
DRAINAGE REPORT

Burt Road Development

Andover & Tewksbury, MA

Prepared for:

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MassDEP Stormwater Checklist



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 8²
- 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.



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.

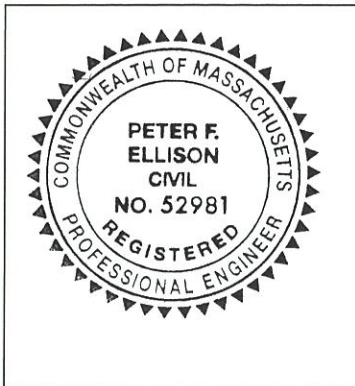
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

8/30/2022

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): **sediment forebay, infiltration basin**

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 Field¹
- 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.

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1

Narrative

Introduction

The Applicant, MCP/Howland Burt Owner, LLC, is proposing to develop a 50-acre parcel located in Andover and Tewksbury, Massachusetts. This location is identified on the Town of Andover's Assessors map as Map 163, Lots 8-#4, 9-#3 & 9A-#3, and Map 115, Lots 4, 5, 6, 7 & 8 within the Town of Tewksbury (the "Site"). The land is currently undeveloped and will be accessed via the extension of Burt Road in the Town of Andover. The project area is abutted by the I-93 to the west; a utility substation to the northwest; railroad right of way to the east, commercial properties, and wetlands to the south and east.

The Applicant is proposing to develop the site by constructing a single building with an approximate total footprint of 167,610 square feet. The proposed site will include associated parking, landscaping, utility and stormwater management infrastructure (the "Project"). In Andover, the property is located within the Industrial Zoning District A and Medical Marijuana Overlay District. Within Tewksbury the property is located within the Industrial 1 Zoning District and the Wireless Communication Facility Overlay District.

This drainage study was performed in order to assess the potential impact of the Project. The Site is currently undeveloped and consists of no impervious surface. Runoff from the existing site primarily sheet flows across the site and discharges untreated to the nearby wetlands. The Project will provide a stormwater management system incorporating traditional and Low Impact Design (LID) Best Management Practices (BMPs) elements to fully comply with the Massachusetts Stormwater Management Handbook. This analysis has been prepared to verify that the Project will have a positive effect on the stormwater conditions both on-site and off-site.

The proposed Stormwater Management Plan has been designed to meet the Stormwater Standards identified in the Massachusetts Department of Environmental Protection (DEP) Stormwater Handbook and the Towns of Andover and Tewksbury Stormwater Regulations. The Stormwater Management Design reduces peak runoff rates and volumes, reduces the risk of erosion and sedimentation migration, and improves stormwater runoff quality.

Existing Conditions

The existing site is approximately 50 acres and consists of undeveloped lands and wetlands. Runoff from the site sheet flows to the nearby wetlands untreated. There are no drainage structures such as catch basins and underground pipes on site.

The site is comprised entirely of natural lying soils. These natural lying soils are mostly identified as Windsor Loamy Sand, hydrologic soil group A, and Freetown Muck, hydrologic soil group, hydrologic soil group B/D. Refer to Appendix C to review the full NRCS Soil Report for which depicts the various soils present at the site.

According to the FEMA Flood Insurance Rate Maps (FIRM), map number 25009C0356F, dated July 3, 2012, the property is not within the flood Hazard and outside of the flood plain. Refer to the attached FIRM Figure at the end of this section (Figure 3) and to the attached Site Plans to see the location of the existing and proposed elevation contours, and the 100-year flood plain.

Proposed Conditions

The proposed plan involves construction of a 167,610 square foot building to be used as warehouse space. The development will also include trees and grassed landscaped areas along with multiple paved parking areas that contains 294 standard parking spaces (including 22 banked parking spaces to be constructed as grass panel), and 40 trailer parking spaces for full size tractor trailers. Proposed development will create impervious coverage on site which will generate stormwater runoff.

The proposed stormwater management has been designed in accordance with the MassDEP Stormwater Management Policy and includes traditional and LID BMPs. BMPs proposed for the site include deep sump catch basins with hoods and sediment forebays prior to the discharge of stormwater into infiltration basins for recharge and treatment. Clean roof runoff will be directed into the infiltration basins for recharge.

The stormwater management system has been designed to provide water quality treatment and water quality control for 0.5" of runoff. This project is not considered a land use with higher potential pollutant load (LUHPPL).

Methodology

The Stormwater Management Plan, which will be implemented as part of this project, will provide adequate collection, management, and treatment of the stormwater runoff.

Existing and proposed hydrologic conditions were analyzed using HydroCAD, an SCS TR-20 based program, to calculate existing and proposed peak discharge rates. This method takes into account existing and proposed pervious and impervious areas including soil types and hydrologic classifications. The 2-, 10-, 25-, and 100-year, 24-hour storm frequencies were used in the

analysis in accordance with the MassDEP and the town of Andover requirements. Rainfall depths are taken from the Northeast Regional Climate Center.

The "Regulatory Compliance" portion of this report addresses the MassDEP Stormwater Management Performance Standards under the Wetlands Protection Act.

Pre-Development Runoff

The existing site contains approximately 50 acres of pervious area consisting of grass land, vegetation, wetlands and wooded area. Currently, all stormwater runoff travels to one of the four design points. Design Point 1 (DP-1) is the wetland to the north of the site which water from Subcatchment 1 (EX-1) flows to via sheet flow. Design Point 2 (DP-2) is also a wetland to the north of the site which water from Subcatchment 2 (EX-2) flows to via sheet flow. Design Point 3 (DP-3) is a wetland to the North-East of the site which water from Subcatchment 3 (EX-3) flows to via sheet flow. Subcatchment 4 (EX-4) is the largest subcatchment and flows to the large wetland (DP-4) located to the South of the site. Subcatchment 7 (EX-7) is an area on the western edge of the site abutting the Interstate 93. EX-7 flows west toward I-93 and ultimately flows south into the large wetland (DP-4).

The *Pre-Development Drainage Areas* are depicted in Figure D-1 of this report. This figure presents the delineation of the existing subcatchment areas and the Design Point. There are 5 existing subcatchment areas which are outlined below:

Existing Subcatchment Area 101 (EX-101) is comprised of 52,055 SF of pervious land area consisting of grass lands, wooded forest, and dirt roads with a weighted curve number (CN) of 62 draining to Discharge Point 2(DP-1).

Existing Subcatchment Area 201 (EX-201) is comprised of 68,794 SF of pervious land area consisting of grass lands, wooded forest, dirt road, and wetlands with a weighted CN of 39 draining to Discharge Point 2(DP-2).

Existing Subcatchment Area 301 (EX-301) is comprised of 14,767 SF of pervious land area consisting of grass lands, wooded forest, and wetlands with a weighted CN of 49 draining to Discharge Point 3(DP-3).

Existing Subcatchment Area 302 (EX-302) is comprised of 336,370 SF of pervious land area consisting of grass lands, dirt road, and wooded forest with a weighted CN of 57 draining to Discharge Point 3(DP-3).

Existing Subcatchment Area 303 (EX-303) is comprised of 286,929 SF of pervious land area consisting of grass lands, dirt road, paved road, and wooded forest with a weighted CN of 54 draining to Discharge Point 3(DP-3).

Post-Development Runoff

The proposed stormwater management system is designed to mitigate the effects of the proposed development by reducing the peak rates of runoff as compared to the existing conditions. In the proposed conditions analysis, the same design points identified and analyzed under the existing conditions were analyzed. The post-development subcatchment areas are identified in Figure D-2, *Post Development Drainage Areas*.

Proposed Subcatchment Area 101 (PR-101) is comprised of a 51,021 SF portion of EX-101 that remains undisturbed and has a weighed CN of 62. Stormwater from this area will continue to run overland to the existing wetland at the northern edge of the site (DP-1).

Proposed Subcatchment Area 201 (PR-201) is comprised of 68,794 SF of undisturbed pervious land area that remains unchanged from the existing Subcatchment EX-201. In earlier revisions, this area was bisected by the entrance road to the site. The current proposal has relocated this access roadway so no alterations to landcover will occur in this subcatchment. This area is still included in the analysis for consistency. Stormwater from PR-201 will continue to sheet flow over land and discharges into the existing wetland in the northeast corner of the site (DP-2).

Proposed Subcatchment Area 301 (PR-301) is comprised of 53,071 SF of open space at the edge of the proposed development area that will flow undetained to the adjacent wetland network on the south and east edge of the project (DP-3). This area mainly consists of grassed daylighting slopes along the perimeter with a weighted CN of 69.

