %

Rammer : Mechanical

Zero voids line based on assumed specific gravity of 2.65

Maximum Dry Density= 132.3 pcf

Optimum Moisture= 7.0 %

Oversize Correction (14% > 3/4 inch Sieve)

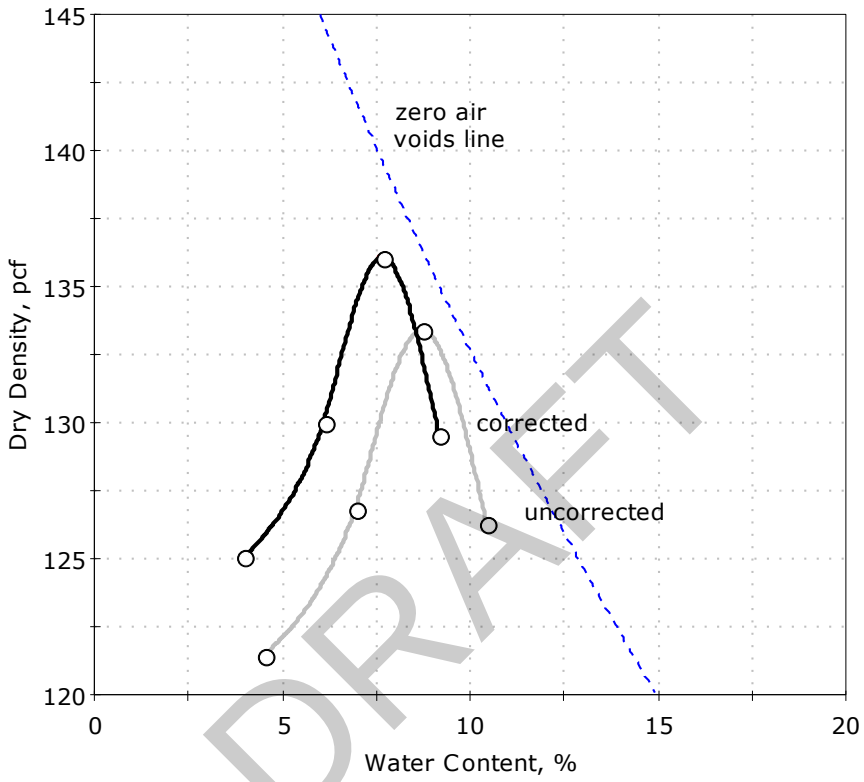
Corrected Maximum Dry Density= 135.5 pcf

Corrected Optimum Moisture= 6.1 %

Assumed Average Bulk Specific Gravity = 2.55

Client:	Haley & Aldrich, Inc.				
Project:	Orchard Hill Park				
Location:	Leominster, MA			Project No:	GTX-320387
Boring ID:	HA24-TP1	Sample Type:	Bag	Tested By:	cwd
Sample ID:	S2	Test Date:	01/10/25	Checked By:	jsc
Depth :	6.0-10.0 ft	Test Id:	799635		
Test Comment:	---				
Visual Description:	Moist, light olive brown silt with gravel				
Sample Comment:	---				

Compaction Report - ASTM D1557



Data Points	Point 1	Point 2	Point 3	Point 4
Dry density, pcf	121.5	126.8	133.4	126.3
Moisture Content, %	4.5	6.9	8.7	10.4

Method : C

Preparation : DRY

As received Moisture :9 %

Rammer : Mechanical

Zero voids line based on assumed specific gravity of 2.70

Maximum Dry Density= 133.4 pcf

Optimum Moisture= 8.7 %

Oversize Correction (12% > 3/4 inch Sieve)

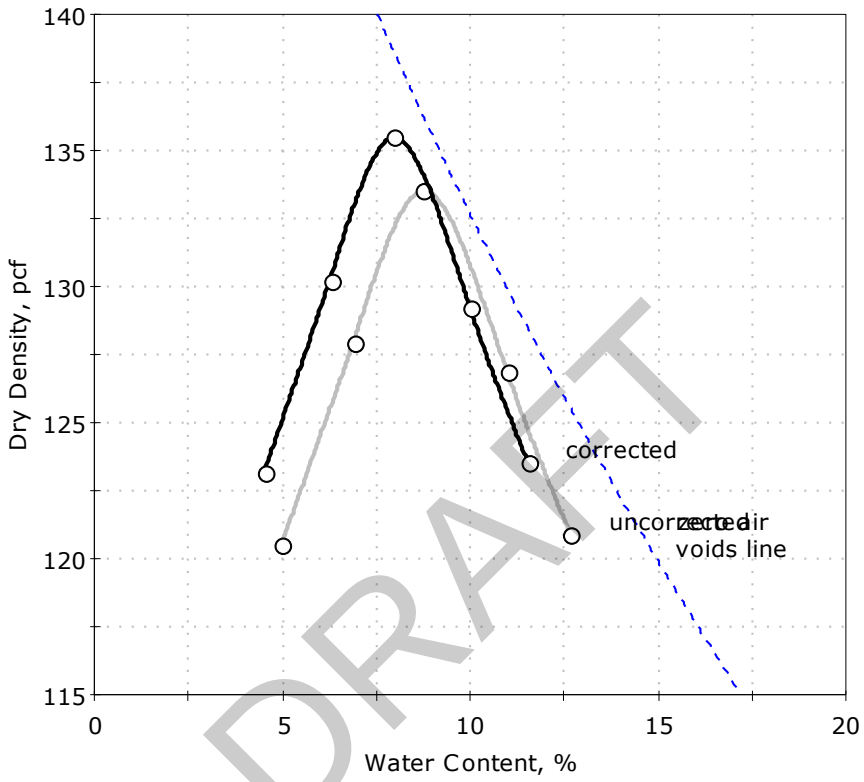
Corrected Maximum Dry Density= 136.1 pcf

Corrected Optimum Moisture= 7.6 %

Assumed Average Bulk Specific Gravity = 2.55

Client:	Haley & Aldrich, Inc.				
Project:	Orchard Hill Park				
Location:	Leominster, MA			Project No:	GTX-320387
Boring ID:	HA24-TP5	Sample Type:	Bag	Tested By:	cwd
Sample ID:	S1	Test Date:	01/10/25	Checked By:	jsc
Depth :	4.0-9.5 ft	Test Id:	799636		
Test Comment:	---				
Visual Description:	Moist, dark olive brown silty sand with gravel				
Sample Comment:	---				

Compaction Report - ASTM D1557



Data Points	Point 1	Point 2	Point 3	Point 4	Point 5
Dry density, pcf	120.5	127.9	133.5	126.9	120.9
Moisture Content, %	5.0	6.9	8.7	11.0	12.7

Method : C

Preparation : DRY

As received Moisture :12 %

Rammer : Mechanical

Zero voids line based on assumed specific gravity of 2.70

Maximum Dry Density= 133.5 pcf

Optimum Moisture= 8.7 %

Oversize Correction (9% > 3/4 inch Sieve)

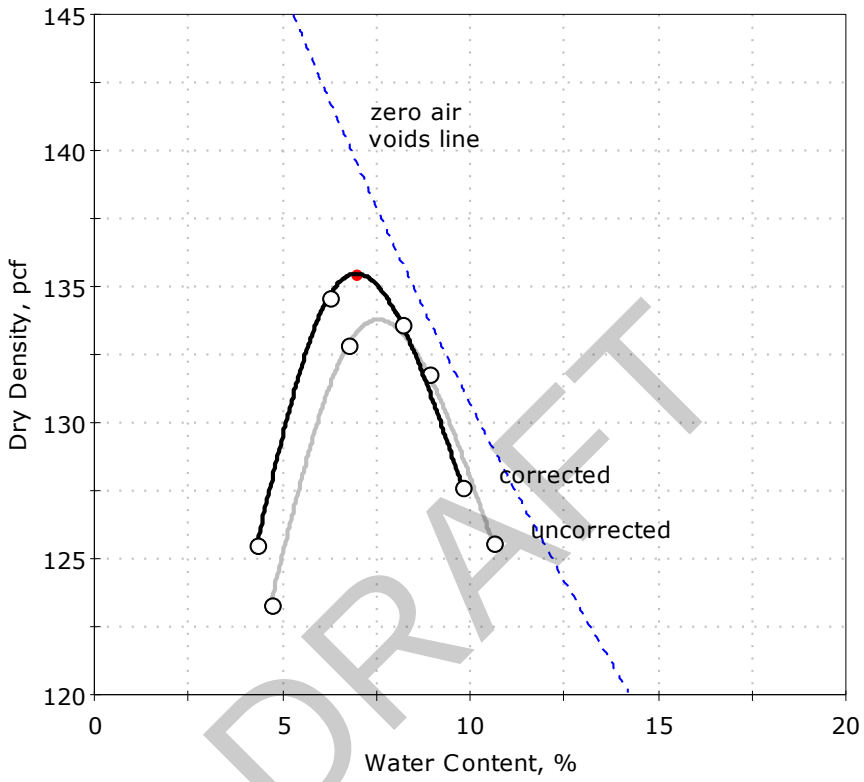
Corrected Maximum Dry Density= 135.5 pcf

Corrected Optimum Moisture= 7.9 %

Assumed Average Bulk Specific Gravity = 2.55

Client:	Haley & Aldrich, Inc.				
Project:	Orchard Hill Park				
Location:	Leominster, MA			Project No:	GTX-320387
Boring ID:	HA24-TP10	Sample Type:	Bag	Tested By:	cwd
Sample ID:	S1	Test Date:	01/10/25	Checked By:	jsc
Depth :	3.0-9.0 ft	Test Id:	799637		
Test Comment:	---				
Visual Description:	Moist, light olive brown silty sand with gravel				
Sample Comment:	---				

Compaction Report - ASTM D1557



Data Points	Point 1	Point 2	Point 3	Point 4
Dry density, pcf	123.3	132.9	131.8	125.6
Moisture Content, %	4.7	6.8	8.9	10.6

Method : C

Preparation : DRY

As received Moisture :8 %

Rammer : Mechanical

Zero voids line based on assumed specific gravity of 2.65

Maximum Dry Density= 133.8 pcf

Optimum Moisture= 7.6 %

Oversize Correction (8% > 3/4 inch Sieve)

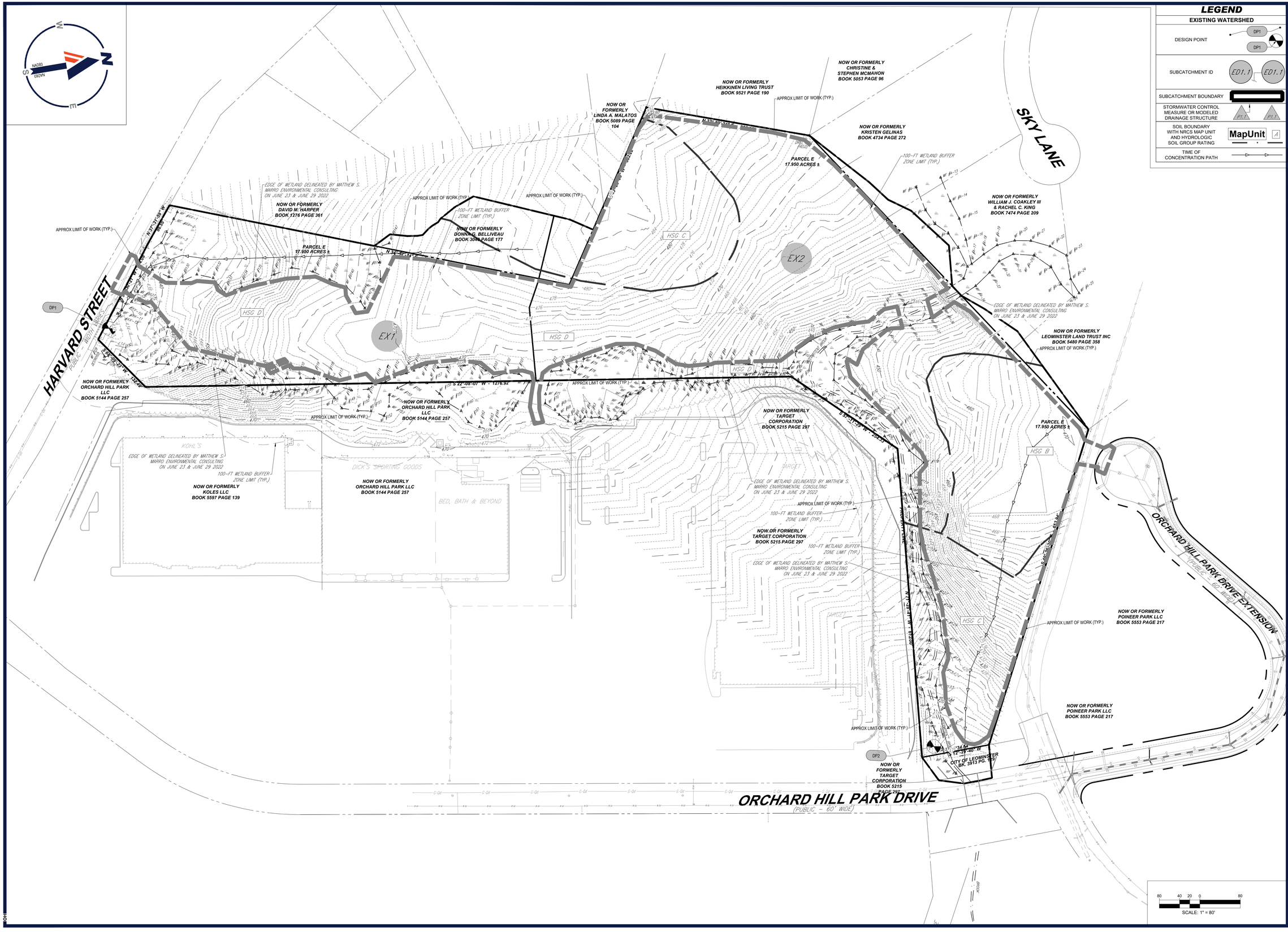
Corrected Maximum Dry Density= 135.5 pcf

Corrected Optimum Moisture= 7.0 %

Assumed Average Bulk Specific Gravity = 2.55

APPENDIX D: EXISTING CONDITIONS HYDROLOGIC ANALYSIS

- *EXISTING CONDITIONS DRAINAGE MAP*
- *EXISTING CONDITIONS HYDROCAD COMPUTATIONS*



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TRANSPORTATION SERVICES

REVISIONS

REV	DATE	COMMENT	DRAWN BY / CHECKED BY
1	07/11/2025	PER PEER REVIEW & PLANNING BOARD COMMENTS	OEH / MKB

811 Know what's below. Call before you dig.
ALWAYS CALL 811
It's fast. It's free. It's the law.

PERMIT SET

THIS DRAWING IS INTENDED FOR MUNICIPAL AND/OR AGENCY REVIEW AND APPROVAL. IT IS NOT INTENDED AS A CONSTRUCTION DOCUMENT UNLESS INDICATED OTHERWISE.

PROJECT No.:	MAA240279.00-0C
DRAWN BY:	OEH
CHECKED BY:	MKB
DATE:	08/11/2025
CAD I.D.:	P-CIVIL-HYDR

PROJECT:

SITE DEVELOPMENT PLANS

FOR

WP EAST ACQUISITIONS LLC

PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT
MAP: 386 | BLK: 4 | LOT: 1C
86 ORCHARD HILL PARK DRIVE
WORCESTER COUNTY
LEOMINSTER, MASSACHUSETTS

BOHLER™
50 WASHINGTON ST., SUITE 2000
WESTBOROUGH, MA 01581
Phone: (508) 480-9900
www.BohlerEngineering.com

SHEET TITLE:

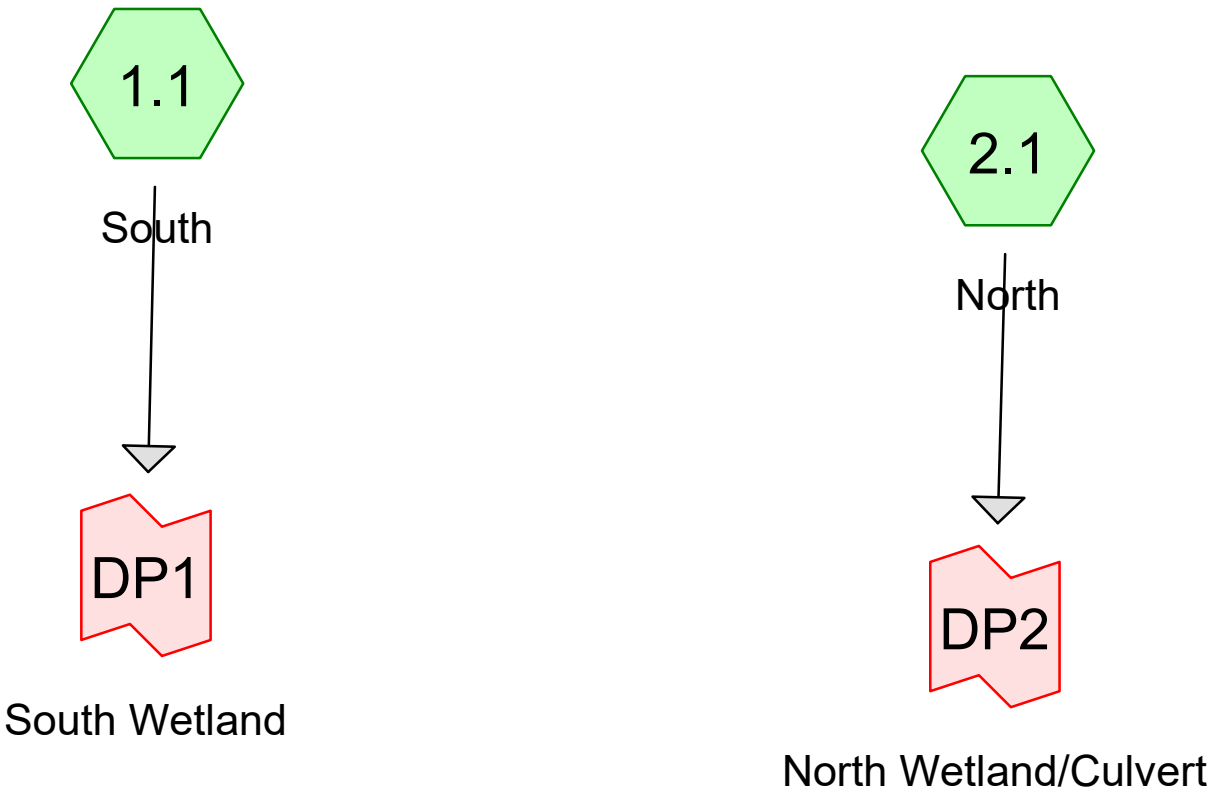
PRE DEVELOPMENT DRAINAGE AREA MAP

SHEET NUMBER:

PRED

REVISION 1 - 07/11/2025

P:\2024\MAA240279.00\CAD\DRAWINGS\PLAN SETS\CIVIL SITE PLANS\P-CIVIL-HYDR-MAA240279.00-0C-----LAYOUT: C-402 PRED
OH



Subcat Reach Pond Link

Routing Diagram for MAA240279 PRE
Prepared by Bohler, Printed 7/17/2025

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.252	98	Water Surface, HSG C (2.1)
2.670	98	Water Surface, HSG D (1.1, 2.1)
2.204	55	Woods, Good, HSG B (2.1)
4.059	70	Woods, Good, HSG C (1.1, 2.1)
10.239	77	Woods, Good, HSG D (1.1, 2.1)

Summary for Subcatchment 1.1: South

Runoff = 7.02 cfs @ 12.31 hrs, Volume= 0.772 af, Depth= 1.54"
Routed to Link DP1 : South Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.12"

Area (sf)	CN	Description
54,834	98	Water Surface, HSG D
54,952	77	Woods, Good, HSG D
1,097	77	Woods, Good, HSG D
99,643	77	Woods, Good, HSG D
17,123	70	Woods, Good, HSG C
6,207	98	Water Surface, HSG D
1,914	98	Water Surface, HSG D
4,529	77	Woods, Good, HSG D
13,437	98	Water Surface, HSG D
7,603	77	Woods, Good, HSG D
8	77	Woods, Good, HSG D
261,347	83	Weighted Average
184,955		70.77% Pervious Area
76,392		29.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0380	0.09		**Sheet Flow, Sheet floW** Woods: Light underbrush n= 0.400 P2= 3.12"
12.1	860	0.0560	1.18		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
21.8	910	Total			

Summary for Subcatchment 2.1: North

Runoff = 9.32 cfs @ 12.29 hrs, Volume= 1.043 af, Depth= 0.93"
Routed to Link DP2 : North Wetland/Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.12"

Area (sf)	CN	Description
213,920	77	Woods, Good, HSG D
24,843	98	Water Surface, HSG D
15,085	98	Water Surface, HSG D
921	77	Woods, Good, HSG D
1,050	77	Woods, Good, HSG D
809	77	Woods, Good, HSG D
79,815	70	Woods, Good, HSG C
10,991	98	Water Surface, HSG C
95,996	55	Woods, Good, HSG B
61,486	77	Woods, Good, HSG D
79,893	70	Woods, Good, HSG C
584,809	73	Weighted Average
533,890		91.29% Pervious Area
50,919		8.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	50	0.0240	0.07		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.12"
7.4	636	0.0820	1.43		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
19.0	686	Total			

Summary for Link DP1: South Wetland

Inflow Area = 6.000 ac, 29.23% Impervious, Inflow Depth = 1.54" for 2-Year event
Inflow = 7.02 cfs @ 12.31 hrs, Volume= 0.772 af
Primary = 7.02 cfs @ 12.31 hrs, Volume= 0.772 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP2: North Wetland/Culvert

Inflow Area = 13.425 ac, 8.71% Impervious, Inflow Depth = 0.93" for 2-Year event
Inflow = 9.32 cfs @ 12.29 hrs, Volume= 1.043 af
Primary = 9.32 cfs @ 12.29 hrs, Volume= 1.043 af, Atten= 0%, Lag= 0.0 min

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

Summary for Subcatchment 1.1: South

Runoff = 13.42 cfs @ 12.29 hrs, Volume= 1.470 af, Depth= 2.94"
Routed to Link DP1 : South Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.74"