Proposed Subcatchment Area 302 (PR-302) is a 30,756 SF area in the rear of the warehouse that includes the grass banked parking area and a pervious pavement system with a weighted CN of 92. Stormwater from this area will flow over land into the pervious pavement and infiltrate into the groundwater. The depth of the pervious pavement area was increased to over 2-feet of pervious stone material. Even during a 100-year storm event, the pervious pavement is able to hold and infiltrate the stormwater runoff without overflow.

Proposed Subcatchment Area 303 (PR-303) is comprised of 107,680 SF of building rooftop area. Stormwater runoff from the rooftop will be caught with internal roof drains and directed into infiltration basin P2 for recharge and treatment. During large storm events, stormwater from basin P2 will overflow into the wetland network on the south and east edge of the project (DP-3).

Proposed Subcatchment Area 304 (PR-304) is comprised of 215,213 SF of building rooftop, paved parking, and open space with a weighted CN of 91. Stormwater from this area will be directed into basin P2 for recharge and treatment. During large storm events, stormwater from basin P2 will overflow into the wetland network on the south and east edge of the project (DP-3).

Proposed Subcatchment Area 305 (PR-305) is a 142,335 SF area comprised of impervious pavement, grassed open space, and undisturbed areas with a weighted CN of 83. Stormwater from this area will be directed into basin P4 for recharge and treatment. During large storm

events, stormwater from basin P4 will overflow into the wetland network on the south and east edge of the project (DP-3).

Proposed Subcatchment Area 306 (PR-306) is a 90,071 SF area comprised of impervious pavement, grassed open space, and undisturbed wooded area with a weighted CN of 83. Stormwater from this area will be directed into basin P3 for recharge and treatment. During large storm events, stormwater from basin P3 will overflow into the wetland network on the south and east edge of the project (DP-3).

Table 1 (Peak Flow Summary)

| Design Point | 2-Yr Storm | | 10-Yr Storm | | 25-Yr Storm | | 100-Yr Storm | |
|--------------|-------------|------------|-------------|------------|-------------|------------|--------------|------------|
| | Exist (cfs) | Prop (cfs) | Exist (cfs) | Prop (cfs) | Exist (cfs) | Prop (cfs) | Exist (cfs) | Prop (cfs) |
| DP-1 | 0.36 | 0.35 | 1.42 | 1.40 | 2.48 | 2.43 | 4.99 | 4.90 |
| DP-2 | 0.00 | 0.00 | 0.04 | 0.04 | 0.29 | 0.29 | 1.69 | 1.69 |
| DP-3 | 1.22 | 0.65 | 7.27 | 1.83 | 14.30 | 5.68 | 32.64 | 24.18 |

For all Design Points, the proposed project matches or decreases peak runoff rates from the existing conditions for the 2-, 10-, 25-, and 100-Year storm events, meeting state and local regulations.

TSS Removal

MassDEP Performance Standard 4 requires a TSS removal of at least 80%. DP-1 and DP-2 are retaining existing conditions, no stormwater treatment is proposed for these untouched areas of woods and open space. All impervious areas are being directed to infiltration basins to receive a minimum of 80% treatment. The large pavement and loading areas in the central portion of the site also includes deep sump and hooded catch basins as well as sediment forebays.

Treatment Train #1, consists of:

- 1 Sediment Forebay
- 2 Infiltration basin

Treatment Train #2, consists of:

- 1 Deep sump catch basins with hoods
- 2 Sediment Forebay
- 3 Infiltration basin

Treatment Train #3, consists of:

1. Pervious Pavement (sized for 1/2" WQV)

The project will achieve a minimum TSS removal rate of 80% for all Design Points, meeting the requirements in Standard 4.

Refer to *Appendix B-Water Quality Data* for TSS Removal Spreadsheet.

Regulatory Compliance

The DEP/CZM Stormwater Management Policy prescribes ten performance standards for site redevelopment projects. The proposed project has been designed in accordance with these standards. Compliance with the standards is outlined below.

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

This project proposes no new untreated stormwater discharges or will cause erosion in the wetlands or waters of the Commonwealth.

2. *Stormwater management systems must be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.*

As summarized in Table 1 Peak Flow Summary, the project decreases peak discharge rates for the 2, 10, 25 and 100-Year storm events for all discharge points. The HydroCAD analysis and output can be found in Appendix A, Hydrology Calculations.

3. *Loss of annual recharge to groundwater should be minimized through the use of infiltration measures where feasible.*

The proposed stormwater management utilizes five infiltration basins and pervious pavement to provide groundwater recharge. The required recharge volume is determined based on the total proposed impervious area and the classification of the soils on site (Hydrologic Soil Type A).

Calculation Method 1 (Mass DEP Stormwater Handbook)

$$Rv = F \times \text{Impervious Area}$$

Rv = Required Recharge Volume, expressed in cubic feet

F= Target Depth Factor associated with each Hydrologic Soil Group

Impervious Area= Pavement and rooftop area on site

| NRCS HYDROLOGIC SOIL TYPE | APPROX. SOIL TEXTURE | TARGET DEPTH FACTOR (F) |
|---------------------------------|----------------------------|----------------------------|
| A | sand | 0.6-inch |
| B | loam | 0.35-inch |
| C | silty loam | 0.25-inch |
| D | clay | 0.1-inch |

Recharge Target Depth by Hydrologic Soil Group

Impervious Area Draining to Infiltration BMP = 435,264 SF

Total Imperious Area = 435,264 SF

Percent of Imperious Area Draining to Infiltration BMP = 100%

Rv = (0.60-inch) x 435,264 SF of Total Impervious Area

Rv = 21,763 cubic feet of Required Recharge Volume

Volume below lowest outlet (From HydroCAD):

P1 = 16,200 cubic feet

P2 = 9,711 cubic feet

P3 = 5,002 cubic feet

P4 = 7,375 cubic feet

Total Proposed Rv = 38,288 cubic feet (volume below lowest outlet)

Therefore, storage volume of the basins and volume of stormwater infiltrated exceed the requirements of Standard 3.

Calculation Method 2 (Town of Andover Stormwater Regulations Section IX.A.1)

$Re_v = [(S)(R_v)(A)]/12$, where

Re_v = Recharge volume (acre*feet)

$R_v = 0.05 + 0.009(I)$ where I is the percent impervious cover

A = site area in acres

S = Soil specific recharge factor

| <u>Hydrologic Group</u> | <u>Soil Specific Recharge Factor</u> |
|-------------------------|--------------------------------------|
| A | 0.60 |
| B | 0.35 |
| C | 0.25 |
| D | 0.10 |

For A Soils

I=59.5, $R_v = 0.577$, A=16.81, S=0.60

$Re_v = [(0.60)(0.554)(16.81)]/12 = 0.492$ acre*feet

$Re_v = 21,432$ CF

Total Proposed $Re_v = 38,288$ CF (below lowest outlets)

Confirm that P1 will empty within 72 hours:

Volume of Storage Below Outlet = 16,200 CF

Infiltration Rate (HSG A soil) = 2.4"/hr

Footprint Area of P1 bottom = 18,000 SF

Time to Drain = 16,200 CF / (2.4"/hr) x (18,000 SF) = **4.5 hr < 72 hr**

Confirm that P2 will empty within 72 hours:

Volume of Storage Below Outlet = 9,711 CF

Infiltration Rate (HSG A soil) = 2.4"/hr

Footprint Area of P2 = 19,632 SF

Time to Drain = 9,711 CF / (2.4"/hr) x (19,632 SF) = **2.5 hr < 72 hr**

Confirm that P3 will empty within 72 hours:

Volume of Storage Below Outlet = 5,002 CF

Infiltration Rate (HSG A soil) = 2.4"/hr

Footprint Area of P3 = 5,500 SF

Time to Drain = 5,002 CF / (2.4"/hr) x (5,500 SF) = **4.5 hr < 72 hr**

Confirm that P4 will empty within 72 hours:

Volume of Storage Below Outlet = 7,375 CF

Infiltration Rate (HSG A soil) = 2.4"/hr

Footprint Area of P4 = 6,733 SF

Time to Drain = $7,375 \text{ CF} / (2.4"/\text{hr}) \times (6,733 \text{ SF}) = \mathbf{5.4 \text{ hr} < 72 \text{ hr}}$

4. *For new development, stormwater management systems must be designed to remove 80 percent of Total Suspended Solids.*

The proposed stormwater management design will implement BMP's including deep sump catch basins with hoods, sediment forebays, infiltration ponds, and pervious pavement to meet the 80% TSS removal rate. Refer to *Appendix B – Water Quality Data* for the TSS Removal Spreadsheet.