Area (sf)	CN	Description
54,834	98	Water Surface, HSG D
54,952	77	Woods, Good, HSG D
1,097	77	Woods, Good, HSG D
99,643	77	Woods, Good, HSG D
17,123	70	Woods, Good, HSG C
6,207	98	Water Surface, HSG D
1,914	98	Water Surface, HSG D
4,529	77	Woods, Good, HSG D
13,437	98	Water Surface, HSG D
7,603	77	Woods, Good, HSG D
8	77	Woods, Good, HSG D
261,347	83	Weighted Average
184,955		70.77% Pervious Area
76,392		29.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0380	0.09		**Sheet Flow, Sheet floW** Woods: Light underbrush n= 0.400 P2= 3.12"
12.1	860	0.0560	1.18		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
21.8	910	Total			

Summary for Subcatchment 2.1: North

Runoff = 22.23 cfs @ 12.27 hrs, Volume= 2.325 af, Depth= 2.08"
Routed to Link DP2 : North Wetland/Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.74"

Area (sf)	CN	Description
213,920	77	Woods, Good, HSG D
24,843	98	Water Surface, HSG D
15,085	98	Water Surface, HSG D
921	77	Woods, Good, HSG D
1,050	77	Woods, Good, HSG D
809	77	Woods, Good, HSG D
79,815	70	Woods, Good, HSG C
10,991	98	Water Surface, HSG C
95,996	55	Woods, Good, HSG B
61,486	77	Woods, Good, HSG D
79,893	70	Woods, Good, HSG C
584,809	73	Weighted Average
533,890		91.29% Pervious Area
50,919		8.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	50	0.0240	0.07		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.12"
7.4	636	0.0820	1.43		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
19.0	686	Total			

Summary for Link DP1: South Wetland

Inflow Area = 6.000 ac, 29.23% Impervious, Inflow Depth = 2.94" for 10-Year event
Inflow = 13.42 cfs @ 12.29 hrs, Volume= 1.470 af
Primary = 13.42 cfs @ 12.29 hrs, Volume= 1.470 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP2: North Wetland/Culvert

Inflow Area = 13.425 ac, 8.71% Impervious, Inflow Depth = 2.08" for 10-Year event
Inflow = 22.23 cfs @ 12.27 hrs, Volume= 2.325 af
Primary = 22.23 cfs @ 12.27 hrs, Volume= 2.325 af, Atten= 0%, Lag= 0.0 min

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

Summary for Subcatchment 1.1: South

Runoff = 17.54 cfs @ 12.29 hrs, Volume= 1.930 af, Depth= 3.86"
Routed to Link DP1 : South Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.75"

Area (sf)	CN	Description
54,834	98	Water Surface, HSG D
54,952	77	Woods, Good, HSG D
1,097	77	Woods, Good, HSG D
99,643	77	Woods, Good, HSG D
17,123	70	Woods, Good, HSG C
6,207	98	Water Surface, HSG D
1,914	98	Water Surface, HSG D
4,529	77	Woods, Good, HSG D
13,437	98	Water Surface, HSG D
7,603	77	Woods, Good, HSG D
8	77	Woods, Good, HSG D
261,347	83	Weighted Average
184,955		70.77% Pervious Area
76,392		29.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0380	0.09		**Sheet Flow, Sheet floW** Woods: Light underbrush n= 0.400 P2= 3.12"
12.1	860	0.0560	1.18		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
21.8	910	Total			

Summary for Subcatchment 2.1: North

Runoff = 31.16 cfs @ 12.27 hrs, Volume= 3.225 af, Depth= 2.88"
Routed to Link DP2 : North Wetland/Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-Year Rainfall=5.75"

Area (sf)	CN	Description
213,920	77	Woods, Good, HSG D
24,843	98	Water Surface, HSG D
15,085	98	Water Surface, HSG D
921	77	Woods, Good, HSG D
1,050	77	Woods, Good, HSG D
809	77	Woods, Good, HSG D
79,815	70	Woods, Good, HSG C
10,991	98	Water Surface, HSG C
95,996	55	Woods, Good, HSG B
61,486	77	Woods, Good, HSG D
79,893	70	Woods, Good, HSG C
584,809	73	Weighted Average
533,890		91.29% Pervious Area
50,919		8.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	50	0.0240	0.07		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.12"
7.4	636	0.0820	1.43		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
19.0	686	Total			

Summary for Link DP1: South Wetland

Inflow Area = 6.000 ac, 29.23% Impervious, Inflow Depth = 3.86" for 25-Year event
Inflow = 17.54 cfs @ 12.29 hrs, Volume= 1.930 af
Primary = 17.54 cfs @ 12.29 hrs, Volume= 1.930 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP2: North Wetland/Culvert

Inflow Area = 13.425 ac, 8.71% Impervious, Inflow Depth = 2.88" for 25-Year event
Inflow = 31.16 cfs @ 12.27 hrs, Volume= 3.225 af
Primary = 31.16 cfs @ 12.27 hrs, Volume= 3.225 af, Atten= 0%, Lag= 0.0 min

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

Summary for Subcatchment 1.1: South

Runoff = 23.96 cfs @ 12.28 hrs, Volume= 2.660 af, Depth= 5.32"
Routed to Link DP1 : South Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.31"

Area (sf)	CN	Description
54,834	98	Water Surface, HSG D
54,952	77	Woods, Good, HSG D
1,097	77	Woods, Good, HSG D
99,643	77	Woods, Good, HSG D
17,123	70	Woods, Good, HSG C
6,207	98	Water Surface, HSG D
1,914	98	Water Surface, HSG D
4,529	77	Woods, Good, HSG D
13,437	98	Water Surface, HSG D
7,603	77	Woods, Good, HSG D
8	77	Woods, Good, HSG D
261,347	83	Weighted Average
184,955		70.77% Pervious Area
76,392		29.23% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0380	0.09		**Sheet Flow, Sheet floW** Woods: Light underbrush n= 0.400 P2= 3.12"
12.1	860	0.0560	1.18		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
21.8	910	Total			

Summary for Subcatchment 2.1: North

Runoff = 45.61 cfs @ 12.26 hrs, Volume= 4.703 af, Depth= 4.20"
Routed to Link DP2 : North Wetland/Culvert

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=7.31"

Area (sf)	CN	Description
213,920	77	Woods, Good, HSG D
24,843	98	Water Surface, HSG D
15,085	98	Water Surface, HSG D
921	77	Woods, Good, HSG D
1,050	77	Woods, Good, HSG D
809	77	Woods, Good, HSG D
79,815	70	Woods, Good, HSG C
10,991	98	Water Surface, HSG C
95,996	55	Woods, Good, HSG B
61,486	77	Woods, Good, HSG D
79,893	70	Woods, Good, HSG C
584,809	73	Weighted Average
533,890		91.29% Pervious Area
50,919		8.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.6	50	0.0240	0.07		**Sheet Flow, Sheet Flow** Woods: Light underbrush n= 0.400 P2= 3.12"
7.4	636	0.0820	1.43		**Shallow Concentrated Flow, SCF** Woodland Kv= 5.0 fps
19.0	686	Total			

Summary for Link DP1: South Wetland

Inflow Area = 6.000 ac, 29.23% Impervious, Inflow Depth = 5.32" for 100-Year event
Inflow = 23.96 cfs @ 12.28 hrs, Volume= 2.660 af
Primary = 23.96 cfs @ 12.28 hrs, Volume= 2.660 af, Atten= 0%, Lag= 0.0 min

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

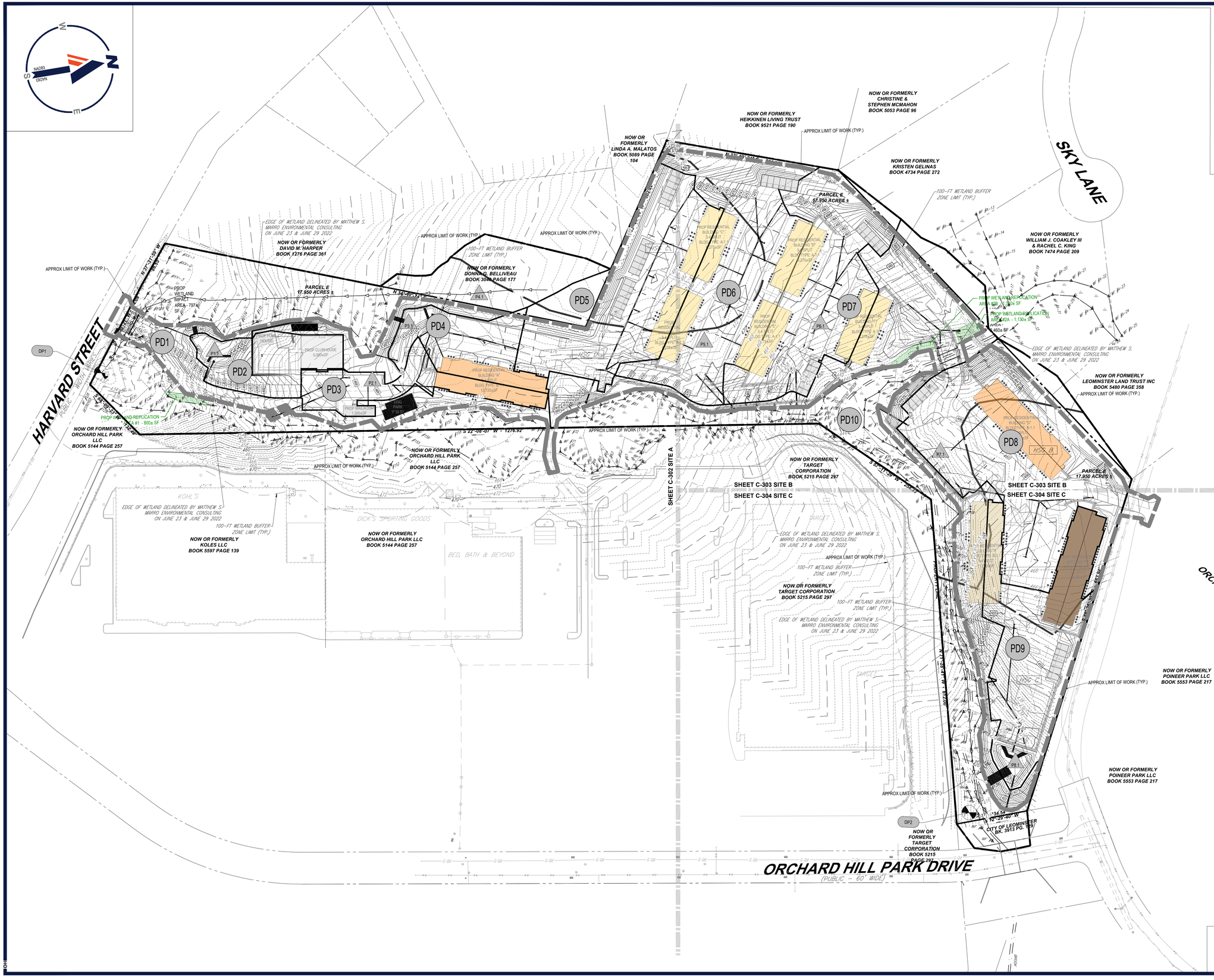
Summary for Link DP2: North Wetland/Culvert

Inflow Area = 13.425 ac, 8.71% Impervious, Inflow Depth = 4.20" for 100-Year event
Inflow = 45.61 cfs @ 12.26 hrs, Volume= 4.703 af
Primary = 45.61 cfs @ 12.26 hrs, Volume= 4.703 af, Atten= 0%, Lag= 0.0 min

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

APPENDIX E: PROPOSED CONDITIONS HYDROLOGIC ANALYSIS

- *PROPOSED CONDITIONS DRAINAGE MAP*
- *PROPOSED CONDITIONS HYDROCAD CALCULATIONS*



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SITE CIVIL AND CONSULTING ENGINEERING
LAND SURVEYING
PROGRAM MANAGEMENT
LANDSCAPE ARCHITECTURE
ECOLOGICAL SERVICES
PERMITTING SERVICES
TRANSPORTATION SERVICES

REVISIONS

REV	DATE	COMMENT	DRAWN BY / CHECKED BY
1	07/11/2025	PER PEER REVIEW & PLANNING BOARD COMMENTS	OEH / MKB

811 Know what's below. Call before you dig.
ALWAYS CALL 811
It's fast. It's free. It's the law.

PERMIT SET

THIS DRAWING IS INTENDED FOR MUNICIPAL AND/OR AGENCY REVIEW AND APPROVAL. IT IS NOT INTENDED AS A CONSTRUCTION DOCUMENT UNLESS INDICATED OTHERWISE.

PROJECT No.:	MAA240279.00-0C
DRAWN BY:	OEH
CHECKED BY:	MKB
DATE:	06/11/2025
CAD I.D.:	P-CIVL-HYDR

PROJECT:

SITE DEVELOPMENT PLANS

FOR

WP EAST ACQUISITIONS LLC

PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT
MAP: 386 | BLK: 4 | LOT: 1C
86 ORCHARD HILL PARK DRIVE
WORCESTER COUNTY
LEOMINSTER, MASSACHUSETTS

BOHLER
50 WASHINGTON ST., SUITE 2000
WESTBOROUGH, MA 01581
Phone: (508) 480-9900
www.BohlerEngineering.com

SHEET TITLE:

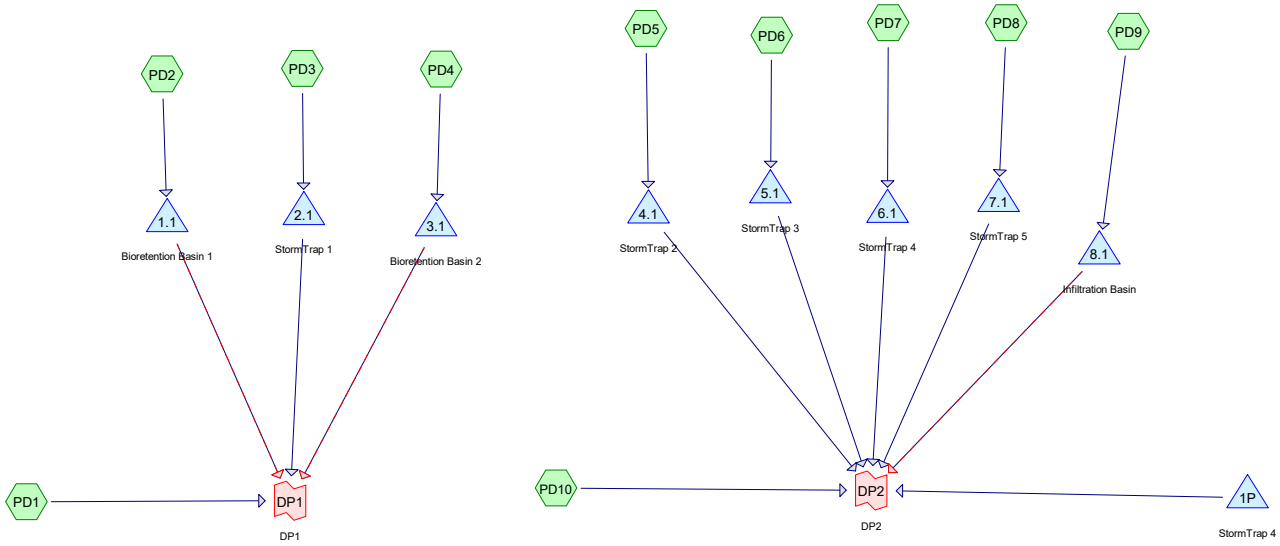
POST DEVELOPMENT DRAINAGE AREA MAP

SHEET NUMBER:

PSTD

REVISION 1 - 07/11/2025

P:\2024\MAA240279.00\CAD\DRAWINGS\PLAN SETS\CIVIL SITE PLANS\P-CIVL-HYDR-MAA240279.00-0C-----XLAYOUT: C-403 PSTD



Subcat Reach Pond Link

Routing Diagram for MAA240279 POST (Rev2)
Prepared by Bohler, Printed 7/11/2025

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.689	61	>75% Grass cover, Good, HSG B (PD10, PD8, PD9)
1.499	74	>75% Grass cover, Good, HSG C (PD10, PD5, PD6, PD9)
4.658	80	>75% Grass cover, Good, HSG D (PD1, PD10, PD2, PD3, PD4, PD5, PD6, PD7, PD8)
0.807	98	Paved parking, HSG B (PD10, PD8, PD9)
1.193	98	Paved parking, HSG C (PD10, PD5, PD6, PD9)
3.123	98	Paved parking, HSG D (PD1, PD10, PD2, PD3, PD4, PD5, PD6, PD7, PD8)
0.666	98	Roofs, HSG B (PD10, PD8, PD9)
0.524	98	Roofs, HSG C (PD10, PD5, PD6, PD9)
1.303	98	Roofs, HSG D (PD10, PD2, PD3, PD4, PD5, PD6, PD7, PD8, PD9)
0.246	98	Water Surface, HSG C (PD10)
2.627	98	Water Surface, HSG D (PD1, PD10)
0.043	55	Woods, Good, HSG B (PD8)
0.867	70	Woods, Good, HSG C (PD1, PD10, PD5)
1.176	77	Woods, Good, HSG D (PD1, PD10, PD5, PD7, PD8)

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.689	1.499	4.658	0.000	6.846	>75% Grass cover, Good	PD1, PD10, PD2, PD3, PD4, PD5, PD6, PD7, PD8, PD9
0.000	0.807	1.193	3.123	0.000	5.123	Paved parking	PD1, PD10, PD2, PD3, PD4, PD5, PD6, PD7, PD8, PD9
0.000	0.666	0.524	1.303	0.000	2.494	Roofs	PD10, PD2, PD3, PD4, PD5, PD6, PD7, PD8, PD9
0.000	0.000	0.246	2.627	0.000	2.874	Water Surface	PD1, PD10
0.000	0.043	0.867	1.176	0.000	2.087	Woods, Good	PD1, PD10, PD5, PD7, PD8

Summary for Subcatchment PD1:

Runoff = 5.82 cfs @ 12.30 hrs, Volume= 0.638 af, Depth= 1.84"
Routed to Link DP1 : DP1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.12"

Area (sf)	CN	Description
69,515	98	Water Surface, HSG D
31,548	77	Woods, Good, HSG D
6,207	98	Water Surface, HSG D
6,264	98	Paved parking, HSG D
48,122	80	>75% Grass cover, Good, HSG D
19,054	70	Woods, Good, HSG C
180,710	87	Weighted Average
98,724		54.63% Pervious Area
81,986		45.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0380	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.12"
12.1	860	0.0560	1.18		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
21.8	910	Total			

Summary for Subcatchment PD10:

Runoff = 6.26 cfs @ 12.22 hrs, Volume= 0.601 af, Depth= 1.69"
Routed to Link DP2 : DP2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.12"

Area (sf)	CN	Description
38,717	98	Water Surface, HSG D
273	98	Roofs, HSG B
784	98	Roofs, HSG C
8,815	98	Roofs, HSG D
10,733	98	Water Surface, HSG C
1,190	98	Paved parking, HSG C
11,844	77	Woods, Good, HSG D
12,933	98	Paved parking, HSG D
24,534	74	>75% Grass cover, Good, HSG C
12,667	70	Woods, Good, HSG C
961	61	>75% Grass cover, Good, HSG B
108	98	Paved parking, HSG B
62,339	80	>75% Grass cover, Good, HSG D
185,898	85	Weighted Average
112,345		60.43% Pervious Area
73,553		39.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0570	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.12"
7.5	500	0.0491	1.11		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.7	550	Total			

Summary for Subcatchment PD2:

Runoff = 1.36 cfs @ 12.09 hrs, Volume= 0.100 af, Depth= 2.09"
Routed to Pond 1.1 : Bioretention Basin 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.12"

Area (sf)	CN	Description
4,447	98	Paved parking, HSG D
4,537	98	Paved parking, HSG D
10,907	80	>75% Grass cover, Good, HSG D
4,963	98	Roofs, HSG D
24,854	90	Weighted Average
10,907		43.88% Pervious Area
13,947		56.12% Impervious Area

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

Summary for Subcatchment PD3:

Runoff = 1.54 cfs @ 12.09 hrs, Volume= 0.120 af, Depth= 2.67"
Routed to Pond 2.1 : StormTrap 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.12"

Area (sf)	CN	Description
2,242	80	>75% Grass cover, Good, HSG D
1,200	98	Roofs, HSG D
13,652	98	Paved parking, HSG D
6,483	98	Roofs, HSG D
23,577	96	Weighted Average
2,242		9.51% Pervious Area
21,335		90.49% Impervious Area

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

Summary for Subcatchment PD4:

Runoff = 1.56 cfs @ 12.09 hrs, Volume= 0.115 af, Depth= 2.18"
Routed to Pond 3.1 : Bioretention Basin 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.12"

Area (sf)	CN	Description
10,505	80	>75% Grass cover, Good, HSG D
10,830	98	Paved parking, HSG D
6,243	98	Roofs, HSG D
27,578	91	Weighted Average
10,505		38.09% Pervious Area
17,073		61.91% Impervious Area

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

Summary for Subcatchment PD5:

Runoff = 3.88 cfs @ 12.09 hrs, Volume= 0.283 af, Depth= 1.93"
Routed to Pond 4.1 : StormTrap 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.12"

Area (sf)	CN	Description
15,663	98	Paved parking, HSG D
7,495	80	>75% Grass cover, Good, HSG D
2,010	77	Woods, Good, HSG D
6,062	70	Woods, Good, HSG C
15,941	98	Paved parking, HSG C
1,351	98	Roofs, HSG D
1,557	98	Roofs, HSG C
1,539	98	Roofs, HSG C
1,539	98	Roofs, HSG C
6,996	98	Roofs, HSG C
16,565	74	>75% Grass cover, Good, HSG C
76,718	88	Weighted Average
32,132		41.88% Pervious Area
44,586		58.12% Impervious Area

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

Summary for Subcatchment PD6:

Runoff = 4.77 cfs @ 12.09 hrs, Volume= 0.352 af, Depth= 2.18"
Routed to Pond 5.1 : StormTrap 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.12"