Water Quality Volumes

The proposed infiltration basins have been sized using the static method to provide a minimum 0.5" WQV below the lowest outlet. Infiltration basins P1, P3, and P4 are all sized for the 0.5" WQV for all impervious area, including rooftop area. Infiltration basin P2 is sized for the 0.5" WQV for impervious pavement area only. Rooftop area is considered "clean" runoff and therefore is not required to be included in the WQV calculation. See below calculations:

Infiltration Basin P1:

0.5" WQV = 24,753 SF impervious * 0.5" = 1,031CF

Volume of Storage Below Outlet = 16,200 CF

Infiltration Basin P2:

0.5" WQV = 157,576 SF impervious * 0.5" = 6,566 CF

Volume of Storage Below Outlet = 9,711 CF

Infiltration Basin P3:

0.5" WQV = 29,750 SF impervious * 0.5" = 2,351 CF

Volume of Storage Below Outlet = 5,002 CF

Infiltration Basin P4:

0.5" WQV = 88,827 SF impervious * 0.5" = 3,701 CF

Volume of Storage Below Outlet = 7,375 CF

The proposed infiltration basins, with the exception of the porous pavement basin P1 include sediment forebays sized to accommodate 1-year worth of sediment as required by Town of Andover Stormwater Regulations. Please see below calculations:

$$\text{Sediment volume} = \text{Area to be sanded (acres)} \times 750 \text{ (lb/acre-storm)} / 90 \text{ (pounds/cf)} \times 10 \text{ (storms/year)}$$
$$= \text{(cf of sediment/year)}$$

Infiltration Basin P2

South Forebay (SF21)

$$\text{Sediment volume (P1)} = 0.28 \text{ ac} \times 750\text{lb/ac-storm} / 90\text{lb/cf} \times 10\text{storm/yr}$$

$$\text{Sediment volume (P1)} = 23 \text{ cf of sediment/year}$$

$$\text{Volume Provided} = 517 \text{ cf}$$

North Forebay (SF22)

$$\text{Sediment volume (P1)} = 3.34 \text{ ac} \times 750\text{lb/ac-storm} / 90\text{lb/cf} \times 10\text{storm/yr}$$

$$\text{Sediment volume (P1)} = 278 \text{ cf of sediment/year}$$

$$\text{Volume Provided} = 431 \text{ cf}$$

Infiltration Basin P3

Sediment Forebay (SF31)

$$\text{Sediment volume (P2)} = 0.68 \text{ ac} \times 750\text{lb/ac-storm} / 90\text{lb/cf} \times 10\text{storm/yr}$$

$$\text{Sediment volume (P2)} = 57 \text{ cf of sediment/year}$$

$$\text{Volume Provided} = 619 \text{ cf}$$

Infiltration Basin P4

Sediment Forebay (SF41)

$$\text{Sediment volume (P4)} = 1.40 \text{ ac} \times 750\text{lb/ac-storm} / 90\text{lb/cf} \times 10\text{storm/yr}$$

$$\text{Sediment volume (P4)} = 170 \text{ cf of sediment/year}$$

$$\text{Volume Provided} = 638 \text{ cf}$$

All sediment forebays have been sized to accommodate at least one year's worth of sediment loading. Additionally, the forebays are also sized to handle the 0.1" minimum WQV per the MA Stormwater Handbook.

5. *Stormwater discharges from areas with higher potential pollutant loads require the use of specific stormwater management BMPs.*

This project is not considered to be a land use with higher potential pollutant loading.

6. *Stormwater discharges to critical areas must utilize certain stormwater management BMPs approved for critical areas. Critical areas are Outstanding Resource Waters, shell fish beds, swimming beaches, cold water fisheries and recharge areas for public water supplies.*

The project site is not located within any critical areas.

7. *Redevelopment of previously developed areas must meet the Stormwater Management Standards to the maximum extent practicable.*

The project is not considered a redevelopment project.

8. Erosion and sediment controls must be implemented to prevent impacts during construction or land disturbance activities.

The project has been designed to include erosion and sedimentation controls to prevent impacts to the resource areas. Construction activities will be isolated from downgradient areas by installing erosion control measures including a construction entrance/exit, and compost filter socks, and inlet protection devices. A Construction Period Pollution Prevention and Erosion and Sedimentation Plan has been prepared for the Project. Prior to construction, the Contractor will prepare a SWPPP and file an e-NOI with the Environmental Protection Agency.

9. All stormwater management systems must have an operation and maintenance plan to ensure that systems function as designed.

The project will include a long-term Operation and Maintenance Plan, see attached document, to provide efficient operation of the features of the proposed drainage system.

10. Illicit Discharges

Only stormwater will be conveyed to the stormwater management system. No illicit materials or connections are permitted. An Illicit Discharge Compliance Statement is included with the Drainage Report.

Conclusion

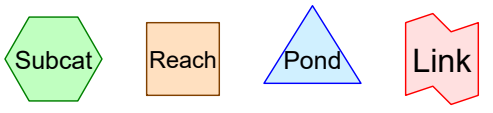
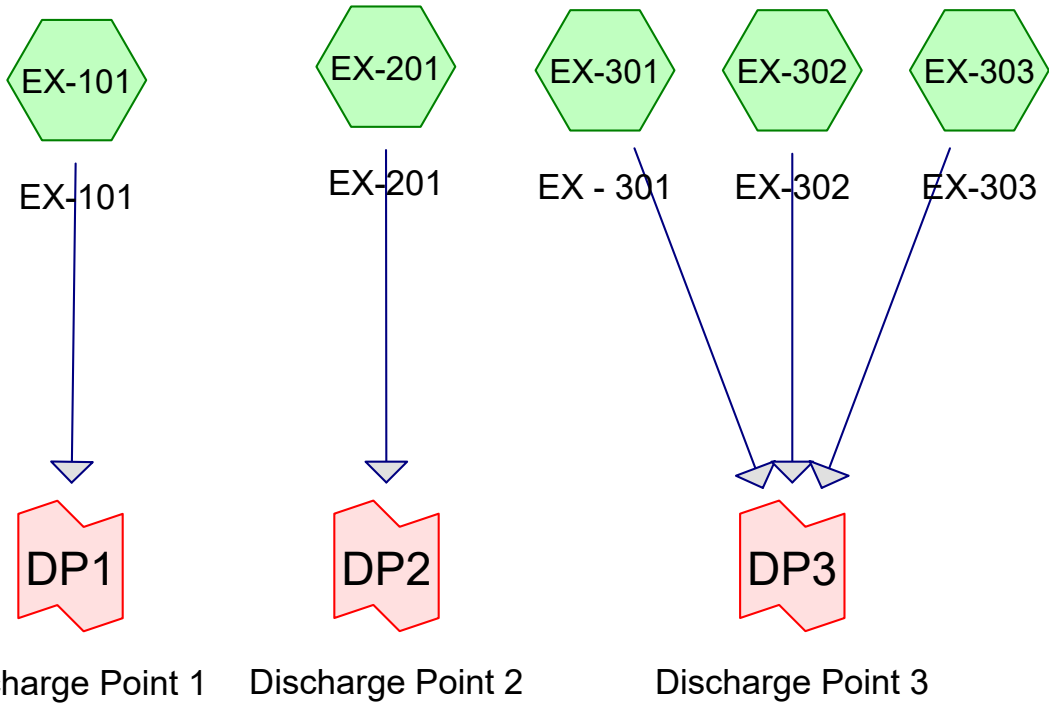
This proposed project is a new development and will introduce new impervious area. However, it provides equal or improved water quality treatment. The stormwater management plan controls the flow of stormwater, mitigates overall post peak runoff rates, and provides water quality treatment. The stormwater management plan provides erosion and sediment control resulting in clean stormwater runoff and a Long-Term Operation and Maintenance plan to ensure the proper functioning of the system over time. The project has been designed in accordance with the Stormwater Management Policy and Town of Andover Regulations.

2

Appendix

A

Hydrologic Calculations
Hydraulic Calculations



Area Listing (all nodes)

| Area (sq-ft) | CN | Description (subcatchment-numbers) |
|-----------------|----|---|
| 14,680 | 72 | Compacted Dirt Road - Windsor (EX-101) |
| 1,307 | 82 | Dirt Road - Sudbury (EX-302) |
| 80,847 | 72 | Dirt Road - Windsor (EX-201, EX-302, EX-303) |
| 353,097 | 68 | Open Space - Windsor (EX-101, EX-301, EX-302, EX-303) |
| 13,983 | 68 | Open space - Windsor (EX-201) |
| 1,960 | 98 | Paved Road - Deerfield (EX-303) |
| 34,238 | 30 | Woods and Forest - Deerfield (EX-201, EX-303) |
| 261 | 77 | Woods and Forest - Freetown (EX-303) |
| 17,250 | 55 | Woods and Forest - Sudbury (EX-302, EX-303) |
| 241,291 | 30 | Woods and Forest - Windsor (EX-101, EX-201, EX-301, EX-302, EX-303) |

Summary for Subcatchment EX-101: EX-101

Runoff = 0.36 cfs @ 12.19 hrs, Volume= 1,994 cf, Depth= 0.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YEAR Rainfall=3.15"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| * 0.635 | 68 | Open Space - Windsor |
| * 0.223 | 30 | Woods and Forest - Windsor |
| * 0.337 | 72 | Compacted Dirt Road - Windsor |
| 1.195 | 62 | Weighted Average |
| 1.195 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 9.8 | 50 | 0.0350 | 0.08 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 0.7 | 141 | 0.0455 | 3.43 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 10.5 | 191 | Total | | | |

Summary for Subcatchment EX-201: EX-201

Runoff = 0.00 cfs @ 24.05 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YEAR Rainfall=3.15"

| Area (sf) | CN | Description |
|-----------|----|------------------------------|
| * 13,983 | 68 | Open space - Windsor |
| * 24,319 | 30 | Woods and Forest - Windsor |
| * 2,265 | 72 | Dirt Road - Windsor |
| * 28,227 | 30 | Woods and Forest - Deerfield |
| 68,794 | 39 | Weighted Average |
| 68,794 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 9.7 | 50 | 0.0358 | 0.09 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 1.6 | 156 | 0.0108 | 1.67 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 11.3 | 206 | Total | | | |

Summary for Subcatchment EX-301: EX - 301

Runoff = 0.00 cfs @ 13.82 hrs, Volume= 122 cf, Depth= 0.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YEAR Rainfall=3.15"

| Area (ac) | CN | Description |
|-----------|----|----------------------------|
| * 0.169 | 68 | Open Space - Windsor |
| * 0.170 | 30 | Woods and Forest - Windsor |
| 0.339 | 49 | Weighted Average |
| 0.339 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 11.8 | 50 | 0.0220 | 0.07 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 0.1 | 24 | 0.0350 | 3.01 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 11.9 | 74 | Total | | | |

Summary for Subcatchment EX-302: EX-302

Runoff = 0.81 cfs @ 12.62 hrs, Volume= 8,220 cf, Depth= 0.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YEAR Rainfall=3.15"

| Area (ac) | CN | Description |
|-----------|----|----------------------------|
| * 2.381 | 30 | Woods and Forest - Windsor |
| * 3.752 | 68 | Open Space - Windsor |
| * 1.549 | 72 | Dirt Road - Windsor |
| * 0.010 | 55 | Woods and Forest - Sudbury |
| * 0.030 | 82 | Dirt Road - Sudbury |
| 7.722 | 57 | Weighted Average |
| 7.722 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 19.6 | 50 | 0.0062 | 0.04 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 8.3 | 840 | 0.0110 | 1.69 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 27.9 | 890 | Total | | | |

Summary for Subcatchment EX-303: EX-303

Runoff = 0.47 cfs @ 12.47 hrs, Volume= 5,019 cf, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-YEAR Rainfall=3.15"

| Area (ac) | CN | Description |
|-----------|----|------------------------------|
| * 3.550 | 68 | Open Space - Windsor |
| * 2.207 | 30 | Woods and Forest - Windsor |
| * 0.255 | 72 | Dirt Road - Windsor |
| * 0.386 | 55 | Woods and Forest - Sudbury |
| * 0.006 | 77 | Woods and Forest - Freetown |
| * 0.138 | 30 | Woods and Forest - Deerfield |
| * 0.045 | 98 | Paved Road - Deerfield |
| 6.587 | 54 | Weighted Average |
| 6.542 | | 99.32% Pervious Area |
| 0.045 | | 0.68% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 8.4 | 50 | 0.0510 | 0.10 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 3.9 | 394 | 0.0108 | 1.67 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 12.3 | 444 | Total | | | |

Summary for Link DP1: Discharge Point 1

Inflow Area = 52,054 sf, 0.00% Impervious, Inflow Depth = 0.46" for 2-YEAR event
 Inflow = 0.36 cfs @ 12.19 hrs, Volume= 1,994 cf
 Primary = 0.36 cfs @ 12.19 hrs, Volume= 1,994 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP2: Discharge Point 2

Inflow Area = 68,794 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-YEAR event
 Inflow = 0.00 cfs @ 24.05 hrs, Volume= 0 cf
 Primary = 0.00 cfs @ 24.05 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP3: Discharge Point 3

Inflow Area = 638,067 sf, 0.31% Impervious, Inflow Depth = 0.25" for 2-YEAR event
 Inflow = 1.22 cfs @ 12.55 hrs, Volume= 13,362 cf
 Primary = 1.22 cfs @ 12.55 hrs, Volume= 13,362 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Subcatchment EX-101: EX-101

Runoff = 1.42 cfs @ 12.16 hrs, Volume= 5,685 cf, Depth= 1.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YEAR Rainfall=4.79"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| * 0.635 | 68 | Open Space - Windsor |
| * 0.223 | 30 | Woods and Forest - Windsor |
| * 0.337 | 72 | Compacted Dirt Road - Windsor |
| 1.195 | 62 | Weighted Average |
| 1.195 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 9.8 | 50 | 0.0350 | 0.08 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 0.7 | 141 | 0.0455 | 3.43 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 10.5 | 191 | Total | | | |

Summary for Subcatchment EX-201: EX-201

Runoff = 0.04 cfs @ 13.75 hrs, Volume= 915 cf, Depth= 0.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YEAR Rainfall=4.79"

| Area (sf) | CN | Description |
|-----------|----|------------------------------|
| * 13,983 | 68 | Open space - Windsor |
| * 24,319 | 30 | Woods and Forest - Windsor |
| * 2,265 | 72 | Dirt Road - Windsor |
| * 28,227 | 30 | Woods and Forest - Deerfield |
| 68,794 | 39 | Weighted Average |
| 68,794 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 9.7 | 50 | 0.0358 | 0.09 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 1.6 | 156 | 0.0108 | 1.67 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 11.3 | 206 | Total | | | |

Summary for Subcatchment EX-301: EX - 301

Runoff = 0.10 cfs @ 12.28 hrs, Volume= 688 cf, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YEAR Rainfall=4.79"

| Area (ac) | CN | Description |
|-----------|----|----------------------------|
| * 0.169 | 68 | Open Space - Windsor |
| * 0.170 | 30 | Woods and Forest - Windsor |
| 0.339 | 49 | Weighted Average |
| 0.339 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 11.8 | 50 | 0.0220 | 0.07 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 0.1 | 24 | 0.0350 | 3.01 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 11.9 | 74 | Total | | | |

Summary for Subcatchment EX-302: EX-302

Runoff = 4.36 cfs @ 12.46 hrs, Volume= 27,879 cf, Depth= 0.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YEAR Rainfall=4.79"

| Area (ac) | CN | Description |
|-----------|----|----------------------------|
| * 2.381 | 30 | Woods and Forest - Windsor |
| * 3.752 | 68 | Open Space - Windsor |
| * 1.549 | 72 | Dirt Road - Windsor |
| * 0.010 | 55 | Woods and Forest - Sudbury |
| * 0.030 | 82 | Dirt Road - Sudbury |
| 7.722 | 57 | Weighted Average |
| 7.722 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 19.6 | 50 | 0.0062 | 0.04 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 8.3 | 840 | 0.0110 | 1.69 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 27.9 | 890 | Total | | | |

Summary for Subcatchment EX-303: EX-303

Runoff = 3.75 cfs @ 12.21 hrs, Volume= 19,626 cf, Depth= 0.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-YEAR Rainfall=4.79"

| Area (ac) | CN | Description |
|-----------|----|------------------------------|
| * 3.550 | 68 | Open Space - Windsor |
| * 2.207 | 30 | Woods and Forest - Windsor |
| * 0.255 | 72 | Dirt Road - Windsor |
| * 0.386 | 55 | Woods and Forest - Sudbury |
| * 0.006 | 77 | Woods and Forest - Freetown |
| * 0.138 | 30 | Woods and Forest - Deerfield |
| * 0.045 | 98 | Paved Road - Deerfield |
| 6.587 | 54 | Weighted Average |
| 6.542 | | 99.32% Pervious Area |
| 0.045 | | 0.68% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 8.4 | 50 | 0.0510 | 0.10 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 3.9 | 394 | 0.0108 | 1.67 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 12.3 | 444 | Total | | | |

Summary for Link DP1: Discharge Point 1

Inflow Area = 52,054 sf, 0.00% Impervious, Inflow Depth = 1.31" for 10-YEAR event
 Inflow = 1.42 cfs @ 12.16 hrs, Volume= 5,685 cf
 Primary = 1.42 cfs @ 12.16 hrs, Volume= 5,685 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP2: Discharge Point 2