Area (sf)	CN	Description
6,487	98	Roofs, HSG C
8,309	98	Roofs, HSG D
1,539	98	Roofs, HSG C
23,118	98	Paved parking, HSG D
12,528	98	Paved parking, HSG C
8,045	74	>75% Grass cover, Good, HSG C
24,141	80	>75% Grass cover, Good, HSG D
84,167	91	Weighted Average
32,186		38.24% Pervious Area
51,981		61.76% Impervious Area

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

Summary for Subcatchment PD7:

Runoff = 3.90 cfs @ 12.09 hrs, Volume= 0.288 af, Depth= 2.18"
Routed to Pond 6.1 : StormTrap 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.12"

Area (sf)	CN	Description
1,539	98	Roofs, HSG D
1,539	98	Roofs, HSG D
1,759	77	Woods, Good, HSG D
26,907	98	Paved parking, HSG D
12,373	98	Roofs, HSG D
24,839	80	>75% Grass cover, Good, HSG D
68,956	91	Weighted Average
26,598		38.57% Pervious Area
42,358		61.43% Impervious Area

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

Summary for Subcatchment PD8:

Runoff = 4.87 cfs @ 12.09 hrs, Volume= 0.353 af, Depth= 1.69"
Routed to Pond 7.1 : StormTrap 5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.12"

Area (sf)	CN	Description
4,083	77	Woods, Good, HSG D
1,891	55	Woods, Good, HSG B
10,731	98	Roofs, HSG B
1,995	98	Roofs, HSG D
1,557	98	Roofs, HSG D
26,336	98	Paved parking, HSG B
17,672	98	Paved parking, HSG D
12,325	80	>75% Grass cover, Good, HSG D
22,315	61	>75% Grass cover, Good, HSG B
3,704	61	>75% Grass cover, Good, HSG B
1,106	98	Paved parking, HSG B
1,656	61	>75% Grass cover, Good, HSG B
3,916	98	Paved parking, HSG B
109,287	85	Weighted Average
45,974		42.07% Pervious Area
63,313		57.93% Impervious Area

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

Summary for Subcatchment PD9:

Runoff = 3.64 cfs @ 12.09 hrs, Volume= 0.269 af, Depth= 2.18"
Routed to Pond 8.1 : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.12"

Area (sf)	CN	Description
1,537	98	Roofs, HSG C
21,782	98	Paved parking, HSG C
2,973	74	>75% Grass cover, Good, HSG C
869	98	Roofs, HSG C
18,023	98	Roofs, HSG B
379	98	Roofs, HSG D
3,703	98	Paved parking, HSG B
1,380	61	>75% Grass cover, Good, HSG B
13,185	74	>75% Grass cover, Good, HSG C
546	98	Paved parking, HSG C
64,377	91	Weighted Average
17,538		27.24% Pervious Area
46,839		72.76% Impervious Area

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

Summary for Pond 1.1: Bioretention Basin 1

Inflow Area = 0.571 ac, 56.12% Impervious, Inflow Depth = 2.09" for 2-Year event
Inflow = 1.36 cfs @ 12.09 hrs, Volume= 0.100 af
Outflow = 0.26 cfs @ 12.54 hrs, Volume= 0.100 af, Atten= 81%, Lag= 27.3 min
Primary = 0.26 cfs @ 12.54 hrs, Volume= 0.100 af
Routed to Link DP1 : DP1
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link DP1 : DP1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 446.06' @ 12.54 hrs Surf.Area= 2,655 sf Storage= 1,511 cf

Plug-Flow detention time= 68.7 min calculated for 0.099 af (100% of inflow)
Center-of-Mass det. time= 69.6 min (877.4 - 807.9)

Volume	Invert	Avail.Storage	Storage Description
#1	444.33'	4,706 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 11,795 cf Overall - 7,089 cf Embedded = 4,706 cf
#2	444.83'	1,593 cf	**Soil Media (Irregular)** Listed below (Recalc) Inside #1 5,310 cf Overall x 30.0% Voids
#3	444.33'	531 cf	**Underdrain Stone (Irregular)** Listed below (Recalc) Inside #1 1,328 cf Overall x 40.0% Voids
#4	446.83'	45 cf	**Mulch (Irregular)** Listed below (Recalc) Inside #1 451 cf Overall x 10.0% Voids
		6,875 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
444.33	2,655	224.0	0	0	2,655
445.50	2,655	224.0	3,106	3,106	2,917
447.00	2,655	224.0	3,983	7,089	3,253
448.00	3,386	248.0	3,013	10,102	4,185
448.50	3,386	248.0	1,693	11,795	4,309

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
444.83	2,655	224.0	0	0	2,655
446.83	2,655	224.0	5,310	5,310	3,103

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
444.33	2,655	224.0	0	0	2,655
444.83	2,655	224.0	1,328	1,328	2,767

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
446.83	2,655	224.0	0	0	2,655
447.00	2,655	224.0	451	451	2,693

Device	Routing	Invert	Outlet Devices
#1	Secondary	448.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Primary	444.33'	**8.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 444.33' / 441.00' S= 0.1665 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#3	Device 2	444.33'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 442.00'
#4	Primary	447.75'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.26 cfs @ 12.54 hrs HW=446.06' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Passes 0.26 cfs of 1.57 cfs potential flow)
└─**3=Exfiltration** (Controls 0.26 cfs)
└─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=444.33' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 1P: StormTrap 4

Volume	Invert	Avail.Storage	Storage Description
#1A	451.25'	0.000 af	**30.27'W x 74.90'L x 5.50'H Field A** 0.286 af Overall - 0.286 af Embedded = 0.000 af x 40.0% Voids
#2A	451.25'	0.230 af	**StormTrap SingleTrap 5-0** x 8 Inside #1 Inside= 101.7"W x 60.0"H => 38.33 sf x 15.40'L = 590.2 cf Outside= 101.7"W x 66.0"H => 46.64 sf x 15.40'L = 718.0 cf 8 Chambers in 2 Rows 16.96' x 61.58' Core + 6.66' Border = 30.27' x 74.90' System
		0.230 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	455.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	451.25'	**18.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 451.25' / 450.75' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#3	Device 2	451.25'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Controls 0.00 cfs)
└─**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
└─**3=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 2.1: StormTrap 1

Inflow Area = 0.541 ac, 90.49% Impervious, Inflow Depth = 2.67" for 2-Year event
Inflow = 1.54 cfs @ 12.09 hrs, Volume= 0.120 af
Outflow = 0.09 cfs @ 14.01 hrs, Volume= 0.120 af, Atten= 94%, Lag= 115.2 min
Primary = 0.09 cfs @ 14.01 hrs, Volume= 0.120 af
Routed to Link DP1 : DP1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 462.88' @ 14.01 hrs Surf.Area= 0.037 ac Storage= 0.070 af

Plug-Flow detention time= 454.4 min calculated for 0.120 af (100% of inflow)
Center-of-Mass det. time= 453.2 min (1,228.0 - 774.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	460.75'	0.000 af	**21.79'W x 74.90'L x 5.50'H Field A** 0.206 af Overall - 0.206 af Embedded = 0.000 af x 40.0% Voids
#2A	460.75'	0.165 af	**StormTrap SingleTrap 5-0** x 4 Inside #1 Inside= 101.7"W x 60.0"H => 38.33 sf x 15.40'L = 590.2 cf Outside= 101.7"W x 66.0"H => 46.64 sf x 15.40'L = 718.0 cf 8.48' x 61.58' Core + 6.66' Border = 21.79' x 74.90' System
		0.165 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	464.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	460.75'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 460.75' / 460.25' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	460.75'	**1.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.09 cfs @ 14.01 hrs HW=462.88' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.09 cfs of 3.74 cfs potential flow)
  ├**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**3=Orifice/Grate** (Orifice Controls 0.09 cfs @ 6.93 fps)

Summary for Pond 3.1: Bioretention Basin 2

Inflow Area = 0.633 ac, 61.91% Impervious, Inflow Depth = 2.18" for 2-Year event
Inflow = 1.56 cfs @ 12.09 hrs, Volume= 0.115 af
Outflow = 0.34 cfs @ 12.51 hrs, Volume= 0.115 af, Atten= 78%, Lag= 25.3 min
Primary = 0.34 cfs @ 12.51 hrs, Volume= 0.115 af
Routed to Link DP1 : DP1
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link DP1 : DP1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 471.01' @ 12.51 hrs Surf.Area= 2,019 sf Storage= 1,670 cf

Plug-Flow detention time= 58.8 min calculated for 0.115 af (100% of inflow)
Center-of-Mass det. time= 58.4 min (861.8 - 803.4)

Volume	Invert	Avail.Storage	Storage Description
#1	468.33'	3,874 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 9,233 cf Overall - 5,359 cf Embedded = 3,874 cf
#2	468.83'	1,204 cf	**Soil Media (Irregular)** Listed below (Recalc) Inside #1 4,014 cf Overall x 30.0% Voids
#3	468.33'	401 cf	**Underdrain Storage (Irregular)** Listed below (Recalc) Inside #1 1,004 cf Overall x 40.0% Voids
#4	470.83'	34 cf	**Mulch (Irregular)** Listed below (Recalc) Inside #1 341 cf Overall x 10.0% Voids
		5,514 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
468.33	2,007	283.0	0	0	2,007
469.50	2,007	283.0	2,348	2,348	2,338
471.00	2,007	283.0	3,011	5,359	2,763
472.00	2,884	302.0	2,432	7,791	3,694
472.50	2,884	302.0	1,442	9,233	3,845

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
468.83	2,007	283.0	0	0	2,007
470.83	2,007	283.0	4,014	4,014	2,573

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
468.33	2,007	283.0	0	0	2,007
468.83	2,007	283.0	1,004	1,004	2,149

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
470.83	2,007	283.0	0	0	2,007
471.00	2,007	283.0	341	341	2,055

Device	Routing	Invert	Outlet Devices
#1	Secondary	472.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Primary	468.33'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 468.33' / 466.00' S= 0.1165 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	468.33'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 467.00'
#4	Device 2	471.75'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.34 cfs @ 12.51 hrs HW=471.01' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Passes 0.34 cfs of 4.41 cfs potential flow)
  ├─**3=Exfiltration** (Controls 0.34 cfs)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=468.33' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 4.1: StormTrap 2

Inflow Area = 1.761 ac, 58.12% Impervious, Inflow Depth = 1.93" for 2-Year event
Inflow = 3.88 cfs @ 12.09 hrs, Volume= 0.283 af
Outflow = 0.18 cfs @ 15.04 hrs, Volume= 0.280 af, Atten= 95%, Lag= 176.8 min
Primary = 0.18 cfs @ 15.04 hrs, Volume= 0.280 af
Routed to Link DP2 : DP2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 473.10' @ 15.04 hrs Surf.Area= 0.145 ac Storage= 0.173 af

Plug-Flow detention time= 557.3 min calculated for 0.280 af (99% of inflow)
Center-of-Mass det. time= 553.5 min (1,369.6 - 816.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	471.75'	0.000 af	**21.79'W x 290.44'L x 5.50'H Field A** 0.799 af Overall - 0.799 af Embedded = 0.000 af x 40.0% Voids
#2A	471.75'	0.640 af	**StormTrap SingleTrap 5-0** x 18 Inside #1 Inside= 101.7"W x 60.0"H => 38.33 sf x 15.40'L = 590.2 cf Outside= 101.7"W x 66.0"H => 46.64 sf x 15.40'L = 718.0 cf 8.48' x 277.13' Core + 6.66' Border = 21.79' x 290.44' System
		0.640 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	475.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	471.75'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 471.75' / 471.25' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	471.75'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.18 cfs @ 15.04 hrs HW=473.10' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Passes 0.18 cfs of 2.70 cfs potential flow)
  ├─**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Orifice Controls 0.18 cfs @ 5.38 fps)

Summary for Pond 5.1: StormTrap 3

Inflow Area = 1.932 ac, 61.76% Impervious, Inflow Depth = 2.18" for 2-Year event
Inflow = 4.77 cfs @ 12.09 hrs, Volume= 0.352 af
Outflow = 0.16 cfs @ 15.84 hrs, Volume= 0.349 af, Atten= 97%, Lag= 224.9 min
Primary = 0.16 cfs @ 15.84 hrs, Volume= 0.349 af
Routed to Link DP2 : DP2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 465.21' @ 15.84 hrs Surf.Area= 0.108 ac Storage= 0.236 af

Plug-Flow detention time= 804.1 min calculated for 0.349 af (99% of inflow)
Center-of-Mass det. time= 799.9 min (1,603.3 - 803.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	462.75'	0.000 af	**38.75'W x 121.08'L x 5.50'H Field A** 0.592 af Overall - 0.592 af Embedded = 0.000 af x 40.0% Voids
#2A	462.75'	0.479 af	**StormTrap SingleTrap 5-0** x 21 Inside #1 Inside= 101.7"W x 60.0"H => 38.33 sf x 15.40'L = 590.2 cf Outside= 101.7"W x 66.0"H => 46.64 sf x 15.40'L = 718.0 cf 21 Chambers in 3 Rows 25.44' x 107.77' Core + 6.66' Border = 38.75' x 121.08' System
		0.479 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	466.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	462.75'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 462.75' / 462.25' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	462.75'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.16 cfs @ 15.84 hrs HW=465.21' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Passes 0.16 cfs of 4.10 cfs potential flow)
  ├─**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Orifice Controls 0.16 cfs @ 7.43 fps)

Summary for Pond 6.1: StormTrap 4

Inflow Area = 1.583 ac, 61.43% Impervious, Inflow Depth = 2.18" for 2-Year event
Inflow = 3.90 cfs @ 12.09 hrs, Volume= 0.288 af
Outflow = 0.15 cfs @ 15.44 hrs, Volume= 0.286 af, Atten= 96%, Lag= 201.3 min
Primary = 0.15 cfs @ 15.44 hrs, Volume= 0.286 af
Routed to Link DP2 : DP2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 453.46' @ 15.44 hrs Surf.Area= 0.095 ac Storage= 0.186 af

Plug-Flow detention time= 679.4 min calculated for 0.286 af (99% of inflow)
Center-of-Mass det. time= 676.1 min (1,479.5 - 803.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	451.25'	0.000 af	**30.27'W x 136.48'L x 5.50'H Field A** 0.522 af Overall - 0.522 af Embedded = 0.000 af x 40.0% Voids
#2A	451.25'	0.420 af	**StormTrap SingleTrap 5-0** x 16 Inside #1 Inside= 101.7"W x 60.0"H => 38.33 sf x 15.40'L = 590.2 cf Outside= 101.7"W x 66.0"H => 46.64 sf x 15.40'L = 718.0 cf 16 Chambers in 2 Rows 16.96' x 123.17' Core + 6.66' Border = 30.27' x 136.48' System
		0.420 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	455.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	451.25'	**18.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 451.25' / 450.75' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#3	Device 2	451.25'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.15 cfs @ 15.44 hrs HW=453.46' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Passes 0.15 cfs of 8.56 cfs potential flow)
  ├─**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Orifice Controls 0.15 cfs @ 7.03 fps)

Summary for Pond 7.1: StormTrap 5

Inflow Area = 2.509 ac, 57.93% Impervious, Inflow Depth = 1.69" for 2-Year event
Inflow = 4.87 cfs @ 12.09 hrs, Volume= 0.353 af
Outflow = 0.15 cfs @ 16.59 hrs, Volume= 0.350 af, Atten= 97%, Lag= 269.7 min
Primary = 0.15 cfs @ 16.59 hrs, Volume= 0.350 af
Routed to Link DP2 : DP2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 448.96' @ 16.59 hrs Surf.Area= 0.121 ac Storage= 0.238 af

Plug-Flow detention time= 866.4 min calculated for 0.350 af (99% of inflow)
Center-of-Mass det. time= 860.8 min (1,688.1 - 827.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	446.75'	0.000 af	**38.75'W x 136.48'L x 5.50'H Field A** 0.668 af Overall - 0.668 af Embedded = 0.000 af x 40.0% Voids
#2A	446.75'	0.540 af	**StormTrap SingleTrap 5-0** x 24 Inside #1 Inside= 101.7"W x 60.0"H => 38.33 sf x 15.40'L = 590.2 cf Outside= 101.7"W x 66.0"H => 46.64 sf x 15.40'L = 718.0 cf 24 Chambers in 3 Rows 25.44' x 123.17' Core + 6.66' Border = 38.75' x 136.48' System
		0.540 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	450.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	446.75'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 446.75' / 446.25' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	446.75'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.15 cfs @ 16.59 hrs HW=448.96' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.15 cfs of 3.82 cfs potential flow)
  ├**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**3=Orifice/Grate** (Orifice Controls 0.15 cfs @ 7.02 fps)

Summary for Pond 8.1: Infiltration Basin

Inflow Area = 1.478 ac, 72.76% Impervious, Inflow Depth = 2.18" for 2-Year event
Inflow = 3.64 cfs @ 12.09 hrs, Volume= 0.269 af
Outflow = 1.71 cfs @ 12.27 hrs, Volume= 0.269 af, Atten= 53%, Lag= 10.7 min
Discarded = 0.05 cfs @ 12.27 hrs, Volume= 0.107 af
Primary = 1.67 cfs @ 12.27 hrs, Volume= 0.162 af
Routed to Link DP2 : DP2
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link DP2 : DP2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 425.11' @ 12.27 hrs Surf.Area= 2,726 sf Storage= 4,368 cf

Plug-Flow detention time= 434.2 min calculated for 0.269 af (100% of inflow)
Center-of-Mass det. time= 435.6 min (1,239.1 - 803.4)

Volume	Invert	Avail.Storage	Storage Description
#1	423.00'	10,814 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
423.00	1,477	171.0	0	0	1,477
424.00	2,030	196.7	1,746	1,746	2,251
425.00	2,656	220.9	2,336	4,082	3,082
426.00	3,355	244.9	2,999	7,081	4,002
427.00	4,125	268.1	3,733	10,814	4,983

Device	Routing	Invert	Outlet Devices
#1	Discarded	423.00'	**0.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 422.00'
#2	Secondary	426.00'	**16.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#3	Primary	423.00'	**18.0" Round Culvert** L= 90.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 423.00' / 418.00' S= 0.0556 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#4	Device 3	425.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 3	424.50'	**24.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.05 cfs @ 12.27 hrs HW=425.10' (Free Discharge)
└**1=Exfiltration** (Controls 0.05 cfs)

Primary OutFlow Max=1.66 cfs @ 12.27 hrs HW=425.10' TW=0.00' (Dynamic Tailwater)
└**3=Culvert** (Passes 1.66 cfs of 9.90 cfs potential flow)
  └**4=Orifice/Grate** (Controls 0.00 cfs)
  └**5=Orifice/Grate** (Orifice Controls 1.66 cfs @ 3.32 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=423.00' TW=0.00' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DP1: DP1

Inflow Area = 5.893 ac, 52.33% Impervious, Inflow Depth = 1.98" for 2-Year event
Inflow = 6.46 cfs @ 12.30 hrs, Volume= 0.973 af
Primary = 6.46 cfs @ 12.30 hrs, Volume= 0.973 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP2: DP2

Inflow Area = 13.531 ac, 54.74% Impervious, Inflow Depth > 1.80" for 2-Year event
Inflow = 8.43 cfs @ 12.22 hrs, Volume= 2.028 af
Primary = 8.43 cfs @ 12.22 hrs, Volume= 2.028 af, Atten= 0%, Lag= 0.0 min

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

Summary for Subcatchment PD1:

Runoff = 10.37 cfs @ 12.30 hrs, Volume= 1.149 af, Depth= 3.32"
Routed to Link DP1 : DP1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.74"

Area (sf)	CN	Description
69,515	98	Water Surface, HSG D
31,548	77	Woods, Good, HSG D
6,207	98	Water Surface, HSG D
6,264	98	Paved parking, HSG D
48,122	80	>75% Grass cover, Good, HSG D
19,054	70	Woods, Good, HSG C
180,710	87	Weighted Average
98,724		54.63% Pervious Area
81,986		45.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0380	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.12"
12.1	860	0.0560	1.18		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
21.8	910	Total			

Summary for Subcatchment PD10:

Runoff = 11.53 cfs @ 12.21 hrs, Volume= 1.113 af, Depth= 3.13"
Routed to Link DP2 : DP2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.74"

Area (sf)	CN	Description
38,717	98	Water Surface, HSG D
273	98	Roofs, HSG B
784	98	Roofs, HSG C
8,815	98	Roofs, HSG D
10,733	98	Water Surface, HSG C
1,190	98	Paved parking, HSG C
11,844	77	Woods, Good, HSG D
12,933	98	Paved parking, HSG D
24,534	74	>75% Grass cover, Good, HSG C
12,667	70	Woods, Good, HSG C
961	61	>75% Grass cover, Good, HSG B
108	98	Paved parking, HSG B
62,339	80	>75% Grass cover, Good, HSG D
185,898	85	Weighted Average
112,345		60.43% Pervious Area
73,553		39.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0570	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.12"
7.5	500	0.0491	1.11		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.7	550	Total			

Summary for Subcatchment PD2:

Runoff = 2.30 cfs @ 12.09 hrs, Volume= 0.172 af, Depth= 3.63"
Routed to Pond 1.1 : Bioretention Basin 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.74"

Area (sf)	CN	Description
4,447	98	Paved parking, HSG D
4,537	98	Paved parking, HSG D
10,907	80	>75% Grass cover, Good, HSG D
4,963	98	Roofs, HSG D
24,854	90	Weighted Average
10,907		43.88% Pervious Area
13,947		56.12% Impervious Area

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

Summary for Subcatchment PD3:

Runoff = 2.41 cfs @ 12.09 hrs, Volume= 0.193 af, Depth= 4.27"
Routed to Pond 2.1 : StormTrap 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.74"

Area (sf)	CN	Description
2,242	80	>75% Grass cover, Good, HSG D
1,200	98	Roofs, HSG D
13,652	98	Paved parking, HSG D
6,483	98	Roofs, HSG D
23,577	96	Weighted Average
2,242		9.51% Pervious Area
21,335		90.49% Impervious Area

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

Summary for Subcatchment PD4:

Runoff = 2.60 cfs @ 12.09 hrs, Volume= 0.197 af, Depth= 3.73"
Routed to Pond 3.1 : Bioretention Basin 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.74"

Area (sf)	CN	Description
10,505	80	>75% Grass cover, Good, HSG D
10,830	98	Paved parking, HSG D
6,243	98	Roofs, HSG D
27,578	91	Weighted Average
10,505		38.09% Pervious Area
17,073		61.91% Impervious Area

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

Summary for Subcatchment PD5:

Runoff = 6.77 cfs @ 12.09 hrs, Volume= 0.502 af, Depth= 3.42"
Routed to Pond 4.1 : StormTrap 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.74"

Area (sf)	CN	Description
15,663	98	Paved parking, HSG D
7,495	80	>75% Grass cover, Good, HSG D
2,010	77	Woods, Good, HSG D
6,062	70	Woods, Good, HSG C
15,941	98	Paved parking, HSG C
1,351	98	Roofs, HSG D
1,557	98	Roofs, HSG C
1,539	98	Roofs, HSG C
1,539	98	Roofs, HSG C
6,996	98	Roofs, HSG C
16,565	74	>75% Grass cover, Good, HSG C
76,718	88	Weighted Average
32,132		41.88% Pervious Area
44,586		58.12% Impervious Area

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

Summary for Subcatchment PD6:

Runoff = 7.93 cfs @ 12.09 hrs, Volume= 0.601 af, Depth= 3.73"
Routed to Pond 5.1 : StormTrap 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.74"

Area (sf)	CN	Description
6,487	98	Roofs, HSG C
8,309	98	Roofs, HSG D
1,539	98	Roofs, HSG C
23,118	98	Paved parking, HSG D
12,528	98	Paved parking, HSG C
8,045	74	>75% Grass cover, Good, HSG C
24,141	80	>75% Grass cover, Good, HSG D
84,167	91	Weighted Average
32,186		38.24% Pervious Area
51,981		61.76% Impervious Area

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

Summary for Subcatchment PD7:

Runoff = 6.50 cfs @ 12.09 hrs, Volume= 0.492 af, Depth= 3.73"
Routed to Pond 6.1 : StormTrap 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.74"

Area (sf)	CN	Description
1,539	98	Roofs, HSG D
1,539	98	Roofs, HSG D
1,759	77	Woods, Good, HSG D
26,907	98	Paved parking, HSG D
12,373	98	Roofs, HSG D
24,839	80	>75% Grass cover, Good, HSG D
68,956	91	Weighted Average
26,598		38.57% Pervious Area
42,358		61.43% Impervious Area

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

Summary for Subcatchment PD8:

Runoff = 8.94 cfs @ 12.09 hrs, Volume= 0.654 af, Depth= 3.13"
Routed to Pond 7.1 : StormTrap 5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.74"

Area (sf)	CN	Description
4,083	77	Woods, Good, HSG D
1,891	55	Woods, Good, HSG B
10,731	98	Roofs, HSG B
1,995	98	Roofs, HSG D
1,557	98	Roofs, HSG D
26,336	98	Paved parking, HSG B
17,672	98	Paved parking, HSG D
12,325	80	>75% Grass cover, Good, HSG D
22,315	61	>75% Grass cover, Good, HSG B
3,704	61	>75% Grass cover, Good, HSG B
1,106	98	Paved parking, HSG B
1,656	61	>75% Grass cover, Good, HSG B
3,916	98	Paved parking, HSG B
109,287	85	Weighted Average
45,974		42.07% Pervious Area
63,313		57.93% Impervious Area

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

Summary for Subcatchment PD9:

Runoff = 6.07 cfs @ 12.09 hrs, Volume= 0.459 af, Depth= 3.73"
Routed to Pond 8.1 : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.74"

Area (sf)	CN	Description
1,537	98	Roofs, HSG C
21,782	98	Paved parking, HSG C
2,973	74	>75% Grass cover, Good, HSG C
869	98	Roofs, HSG C
18,023	98	Roofs, HSG B
379	98	Roofs, HSG D
3,703	98	Paved parking, HSG B
1,380	61	>75% Grass cover, Good, HSG B
13,185	74	>75% Grass cover, Good, HSG C
546	98	Paved parking, HSG C
64,377	91	Weighted Average
17,538		27.24% Pervious Area
46,839		72.76% Impervious Area

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

Summary for Pond 1.1: Bioretention Basin 1

Inflow Area = 0.571 ac, 56.12% Impervious, Inflow Depth = 3.63" for 10-Year event
Inflow = 2.30 cfs @ 12.09 hrs, Volume= 0.172 af
Outflow = 0.34 cfs @ 12.60 hrs, Volume= 0.172 af, Atten= 85%, Lag= 30.5 min
Primary = 0.34 cfs @ 12.60 hrs, Volume= 0.172 af
Routed to Link DP1 : DP1
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link DP1 : DP1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 447.24' @ 12.60 hrs Surf.Area= 2,822 sf Storage= 2,824 cf

Plug-Flow detention time= 86.6 min calculated for 0.172 af (100% of inflow)
Center-of-Mass det. time= 87.3 min (879.9 - 792.5)

Volume	Invert	Avail.Storage	Storage Description
#1	444.33'	4,706 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 11,795 cf Overall - 7,089 cf Embedded = 4,706 cf
#2	444.83'	1,593 cf	**Soil Media (Irregular)** Listed below (Recalc) Inside #1 5,310 cf Overall x 30.0% Voids
#3	444.33'	531 cf	**Underdrain Stone (Irregular)** Listed below (Recalc) Inside #1 1,328 cf Overall x 40.0% Voids
#4	446.83'	45 cf	**Mulch (Irregular)** Listed below (Recalc) Inside #1 451 cf Overall x 10.0% Voids
		6,875 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
444.33	2,655	224.0	0	0	2,655
445.50	2,655	224.0	3,106	3,106	2,917
447.00	2,655	224.0	3,983	7,089	3,253
448.00	3,386	248.0	3,013	10,102	4,185
448.50	3,386	248.0	1,693	11,795	4,309

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
444.83	2,655	224.0	0	0	2,655
446.83	2,655	224.0	5,310	5,310	3,103

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
444.33	2,655	224.0	0	0	2,655
444.83	2,655	224.0	1,328	1,328	2,767

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
446.83	2,655	224.0	0	0	2,655
447.00	2,655	224.0	451	451	2,693

Device	Routing	Invert	Outlet Devices
#1	Secondary	448.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Primary	444.33'	**8.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 444.33' / 441.00' S= 0.1665 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#3	Device 2	444.33'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 442.00'
#4	Primary	447.75'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.34 cfs @ 12.60 hrs HW=447.24' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Passes 0.34 cfs of 2.13 cfs potential flow)
└─**3=Exfiltration** (Controls 0.34 cfs)
└─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=444.33' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 1P: StormTrap 4

Volume	Invert	Avail.Storage	Storage Description
#1A	451.25'	0.000 af	**30.27'W x 74.90'L x 5.50'H Field A** 0.286 af Overall - 0.286 af Embedded = 0.000 af x 40.0% Voids
#2A	451.25'	0.230 af	**StormTrap SingleTrap 5-0** x 8 Inside #1 Inside= 101.7"W x 60.0"H => 38.33 sf x 15.40'L = 590.2 cf Outside= 101.7"W x 66.0"H => 46.64 sf x 15.40'L = 718.0 cf 8 Chambers in 2 Rows 16.96' x 61.58' Core + 6.66' Border = 30.27' x 74.90' System
		0.230 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	455.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	451.25'	**18.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 451.25' / 450.75' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#3	Device 2	451.25'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Controls 0.00 cfs)
└─**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
└─**3=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 2.1: StormTrap 1

Inflow Area = 0.541 ac, 90.49% Impervious, Inflow Depth = 4.27" for 10-Year event
Inflow = 2.41 cfs @ 12.09 hrs, Volume= 0.193 af
Outflow = 0.11 cfs @ 14.59 hrs, Volume= 0.193 af, Atten= 95%, Lag= 150.1 min
Primary = 0.11 cfs @ 14.59 hrs, Volume= 0.193 af
Routed to Link DP1 : DP1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 464.34' @ 14.59 hrs Surf.Area= 0.037 ac Storage= 0.118 af

Plug-Flow detention time= 571.3 min calculated for 0.193 af (100% of inflow)
Center-of-Mass det. time= 570.4 min (1,334.1 - 763.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	460.75'	0.000 af	**21.79'W x 74.90'L x 5.50'H Field A** 0.206 af Overall - 0.206 af Embedded = 0.000 af x 40.0% Voids
#2A	460.75'	0.165 af	**StormTrap SingleTrap 5-0** x 4 Inside #1 Inside= 101.7"W x 60.0"H => 38.33 sf x 15.40'L = 590.2 cf Outside= 101.7"W x 66.0"H => 46.64 sf x 15.40'L = 718.0 cf 8.48' x 61.58' Core + 6.66' Border = 21.79' x 74.90' System
		0.165 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	464.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	460.75'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 460.75' / 460.25' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	460.75'	**1.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.11 cfs @ 14.59 hrs HW=464.34' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.11 cfs of 5.14 cfs potential flow)
  ├**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**3=Orifice/Grate** (Orifice Controls 0.11 cfs @ 9.04 fps)

Summary for Pond 3.1: Bioretention Basin 2

Inflow Area = 0.633 ac, 61.91% Impervious, Inflow Depth = 3.73" for 10-Year event
Inflow = 2.60 cfs @ 12.09 hrs, Volume= 0.197 af
Outflow = 0.43 cfs @ 12.57 hrs, Volume= 0.197 af, Atten= 84%, Lag= 28.8 min
Primary = 0.43 cfs @ 12.57 hrs, Volume= 0.197 af
  Routed to Link DP1 : DP1
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
  Routed to Link DP1 : DP1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 471.66' @ 12.57 hrs Surf.Area= 2,569 sf Storage= 3,148 cf

Plug-Flow detention time= 75.8 min calculated for 0.197 af (100% of inflow)
Center-of-Mass det. time= 75.2 min (863.8 - 788.6)

Volume	Invert	Avail.Storage	Storage Description
#1	468.33'	3,874 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 9,233 cf Overall - 5,359 cf Embedded = 3,874 cf
#2	468.83'	1,204 cf	**Soil Media (Irregular)** Listed below (Recalc) Inside #1 4,014 cf Overall x 30.0% Voids
#3	468.33'	401 cf	**Underdrain Storage (Irregular)** Listed below (Recalc) Inside #1 1,004 cf Overall x 40.0% Voids
#4	470.83'	34 cf	**Mulch (Irregular)** Listed below (Recalc) Inside #1 341 cf Overall x 10.0% Voids
		5,514 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
468.33	2,007	283.0	0	0	2,007
469.50	2,007	283.0	2,348	2,348	2,338
471.00	2,007	283.0	3,011	5,359	2,763
472.00	2,884	302.0	2,432	7,791	3,694
472.50	2,884	302.0	1,442	9,233	3,845

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
468.83	2,007	283.0	0	0	2,007
470.83	2,007	283.0	4,014	4,014	2,573

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
468.33	2,007	283.0	0	0	2,007
468.83	2,007	283.0	1,004	1,004	2,149

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
470.83	2,007	283.0	0	0	2,007
471.00	2,007	283.0	341	341	2,055

Device	Routing	Invert	Outlet Devices
#1	Secondary	472.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Primary	468.33'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 468.33' / 466.00' S= 0.1165 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	468.33'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 467.00'
#4	Device 2	471.75'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.43 cfs @ 12.57 hrs HW=471.66' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Passes 0.43 cfs of 5.02 cfs potential flow)
  ├─**3=Exfiltration** (Controls 0.43 cfs)
  └─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=468.33' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 4.1: StormTrap 2

Inflow Area = 1.761 ac, 58.12% Impervious, Inflow Depth = 3.42" for 10-Year event
Inflow = 6.77 cfs @ 12.09 hrs, Volume= 0.502 af
Outflow = 0.26 cfs @ 15.50 hrs, Volume= 0.499 af, Atten= 96%, Lag= 204.5 min
Primary = 0.26 cfs @ 15.50 hrs, Volume= 0.499 af
Routed to Link DP2 : DP2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 474.32' @ 15.50 hrs Surf.Area= 0.145 ac Storage= 0.328 af

Plug-Flow detention time= 712.8 min calculated for 0.499 af (99% of inflow)
Center-of-Mass det. time= 708.8 min (1,508.6 - 799.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	471.75'	0.000 af	**21.79'W x 290.44'L x 5.50'H Field A** 0.799 af Overall - 0.799 af Embedded = 0.000 af x 40.0% Voids
#2A	471.75'	0.640 af	**StormTrap SingleTrap 5-0** x 18 Inside #1 Inside= 101.7"W x 60.0"H => 38.33 sf x 15.40'L = 590.2 cf Outside= 101.7"W x 66.0"H => 46.64 sf x 15.40'L = 718.0 cf 8.48' x 277.13' Core + 6.66' Border = 21.79' x 290.44' System
		0.640 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	475.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	471.75'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 471.75' / 471.25' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	471.75'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.26 cfs @ 15.50 hrs HW=474.32' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Passes 0.26 cfs of 4.21 cfs potential flow)
  ├─**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Orifice Controls 0.26 cfs @ 7.55 fps)

Summary for Pond 5.1: StormTrap 3

Inflow Area = 1.932 ac, 61.76% Impervious, Inflow Depth = 3.73" for 10-Year event
Inflow = 7.93 cfs @ 12.09 hrs, Volume= 0.601 af
Outflow = 0.50 cfs @ 13.79 hrs, Volume= 0.597 af, Atten= 94%, Lag= 102.1 min
Primary = 0.50 cfs @ 13.79 hrs, Volume= 0.597 af
Routed to Link DP2 : DP2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 466.83' @ 13.79 hrs Surf.Area= 0.108 ac Storage= 0.390 af

Plug-Flow detention time= 925.1 min calculated for 0.596 af (99% of inflow)
Center-of-Mass det. time= 922.3 min (1,710.9 - 788.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	462.75'	0.000 af	**38.75'W x 121.08'L x 5.50'H Field A** 0.592 af Overall - 0.592 af Embedded = 0.000 af x 40.0% Voids
#2A	462.75'	0.479 af	**StormTrap SingleTrap 5-0** x 21 Inside #1 Inside= 101.7"W x 60.0"H => 38.33 sf x 15.40'L = 590.2 cf Outside= 101.7"W x 66.0"H => 46.64 sf x 15.40'L = 718.0 cf 21 Chambers in 3 Rows 25.44' x 107.77' Core + 6.66' Border = 38.75' x 121.08' System
		0.479 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	466.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	462.75'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 462.75' / 462.25' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	462.75'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.50 cfs @ 13.79 hrs HW=466.83' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Passes 0.50 cfs of 5.54 cfs potential flow)
  ├─**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.29 cfs @ 0.92 fps)
  └─**3=Orifice/Grate** (Orifice Controls 0.21 cfs @ 9.62 fps)

Summary for Pond 6.1: StormTrap 4

Inflow Area = 1.583 ac, 61.43% Impervious, Inflow Depth = 3.73" for 10-Year event
Inflow = 6.50 cfs @ 12.09 hrs, Volume= 0.492 af
Outflow = 0.21 cfs @ 15.87 hrs, Volume= 0.490 af, Atten= 97%, Lag= 226.6 min
Primary = 0.21 cfs @ 15.87 hrs, Volume= 0.490 af
Routed to Link DP2 : DP2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 455.25' @ 15.87 hrs Surf.Area= 0.095 ac Storage= 0.336 af

Plug-Flow detention time= 873.7 min calculated for 0.490 af (100% of inflow)
Center-of-Mass det. time= 870.7 min (1,659.3 - 788.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	451.25'	0.000 af	**30.27'W x 136.48'L x 5.50'H Field A** 0.522 af Overall - 0.522 af Embedded = 0.000 af x 40.0% Voids
#2A	451.25'	0.420 af	**StormTrap SingleTrap 5-0** x 16 Inside #1 Inside= 101.7"W x 60.0"H => 38.33 sf x 15.40'L = 590.2 cf Outside= 101.7"W x 66.0"H => 46.64 sf x 15.40'L = 718.0 cf 16 Chambers in 2 Rows 16.96' x 123.17' Core + 6.66' Border = 30.27' x 136.48' System
		0.420 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	455.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	451.25'	**18.0" Round Culvert**
			L= 100.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 451.25' / 450.75' S= 0.0050 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#3	Device 2	451.25'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.21 cfs @ 15.87 hrs HW=455.25' TW=0.00' (Dynamic Tailwater)
↑**2=Culvert** (Passes 0.21 cfs of 13.46 cfs potential flow)
↑**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
3=Orifice/Grate (Orifice Controls 0.21 cfs @ 9.53 fps)

Summary for Pond 7.1: StormTrap 5

Inflow Area = 2.509 ac, 57.93% Impervious, Inflow Depth = 3.13" for 10-Year event
Inflow = 8.94 cfs @ 12.09 hrs, Volume= 0.654 af
Outflow = 0.46 cfs @ 14.60 hrs, Volume= 0.647 af, Atten= 95%, Lag= 150.3 min
Primary = 0.46 cfs @ 14.60 hrs, Volume= 0.647 af
Routed to Link DP2 : DP2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 450.82' @ 14.60 hrs Surf.Area= 0.121 ac Storage= 0.440 af

Plug-Flow detention time= 1,049.4 min calculated for 0.647 af (99% of inflow)
Center-of-Mass det. time= 1,042.6 min (1,852.2 - 809.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	446.75'	0.000 af	**38.75'W x 136.48'L x 5.50'H Field A**
			0.668 af Overall - 0.668 af Embedded = 0.000 af x 40.0% Voids
#2A	446.75'	0.540 af	**StormTrap SingleTrap 5-0** x 24 Inside #1
			Inside= 101.7"W x 60.0"H => 38.33 sf x 15.40'L = 590.2 cf
			Outside= 101.7"W x 66.0"H => 46.64 sf x 15.40'L = 718.0 cf
			24 Chambers in 3 Rows
			25.44' x 123.17' Core + 6.66' Border = 38.75' x 136.48' System
		0.540 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	450.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	446.75'	**12.0" Round Culvert**
			L= 100.0' CPP, square edge headwall, Ke= 0.500
			Inlet / Outlet Invert= 446.75' / 446.25' S= 0.0050 '/' Cc= 0.900
			n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	446.75'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.46 cfs @ 14.60 hrs HW=450.82' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Passes 0.46 cfs of 5.53 cfs potential flow)
  ├─**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.25 cfs @ 0.88 fps)
  └─**3=Orifice/Grate** (Orifice Controls 0.21 cfs @ 9.62 fps)

Summary for Pond 8.1: Infiltration Basin

Inflow Area = 1.478 ac, 72.76% Impervious, Inflow Depth = 3.73" for 10-Year event
Inflow = 6.07 cfs @ 12.09 hrs, Volume= 0.459 af
Outflow = 4.13 cfs @ 12.18 hrs, Volume= 0.459 af, Atten= 32%, Lag= 5.7 min
Discarded = 0.06 cfs @ 12.18 hrs, Volume= 0.113 af
Primary = 4.07 cfs @ 12.18 hrs, Volume= 0.346 af
Routed to Link DP2 : DP2
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link DP2 : DP2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 425.66' @ 12.18 hrs Surf.Area= 3,106 sf Storage= 5,974 cf

Plug-Flow detention time= 272.6 min calculated for 0.459 af (100% of inflow)
Center-of-Mass det. time= 274.1 min (1,062.7 - 788.6)

Volume	Invert	Avail.Storage	Storage Description
#1	423.00'	10,814 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
423.00	1,477	171.0	0	0	1,477
424.00	2,030	196.7	1,746	1,746	2,251
425.00	2,656	220.9	2,336	4,082	3,082
426.00	3,355	244.9	2,999	7,081	4,002
427.00	4,125	268.1	3,733	10,814	4,983

Device	Routing	Invert	Outlet Devices
#1	Discarded	423.00'	**0.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 422.00'
#2	Secondary	426.00'	**16.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#3	Primary	423.00'	**18.0" Round Culvert** L= 90.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 423.00' / 418.00' S= 0.0556 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#4	Device 3	425.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 3	424.50'	**24.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.06 cfs @ 12.18 hrs HW=425.65' (Free Discharge)
└**1=Exfiltration** (Controls 0.06 cfs)

Primary OutFlow Max=4.00 cfs @ 12.18 hrs HW=425.65' TW=0.00' (Dynamic Tailwater)
└**3=Culvert** (Passes 4.00 cfs of 11.74 cfs potential flow)
  ├**4=Orifice/Grate** (Weir Controls 1.56 cfs @ 1.28 fps)
  └**5=Orifice/Grate** (Orifice Controls 2.44 cfs @ 4.88 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=423.00' TW=0.00' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DP1: DP1

Inflow Area = 5.893 ac, 52.33% Impervious, Inflow Depth = 3.48" for 10-Year event
Inflow = 11.20 cfs @ 12.30 hrs, Volume= 1.710 af
Primary = 11.20 cfs @ 12.30 hrs, Volume= 1.710 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP2: DP2

Inflow Area = 13.531 ac, 54.74% Impervious, Inflow Depth > 3.27" for 10-Year event
Inflow = 16.24 cfs @ 12.20 hrs, Volume= 3.691 af
Primary = 16.24 cfs @ 12.20 hrs, Volume= 3.691 af, Atten= 0%, Lag= 0.0 min

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

Summary for Subcatchment PD1:

Runoff = 13.22 cfs @ 12.29 hrs, Volume= 1.479 af, Depth= 4.28"
Routed to Link DP1 : DP1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.75"

Area (sf)	CN	Description
69,515	98	Water Surface, HSG D
31,548	77	Woods, Good, HSG D
6,207	98	Water Surface, HSG D
6,264	98	Paved parking, HSG D
48,122	80	>75% Grass cover, Good, HSG D
19,054	70	Woods, Good, HSG C
180,710	87	Weighted Average
98,724		54.63% Pervious Area
81,986		45.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0380	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.12"
12.1	860	0.0560	1.18		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
21.8	910	Total			

Summary for Subcatchment PD10:

Runoff = 14.88 cfs @ 12.21 hrs, Volume= 1.446 af, Depth= 4.07"
Routed to Link DP2 : DP2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.75"