Inflow Area = 68,794 sf, 0.00% Impervious, Inflow Depth = 0.16" for 10-YEAR event
 Inflow = 0.04 cfs @ 13.75 hrs, Volume= 915 cf
 Primary = 0.04 cfs @ 13.75 hrs, Volume= 915 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP3: Discharge Point 3

Inflow Area = 638,067 sf, 0.31% Impervious, Inflow Depth = 0.91" for 10-YEAR event
 Inflow = 7.27 cfs @ 12.40 hrs, Volume= 48,193 cf
 Primary = 7.27 cfs @ 12.40 hrs, Volume= 48,193 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Subcatchment EX-101: EX-101

Runoff = 2.48 cfs @ 12.15 hrs, Volume= 9,336 cf, Depth= 2.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YEAR Rainfall=6.09"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| * 0.635 | 68 | Open Space - Windsor |
| * 0.223 | 30 | Woods and Forest - Windsor |
| * 0.337 | 72 | Compacted Dirt Road - Windsor |
| 1.195 | 62 | Weighted Average |
| 1.195 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 9.8 | 50 | 0.0350 | 0.08 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 0.7 | 141 | 0.0455 | 3.43 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 10.5 | 191 | Total | | | |

Summary for Subcatchment EX-201: EX-201

Runoff = 0.29 cfs @ 12.42 hrs, Volume= 2,703 cf, Depth= 0.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YEAR Rainfall=6.09"

| Area (sf) | CN | Description |
|-----------|----|------------------------------|
| * 13,983 | 68 | Open space - Windsor |
| * 24,319 | 30 | Woods and Forest - Windsor |
| * 2,265 | 72 | Dirt Road - Windsor |
| * 28,227 | 30 | Woods and Forest - Deerfield |
| 68,794 | 39 | Weighted Average |
| 68,794 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 9.7 | 50 | 0.0358 | 0.09 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 1.6 | 156 | 0.0108 | 1.67 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 11.3 | 206 | Total | | | |

Summary for Subcatchment EX-301: EX - 301

Runoff = 0.28 cfs @ 12.20 hrs, Volume= 1,371 cf, Depth= 1.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YEAR Rainfall=6.09"

| Area (ac) | CN | Description |
|-----------|----|----------------------------|
| * 0.169 | 68 | Open Space - Windsor |
| * 0.170 | 30 | Woods and Forest - Windsor |
| 0.339 | 49 | Weighted Average |
| 0.339 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 11.8 | 50 | 0.0220 | 0.07 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 0.1 | 24 | 0.0350 | 3.01 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 11.9 | 74 | Total | | | |

Summary for Subcatchment EX-302: EX-302

Runoff = 8.40 cfs @ 12.43 hrs, Volume= 48,519 cf, Depth= 1.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YEAR Rainfall=6.09"

| Area (ac) | CN | Description |
|-----------|----|----------------------------|
| * 2.381 | 30 | Woods and Forest - Windsor |
| * 3.752 | 68 | Open Space - Windsor |
| * 1.549 | 72 | Dirt Road - Windsor |
| * 0.010 | 55 | Woods and Forest - Sudbury |
| * 0.030 | 82 | Dirt Road - Sudbury |
| 7.722 | 57 | Weighted Average |
| 7.722 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 19.6 | 50 | 0.0062 | 0.04 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 8.3 | 840 | 0.0110 | 1.69 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 27.9 | 890 | Total | | | |

Summary for Subcatchment EX-303: EX-303

Runoff = 8.14 cfs @ 12.19 hrs, Volume= 35,648 cf, Depth= 1.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YEAR Rainfall=6.09"

| Area (ac) | CN | Description |
|-----------|----|------------------------------|
| * 3.550 | 68 | Open Space - Windsor |
| * 2.207 | 30 | Woods and Forest - Windsor |
| * 0.255 | 72 | Dirt Road - Windsor |
| * 0.386 | 55 | Woods and Forest - Sudbury |
| * 0.006 | 77 | Woods and Forest - Freetown |
| * 0.138 | 30 | Woods and Forest - Deerfield |
| * 0.045 | 98 | Paved Road - Deerfield |
| 6.587 | 54 | Weighted Average |
| 6.542 | | 99.32% Pervious Area |
| 0.045 | | 0.68% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 8.4 | 50 | 0.0510 | 0.10 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 3.9 | 394 | 0.0108 | 1.67 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 12.3 | 444 | Total | | | |

Summary for Link DP1: Discharge Point 1

Inflow Area = 52,054 sf, 0.00% Impervious, Inflow Depth = 2.15" for 25-YEAR event
 Inflow = 2.48 cfs @ 12.15 hrs, Volume= 9,336 cf
 Primary = 2.48 cfs @ 12.15 hrs, Volume= 9,336 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP2: Discharge Point 2

Inflow Area = 68,794 sf, 0.00% Impervious, Inflow Depth = 0.47" for 25-YEAR event
 Inflow = 0.29 cfs @ 12.42 hrs, Volume= 2,703 cf
 Primary = 0.29 cfs @ 12.42 hrs, Volume= 2,703 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP3: Discharge Point 3

Inflow Area = 638,067 sf, 0.31% Impervious, Inflow Depth = 1.61" for 25-YEAR event
 Inflow = 14.30 cfs @ 12.34 hrs, Volume= 85,539 cf
 Primary = 14.30 cfs @ 12.34 hrs, Volume= 85,539 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Subcatchment EX-101: EX-101

Runoff = 4.99 cfs @ 12.15 hrs, Volume= 18,091 cf, Depth= 4.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YEAR Rainfall=8.78"

| Area (ac) | CN | Description |
|-----------|----|-------------------------------|
| * 0.635 | 68 | Open Space - Windsor |
| * 0.223 | 30 | Woods and Forest - Windsor |
| * 0.337 | 72 | Compacted Dirt Road - Windsor |
| 1.195 | 62 | Weighted Average |
| 1.195 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 9.8 | 50 | 0.0350 | 0.08 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 0.7 | 141 | 0.0455 | 3.43 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 10.5 | 191 | Total | | | |

Summary for Subcatchment EX-201: EX-201

Runoff = 1.69 cfs @ 12.19 hrs, Volume= 8,600 cf, Depth= 1.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YEAR Rainfall=8.78"

| Area (sf) | CN | Description |
|-----------|----|------------------------------|
| * 13,983 | 68 | Open space - Windsor |
| * 24,319 | 30 | Woods and Forest - Windsor |
| * 2,265 | 72 | Dirt Road - Windsor |
| * 28,227 | 30 | Woods and Forest - Deerfield |
| 68,794 | 39 | Weighted Average |
| 68,794 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 9.7 | 50 | 0.0358 | 0.09 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 1.6 | 156 | 0.0108 | 1.67 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 11.3 | 206 | Total | | | |

Summary for Subcatchment EX-301: EX - 301

Runoff = 0.79 cfs @ 12.18 hrs, Volume= 3,228 cf, Depth= 2.62"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YEAR Rainfall=8.78"

| Area (ac) | CN | Description |
|-----------|----|----------------------------|
| * 0.169 | 68 | Open Space - Windsor |
| * 0.170 | 30 | Woods and Forest - Windsor |
| 0.339 | 49 | Weighted Average |
| 0.339 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 11.8 | 50 | 0.0220 | 0.07 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 0.1 | 24 | 0.0350 | 3.01 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 11.9 | 74 | Total | | | |

Summary for Subcatchment EX-302: EX-302

Runoff = 18.46 cfs @ 12.40 hrs, Volume= 100,034 cf, Depth= 3.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YEAR Rainfall=8.78"

| Area (ac) | CN | Description |
|-----------|----|----------------------------|
| * 2.381 | 30 | Woods and Forest - Windsor |
| * 3.752 | 68 | Open Space - Windsor |
| * 1.549 | 72 | Dirt Road - Windsor |
| * 0.010 | 55 | Woods and Forest - Sudbury |
| * 0.030 | 82 | Dirt Road - Sudbury |
| 7.722 | 57 | Weighted Average |
| 7.722 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 19.6 | 50 | 0.0062 | 0.04 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 8.3 | 840 | 0.0110 | 1.69 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 27.9 | 890 | Total | | | |

Summary for Subcatchment EX-303: EX-303

Runoff = 19.45 cfs @ 12.18 hrs, Volume= 76,776 cf, Depth= 3.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YEAR Rainfall=8.78"

| Area (ac) | CN | Description |
|-----------|----|------------------------------|
| * 3.550 | 68 | Open Space - Windsor |
| * 2.207 | 30 | Woods and Forest - Windsor |
| * 0.255 | 72 | Dirt Road - Windsor |
| * 0.386 | 55 | Woods and Forest - Sudbury |
| * 0.006 | 77 | Woods and Forest - Freetown |
| * 0.138 | 30 | Woods and Forest - Deerfield |
| * 0.045 | 98 | Paved Road - Deerfield |
| 6.587 | 54 | Weighted Average |
| 6.542 | | 99.32% Pervious Area |
| 0.045 | | 0.68% Impervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 8.4 | 50 | 0.0510 | 0.10 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 3.9 | 394 | 0.0108 | 1.67 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 12.3 | 444 | Total | | | |