Area (sf)	CN	Description
38,717	98	Water Surface, HSG D
273	98	Roofs, HSG B
784	98	Roofs, HSG C
8,815	98	Roofs, HSG D
10,733	98	Water Surface, HSG C
1,190	98	Paved parking, HSG C
11,844	77	Woods, Good, HSG D
12,933	98	Paved parking, HSG D
24,534	74	>75% Grass cover, Good, HSG C
12,667	70	Woods, Good, HSG C
961	61	>75% Grass cover, Good, HSG B
108	98	Paved parking, HSG B
62,339	80	>75% Grass cover, Good, HSG D
185,898	85	Weighted Average
112,345		60.43% Pervious Area
73,553		39.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0570	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.12"
7.5	500	0.0491	1.11		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.7	550	Total			

Summary for Subcatchment PD2:

Runoff = 2.88 cfs @ 12.09 hrs, Volume= 0.219 af, Depth= 4.60"
Routed to Pond 1.1 : Bioretention Basin 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.75"

Area (sf)	CN	Description
4,447	98	Paved parking, HSG D
4,537	98	Paved parking, HSG D
10,907	80	>75% Grass cover, Good, HSG D
4,963	98	Roofs, HSG D
24,854	90	Weighted Average
10,907		43.88% Pervious Area
13,947		56.12% Impervious Area

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

Summary for Subcatchment PD3:

Runoff = 2.94 cfs @ 12.09 hrs, Volume= 0.238 af, Depth= 5.28"
Routed to Pond 2.1 : StormTrap 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.75"

Area (sf)	CN	Description
2,242	80	>75% Grass cover, Good, HSG D
1,200	98	Roofs, HSG D
13,652	98	Paved parking, HSG D
6,483	98	Roofs, HSG D
23,577	96	Weighted Average
2,242		9.51% Pervious Area
21,335		90.49% Impervious Area

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

Summary for Subcatchment PD4:

Runoff = 3.24 cfs @ 12.09 hrs, Volume= 0.249 af, Depth= 4.71"
Routed to Pond 3.1 : Bioretention Basin 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.75"

Area (sf)	CN	Description
10,505	80	>75% Grass cover, Good, HSG D
10,830	98	Paved parking, HSG D
6,243	98	Roofs, HSG D
27,578	91	Weighted Average
10,505		38.09% Pervious Area
17,073		61.91% Impervious Area

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

Summary for Subcatchment PD5:

Runoff = 8.58 cfs @ 12.09 hrs, Volume= 0.644 af, Depth= 4.39"
Routed to Pond 4.1 : StormTrap 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.75"

Area (sf)	CN	Description
15,663	98	Paved parking, HSG D
7,495	80	>75% Grass cover, Good, HSG D
2,010	77	Woods, Good, HSG D
6,062	70	Woods, Good, HSG C
15,941	98	Paved parking, HSG C
1,351	98	Roofs, HSG D
1,557	98	Roofs, HSG C
1,539	98	Roofs, HSG C
1,539	98	Roofs, HSG C
6,996	98	Roofs, HSG C
16,565	74	>75% Grass cover, Good, HSG C
76,718	88	Weighted Average
32,132		41.88% Pervious Area
44,586		58.12% Impervious Area

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

Summary for Subcatchment PD6:

Runoff = 9.89 cfs @ 12.09 hrs, Volume= 0.759 af, Depth= 4.71"
Routed to Pond 5.1 : StormTrap 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.75"

Area (sf)	CN	Description
6,487	98	Roofs, HSG C
8,309	98	Roofs, HSG D
1,539	98	Roofs, HSG C
23,118	98	Paved parking, HSG D
12,528	98	Paved parking, HSG C
8,045	74	>75% Grass cover, Good, HSG C
24,141	80	>75% Grass cover, Good, HSG D
84,167	91	Weighted Average
32,186		38.24% Pervious Area
51,981		61.76% Impervious Area

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

Summary for Subcatchment PD7:

Runoff = 8.11 cfs @ 12.09 hrs, Volume= 0.622 af, Depth= 4.71"
Routed to Pond 6.1 : StormTrap 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.75"

Area (sf)	CN	Description
1,539	98	Roofs, HSG D
1,539	98	Roofs, HSG D
1,759	77	Woods, Good, HSG D
26,907	98	Paved parking, HSG D
12,373	98	Roofs, HSG D
24,839	80	>75% Grass cover, Good, HSG D
68,956	91	Weighted Average
26,598		38.57% Pervious Area
42,358		61.43% Impervious Area

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

Summary for Subcatchment PD8:

Runoff = 11.51 cfs @ 12.09 hrs, Volume= 0.850 af, Depth= 4.07"
Routed to Pond 7.1 : StormTrap 5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.75"

Area (sf)	CN	Description
4,083	77	Woods, Good, HSG D
1,891	55	Woods, Good, HSG B
10,731	98	Roofs, HSG B
1,995	98	Roofs, HSG D
1,557	98	Roofs, HSG D
26,336	98	Paved parking, HSG B
17,672	98	Paved parking, HSG D
12,325	80	>75% Grass cover, Good, HSG D
22,315	61	>75% Grass cover, Good, HSG B
3,704	61	>75% Grass cover, Good, HSG B
1,106	98	Paved parking, HSG B
1,656	61	>75% Grass cover, Good, HSG B
3,916	98	Paved parking, HSG B
109,287	85	Weighted Average
45,974		42.07% Pervious Area
63,313		57.93% Impervious Area

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

Summary for Subcatchment PD9:

Runoff = 7.57 cfs @ 12.09 hrs, Volume= 0.580 af, Depth= 4.71"
Routed to Pond 8.1 : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.75"

Area (sf)	CN	Description
1,537	98	Roofs, HSG C
21,782	98	Paved parking, HSG C
2,973	74	>75% Grass cover, Good, HSG C
869	98	Roofs, HSG C
18,023	98	Roofs, HSG B
379	98	Roofs, HSG D
3,703	98	Paved parking, HSG B
1,380	61	>75% Grass cover, Good, HSG B
13,185	74	>75% Grass cover, Good, HSG C
546	98	Paved parking, HSG C
64,377	91	Weighted Average
17,538		27.24% Pervious Area
46,839		72.76% Impervious Area

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

Summary for Pond 1.1: Bioretention Basin 1

Inflow Area = 0.571 ac, 56.12% Impervious, Inflow Depth = 4.60" for 25-Year event
Inflow = 2.88 cfs @ 12.09 hrs, Volume= 0.219 af
Outflow = 0.38 cfs @ 12.65 hrs, Volume= 0.219 af, Atten= 87%, Lag= 33.4 min
Primary = 0.38 cfs @ 12.65 hrs, Volume= 0.219 af
Routed to Link DP1 : DP1
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link DP1 : DP1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 447.55' @ 12.65 hrs Surf.Area= 3,045 sf Storage= 3,733 cf

Plug-Flow detention time= 101.7 min calculated for 0.219 af (100% of inflow)
Center-of-Mass det. time= 101.2 min (887.3 - 786.1)

Volume	Invert	Avail.Storage	Storage Description
#1	444.33'	4,706 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 11,795 cf Overall - 7,089 cf Embedded = 4,706 cf
#2	444.83'	1,593 cf	**Soil Media (Irregular)** Listed below (Recalc) Inside #1 5,310 cf Overall x 30.0% Voids
#3	444.33'	531 cf	**Underdrain Stone (Irregular)** Listed below (Recalc) Inside #1 1,328 cf Overall x 40.0% Voids
#4	446.83'	45 cf	**Mulch (Irregular)** Listed below (Recalc) Inside #1 451 cf Overall x 10.0% Voids
		6,875 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
444.33	2,655	224.0	0	0	2,655
445.50	2,655	224.0	3,106	3,106	2,917
447.00	2,655	224.0	3,983	7,089	3,253
448.00	3,386	248.0	3,013	10,102	4,185
448.50	3,386	248.0	1,693	11,795	4,309

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
444.83	2,655	224.0	0	0	2,655
446.83	2,655	224.0	5,310	5,310	3,103

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
444.33	2,655	224.0	0	0	2,655
444.83	2,655	224.0	1,328	1,328	2,767

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
446.83	2,655	224.0	0	0	2,655
447.00	2,655	224.0	451	451	2,693

Device	Routing	Invert	Outlet Devices
#1	Secondary	448.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Primary	444.33'	**8.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 444.33' / 441.00' S= 0.1665 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#3	Device 2	444.33'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 442.00'
#4	Primary	447.75'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.38 cfs @ 12.65 hrs HW=447.55' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Passes 0.38 cfs of 2.25 cfs potential flow)
└─**3=Exfiltration** (Controls 0.38 cfs)
└─**4=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=444.33' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 1P: StormTrap 4

Volume	Invert	Avail.Storage	Storage Description
#1A	451.25'	0.000 af	**30.27'W x 74.90'L x 5.50'H Field A** 0.286 af Overall - 0.286 af Embedded = 0.000 af x 40.0% Voids
#2A	451.25'	0.230 af	**StormTrap SingleTrap 5-0** x 8 Inside #1 Inside= 101.7"W x 60.0"H => 38.33 sf x 15.40'L = 590.2 cf Outside= 101.7"W x 66.0"H => 46.64 sf x 15.40'L = 718.0 cf 8 Chambers in 2 Rows 16.96' x 61.58' Core + 6.66' Border = 30.27' x 74.90' System
		0.230 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	455.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	451.25'	**18.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 451.25' / 450.75' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#3	Device 2	451.25'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Controls 0.00 cfs)
└─**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
└─**3=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 2.1: StormTrap 1

Inflow Area = 0.541 ac, 90.49% Impervious, Inflow Depth = 5.28" for 25-Year event
Inflow = 2.94 cfs @ 12.09 hrs, Volume= 0.238 af
Outflow = 0.38 cfs @ 12.64 hrs, Volume= 0.238 af, Atten= 87%, Lag= 33.2 min
Primary = 0.38 cfs @ 12.64 hrs, Volume= 0.238 af
Routed to Link DP1 : DP1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 464.82' @ 12.64 hrs Surf.Area= 0.037 ac Storage= 0.134 af

Plug-Flow detention time= 558.6 min calculated for 0.238 af (100% of inflow)
Center-of-Mass det. time= 557.8 min (1,316.9 - 759.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	460.75'	0.000 af	**21.79'W x 74.90'L x 5.50'H Field A** 0.206 af Overall - 0.206 af Embedded = 0.000 af x 40.0% Voids
#2A	460.75'	0.165 af	**StormTrap SingleTrap 5-0** x 4 Inside #1 Inside= 101.7"W x 60.0"H => 38.33 sf x 15.40'L = 590.2 cf Outside= 101.7"W x 66.0"H => 46.64 sf x 15.40'L = 718.0 cf 8.48' x 61.58' Core + 6.66' Border = 21.79' x 74.90' System
		0.165 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	464.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	460.75'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 460.75' / 460.25' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	460.75'	**1.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.38 cfs @ 12.64 hrs HW=464.82' TW=0.00' (Dynamic Tailwater)
↑**2=Culvert** (Passes 0.38 cfs of 5.53 cfs potential flow)
↑**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.26 cfs @ 0.89 fps)
3=Orifice/Grate (Orifice Controls 0.12 cfs @ 9.64 fps)

Summary for Pond 3.1: Bioretention Basin 2

Inflow Area = 0.633 ac, 61.91% Impervious, Inflow Depth = 4.71" for 25-Year event
Inflow = 3.24 cfs @ 12.09 hrs, Volume= 0.249 af
Outflow = 1.19 cfs @ 12.35 hrs, Volume= 0.249 af, Atten= 63%, Lag= 16.0 min
Primary = 1.19 cfs @ 12.35 hrs, Volume= 0.249 af
Routed to Link DP1 : DP1
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link DP1 : DP1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 471.84' @ 12.35 hrs Surf.Area= 2,736 sf Storage= 3,630 cf

Plug-Flow detention time= 74.8 min calculated for 0.249 af (100% of inflow)
Center-of-Mass det. time= 74.2 min (856.5 - 782.4)

Volume	Invert	Avail.Storage	Storage Description
#1	468.33'	3,874 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 9,233 cf Overall - 5,359 cf Embedded = 3,874 cf
#2	468.83'	1,204 cf	**Soil Media (Irregular)** Listed below (Recalc) Inside #1 4,014 cf Overall x 30.0% Voids
#3	468.33'	401 cf	**Underdrain Storage (Irregular)** Listed below (Recalc) Inside #1 1,004 cf Overall x 40.0% Voids
#4	470.83'	34 cf	**Mulch (Irregular)** Listed below (Recalc) Inside #1 341 cf Overall x 10.0% Voids
		5,514 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
468.33	2,007	283.0	0	0	2,007
469.50	2,007	283.0	2,348	2,348	2,338
471.00	2,007	283.0	3,011	5,359	2,763
472.00	2,884	302.0	2,432	7,791	3,694
472.50	2,884	302.0	1,442	9,233	3,845

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
468.83	2,007	283.0	0	0	2,007
470.83	2,007	283.0	4,014	4,014	2,573

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
468.33	2,007	283.0	0	0	2,007
468.83	2,007	283.0	1,004	1,004	2,149

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
470.83	2,007	283.0	0	0	2,007
471.00	2,007	283.0	341	341	2,055

Device	Routing	Invert	Outlet Devices
#1	Secondary	472.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Primary	468.33'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 468.33' / 466.00' S= 0.1165 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	468.33'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 467.00'
#4	Device 2	471.75'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.19 cfs @ 12.35 hrs HW=471.84' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Passes 1.19 cfs of 5.18 cfs potential flow)
  ├─**3=Exfiltration** (Controls 0.45 cfs)
  └─**4=Orifice/Grate** (Weir Controls 0.73 cfs @ 0.99 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=468.33' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 4.1: StormTrap 2

Inflow Area = 1.761 ac, 58.12% Impervious, Inflow Depth = 4.39" for 25-Year event
Inflow = 8.58 cfs @ 12.09 hrs, Volume= 0.644 af
Outflow = 0.30 cfs @ 15.69 hrs, Volume= 0.640 af, Atten= 97%, Lag= 216.4 min
Primary = 0.30 cfs @ 15.69 hrs, Volume= 0.640 af
Routed to Link DP2 : DP2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 475.12' @ 15.69 hrs Surf.Area= 0.145 ac Storage= 0.432 af

Plug-Flow detention time= 798.3 min calculated for 0.640 af (99% of inflow)
Center-of-Mass det. time= 794.5 min (1,587.4 - 792.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	471.75'	0.000 af	**21.79'W x 290.44'L x 5.50'H Field A** 0.799 af Overall - 0.799 af Embedded = 0.000 af x 40.0% Voids
#2A	471.75'	0.640 af	**StormTrap SingleTrap 5-0** x 18 Inside #1 Inside= 101.7"W x 60.0"H => 38.33 sf x 15.40'L = 590.2 cf Outside= 101.7"W x 66.0"H => 46.64 sf x 15.40'L = 718.0 cf 8.48' x 277.13' Core + 6.66' Border = 21.79' x 290.44' System
		0.640 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	475.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	471.75'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 471.75' / 471.25' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	471.75'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.30 cfs @ 15.69 hrs HW=475.12' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Passes 0.30 cfs of 4.96 cfs potential flow)
  ├─**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └─**3=Orifice/Grate** (Orifice Controls 0.30 cfs @ 8.71 fps)

Summary for Pond 5.1: StormTrap 3

Inflow Area = 1.932 ac, 61.76% Impervious, Inflow Depth = 4.71" for 25-Year event
Inflow = 9.89 cfs @ 12.09 hrs, Volume= 0.759 af
Outflow = 2.43 cfs @ 12.47 hrs, Volume= 0.755 af, Atten= 75%, Lag= 23.2 min
Primary = 2.43 cfs @ 12.47 hrs, Volume= 0.755 af
Routed to Link DP2 : DP2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 467.06' @ 12.47 hrs Surf.Area= 0.108 ac Storage= 0.413 af

Plug-Flow detention time= 770.4 min calculated for 0.754 af (99% of inflow)
Center-of-Mass det. time= 768.3 min (1,550.6 - 782.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	462.75'	0.000 af	**38.75'W x 121.08'L x 5.50'H Field A** 0.592 af Overall - 0.592 af Embedded = 0.000 af x 40.0% Voids
#2A	462.75'	0.479 af	**StormTrap SingleTrap 5-0** x 21 Inside #1 Inside= 101.7"W x 60.0"H => 38.33 sf x 15.40'L = 590.2 cf Outside= 101.7"W x 66.0"H => 46.64 sf x 15.40'L = 718.0 cf 21 Chambers in 3 Rows 25.44' x 107.77' Core + 6.66' Border = 38.75' x 121.08' System
		0.479 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	466.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	462.75'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 462.75' / 462.25' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	462.75'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.39 cfs @ 12.47 hrs HW=467.06' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Passes 2.39 cfs of 5.71 cfs potential flow)
  ├─**1=Sharp-Crested Rectangular Weir** (Weir Controls 2.18 cfs @ 1.81 fps)
  └─**3=Orifice/Grate** (Orifice Controls 0.22 cfs @ 9.89 fps)

Summary for Pond 6.1: StormTrap 4

Inflow Area = 1.583 ac, 61.43% Impervious, Inflow Depth = 4.71" for 25-Year event
Inflow = 8.11 cfs @ 12.09 hrs, Volume= 0.622 af
Outflow = 1.34 cfs @ 12.57 hrs, Volume= 0.619 af, Atten= 84%, Lag= 28.8 min
Primary = 1.34 cfs @ 12.57 hrs, Volume= 0.619 af
Routed to Link DP2 : DP2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 455.45' @ 12.57 hrs Surf.Area= 0.095 ac Storage= 0.353 af

Plug-Flow detention time= 737.3 min calculated for 0.619 af (100% of inflow)
Center-of-Mass det. time= 736.3 min (1,518.6 - 782.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	451.25'	0.000 af	**30.27'W x 136.48'L x 5.50'H Field A** 0.522 af Overall - 0.522 af Embedded = 0.000 af x 40.0% Voids
#2A	451.25'	0.420 af	**StormTrap SingleTrap 5-0** x 16 Inside #1 Inside= 101.7"W x 60.0"H => 38.33 sf x 15.40'L = 590.2 cf Outside= 101.7"W x 66.0"H => 46.64 sf x 15.40'L = 718.0 cf 16 Chambers in 2 Rows 16.96' x 123.17' Core + 6.66' Border = 30.27' x 136.48' System
		0.420 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	455.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	451.25'	**18.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 451.25' / 450.75' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#3	Device 2	451.25'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.32 cfs @ 12.57 hrs HW=455.44' TW=0.00' (Dynamic Tailwater)
↑**2=Culvert** (Passes 1.32 cfs of 13.89 cfs potential flow)
↑**1=Sharp-Crested Rectangular Weir** (Weir Controls 1.11 cfs @ 1.44 fps)
3=Orifice/Grate (Orifice Controls 0.21 cfs @ 9.76 fps)

Summary for Pond 7.1: StormTrap 5

Inflow Area = 2.509 ac, 57.93% Impervious, Inflow Depth = 4.07" for 25-Year event
Inflow = 11.51 cfs @ 12.09 hrs, Volume= 0.850 af
Outflow = 2.19 cfs @ 12.55 hrs, Volume= 0.842 af, Atten= 81%, Lag= 27.3 min
Primary = 2.19 cfs @ 12.55 hrs, Volume= 0.842 af
Routed to Link DP2 : DP2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 451.04' @ 12.55 hrs Surf.Area= 0.121 ac Storage= 0.463 af

Plug-Flow detention time= 847.8 min calculated for 0.842 af (99% of inflow)
Center-of-Mass det. time= 842.1 min (1,644.3 - 802.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	446.75'	0.000 af	**38.75'W x 136.48'L x 5.50'H Field A** 0.668 af Overall - 0.668 af Embedded = 0.000 af x 40.0% Voids
#2A	446.75'	0.540 af	**StormTrap SingleTrap 5-0** x 24 Inside #1 Inside= 101.7"W x 60.0"H => 38.33 sf x 15.40'L = 590.2 cf Outside= 101.7"W x 66.0"H => 46.64 sf x 15.40'L = 718.0 cf 24 Chambers in 3 Rows 25.44' x 123.17' Core + 6.66' Border = 38.75' x 136.48' System
		0.540 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	450.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	446.75'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 446.75' / 446.25' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	446.75'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.18 cfs @ 12.55 hrs HW=451.04' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Passes 2.18 cfs of 5.69 cfs potential flow)
  ├─**1=Sharp-Crested Rectangular Weir** (Weir Controls 1.97 cfs @ 1.75 fps)
  └─**3=Orifice/Grate** (Orifice Controls 0.22 cfs @ 9.87 fps)

Summary for Pond 8.1: Infiltration Basin

Inflow Area = 1.478 ac, 72.76% Impervious, Inflow Depth = 4.71" for 25-Year event
Inflow = 7.57 cfs @ 12.09 hrs, Volume= 0.580 af
Outflow = 6.36 cfs @ 12.15 hrs, Volume= 0.580 af, Atten= 16%, Lag= 3.9 min
Discarded = 0.06 cfs @ 12.15 hrs, Volume= 0.116 af
Primary = 6.30 cfs @ 12.15 hrs, Volume= 0.464 af
Routed to Link DP2 : DP2
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link DP2 : DP2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 425.77' @ 12.15 hrs Surf.Area= 3,189 sf Storage= 6,336 cf

Plug-Flow detention time= 223.3 min calculated for 0.580 af (100% of inflow)
Center-of-Mass det. time= 224.8 min (1,007.2 - 782.4)

Volume	Invert	Avail.Storage	Storage Description
#1	423.00'	10,814 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
423.00	1,477	171.0	0	0	1,477
424.00	2,030	196.7	1,746	1,746	2,251
425.00	2,656	220.9	2,336	4,082	3,082
426.00	3,355	244.9	2,999	7,081	4,002
427.00	4,125	268.1	3,733	10,814	4,983

Device	Routing	Invert	Outlet Devices
#1	Discarded	423.00'	**0.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 422.00'
#2	Secondary	426.00'	**16.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#3	Primary	423.00'	**18.0" Round Culvert** L= 90.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 423.00' / 418.00' S= 0.0556 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#4	Device 3	425.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 3	424.50'	**24.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.06 cfs @ 12.15 hrs HW=425.77' (Free Discharge)
└**1=Exfiltration** (Controls 0.06 cfs)