Summary for Link DP1: Discharge Point 1

Inflow Area = 52,054 sf, 0.00% Impervious, Inflow Depth = 4.17" for 100-YEAR event
 Inflow = 4.99 cfs @ 12.15 hrs, Volume= 18,091 cf
 Primary = 4.99 cfs @ 12.15 hrs, Volume= 18,091 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP2: Discharge Point 2

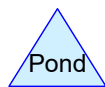
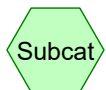
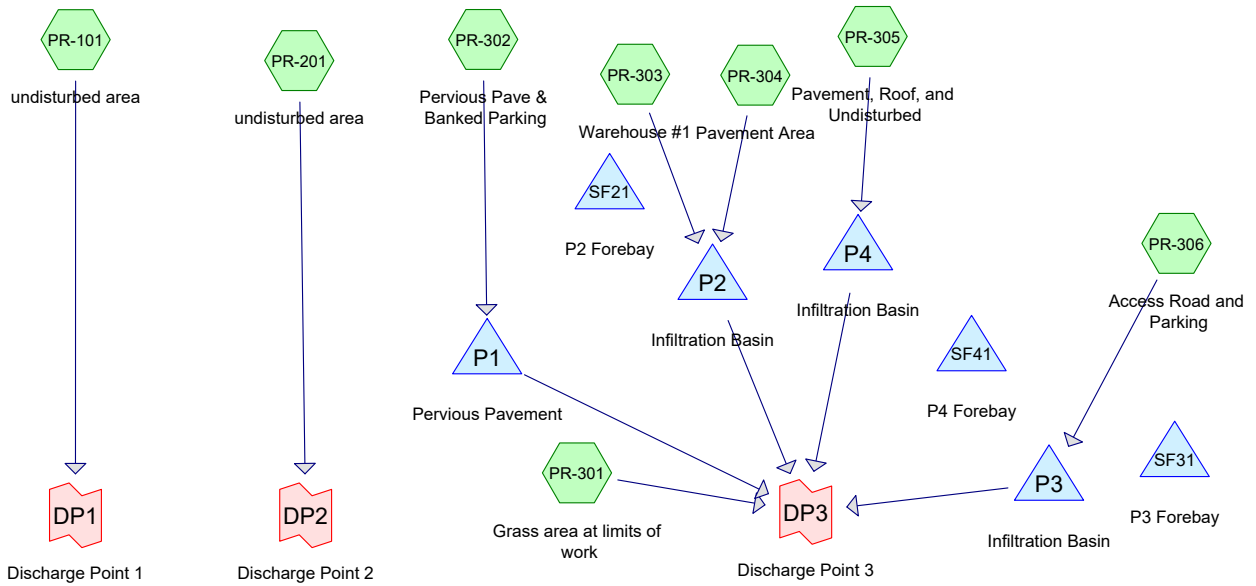
Inflow Area = 68,794 sf, 0.00% Impervious, Inflow Depth = 1.50" for 100-YEAR event
 Inflow = 1.69 cfs @ 12.19 hrs, Volume= 8,600 cf
 Primary = 1.69 cfs @ 12.19 hrs, Volume= 8,600 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs

Summary for Link DP3: Discharge Point 3

Inflow Area = 638,067 sf, 0.31% Impervious, Inflow Depth = 3.39" for 100-YEAR event
 Inflow = 32.64 cfs @ 12.25 hrs, Volume= 180,038 cf
 Primary = 32.64 cfs @ 12.25 hrs, Volume= 180,038 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs



Area Listing (all nodes)

| Area (sq-ft) | CN | Description (subcatchment-numbers) |
|-----------------|----|---|
| 2,265 | 72 | Dirt Road - HSG A (PR-201) |
| 174 | 72 | Dirt Road - HSG A - undisturbed (PR-305) |
| 14,680 | 72 | Dirt Road - undisturbed (PR-101) |
| 145,255 | 98 | Impervious - HSG A (PR-305, PR-306) |
| 79,067 | 68 | Open Space - HSG A (PR-304, PR-305) |
| 19,094 | 77 | Open Space - HSG A (PR-306) |
| 6,447 | 68 | Open Space - HSG A - undisturbed (PR-305) |
| 18,807 | 79 | Open Space - HSG B (PR-301, PR-304) |
| 218 | 89 | Open Space - HSG D (PR-301) |
| 27,051 | 68 | Open Space - undisturbed (PR-101) |
| 52,394 | 68 | Open Space, HSG A (PR-301, PR-302) |
| 13,983 | 68 | Open space - HSG A (PR-201) |
| 157,576 | 98 | Paved parking - HSG A (PR-304) |
| 24,753 | 98 | Paved parking, HSG A (PR-302) |
| 107,680 | 98 | Roofs, HSG A (PR-303) |
| 52,546 | 30 | Woods and Forest - HSG A (PR-201) |
| 27,661 | 30 | Woods and Forest - HSG A - undisturbed (PR-305, PR-306) |
| 9,290 | 30 | Woods and Forest - undisturbed (PR-101) |

Summary for Subcatchment PR-101: undisturbed area

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

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 0.5 inch wqv Rainfall=0.50"

| Area (sf) | CN | Description |
|-----------|----|--------------------------------|
| * 27,051 | 68 | Open Space - undisturbed |
| * 9,290 | 30 | Woods and Forest - undisturbed |
| * 14,680 | 72 | Dirt Road - undisturbed |
| 51,021 | 62 | Weighted Average |
| 51,021 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 9.8 | 50 | 0.0350 | 0.08 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 0.7 | 141 | 0.0455 | 3.43 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 10.5 | 191 | Total | | | |

Summary for Subcatchment PR-201: undisturbed area

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

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 0.5 inch wqv Rainfall=0.50"

| Area (sf) | CN | Description |
|-----------|----|--------------------------|
| * 13,983 | 68 | Open space - HSG A |
| * 52,546 | 30 | Woods and Forest - HSG A |
| * 2,265 | 72 | Dirt Road - HSG A |
| 68,794 | 39 | Weighted Average |
| 68,794 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 9.7 | 50 | 0.0358 | 0.09 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 1.6 | 156 | 0.0108 | 1.67 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 11.3 | 206 | Total | | | |

Summary for Subcatchment PR-301: Grass area at limits of work

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Depth= 0.00"

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 0.5 inch wqv Rainfall=0.50"

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Type III 24-hr 0.5 inch wqv Rainfall=0.50"

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| | Area (sf) | CN | Description |
|---|-----------|----|-----------------------|
| * | 46,391 | 68 | Open Space, HSG A |
| * | 6,462 | 79 | Open Space - HSG B |
| * | 218 | 89 | Open Space - HSG D |
| | 53,071 | 69 | Weighted Average |
| | 53,071 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 0.5 | 36 | 0.0200 | 1.13 | | Sheet Flow, Smooth surfaces n= 0.011 P2= 3.23" |
| 2.7 | 14 | 0.0100 | 0.09 | | Sheet Flow, Grass: Short n= 0.150 P2= 3.23" |
| 15.3 | 676 | 0.0110 | 0.73 | | Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps |
| 6.4 | 210 | 0.0120 | 0.55 | | Shallow Concentrated Flow, Woodland Kv= 5.0 fps |
| 24.9 | 936 | Total | | | |

Summary for Subcatchment PR-302: Pervious Pave & Banked Parking

Runoff = 0.06 cfs @ 12.11 hrs, Volume= 228 cf, Depth= 0.09"

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 0.5 inch wqv Rainfall=0.50"

| | Area (sf) | CN | Description |
|---|-----------|----|------------------------|
| | 24,753 | 98 | Paved parking, HSG A |
| * | 6,003 | 68 | Open Space, HSG A |
| | 30,756 | 92 | Weighted Average |
| | 6,003 | | 19.52% Pervious Area |
| | 24,753 | | 80.48% Impervious Area |

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

Summary for Subcatchment PR-303: Warehouse #1

Runoff = 0.92 cfs @ 12.09 hrs, Volume= 2,853 cf, Depth= 0.32"

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 0.5 inch wqv Rainfall=0.50"

| | Area (sf) | CN | Description |
|--|-----------|----|-------------------------|
| | 107,680 | 98 | Roofs, HSG A |
| | 107,680 | | 100.00% Impervious Area |