Primary OutFlow Max=6.25 cfs @ 12.15 hrs HW=425.77' TW=0.00' (Dynamic Tailwater)
└**3=Culvert** (Passes 6.25 cfs of 12.09 cfs potential flow)
  └**4=Orifice/Grate** (Weir Controls 3.68 cfs @ 1.70 fps)
  └**5=Orifice/Grate** (Orifice Controls 2.58 cfs @ 5.15 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=423.00' TW=0.00' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DP1: DP1

Inflow Area = 5.893 ac, 52.33% Impervious, Inflow Depth = 4.45" for 25-Year event
Inflow = 14.81 cfs @ 12.31 hrs, Volume= 2.184 af
Primary = 14.81 cfs @ 12.31 hrs, Volume= 2.184 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP2: DP2

Inflow Area = 13.531 ac, 54.74% Impervious, Inflow Depth > 4.23" for 25-Year event
Inflow = 21.14 cfs @ 12.19 hrs, Volume= 4.767 af
Primary = 21.14 cfs @ 12.19 hrs, Volume= 4.767 af, Atten= 0%, Lag= 0.0 min

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

Summary for Subcatchment PD1:

Runoff = 17.62 cfs @ 12.29 hrs, Volume= 1.998 af, Depth= 5.78"
Routed to Link DP1 : DP1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.31"

Area (sf)	CN	Description
69,515	98	Water Surface, HSG D
31,548	77	Woods, Good, HSG D
6,207	98	Water Surface, HSG D
6,264	98	Paved parking, HSG D
48,122	80	>75% Grass cover, Good, HSG D
19,054	70	Woods, Good, HSG C
180,710	87	Weighted Average
98,724		54.63% Pervious Area
81,986		45.37% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	50	0.0380	0.09		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.12"
12.1	860	0.0560	1.18		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
21.8	910	Total			

Summary for Subcatchment PD10:

Runoff = 20.05 cfs @ 12.21 hrs, Volume= 1.974 af, Depth= 5.55"
Routed to Link DP2 : DP2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.31"

Area (sf)	CN	Description
38,717	98	Water Surface, HSG D
273	98	Roofs, HSG B
784	98	Roofs, HSG C
8,815	98	Roofs, HSG D
10,733	98	Water Surface, HSG C
1,190	98	Paved parking, HSG C
11,844	77	Woods, Good, HSG D
12,933	98	Paved parking, HSG D
24,534	74	>75% Grass cover, Good, HSG C
12,667	70	Woods, Good, HSG C
961	61	>75% Grass cover, Good, HSG B
108	98	Paved parking, HSG B
62,339	80	>75% Grass cover, Good, HSG D
185,898	85	Weighted Average
112,345		60.43% Pervious Area
73,553		39.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.2	50	0.0570	0.10		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.12"
7.5	500	0.0491	1.11		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
15.7	550	Total			

Summary for Subcatchment PD2:

Runoff = 3.77 cfs @ 12.09 hrs, Volume= 0.291 af, Depth= 6.13"
Routed to Pond 1.1 : Bioretention Basin 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.31"

Area (sf)	CN	Description
4,447	98	Paved parking, HSG D
4,537	98	Paved parking, HSG D
10,907	80	>75% Grass cover, Good, HSG D
4,963	98	Roofs, HSG D
24,854	90	Weighted Average
10,907		43.88% Pervious Area
13,947		56.12% Impervious Area

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

Summary for Subcatchment PD3:

Runoff = 3.76 cfs @ 12.09 hrs, Volume= 0.308 af, Depth= 6.83"
Routed to Pond 2.1 : StormTrap 1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.31"

Area (sf)	CN	Description
2,242	80	>75% Grass cover, Good, HSG D
1,200	98	Roofs, HSG D
13,652	98	Paved parking, HSG D
6,483	98	Roofs, HSG D
23,577	96	Weighted Average
2,242		9.51% Pervious Area
21,335		90.49% Impervious Area

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

Summary for Subcatchment PD4:

Runoff = 4.23 cfs @ 12.09 hrs, Volume= 0.329 af, Depth= 6.24"
Routed to Pond 3.1 : Bioretention Basin 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.31"

Area (sf)	CN	Description
10,505	80	>75% Grass cover, Good, HSG D
10,830	98	Paved parking, HSG D
6,243	98	Roofs, HSG D
27,578	91	Weighted Average
10,505		38.09% Pervious Area
17,073		61.91% Impervious Area

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

Summary for Subcatchment PD5:

Runoff = 11.34 cfs @ 12.09 hrs, Volume= 0.865 af, Depth= 5.89"
Routed to Pond 4.1 : StormTrap 2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.31"

Area (sf)	CN	Description
15,663	98	Paved parking, HSG D
7,495	80	>75% Grass cover, Good, HSG D
2,010	77	Woods, Good, HSG D
6,062	70	Woods, Good, HSG C
15,941	98	Paved parking, HSG C
1,351	98	Roofs, HSG D
1,557	98	Roofs, HSG C
1,539	98	Roofs, HSG C
1,539	98	Roofs, HSG C
6,996	98	Roofs, HSG C
16,565	74	>75% Grass cover, Good, HSG C
76,718	88	Weighted Average
32,132		41.88% Pervious Area
44,586		58.12% Impervious Area

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

Summary for Subcatchment PD6:

Runoff = 12.90 cfs @ 12.09 hrs, Volume= 1.005 af, Depth= 6.24"
Routed to Pond 5.1 : StormTrap 3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.31"

Area (sf)	CN	Description
6,487	98	Roofs, HSG C
8,309	98	Roofs, HSG D
1,539	98	Roofs, HSG C
23,118	98	Paved parking, HSG D
12,528	98	Paved parking, HSG C
8,045	74	>75% Grass cover, Good, HSG C
24,141	80	>75% Grass cover, Good, HSG D
84,167	91	Weighted Average
32,186		38.24% Pervious Area
51,981		61.76% Impervious Area

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

Summary for Subcatchment PD7:

Runoff = 10.57 cfs @ 12.09 hrs, Volume= 0.824 af, Depth= 6.24"
Routed to Pond 6.1 : StormTrap 4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.31"

Area (sf)	CN	Description
1,539	98	Roofs, HSG D
1,539	98	Roofs, HSG D
1,759	77	Woods, Good, HSG D
26,907	98	Paved parking, HSG D
12,373	98	Roofs, HSG D
24,839	80	>75% Grass cover, Good, HSG D
68,956	91	Weighted Average
26,598		38.57% Pervious Area
42,358		61.43% Impervious Area

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

Summary for Subcatchment PD8:

Runoff = 15.48 cfs @ 12.09 hrs, Volume= 1.160 af, Depth= 5.55"
Routed to Pond 7.1 : StormTrap 5

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.31"

Area (sf)	CN	Description
4,083	77	Woods, Good, HSG D
1,891	55	Woods, Good, HSG B
10,731	98	Roofs, HSG B
1,995	98	Roofs, HSG D
1,557	98	Roofs, HSG D
26,336	98	Paved parking, HSG B
17,672	98	Paved parking, HSG D
12,325	80	>75% Grass cover, Good, HSG D
22,315	61	>75% Grass cover, Good, HSG B
3,704	61	>75% Grass cover, Good, HSG B
1,106	98	Paved parking, HSG B
1,656	61	>75% Grass cover, Good, HSG B
3,916	98	Paved parking, HSG B
109,287	85	Weighted Average
45,974		42.07% Pervious Area
63,313		57.93% Impervious Area

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

Summary for Subcatchment PD9:

Runoff = 9.86 cfs @ 12.09 hrs, Volume= 0.769 af, Depth= 6.24"
Routed to Pond 8.1 : Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.31"

Area (sf)	CN	Description
1,537	98	Roofs, HSG C
21,782	98	Paved parking, HSG C
2,973	74	>75% Grass cover, Good, HSG C
869	98	Roofs, HSG C
18,023	98	Roofs, HSG B
379	98	Roofs, HSG D
3,703	98	Paved parking, HSG B
1,380	61	>75% Grass cover, Good, HSG B
13,185	74	>75% Grass cover, Good, HSG C
546	98	Paved parking, HSG C
64,377	91	Weighted Average
17,538		27.24% Pervious Area
46,839		72.76% Impervious Area

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

Summary for Pond 1.1: Bioretention Basin 1

Inflow Area = 0.571 ac, 56.12% Impervious, Inflow Depth = 6.13" for 100-Year event
Inflow = 3.77 cfs @ 12.09 hrs, Volume= 0.291 af
Outflow = 1.18 cfs @ 12.41 hrs, Volume= 0.291 af, Atten= 69%, Lag= 19.2 min
Primary = 1.18 cfs @ 12.41 hrs, Volume= 0.291 af
Routed to Link DP1 : DP1
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link DP1 : DP1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 447.85' @ 12.41 hrs Surf.Area= 3,267 sf Storage= 4,667 cf

Plug-Flow detention time= 105.8 min calculated for 0.291 af (100% of inflow)
Center-of-Mass det. time= 105.2 min (883.8 - 778.6)

Volume	Invert	Avail.Storage	Storage Description
#1	444.33'	4,706 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 11,795 cf Overall - 7,089 cf Embedded = 4,706 cf
#2	444.83'	1,593 cf	**Soil Media (Irregular)** Listed below (Recalc) Inside #1 5,310 cf Overall x 30.0% Voids
#3	444.33'	531 cf	**Underdrain Stone (Irregular)** Listed below (Recalc) Inside #1 1,328 cf Overall x 40.0% Voids
#4	446.83'	45 cf	**Mulch (Irregular)** Listed below (Recalc) Inside #1 451 cf Overall x 10.0% Voids
		6,875 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
444.33	2,655	224.0	0	0	2,655
445.50	2,655	224.0	3,106	3,106	2,917
447.00	2,655	224.0	3,983	7,089	3,253
448.00	3,386	248.0	3,013	10,102	4,185
448.50	3,386	248.0	1,693	11,795	4,309

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
444.83	2,655	224.0	0	0	2,655
446.83	2,655	224.0	5,310	5,310	3,103

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
444.33	2,655	224.0	0	0	2,655
444.83	2,655	224.0	1,328	1,328	2,767

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
446.83	2,655	224.0	0	0	2,655
447.00	2,655	224.0	451	451	2,693

Device	Routing	Invert	Outlet Devices
#1	Secondary	448.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Primary	444.33'	**8.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 444.33' / 441.00' S= 0.1665 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.35 sf
#3	Device 2	444.33'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 442.00'
#4	Primary	447.75'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.17 cfs @ 12.41 hrs HW=447.84' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Passes 0.41 cfs of 2.37 cfs potential flow)
└─**3=Exfiltration** (Controls 0.41 cfs)
└─**4=Orifice/Grate** (Weir Controls 0.76 cfs @ 1.00 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=444.33' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 1P: StormTrap 4

Volume	Invert	Avail.Storage	Storage Description
#1A	451.25'	0.000 af	**30.27'W x 74.90'L x 5.50'H Field A** 0.286 af Overall - 0.286 af Embedded = 0.000 af x 40.0% Voids
#2A	451.25'	0.230 af	**StormTrap SingleTrap 5-0** x 8 Inside #1 Inside= 101.7"W x 60.0"H => 38.33 sf x 15.40'L = 590.2 cf Outside= 101.7"W x 66.0"H => 46.64 sf x 15.40'L = 718.0 cf 8 Chambers in 2 Rows 16.96' x 61.58' Core + 6.66' Border = 30.27' x 74.90' System
		0.230 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	455.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	451.25'	**18.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 451.25' / 450.75' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#3	Device 2	451.25'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=0.00' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Controls 0.00 cfs)
└─**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
└─**3=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 2.1: StormTrap 1

Inflow Area = 0.541 ac, 90.49% Impervious, Inflow Depth = 6.83" for 100-Year event
Inflow = 3.76 cfs @ 12.09 hrs, Volume= 0.308 af
Outflow = 1.89 cfs @ 12.25 hrs, Volume= 0.308 af, Atten= 50%, Lag= 9.9 min
Primary = 1.89 cfs @ 12.25 hrs, Volume= 0.308 af
Routed to Link DP1 : DP1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 465.02' @ 12.25 hrs Surf.Area= 0.037 ac Storage= 0.140 af

Plug-Flow detention time= 467.1 min calculated for 0.308 af (100% of inflow)
Center-of-Mass det. time= 467.9 min (1,222.0 - 754.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	460.75'	0.000 af	**21.79'W x 74.90'L x 5.50'H Field A** 0.206 af Overall - 0.206 af Embedded = 0.000 af x 40.0% Voids
#2A	460.75'	0.165 af	**StormTrap SingleTrap 5-0** x 4 Inside #1 Inside= 101.7"W x 60.0"H => 38.33 sf x 15.40'L = 590.2 cf Outside= 101.7"W x 66.0"H => 46.64 sf x 15.40'L = 718.0 cf 8.48' x 61.58' Core + 6.66' Border = 21.79' x 74.90' System
		0.165 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	464.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	460.75'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 460.75' / 460.25' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	460.75'	**1.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=1.88 cfs @ 12.25 hrs HW=465.01' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 1.88 cfs of 5.68 cfs potential flow)
  ├**1=Sharp-Crested Rectangular Weir** (Weir Controls 1.76 cfs @ 1.68 fps)
  └**3=Orifice/Grate** (Orifice Controls 0.12 cfs @ 9.87 fps)

Summary for Pond 3.1: Bioretention Basin 2

Inflow Area = 0.633 ac, 61.91% Impervious, Inflow Depth = 6.24" for 100-Year event
Inflow = 4.23 cfs @ 12.09 hrs, Volume= 0.329 af
Outflow = 2.83 cfs @ 12.19 hrs, Volume= 0.329 af, Atten= 33%, Lag= 6.0 min
Primary = 2.83 cfs @ 12.19 hrs, Volume= 0.329 af
Routed to Link DP1 : DP1
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link DP1 : DP1

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 471.95' @ 12.19 hrs Surf.Area= 2,838 sf Storage= 3,933 cf

Plug-Flow detention time= 67.8 min calculated for 0.329 af (100% of inflow)
Center-of-Mass det. time= 67.2 min (842.3 - 775.1)

Volume	Invert	Avail.Storage	Storage Description
#1	468.33'	3,874 cf	**Custom Stage Data (Irregular)** Listed below (Recalc) 9,233 cf Overall - 5,359 cf Embedded = 3,874 cf
#2	468.83'	1,204 cf	**Soil Media (Irregular)** Listed below (Recalc) Inside #1 4,014 cf Overall x 30.0% Voids
#3	468.33'	401 cf	**Underdrain Storage (Irregular)** Listed below (Recalc) Inside #1 1,004 cf Overall x 40.0% Voids
#4	470.83'	34 cf	**Mulch (Irregular)** Listed below (Recalc) Inside #1 341 cf Overall x 10.0% Voids
		5,514 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
468.33	2,007	283.0	0	0	2,007
469.50	2,007	283.0	2,348	2,348	2,338
471.00	2,007	283.0	3,011	5,359	2,763
472.00	2,884	302.0	2,432	7,791	3,694
472.50	2,884	302.0	1,442	9,233	3,845

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
468.83	2,007	283.0	0	0	2,007
470.83	2,007	283.0	4,014	4,014	2,573

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
468.33	2,007	283.0	0	0	2,007
468.83	2,007	283.0	1,004	1,004	2,149

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
470.83	2,007	283.0	0	0	2,007
471.00	2,007	283.0	341	341	2,055

Device	Routing	Invert	Outlet Devices
#1	Secondary	472.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88
#2	Primary	468.33'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 468.33' / 466.00' S= 0.1165 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	468.33'	**2.410 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 467.00'
#4	Device 2	471.75'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.78 cfs @ 12.19 hrs HW=471.95' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Passes 2.78 cfs of 5.27 cfs potential flow)
  ├─**3=Exfiltration** (Controls 0.47 cfs)
  └─**4=Orifice/Grate** (Weir Controls 2.31 cfs @ 1.46 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=468.33' TW=0.00' (Dynamic Tailwater)
└─**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 4.1: StormTrap 2

Inflow Area = 1.761 ac, 58.12% Impervious, Inflow Depth = 5.89" for 100-Year event
Inflow = 11.34 cfs @ 12.09 hrs, Volume= 0.865 af
Outflow = 0.92 cfs @ 13.10 hrs, Volume= 0.861 af, Atten= 92%, Lag= 60.8 min
Primary = 0.92 cfs @ 13.10 hrs, Volume= 0.861 af
Routed to Link DP2 : DP2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 475.88' @ 13.10 hrs Surf.Area= 0.145 ac Storage= 0.528 af

Plug-Flow detention time= 780.4 min calculated for 0.861 af (99% of inflow)
Center-of-Mass det. time= 777.1 min (1,562.0 - 784.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	471.75'	0.000 af	**21.79'W x 290.44'L x 5.50'H Field A** 0.799 af Overall - 0.799 af Embedded = 0.000 af x 40.0% Voids
#2A	471.75'	0.640 af	**StormTrap SingleTrap 5-0** x 18 Inside #1 Inside= 101.7"W x 60.0"H => 38.33 sf x 15.40'L = 590.2 cf Outside= 101.7"W x 66.0"H => 46.64 sf x 15.40'L = 718.0 cf 8.48' x 277.13' Core + 6.66' Border = 21.79' x 290.44' System
		0.640 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	475.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	471.75'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 471.75' / 471.25' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	471.75'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.92 cfs @ 13.10 hrs HW=475.88' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Passes 0.92 cfs of 5.57 cfs potential flow)
  ├**1=Sharp-Crested Rectangular Weir** (Weir Controls 0.59 cfs @ 1.17 fps)
  └**3=Orifice/Grate** (Orifice Controls 0.33 cfs @ 9.66 fps)

Summary for Pond 5.1: StormTrap 3

Inflow Area = 1.932 ac, 61.76% Impervious, Inflow Depth = 6.24" for 100-Year event
Inflow = 12.90 cfs @ 12.09 hrs, Volume= 1.005 af
Outflow = 6.00 cfs @ 12.26 hrs, Volume= 1.001 af, Atten= 53%, Lag= 10.4 min
Primary = 6.00 cfs @ 12.26 hrs, Volume= 1.001 af
Routed to Link DP2 : DP2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 467.46' @ 12.26 hrs Surf.Area= 0.108 ac Storage= 0.451 af

Plug-Flow detention time= 616.9 min calculated for 1.000 af (99% of inflow)
Center-of-Mass det. time= 615.5 min (1,390.7 - 775.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	462.75'	0.000 af	**38.75'W x 121.08'L x 5.50'H Field A** 0.592 af Overall - 0.592 af Embedded = 0.000 af x 40.0% Voids
#2A	462.75'	0.479 af	**StormTrap SingleTrap 5-0** x 21 Inside #1 Inside= 101.7"W x 60.0"H => 38.33 sf x 15.40'L = 590.2 cf Outside= 101.7"W x 66.0"H => 46.64 sf x 15.40'L = 718.0 cf 21 Chambers in 3 Rows 25.44' x 107.77' Core + 6.66' Border = 38.75' x 121.08' System
		0.479 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	466.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	462.75'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 462.75' / 462.25' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	462.75'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=6.00 cfs @ 12.26 hrs HW=467.45' TW=0.00' (Dynamic Tailwater)
└─**2=Culvert** (Barrel Controls 6.00 cfs @ 7.64 fps)
  ├─**1=Sharp-Crested Rectangular Weir** (Passes < 7.43 cfs potential flow)
  └─**3=Orifice/Grate** (Passes < 0.23 cfs potential flow)

Summary for Pond 6.1: StormTrap 4

Inflow Area = 1.583 ac, 61.43% Impervious, Inflow Depth = 6.24" for 100-Year event
Inflow = 10.57 cfs @ 12.09 hrs, Volume= 0.824 af
Outflow = 4.94 cfs @ 12.27 hrs, Volume= 0.821 af, Atten= 53%, Lag= 10.8 min
Primary = 4.94 cfs @ 12.27 hrs, Volume= 0.821 af
Routed to Link DP2 : DP2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 455.77' @ 12.27 hrs Surf.Area= 0.095 ac Storage= 0.379 af

Plug-Flow detention time= 596.0 min calculated for 0.821 af (100% of inflow)
Center-of-Mass det. time= 594.0 min (1,369.1 - 775.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	451.25'	0.000 af	**30.27'W x 136.48'L x 5.50'H Field A** 0.522 af Overall - 0.522 af Embedded = 0.000 af x 40.0% Voids
#2A	451.25'	0.420 af	**StormTrap SingleTrap 5-0** x 16 Inside #1 Inside= 101.7"W x 60.0"H => 38.33 sf x 15.40'L = 590.2 cf Outside= 101.7"W x 66.0"H => 46.64 sf x 15.40'L = 718.0 cf 16 Chambers in 2 Rows 16.96' x 123.17' Core + 6.66' Border = 30.27' x 136.48' System
		0.420 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	455.25'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	451.25'	**18.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 451.25' / 450.75' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#3	Device 2	451.25'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=4.86 cfs @ 12.27 hrs HW=455.76' TW=0.00' (Dynamic Tailwater)
↑**2=Culvert** (Passes 4.86 cfs of 14.56 cfs potential flow)
↑**1=Sharp-Crested Rectangular Weir** (Weir Controls 4.64 cfs @ 2.33 fps)
3=Orifice/Grate (Orifice Controls 0.22 cfs @ 10.13 fps)

Summary for Pond 7.1: StormTrap 5

Inflow Area = 2.509 ac, 57.93% Impervious, Inflow Depth = 5.55" for 100-Year event
Inflow = 15.48 cfs @ 12.09 hrs, Volume= 1.160 af
Outflow = 6.06 cfs @ 12.33 hrs, Volume= 1.152 af, Atten= 61%, Lag= 14.2 min
Primary = 6.06 cfs @ 12.33 hrs, Volume= 1.152 af
Routed to Link DP2 : DP2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 451.54' @ 12.33 hrs Surf.Area= 0.121 ac Storage= 0.517 af