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

Summary for Subcatchment PR-304: Pavement Area

Runoff = 0.26 cfs @ 12.12 hrs, Volume= 1,268 cf, Depth= 0.07"

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 0.5 inch wqv Rainfall=0.50"

| | Area (sf) | CN | Description |
|---|-----------|----|------------------------|
| * | 45,292 | 68 | Open Space - HSG A |
| * | 157,576 | 98 | Paved parking - HSG A |
| * | 12,345 | 79 | Open Space - HSG B |
| | 215,213 | 91 | Weighted Average |
| | 57,637 | | 26.78% Pervious Area |
| | 157,576 | | 73.22% Impervious Area |

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

Summary for Subcatchment PR-305: Pavement, Roof, and Undisturbed

Runoff = 0.00 cfs @ 17.02 hrs, Volume= 45 cf, Depth= 0.00"

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 0.5 inch wqv Rainfall=0.50"

| | Area (sf) | CN | Description |
|---|-----------|----|--|
| * | 88,827 | 98 | Impervious - HSG A |
| * | 33,775 | 68 | Open Space - HSG A |
| * | 13,112 | 30 | Woods and Forest - HSG A - undisturbed |
| * | 6,447 | 68 | Open Space - HSG A - undisturbed |
| * | 174 | 72 | Dirt Road - HSG A - undisturbed |
| | 142,335 | 83 | Weighted Average |
| | 53,508 | | 37.59% Pervious Area |
| | 88,827 | | 62.41% Impervious Area |

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

Summary for Subcatchment PR-306: Access Road and Parking

Runoff = 0.00 cfs @ 17.02 hrs, Volume= 29 cf, Depth= 0.00"

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 0.5 inch wqv Rainfall=0.50"

| | Area (sf) | CN | Description |
|---|-----------|----|--|
| * | 56,428 | 98 | Impervious - HSG A |
| * | 19,094 | 77 | Open Space - HSG A |
| * | 14,549 | 30 | Woods and Forest - HSG A - undisturbed |
| | 90,071 | 83 | Weighted Average |
| | 33,643 | | 37.35% Pervious Area |
| | 56,428 | | 62.65% Impervious Area |

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

Summary for Pond P1: Pervious Pavement

Inflow Area = 30,756 sf, 80.48% Impervious, Inflow Depth = 0.09" for 0.5 inch wqv event
 Inflow = 0.06 cfs @ 12.11 hrs, Volume= 228 cf
 Outflow = 0.06 cfs @ 12.11 hrs, Volume= 228 cf, Atten= 0%, Lag= 0.0 min
 Discarded = 0.06 cfs @ 12.11 hrs, Volume= 228 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 95.75' @ 0.00 hrs Surf.Area= 18,000 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 0.0 min (898.7 - 898.7)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|--------|---------------|---|
| #1 | 95.75' | 16,200 cf | 24.00'W x 750.00'L x 2.25'H Prismatic 40,500 cf Overall x 40.0% Voids |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|---|
| #1 | Primary | 97.90' | 750.0' long Sharp-Crested Vee/Trap Weir Cv= 2.62 (C= 3.28) |
| #2 | Discarded | 95.75' | 2.410 in/hr Exfiltration over Surface area |

Discarded OutFlow Max=0.00 cfs @ 12.11 hrs HW=95.75' (Free Discharge)
 ↳2=Exfiltration (Passes 0.00 cfs of 1.00 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=95.75' TW=0.00' (Dynamic Tailwater)
 ↳1=Sharp-Crested Vee/Trap Weir (Controls 0.00 cfs)

Summary for Pond P2: Infiltration Basin

Inflow Area = 322,893 sf, 82.15% Impervious, Inflow Depth = 0.15" for 0.5 inch wqv event
 Inflow = 1.16 cfs @ 12.10 hrs, Volume= 4,121 cf
 Outflow = 1.10 cfs @ 12.12 hrs, Volume= 4,122 cf, Atten= 6%, Lag= 1.7 min
 Discarded = 1.10 cfs @ 12.12 hrs, Volume= 4,122 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 92.67' @ 12.12 hrs Surf.Area= 19,633 sf Storage= 10 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 0.1 min (844.2 - 844.1)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|--------|---------------|--|
| #1 | 92.67' | 108,964 cf | Custom Stage Data (Irregular) Listed below (Recalc) |

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Type III 24-hr 0.5 inch wqv Rainfall=0.50"

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| Elevation (feet) | Surf.Area (sq-ft) | Perim. (feet) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | Wet.Area (sq-ft) |
|------------------|-------------------|---------------|------------------------|------------------------|------------------|
| 92.67 | 19,632 | 822.0 | 0 | 0 | 19,632 |
| 93.00 | 20,458 | 829.0 | 6,614 | 6,614 | 20,591 |
| 94.00 | 22,973 | 847.0 | 21,703 | 28,318 | 23,134 |
| 95.00 | 25,545 | 866.0 | 24,248 | 52,565 | 25,862 |
| 96.00 | 28,174 | 885.0 | 26,849 | 79,414 | 28,650 |
| 97.00 | 30,947 | 904.0 | 29,550 | 108,964 | 31,499 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|--|
| #1 | Primary | 93.00' | 12.0" Round Culvert L= 27.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.00' / 91.45' S= 0.0574 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf |
| #2 | Device 1 | 93.15' | 2.0" Vert. Orifice/Grate C= 0.600 |
| #3 | Device 1 | 96.25' | 48.0" x 48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads |
| #4 | Primary | 96.40' | 30.0' 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 |
| #5 | Discarded | 92.67' | 2.410 in/hr Exfiltration over Surface area |

Discarded OutFlow Max=1.10 cfs @ 12.12 hrs HW=92.67' (Free Discharge)
 ↳5=Exfiltration (Exfiltration Controls 1.10 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=92.67' TW=0.00' (Dynamic Tailwater)
 ↳1=Culvert (Controls 0.00 cfs)
 ↳2=Orifice/Grate (Controls 0.00 cfs)
 ↳3=Orifice/Grate (Controls 0.00 cfs)
 ↳4=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond P3: Infiltration Basin

Inflow Area = 90,071 sf, 62.65% Impervious, Inflow Depth = 0.00" for 0.5 inch wqv event
 Inflow = 0.00 cfs @ 17.02 hrs, Volume= 29 cf
 Outflow = 0.00 cfs @ 17.02 hrs, Volume= 29 cf, Atten= 0%, Lag= 0.0 min
 Discarded = 0.00 cfs @ 17.02 hrs, Volume= 29 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 96.90' @ 0.00 hrs Surf.Area= 4,600 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 0.0 min (1,160.1 - 1,160.1)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|--------|---------------|--|
| #1 | 96.90' | 34,920 cf | Custom Stage Data (Conic) Listed below (Recalc) |

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Type III 24-hr 0.5 inch wqv Rainfall=0.50"

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| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | Wet.Area (sq-ft) |
|------------------|-------------------|------------------------|------------------------|------------------|
| 96.90 | 4,600 | 0 | 0 | 4,600 |
| 97.00 | 4,680 | 464 | 464 | 4,684 |
| 98.00 | 5,499 | 5,084 | 5,548 | 5,541 |
| 99.00 | 6,374 | 5,931 | 11,479 | 6,457 |
| 100.00 | 7,306 | 6,835 | 18,314 | 7,434 |
| 101.00 | 8,294 | 7,795 | 26,109 | 8,471 |
| 102.00 | 9,339 | 8,811 | 34,920 | 9,567 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|---------|--|
| #1 | Primary | 97.90' | 12.0" Round RCP_Round 12" L= 22.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 97.90' / 97.80' S= 0.0045 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf |
| #2 | Device 1 | 101.80' | 48.0" x 48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads |
| #3 | Discarded | 96.90' | 2.410 in/hr Exfiltration over Surface area |
| #4 | Primary | 97.90' | 2.0" Vert. Low Flow Orifice C= 0.600 |

Discarded OutFlow Max=0.00 cfs @ 17.02 hrs HW=96.90' (Free Discharge)
 ↳ **3=Exfiltration** (Passes 0.00 cfs of 0.26 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=96.90' TW=0.00' (Dynamic Tailwater)
 ↳ **1=RCP_Round 12"** (Controls 0.00 cfs)
 ↳ **2=Orifice/Grate** (Controls 0.00 cfs)
 ↳ **4=Low Flow Orifice** (Controls 0.00 cfs)