Plug-Flow detention time= 650.5 min calculated for 1.152 af (99% of inflow)
Center-of-Mass det. time= 645.8 min (1,439.4 - 793.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	446.75'	0.000 af	**38.75'W x 136.48'L x 5.50'H Field A** 0.668 af Overall - 0.668 af Embedded = 0.000 af x 40.0% Voids
#2A	446.75'	0.540 af	**StormTrap SingleTrap 5-0** x 24 Inside #1 Inside= 101.7"W x 60.0"H => 38.33 sf x 15.40'L = 590.2 cf Outside= 101.7"W x 66.0"H => 46.64 sf x 15.40'L = 718.0 cf 24 Chambers in 3 Rows 25.44' x 123.17' Core + 6.66' Border = 38.75' x 136.48' System
		0.540 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	450.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	446.75'	**12.0" Round Culvert** L= 100.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 446.75' / 446.25' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#3	Device 2	446.75'	**2.0" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=6.06 cfs @ 12.33 hrs HW=451.53' TW=0.00' (Dynamic Tailwater)
└**2=Culvert** (Barrel Controls 6.06 cfs @ 7.71 fps)
  ├**1=Sharp-Crested Rectangular Weir** (Passes < 8.72 cfs potential flow)
  └**3=Orifice/Grate** (Passes < 0.23 cfs potential flow)

Summary for Pond 8.1: Infiltration Basin

Inflow Area = 1.478 ac, 72.76% Impervious, Inflow Depth = 6.24" for 100-Year event
Inflow = 9.86 cfs @ 12.09 hrs, Volume= 0.769 af
Outflow = 8.94 cfs @ 12.13 hrs, Volume= 0.769 af, Atten= 9%, Lag= 2.3 min
Discarded = 0.06 cfs @ 12.13 hrs, Volume= 0.120 af
Primary = 8.87 cfs @ 12.13 hrs, Volume= 0.649 af
Routed to Link DP2 : DP2
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Link DP2 : DP2

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 425.88' @ 12.13 hrs Surf.Area= 3,269 sf Storage= 6,691 cf

Plug-Flow detention time= 176.0 min calculated for 0.768 af (100% of inflow)
Center-of-Mass det. time= 177.6 min (952.8 - 775.1)

Volume	Invert	Avail.Storage	Storage Description
#1	423.00'	10,814 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
423.00	1,477	171.0	0	0	1,477
424.00	2,030	196.7	1,746	1,746	2,251
425.00	2,656	220.9	2,336	4,082	3,082
426.00	3,355	244.9	2,999	7,081	4,002
427.00	4,125	268.1	3,733	10,814	4,983

Device	Routing	Invert	Outlet Devices
#1	Discarded	423.00'	**0.270 in/hr Exfiltration over Wetted area** Conductivity to Groundwater Elevation = 422.00'
#2	Secondary	426.00'	**16.0' long x 10.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64
#3	Primary	423.00'	**18.0" Round Culvert** L= 90.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 423.00' / 418.00' S= 0.0556 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf
#4	Device 3	425.50'	**24.0" x 24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#5	Device 3	424.50'	**24.0" W x 3.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.06 cfs @ 12.13 hrs HW=425.87' (Free Discharge)
└**1=Exfiltration** (Controls 0.06 cfs)

Primary OutFlow Max=8.67 cfs @ 12.13 hrs HW=425.87' TW=0.00' (Dynamic Tailwater)
└**3=Culvert** (Passes 8.67 cfs of 12.40 cfs potential flow)
  └**4=Orifice/Grate** (Weir Controls 5.98 cfs @ 2.00 fps)
  └**5=Orifice/Grate** (Orifice Controls 2.69 cfs @ 5.38 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=423.00' TW=0.00' (Dynamic Tailwater)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Link DP1: DP1

Inflow Area = 5.893 ac, 52.33% Impervious, Inflow Depth = 5.96" for 100-Year event
Inflow = 22.18 cfs @ 12.28 hrs, Volume= 2.927 af
Primary = 22.18 cfs @ 12.28 hrs, Volume= 2.927 af, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP2: DP2

Inflow Area = 13.531 ac, 54.74% Impervious, Inflow Depth > 5.73" for 100-Year event
Inflow = 43.82 cfs @ 12.21 hrs, Volume= 6.457 af
Primary = 43.82 cfs @ 12.21 hrs, Volume= 6.457 af, Atten= 0%, Lag= 0.0 min

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

APPENDIX F: STORMWATER CALCULATIONS

- *MA STANDARD #3 – RECHARGE AND DRAWDOWN TIME*
- *MA STANDARD #4 – WATER QUALITY AND TSS REMOVAL*
- *NOAA RAINFALL DATA*

NOAA Atlas 14, Volume 10, Version 3
Location name: Leominster, Massachusetts, USA*
Latitude: 42.5276°, Longitude: -71.7139°
Elevation: 468 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sandra Pavlovic, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Orlan Wilhite

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.332 (0.257-0.418)	0.392 (0.303-0.493)	0.489 (0.377-0.617)	0.569 (0.437-0.721)	0.679 (0.504-0.888)	0.763 (0.555-1.01)	0.849 (0.599-1.16)	0.943 (0.634-1.31)	1.07 (0.696-1.53)	1.18 (0.745-1.71)
10-min	0.471 (0.365-0.592)	0.555 (0.429-0.698)	0.692 (0.533-0.873)	0.805 (0.617-1.02)	0.961 (0.714-1.26)	1.08 (0.785-1.43)	1.20 (0.848-1.64)	1.34 (0.898-1.86)	1.52 (0.985-2.17)	1.67 (1.06-2.42)
15-min	0.554 (0.429-0.697)	0.653 (0.505-0.822)	0.814 (0.627-1.03)	0.947 (0.726-1.20)	1.13 (0.839-1.48)	1.27 (0.923-1.69)	1.42 (0.998-1.93)	1.57 (1.06-2.18)	1.79 (1.16-2.55)	1.96 (1.24-2.85)
30-min	0.740 (0.573-0.931)	0.872 (0.674-1.10)	1.09 (0.838-1.37)	1.27 (0.970-1.60)	1.51 (1.12-1.98)	1.70 (1.23-2.26)	1.89 (1.33-2.58)	2.10 (1.41-2.92)	2.39 (1.55-3.41)	2.62 (1.66-3.80)
60-min	0.926 (0.717-1.16)	1.09 (0.843-1.37)	1.36 (1.05-1.72)	1.58 (1.21-2.01)	1.89 (1.40-2.47)	2.12 (1.54-2.82)	2.36 (1.67-3.22)	2.62 (1.76-3.65)	2.98 (1.93-4.26)	3.27 (2.07-4.74)
2-hr	1.15 (0.899-1.43)	1.38 (1.08-1.72)	1.76 (1.37-2.20)	2.07 (1.61-2.61)	2.51 (1.88-3.27)	2.83 (2.09-3.76)	3.18 (2.28-4.36)	3.58 (2.42-4.95)	4.19 (2.73-5.95)	4.70 (2.99-6.78)
3-hr	1.31 (1.03-1.63)	1.59 (1.25-1.97)	2.04 (1.60-2.54)	2.42 (1.89-3.03)	2.94 (2.22-3.82)	3.32 (2.47-4.40)	3.74 (2.71-5.13)	4.24 (2.88-5.84)	5.02 (3.27-7.09)	5.68 (3.62-8.15)
6-hr	1.67 (1.33-2.06)	2.03 (1.62-2.50)	2.63 (2.08-3.24)	3.12 (2.46-3.86)	3.80 (2.90-4.90)	4.29 (3.22-5.66)	4.84 (3.54-6.61)	5.51 (3.76-7.53)	6.54 (4.29-9.19)	7.44 (4.76-10.6)
12-hr	2.13 (1.72-2.60)	2.58 (2.08-3.15)	3.32 (2.66-4.06)	3.93 (3.13-4.83)	4.77 (3.68-6.11)	5.40 (4.08-7.04)	6.07 (4.46-8.20)	6.89 (4.73-9.34)	8.13 (5.36-11.3)	9.19 (5.91-13.0)
24-hr	2.58 (2.10-3.11)	3.12 (2.54-3.77)	4.00 (3.24-4.86)	4.74 (3.82-5.77)	5.75 (4.48-7.29)	6.50 (4.96-8.40)	7.31 (5.41-9.78)	8.28 (5.72-11.2)	9.74 (6.45-13.5)	11.0 (7.09-15.4)
2-day	2.93 (2.42-3.51)	3.57 (2.94-4.28)	4.60 (3.78-5.53)	5.46 (4.45-6.60)	6.65 (5.23-8.36)	7.53 (5.79-9.65)	8.48 (6.33-11.3)	9.62 (6.69-12.9)	11.3 (7.55-15.6)	12.8 (8.31-17.9)
3-day	3.20 (2.66-3.81)	3.88 (3.22-4.63)	5.00 (4.13-5.98)	5.93 (4.86-7.12)	7.20 (5.70-9.01)	8.15 (6.30-10.4)	9.17 (6.87-12.1)	10.4 (7.26-13.8)	12.2 (8.18-16.8)	13.8 (8.98-19.2)
4-day	3.44 (2.87-4.08)	4.16 (3.46-4.94)	5.32 (4.41-6.34)	6.29 (5.18-7.53)	7.62 (6.05-9.50)	8.61 (6.68-10.9)	9.68 (7.27-12.7)	10.9 (7.67-14.5)	12.8 (8.60-17.5)	14.4 (9.42-20.1)
7-day	4.10 (3.45-4.83)	4.87 (4.09-5.74)	6.11 (5.12-7.23)	7.15 (5.94-8.49)	8.57 (6.86-10.6)	9.64 (7.52-12.1)	10.8 (8.12-14.0)	12.1 (8.51-15.9)	14.0 (9.42-19.0)	15.6 (10.2-21.5)
10-day	4.76 (4.03-5.58)	5.55 (4.69-6.51)	6.84 (5.76-8.05)	7.91 (6.61-9.35)	9.38 (7.54-11.5)	10.5 (8.21-13.1)	11.7 (8.78-15.0)	13.0 (9.17-17.0)	14.8 (10.0-20.0)	16.4 (10.7-22.5)
20-day	6.81 (5.84-7.91)	7.64 (6.54-8.89)	9.01 (7.68-10.5)	10.1 (8.58-11.9)	11.7 (9.48-14.1)	12.9 (10.2-15.9)	14.1 (10.6-17.8)	15.3 (11.0-19.9)	17.0 (11.6-22.8)	18.2 (12.0-24.9)
30-day	8.52 (7.36-9.84)	9.39 (8.10-10.9)	10.8 (9.28-12.5)	12.0 (10.2-14.0)	13.6 (11.1-16.3)	14.9 (11.8-18.1)	16.1 (12.2-20.1)	17.3 (12.4-22.4)	18.8 (12.8-25.0)	19.8 (13.1-27.0)
45-day	10.6 (9.25-12.2)	11.6 (10.0-13.3)	13.0 (11.3-15.1)	14.3 (12.3-16.6)	16.0 (13.1-19.0)	17.4 (13.8-21.0)	18.6 (14.1-23.0)	19.8 (14.3-25.4)	21.1 (14.5-28.0)	22.0 (14.6-29.8)
60-day	12.4 (10.8-14.2)	13.4 (11.7-15.3)	14.9 (13.0-17.1)	16.2 (14.0-18.7)	18.0 (14.8-21.3)	19.5 (15.5-23.4)	20.8 (15.7-25.5)	21.9 (15.9-28.0)	23.2 (15.9-30.6)	23.9 (16.0-32.3)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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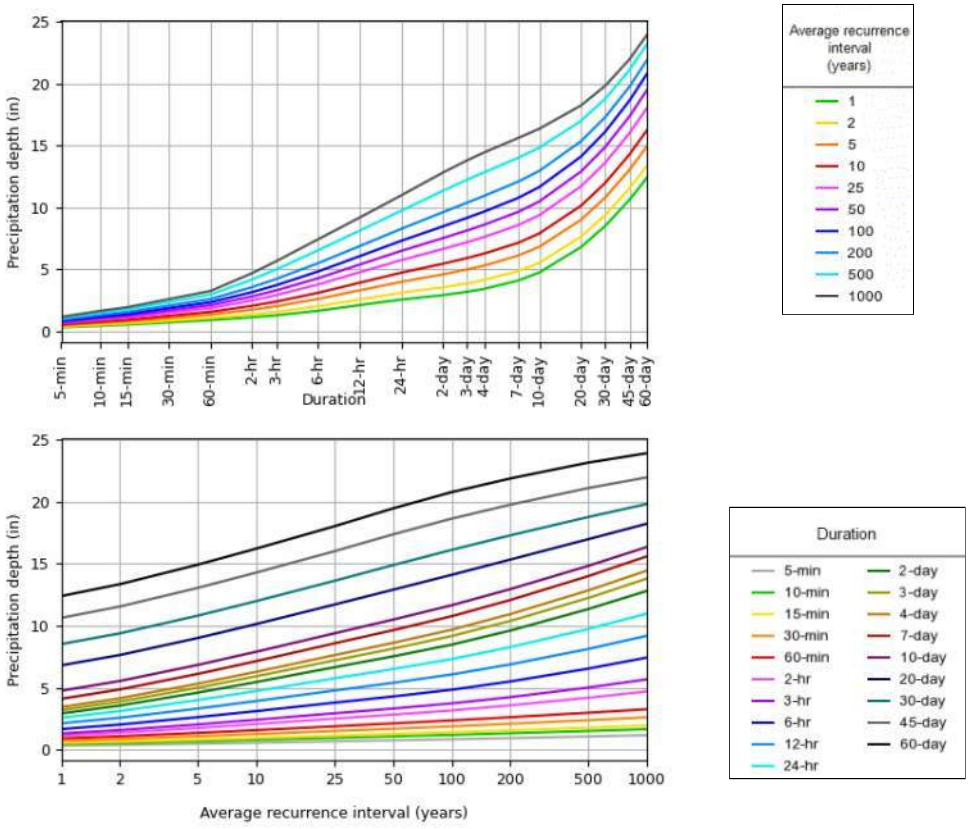
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 42.5276°, Longitude: -71.7139°



NOAA Atlas 14, Volume 10, Version 3

Created (GMT): Wed Mar 5 15:32:46 2025

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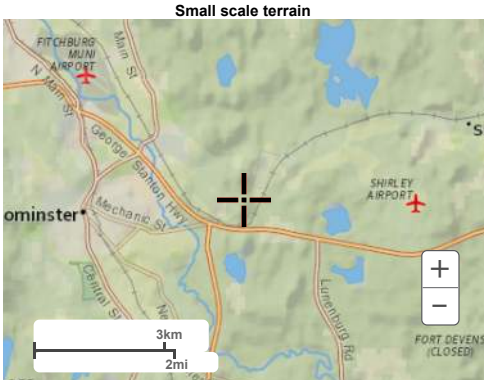
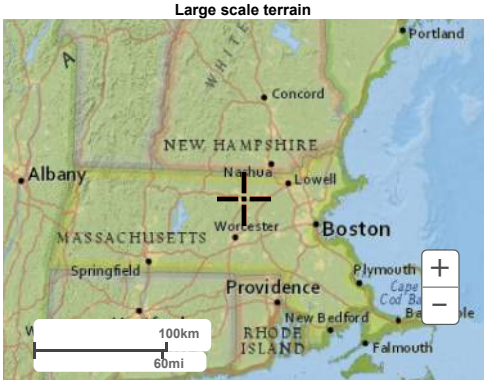
Maps & aerials

Small scale terrain

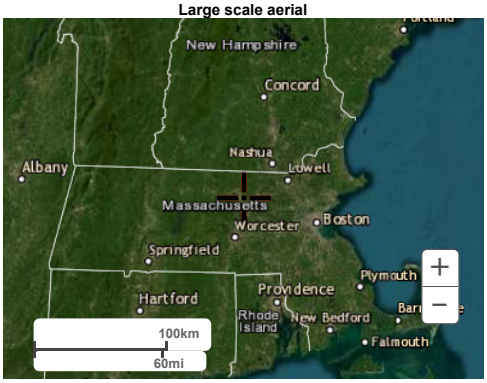


Large scale terrain



Large scale map

Large scale aerial



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Questions?: HDSC.Questions@noaa.gov

Disclaimer

Orchard Hill Park
86 Orchard Hill Park Drive
Leominster, MA
Bohler Job Number: MAA240279
March 28, 2025

MA DEP Standard 3: Recharge Volume Calculations

Required Recharge Volume - A Soils (0.60 in.)	
Existing Site Impervious Area (ac)	0.000
Proposed Site Impervious Area (ac)	0.000
Proposed Increase in Site Impervious Area (ac)	0.000
Recharge Volume Required (cf)	**0**

Required Recharge Volume - B Soils (0.35 in.)	
Existing Site Impervious Area (ac)	0.000
Proposed Site Impervious Area (ac)	1.467
Proposed Increase in Site Impervious Area (ac)	1.467
Recharge Volume Required (cf)	**1,864**

Required Recharge Volume - C Soils (0.25 in.)	
Existing Site Impervious Area (ac)	0.000
Proposed Site Impervious Area (ac)	0.618
Proposed Increase in Site Impervious Area (ac)	0.618
Recharge Volume Required (cf)	**561**

Required Recharge Volume - D Soils (0.10 in.)	
Existing Site Impervious Area (ac)	0.000
Proposed Site Impervious Area (ac)	0.621
Proposed Increase in Site Impervious Area (ac)	0.621
Recharge Volume Required (cf)	**225**

Total Recharge Volume Required (cf)	**2,650**

Provided Recharge Volume*	
P8.1	2,836
Total Recharge Volume Provided (cf)	**2,836**

Provided greater than or Equal to Required

*Volume provided below lowest outlet in cubic feet (cf)

Prepared By:
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Leominster, MA
Bohler Job Number: MAA240279
March 28, 2025

MA DEP Standard 3: Drawdown Time Calculations

Drawdown Time - P8.1	
Volume below outlet pipe (Rv) (cf)	2,836
Soil Type	Silt Loam - C
Infiltration rate (K)*	0.27
Bottom Area (sf)	1,765
Drawdown time (Hours)*	**71.4**

*Infiltration Rates taken from Rawls Table
**Drawdown time = Rv / (K) x (bottom area)

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March 31, 2025

MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: All Extended Dry Detention Basins (PD3, PD5, PD6, PD7, & PD8)

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep-Sump Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Proprietary Water Quality Unit	**0.50**	**0.75**	**0.38**	**0.38**
Extended Dry Detention Basin	**0.50**	**0.38**	**0.19**	**0.19**
		Total TSS Removal =	**81%**	

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

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March 31, 2025

MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: All Bioretention Areas (PD2 & PD4)

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep-Sump Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Proprietary Water Quality Unit	**0.50**	**0.75**	**0.38**	**0.38**
Bioretention Area	**0.90**	**0.38**	**0.34**	**0.04**
		Total TSS Removal =	**96%**	

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

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March 31, 2025

MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: Infiltration Basin (PD9)

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep-Sump Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Proprietary Water Quality Unit	**0.50**	**0.75**	**0.38**	**0.38**
Infiltration Basin	**0.80**	**0.38**	**0.30**	**0.08**
		Total TSS Removal =	**93%**	

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

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Orchard Hill Park
86 Orchard Hill Park Drive
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March 31, 2025

MA DEP Standard 4: TSS Removal Calculation Worksheet

BMP Treatment Train: PD1 & PD10

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Deep-Sump Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Proprietary Water Quality Unit	**0.50**	**0.75**	**0.38**	**0.38**
		Total TSS Removal =	**63%**	

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

Prepared By:
BOHLER
352 Turnpike Road
Southborough, MA 01772
(508) 480-9900

Orchard Hill Park
86 Orchard Hill Park Drive
Leominster, MA
Bohler Job Number: MAA240279
March 31, 2025

MA DEP Standard 4: Weighted TSS Removal Rate

Design Point - Treatment Train Description(s)	TSS Removal (%)	Treated Imp. Area* (ac)	TSS Removal (%)	Untreated Imp. Area (ac)	Total Area
DP#1 (PD-#1)	56	0.144	0	0.000	0.144
DP#1 (PD-#2) - Bioretention Area (P1.1)	96	0.206	0	0.000	0.206
DP#1 (PD-#3) - Bioretention Area (P2.1)	96	0.213	0	0.000	0.213
DP#1 (PD-#4) - Dry Detention Basin (P3.1)	81	0.314	0	0.000	0.314
DP#2 (PD-#5) - Dry Detention Basin (P4.1)	81	0.441	0	0.000	0.441
DP#2 (PD-#6) - Dry Detention Basin (P5.1)	81	0.818	0	0.000	0.818
DP#2 (PD-#7) - Dry Detention Basin (P6.1)	81	0.549	0	0.000	0.549
DP#2 (PD-#8) - Dry Detention Basin (P7.1)	81	1.036	0	0.000	1.036
DP#2 (PD-#9) - Infiltration Basin (P8.1)	93	0.690	0	0.000	0.690
DP#2 (PD-#10)	56	0.329	0	0.000	0.329
Weighted TSS Removal Rate	**82**				

*Excludes roof runoff

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Bohler Job Number: MAA240279
March 28, 2025

MA DEP Standard 4: Water Quality Volume Calculations

Water Quality Volume Required	
Water Quality Volume runoff (in.)*	1.0
Total Post Development Impervious Area (sf)	331,753
Required Water Quality Volume (cf)	**27,646**
*Water Quality volume runoff is equal to 0.5 or 1.0 inches of runoff times the total impervious area of the post development project site.	

Water Quality Volume Provided*	
P1.1	2,815
P2.1	6,621
P3.1	2,169
P4.1	25,700
P5.1	19,210
P6.1	9,235
P7.1	21,693
P8.1	2,836
Total Provided Water Quality Volume (cf)	**90,279**

Required Water Quality Volume Provided

*Volume provided below lowest outlet pipe in cubic feet (cf)

Prepared By:
BOHLER
352 Turnpike Road
Southborough, MA 01772
(508) 480-9900

State of New Jersey

PHILIP D. MURPHY
Governor

SHEILA Y. OLIVER
Lt. Governor

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Mail Code – 401-02B
Division of Water Quality
Bureau of Nonpoint Pollution Control
P.O. Box 420 – 401 E. State St.
Trenton, NJ 08625-0420
Phone: (609) 633-7021 / Fax: (609) 777-0432
http://www.state.nj.us/dep/dwq/bnpc_home.htm

CATHERINE R. McCABE
Acting Commissioner

March 27, 2018

Graham Bryant, M.Sc., P.E.
President
Hydroworks, LLC
136 Central Avenue
Clark, NJ 07066

Re: MTD Lab Certification
HydroStorm Hydrodynamic Separator by Hydroworks, LLC
Online Installation

TSS Removal Rate 50%

Dear Mr. Bryant:

The Stormwater Management rules under N.J.A.C. 7:8-5.5(b) and 5.7 (c) allow the use of manufactured treatment devices (MTDs) for compliance with the design and performance standards at N.J.A.C. 7:8-5 if the pollutant removal rates have been verified by the New Jersey Corporation for Advanced Technology (NJCAT) and have been certified by the New Jersey Department of Environmental Protection (NJDEP). Hydroworks, LLC has requested an MTD Laboratory Certification for the Hydroworks HydroStorm Hydrodynamic Separator.

The project falls under the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advance Technology" dated January 25, 2013. The applicable protocol is the "New Jersey Laboratory Testing Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device" dated January 25, 2013.

NJCAT verification documents submitted to the NJDEP indicate that the requirements of the aforementioned protocol have been met or exceeded. The NJCAT letter also included a recommended certification TSS removal rate and the required maintenance plan. The NJCAT Verification Report with the Verification Appendix (dated February 2018) for this device is published online at http://www.njcat.org/verification-process/technology-verification-database.html.

The NJDEP certifies the use of the HydroStorm by Hydroworks, LLC at a TSS removal rate of 50% when designed, operated, and maintained in accordance with the information provided in the Verification Appendix and the following conditions:

1. The maximum treatment flow rate (MTFR) for the manufactured treatment device (MTD) is calculated using the New Jersey Water Quality Design Storm (1.25 inches in 2 hrs) in N.J.A.C. 7:8-5.5.

2. The HydroStorm shall be installed using the same configuration reviewed by NJCAT and shall be sized in accordance with the criteria specified in item 6 below.

3. This HydroStorm cannot be used in series with another MTD or a media filter (such as a sand filter) to achieve an enhanced removal rate for total suspended solids (TSS) removal under N.J.A.C. 7:8-5.5.

4. Additional design criteria for MTDs can be found in Chapter 9.6 of the New Jersey Stormwater Best Management Practices (NJ Stormwater BMP) Manual, which can be found online at www.njstormwater.org.

5. The maintenance plan for a site using this device shall incorporate, at a minimum, the maintenance requirements for the Hydrostorm. A copy of the maintenance plan is attached to this certification. However, it is recommended to review the maintenance website at http://www.hydroworks.com/hydrostormo&m.pdf for any changes to the maintenance requirements.

6. Sizing Requirement:

   The example below demonstrates the sizing procedure for the Hydrostorm:

   Example: A 0.25-acre impervious site is to be treated to 50% TSS removal using a HydroStorm. The impervious site runoff (Q) based on the New Jersey Water Quality Design Storm was determined to be 0.79 cfs.

   Maximum Treatment Flow Rate (MTFR) Evaluation:

   The site runoff (Q) was based on the following:
   time of concentration = 10 minutes
   i = 3.2 in/hr (page 5-8, Fig. 5-3 of the NJ Stormwater BMP Manual)
   c = 0.99 (runoff coefficient for impervious)
   Q = ciA = 0.99 x 3.2 x 0.25 = 0.79 cfs

   Given the site runoff is 0.79 cfs and based on Table 1 below, the HydroStorm Model HS4 with a MTFR of 0.88 cfs could be used for this site to remove 50% of the TSS from the impervious area without exceeding the MTFR.

   The sizing table corresponding to the available system models is noted below. Additional specifications regarding each model can be found in the Verification Appendix under Table A-1.

Table 1 HydroStorm Sizing Information

HydroStorm Model	NJDEP 50% TSS Maximum Treatment Flow Rate (cfs)	Treatment Area (ft^2)	Hydraulic Loading Rate (gpm/ft^2)	50% Maximum Sediment Storage (ft^3)
HS3	0.50	7.1	31.4	3.6
HS4	0.88	12.6	31.4	6.3
HS5	1.37	19.6	31.4	9.8
HS6	1.98	28.3	31.4	14.2
HS7	2.69	38.5	31.4	19.3
HS8	3.52	50.3	31.4	25.2
HS9	4.45	63.6	31.4	31.8
HS10	5.49	78.5	31.4	39.3
HS11	6.65	95.0	31.4	47.5
HS12	7.91	113.0	31.4	56.5

A detailed maintenance plan is mandatory for any project with a Stormwater BMP subject to the Stormwater Management Rules, N.J.A.C. 7:8. The plan must include all of the items identified in the Stormwater Management Rules, N.J.A.C. 7:8-5.8. Such items include, but are not limited to, the list of inspection and maintenance equipment and tools, specific corrective and preventative maintenance tasks, indication of problems in the system, and training of maintenance personnel. Additional information can be found in Chapter 8: Maintenance and Retrofit of Stormwater Management Measures.

If you have any questions regarding the above information, please contact Brian Salvo or Nick Grotts of my office at (609) 633-7021.

Sincerely,

James J. Murphy, Chief
Bureau of Nonpoint Pollution Control

Attachment: Maintenance Plan

cc: Chron File
Richard Magee, NJCAT
Vince Mazzei, NJDEP - DLUR
Ravi Patraju, NJDEP - BES
Gabriel Mahon, NJDEP - BNPC
Brian Salvo, NJDEP – BNPC
Nick Grotts, NJDEP – BNPC

APPENDIX G: OPERATION AND MAINTENANCE

- *STORMWATER OPERATION AND MAINTENANCE PLAN*
- *INSPECTION REPORT*
- *INSPECTION AND MAINTENANCE LOG FORM*
- *LONG-TERM POLLUTION PREVENTION PLAN*
- *ILLICIT DISCHARGE STATEMENT*
- *SPILL PREVENTION*
- *PROPOSED OPERATION AND MAINTENANCE MAP*
- *MANUFACTURER'S INSPECTION AND MAINTENANCE MANUALS*

STORMWATER OPERATION AND MAINTENANCE PLAN

Proposed 308-Unit Residential Development
86 Orchard Hill Park Drive
Leominster, MA

RESPONSIBLE PARTY DURING CONSTRUCTION:

TBD

RESPONSIBLE PARTY POST CONSTRUCTION:

WP East Acquisitions LLC
91 Hartwell Ave
Lexington, MA

Construction Phase

During the construction phase, all erosion control devices and measures shall be maintained in accordance with the final record plans, local/state approvals and conditions, the EPA Construction General Permit and the Stormwater Pollution Prevention Plan (SWPPP) if applicable. Additionally, the maintenance of all erosion / siltation control measures during construction shall be the responsibility of the general contractor. Contact information of the OWNER and CONTRACTOR shall be listed in the SWPPP for this site. The SWPPP also includes information regarding construction period allowable and illicit discharges, housekeeping and emergency response procedures. Upon proper notice to the property owner, the Town/City or its authorized designee shall be allowed to enter the property at a reasonable time and in a reasonable manner for the purposes of inspection.

Post Development Controls

Once construction is completed, the post development stormwater controls are to be operated and maintained in compliance with the following permanent procedures (note that the continued implementation of these procedures shall be the responsibility of the Owner or its assignee):

1. Parking lots: Sweep at least four (4) times per year and on a more frequent basis depending on sanding operations. All resulting sweepings shall be collected and properly disposed of offsite in accordance with MADEP and other applicable requirements.

2. Roadways: Sweep at least four (4) times per year and on a more frequent basis depending on sanding operations. All resulting sweepings shall be collected and properly disposed of off site in accordance with MADEP and other applicable requirements.

3. Catch basins, yard drains, trench drains, manholes and piping: Inspect four (4) times per year and at the end of foliage and snow-removal seasons. These features shall be cleaned four (4) times per year. or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the catch basin or underground system. Accumulated sediment and hydrocarbons present must be removed

and properly disposed of off-site in accordance with MADEP and other applicable requirements.

4. Riprap apron / Scour Hole: Riprap and scour holes should be checked at least annually and after every major storm event (generally equal or greater to 3.0 inches in 24 hours) for displaced stones, slumping, and erosion at edges, especially downstream or downslope. If the riprap is damaged, it should be repaired before further damage can take place. Note and repair any erosion, stone displacement or low spots in the areas. Woody vegetation should be removed from the riprap annually.

5. Water Quality Unit (Proprietary Separator): Follow manufacturer's recommendations (attached).

6. StormTrap SingleTrap (Detention Basin): Follow manufacturer's recommendations (attached).

7. Infiltration Basin: Preventative maintenance after every major storm event during the first three (3) months of operation and at least twice per year thereafter. Inspect structure and pretreatment BMP to ensure proper operation after every major storm event (generally equal or greater to 3.0 inches in 24 hours) for the first three months. Mow the buffer area, side slopes and basin bottom if grassed floor, rake if stone or sand bottom, remove trash and debris, remove grass clippings and accumulated organic matter. Any sediment removed shall be disposed of in accordance with MADEP and other applicable requirements.

8. Bioretention Areas: shall be inspected and cleared of trashed monthly; mowed 2 to 12 times per year; mulched annually; fertilized annually; dead vegetation removed annually; pruned annually; replace entire media and all vegetation as needed. Any sediment removed shall be disposed of in accordance with MADEP and other applicable requirements.

9. Forebays: The sediment forebay areas shall be inspected once per month to ensure they are operating as intended and that all components are stable and in working order. Inspections shall be by qualified personnel. During the growing season, the forebay shall be mowed at least twice, with additional cuttings performed as needed. All vegetation (i.e. tree saplings) will be removed from embankments and the forebay bottom. The inlet to the forebay shall be inspected for erosion and sedimentation, and riprap shall be promptly repaired as needed. Sediment forebays shall be cleaned quarterly and when sediment depth reaches half the height of the stone weir, or three to six feet, whichever is less. After sediment is removed, replace any vegetation damaged during the clean out by either reseeding or re-sodding. Any sediment removed shall be disposed of in accordance with MADEP and other applicable requirements.

10. Oil/Grit Separators: Cleaning includes removal of accumulated oil and grease and sediment using a vacuum truck or other ordinary catch basin cleaning device. In areas of high sediment loading, inspect and clean inlets after every major storm. At a minimum, inspect oil grit separators monthly, and clean them out at least twice per year. Polluted water or sediments removed from an oil grit separator should be disposed of in accordance with all applicable local, state, and federal laws and regulations.

11. Constructed Stormwater Wetlands: Inspect the constructed wetlands twice a year during both the growing and non-growing seasons for the first three years after construction. During inspections, record and map the following information:

    - The types and distribution of the dominant wetland plants in the marsh.
    - The presence and distribution of planted wetland species
    - The presence and distribution of invasive wetland species (invasives must be removed)
    - Indications that other species replacing the planted wetlands species
    - Percentage of standing water that is unvegetated (excluding the deep-water cells which are not suitable for emergent plant growth)
    - The maximum elevation and the vegetative condition in this zone, if the design elevation of the normal pool is being maintained for wetlands with extended zones
    - Stability of the original depth zones and the micro-topographic features
    - Accumulation of sediment in the forebay and micropool, and survival rate of plants (cells with dead plants must be replanted). The sediment forebay should be cleaned at least once a year.

12. Extended Dry Detention Basin: Inspect the extended dry detention basin at least twice a year, including inspection of the outlet structure for evidence of clogging or outflow release velocities greater than the design flow. Mow the upper-stage, side slopes, embankment, and emergency spillway at least twice a year, and remove trash and debris twice a year. Remove sediment from the basin at least once every five (5) years. Any sediment removed shall be disposed of in accordance with MADEP and other applicable requirements.

13. Water Quality Swale: Inspect swales for the first few months after construction and at least twice a year thereafter to make sure vegetation is adequate and slopes are not eroding. Check for rilling and gullying. Repair eroded areas and re-vegetate. Mow dry swales as needed. Wet swales may not need to be mowed depending on vegetation. Do not cut the grass shorter than three to four inches, and do not let the grass height exceed six inches. Regular maintenance includes mowing, fertilizing, liming, watering, pruning, weeding, and pest control as necessary. Remove sediment and debris manually at least once a year. Re-seed as necessary. Any sediment removed shall be disposed of in accordance with MADEP and other applicable requirements.

All components of the stormwater system will be accessible by the owner or their assignee.

STORMWATER MANAGEMENT SYSTEM

POST-CONSTRUCTION INSPECTION REPORT

LOCATION:

Proposed 308-Unit Residential Development
86 Orchard Hill Park Drive
Leominster, MA

RESPONSIBLE PARTY:

Owner

NAME OF INSPECTOR:	INSPECTION DATE:
Note Condition of the Following (sediment depth, debris, standing water, damage, etc.):	
Catch Basins:	
Discharge Points/ Flared End Sections / Rip Rap:	
Infiltration Basin:	
Water Quality Units:	
StormTrap SingleTrap:	

Other:
Note Recommended Actions to be taken on the Following (sediment and/or debris removal, repairs, etc.):
Catch Basins:
Discharge Points / Flared End Sections / Rip Rap:
Infiltration Basin:
Water Quality Units:
StormTrap SingleTrap:
Other:
Comments:

STORMWATER INSPECTION AND MAINTENANCE LOG FORM			
Orchard Hill Park ***86 Orchard Hill Park Drive - Leominster, MA***			
Stormwater Management Practice	Responsible Party	Date	Maintenance Activity Performed

LONG-TERM POLLUTION PREVENTION PLAN

Proposed 302-Unit Residential Development
86 Orchard Hill Park Drive
Leominster, MA

RESPONSIBLE PARTY DURING CONSTRUCTION:

Contractor – TBD

RESPONSIBLE PARTY POST CONSTRUCTION:

Owner

For this site, the Long-Term Pollution Prevention Plan will consist of the following:

- The property owner shall be responsible for "good housekeeping" including proper periodic maintenance of building and pavement areas, curbing, landscaping, etc.
- Proper storage and removal of solid waste (dumpsters).
- Sweeping of parking lots, drive aisles and access aisles a minimum of twice per year with a commercial cleaning unit. Any sediment removed shall be disposed of in accordance with applicable local and state requirements.
- Sweeping of roadways a minimum of twice per year with a commercial cleaning unit. Any sediment removed shall be disposed of in accordance with applicable local and state requirements.
- Regular inspections and maintenance of Stormwater Management System as noted in the "O&M Plan".
- Snow removal shall be the responsibility of the property owner. Snow shall not be plowed, dumped and/or placed in forebays, infiltration basins or similar stormwater controls. Salting and/or sanding of pavement / walkway areas during winter conditions shall only be done in accordance with all state/local requirements and approvals.

- No outdoor maintenance or washing of vehicles allowed.
- Trash and other debris shall be removed from all areas of the site at least twice yearly.
- Reseed any bare areas as soon as they occur. Erosion control measures shall be installed in these areas to prevent deposits of sediment from entering the drainage system.
- Grass shall be maintained at a minimum blade height of two to three inches and only 1/3 of the plant height shall be removed at a time. Clippings shall not be disposed of within stormwater management areas or adjacent resource areas.
- Plants shall be pruned as necessary.
- The use of fertilizers will be kept at a level consistent with typical residential use. Fertilizer will be applied a maximum of once to twice per year during the initial planting and stabilization of landscaped areas. Once plants are established and growing well fertilizer will be applied judiciously.
- The use of pesticides will be kept at a level consistent with typical residential use. Where possible mechanical methods (i.e. pest traps) or biological methods (i.e. beneficial insects) of pest control shall be implemented. If pesticides (insecticide, herbicide, and fungicide) are required to be used, a pesticide which poses the lowest risk to public health and the environment shall be used.
- Pet waste shall be disposed of in accordance with local regulations. Pet waste shall not be disposed of in a storm drain or catch basin.
- Snow piles shall be located adjacent to or on pervious surfaces in upland areas. This will allow snow melt water to filter into the soil, leaving behind sand and debris which can be removed in the springtime.
- In no case shall snow be disposed of or stored in resource areas (wetlands, floodplain, streams, or other water bodies).
- In no case shall snow be disposed of or stored in the detention basins, infiltration basins or bioretention areas.
- If necessary, stockpiled snow will be removed from the Site and disposed of at an off-site location in accordance with all local, state and federal regulations.
- The amount of sand and deicing chemicals shall be kept at the minimum amount required to provide safe pedestrian and vehicle travel.
- Deicing chemicals are recommended as a pretreatment to storm events to minimize the amount of applied sand.

- Sand and deicing chemicals should be stockpiled under covered storage facilities that prevent precipitation and adjacent runoff from coming in contact with the deicing materials. Stockpile areas shall be located outside resource areas.

- The primary agents used for deicing at parking lots, sidewalks and the access roads shall consist of salt alternatives such as calcium carbonate (CaCO3) or potassium chloride (KCl) or sodium chloride.

- Deliveries shall be monitored by owner or owner's representative to ensure proper delivery and, in the event that a spillage occurs, it shall be contained and cleaned up immediately in accordance with the spill prevention program for the project.

- Recycle materials whenever possible. Provide separate containers for recycle materials. Recycling products will be removed by a certified waste hauler.

OPERATON AND MAINTENANCE TRAINING PROGRAM

The Owner will coordinate an annual in-house training session to discuss the Operations and Maintenance Plan, the Long-Term Pollution Prevention Plan, and the Spill Prevention Plan and response procedures. Annual training will include the following:

Discuss the Operations and Maintenance Plan:

- Explain the general operations of the stormwater management system and its BMPs
- Identify potential sources of stormwater pollution and measures / methods of reducing or eliminating that pollution
- Emphasize good housekeeping measures

Discuss the Spill Prevention and Response Procedures:

- Explain the process in the event of a spill
- Identify potential sources of spills and procedures for cleanup and /or reporting and notification
- Complete a yearly inventory or Materials Safety Data sheets of all tenants and confirm that no potentially harmful chemicals are in use.

ILLICIT DISCHARGE STATEMENT

Certain types of non-stormwater discharges are allowed under the U.S. Environmental Protection Agency Construction General Permit. These types of discharges will be allowed under the conditions that no pollutants will be allowed to come in contact with the water prior to or after its discharge. The control measures which have been outlined previously in this LTPPP will be strictly followed to ensure that no contamination of these non-storm water discharges takes place. Any existing illicit discharges, if discovered during the course of the work, will be reported to MassDEP and the local DPW, as applicable, to be addressed in accordance with their respective policies. No illicit discharges will be allowed in conjunction with the proposed improvements.

Duly Acknowledged:

_____

Name & Title Date

SPILL PREVENTION AND RESPONSE PROCEDURES (POST CONSTRUCTION)

In order to prevent or minimize the potential for a spill of Hazardous Substances or Oil or come into contact with stormwater, the following steps will be implemented:

1. All Hazardous Substances or Oil (such as pesticides, petroleum products, fertilizers, detergents, acids, paints, paint solvents, cleaning solvents, etc.) will be stored in a secure location, with their lids on, preferably under cover, when not in use.

2. The minimum practical quantity of all such materials will be kept on site.

3. A spill control and containment kit (containing, for example, absorbent materials, acid neutralizing powder, brooms, dust pans, mops, rags, gloves, goggles, plastic and metal trash containers, etc.) will be provided on site.

4. Manufacturer's recommended methods for spill cleanup will be clearly posted and site personnel will be trained regarding these procedures and the location of the information and cleanup supplies.

5. It is the OWNER's responsibility to ensure that all Hazardous Waste on site is disposed of properly by a licensed hazardous material disposal company. The OWNER is responsible for not exceeding Hazardous Waste storage requirements mandated by the EPA or state and local authorities.

In the event of a spill of Hazardous Substances or Oil, the following procedures should be followed:

1. All measures should be taken to contain and abate the spill and to prevent the discharge of the Hazardous Substance or Oil to stormwater or off-site. (The spill area should be kept well ventilated and personnel should wear appropriate protective clothing to prevent injury from contact with the Hazardous Substances.)

2. For spills of less than five (5) gallons of material, proceed with source control and containment, clean-up with absorbent materials or other applicable means unless an imminent hazard or other circumstances dictate that the spill should be treated by a professional emergency response contractor.

3. For spills greater than five (5) gallons of material immediately contact the MADEP at the toll-free 24-hour statewide emergency number: **1-888-304-1133**, the local fire department (**9-1-1**) and an approved emergency response contractor. Provide information on the type of material spilled, the location of the spill, the quantity spilled, and the time of the spill to the emergency response contractor or coordinator, and proceed with prevention, containment and/or clean-up if so desired. (Use the form provided, or similar).

4. If there is a Reportable Quantity (RQ) release, then the National Response Center should be notified immediately at (800) 424-8802; within 14 days a report should be submitted to the EPA regional office describing the release, the date and circumstances of the release and the steps taken to prevent another release. This Pollution Prevention Plan should be updated to reflect any such steps or actions taken and measures to prevent the same from reoccurring.

SPILL PREVENTION CONTROL AND COUNTERMEASURE FORM

Orchard Hill Park
86 Orchard Hill Park Drive
Leominster, Massachusetts

Where a release containing a hazardous substance occurs, the following steps shall be taken by the facility manager and/or supervisor:

1. Immediately notify The Town Fire Department (at **9-1-1**)

2. All measures must be taken to contain and abate the spill and to prevent the discharge of the pollutant(s) to off-site locations, receiving waters, wetlands and/or resource areas.

3. Notify the Town Health Department at (978) 962-3558 and the Town Conservation Commission at (978) 534-7524.

4. Provide documentation from licensed contractor showing disposal and cleanup procedures were completed as well as details on chemicals that were spilled to the Town Health Department and Conservation Commission.

Date of spill:_____ Time:_____ Reported By:_____

Weather Conditions:_____

Material Spilled	**Location of Spill**	**Approximate Quantity of Spill (in gallons)**	**Agency(s) Notified**	**Date of Notification**

Cause of Spill: _____

_____

Measures Taken to Clean up Spill: _____

_____

Type of equipment: _____ Make: _____ Size: _____

License or S/N: _____

Location and Method of Disposal _____

_____

Procedures, method, and precautions instituted to prevent a similar occurrence from recurring: _____

_____

_____

Additional Contact Numbers:

- DEPARTMENT OF ENVIRONMENTAL PROTECTION (DEP) EMERGENCY PHONE: 1-888-304-1133
- NATIONAL RESPONSE CENTER PHONE: (800) 424-8802
- U.S. ENVIRONMENTAL PROTECTION AGENCY PHONE: (888) 372-7341