Summary for Pond P4: Infiltration Basin

Inflow Area = 142,335 sf, 62.41% Impervious, Inflow Depth = 0.00" for 0.5 inch wqv event
 Inflow = 0.00 cfs @ 17.02 hrs, Volume= 45 cf
 Outflow = 0.00 cfs @ 17.02 hrs, Volume= 45 cf, Atten= 0%, Lag= 0.0 min
 Discarded = 0.00 cfs @ 17.02 hrs, Volume= 45 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 93.50' @ 0.00 hrs Surf.Area= 6,773 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 0.0 min (1,160.1 - 1,160.1)

| Volume | Invert | Avail.Storage | Storage Description | | |
|------------------|-------------------|---------------|--|------------------------|------------------|
| #1 | 93.50' | 43,368 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) |
| 93.50 | 6,773 | 396.0 | 0 | 0 | 6,773 |
| 94.00 | 7,375 | 406.0 | 3,536 | 3,536 | 7,442 |
| 95.00 | 8,621 | 425.0 | 7,990 | 11,526 | 8,765 |
| 96.00 | 9,923 | 443.0 | 9,264 | 20,790 | 10,082 |
| 97.00 | 11,282 | 462.0 | 10,595 | 31,385 | 11,523 |
| 98.00 | 12,697 | 481.0 | 11,983 | 43,368 | 13,025 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|--|
| #1 | Primary | 94.50' | 12.0" Round Culvert L= 27.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 94.50' / 94.35' S= 0.0056 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf |
| #2 | Device 1 | 94.50' | 2.0" Vert. Orifice/Grate C= 0.600 |
| #3 | Device 1 | 95.50' | 36.0" W x 21.0" H Vert. Orifice/Grate C= 0.600 |
| #4 | Device 1 | 97.25' | 48.0" x 48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads |
| #5 | Primary | 97.50' | 30.0' 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 |
| #6 | Discarded | 93.50' | 2.410 in/hr Exfiltration over Surface area |

Discarded OutFlow Max=0.00 cfs @ 17.02 hrs HW=93.50' (Free Discharge)

6=Exfiltration (Passes 0.00 cfs of 0.38 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=93.50' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Controls 0.00 cfs)
- 2=Orifice/Grate (Controls 0.00 cfs)
- 3=Orifice/Grate (Controls 0.00 cfs)
- 4=Orifice/Grate (Controls 0.00 cfs)
- 5=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond SF21: P2 Forebay

| Volume | Invert | Avail.Storage | Storage Description | | |
|------------------|-------------------|---------------|--|------------------------|------------------|
| #1 | 92.67' | 1,828 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) |
| 92.67 | 1,316 | 80.0 | 0 | 0 | 1,316 |
| 93.67 | 2,394 | 102.0 | 1,828 | 1,828 | 1,647 |

Summary for Pond SF31: P3 Forebay

| Volume | Invert | Avail.Storage | Storage Description | |
|------------------|-------------------|------------------------|--|--|
| #1 | 96.90' | 619 cf | Custom Stage Data (Prismatic) Listed below (Recalc) | |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | |
| 96.90 | 416 | 0 | 0 | |
| 97.90 | 822 | 619 | 619 | |

Summary for Pond SF41: P4 Forebay

| Volume | Invert | Avail.Storage | Storage Description | |
|--------|--------|---------------|--|--|
| #1 | 93.50' | 1,024 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) |
|---------------------|----------------------|------------------|---------------------------|---------------------------|---------------------|
| 93.50 | 520 | 78.0 | 0 | 0 | 520 |
| 94.80 | 1,091 | 100.0 | 1,024 | 1,024 | 852 |

Summary for Link DP1: Discharge Point 1

Inflow Area = 51,021 sf, 0.00% Impervious, Inflow Depth = 0.00" for 0.5 inch wqv event
 Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP2: Discharge Point 2

Inflow Area = 68,794 sf, 0.00% Impervious, Inflow Depth = 0.00" for 0.5 inch wqv event
 Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP3: Discharge Point 3

Inflow Area = 639,126 sf, 68.10% Impervious, Inflow Depth = 0.00" for 0.5 inch wqv event
 Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Subcatchment PR-101: undisturbed area

Runoff = 0.35 cfs @ 12.19 hrs, Volume= 1,955 cf, Depth= 0.46"

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=3.15"

| Area (sf) | CN | Description |
|-----------|----|--------------------------------|
| * 27,051 | 68 | Open Space - undisturbed |
| * 9,290 | 30 | Woods and Forest - undisturbed |
| * 14,680 | 72 | Dirt Road - undisturbed |
| 51,021 | 62 | Weighted Average |
| 51,021 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 9.8 | 50 | 0.0350 | 0.08 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 0.7 | 141 | 0.0455 | 3.43 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 10.5 | 191 | Total | | | |

Summary for Subcatchment PR-201: undisturbed area

Runoff = 0.00 cfs @ 24.05 hrs, Volume= 0 cf, Depth= 0.00"

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=3.15"

| Area (sf) | CN | Description |
|-----------|----|--------------------------|
| * 13,983 | 68 | Open space - HSG A |
| * 52,546 | 30 | Woods and Forest - HSG A |
| * 2,265 | 72 | Dirt Road - HSG A |
| 68,794 | 39 | Weighted Average |
| 68,794 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 9.7 | 50 | 0.0358 | 0.09 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 1.6 | 156 | 0.0108 | 1.67 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 11.3 | 206 | Total | | | |

Summary for Subcatchment PR-301: Grass area at limits of work

Runoff = 0.57 cfs @ 12.40 hrs, Volume= 3,324 cf, Depth= 0.75"

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=3.15"

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Type III 24-hr 2-YEAR Rainfall=3.15"

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| | Area (sf) | CN | Description |
|---|-----------|----|-----------------------|
| * | 46,391 | 68 | Open Space, HSG A |
| * | 6,462 | 79 | Open Space - HSG B |
| * | 218 | 89 | Open Space - HSG D |
| | 53,071 | 69 | Weighted Average |
| | 53,071 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 0.5 | 36 | 0.0200 | 1.13 | | Sheet Flow, Smooth surfaces n= 0.011 P2= 3.23" |
| 2.7 | 14 | 0.0100 | 0.09 | | Sheet Flow, Grass: Short n= 0.150 P2= 3.23" |
| 15.3 | 676 | 0.0110 | 0.73 | | Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps |
| 6.4 | 210 | 0.0120 | 0.55 | | Shallow Concentrated Flow, Woodland Kv= 5.0 fps |
| 24.9 | 936 | Total | | | |

Summary for Subcatchment PR-302: Pervious Pave & Banked Parking

Runoff = 1.86 cfs @ 12.09 hrs, Volume= 5,903 cf, Depth= 2.30"

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=3.15"

| | Area (sf) | CN | Description |
|---|-----------|----|------------------------|
| | 24,753 | 98 | Paved parking, HSG A |
| * | 6,003 | 68 | Open Space, HSG A |
| | 30,756 | 92 | Weighted Average |
| | 6,003 | | 19.52% Pervious Area |
| | 24,753 | | 80.48% Impervious Area |

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

Summary for Subcatchment PR-303: Warehouse #1

Runoff = 7.56 cfs @ 12.08 hrs, Volume= 26,181 cf, Depth= 2.92"

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=3.15"

| | Area (sf) | CN | Description |
|--|-----------|----|-------------------------|
| | 107,680 | 98 | Roofs, HSG A |
| | 107,680 | | 100.00% Impervious Area |

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

Summary for Subcatchment PR-304: Pavement Area

Runoff = 12.61 cfs @ 12.09 hrs, Volume= 39,660 cf, Depth= 2.21"

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=3.15"

| | Area (sf) | CN | Description |
|---|-----------|----|------------------------|
| * | 45,292 | 68 | Open Space - HSG A |
| * | 157,576 | 98 | Paved parking - HSG A |
| * | 12,345 | 79 | Open Space - HSG B |
| | 215,213 | 91 | Weighted Average |
| | 57,637 | | 26.78% Pervious Area |
| | 157,576 | | 73.22% Impervious Area |

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

Summary for Subcatchment PR-305: Pavement, Roof, and Undisturbed

Runoff = 6.00 cfs @ 12.09 hrs, Volume= 18,601 cf, Depth= 1.57"

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=3.15"

| | Area (sf) | CN | Description |
|---|-----------|----|--|
| * | 88,827 | 98 | Impervious - HSG A |
| * | 33,775 | 68 | Open Space - HSG A |
| * | 13,112 | 30 | Woods and Forest - HSG A - undisturbed |
| * | 6,447 | 68 | Open Space - HSG A - undisturbed |
| * | 174 | 72 | Dirt Road - HSG A - undisturbed |
| | 142,335 | 83 | Weighted Average |
| | 53,508 | | 37.59% Pervious Area |
| | 88,827 | | 62.41% Impervious Area |

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

Summary for Subcatchment PR-306: Access Road and Parking

Runoff = 3.80 cfs @ 12.09 hrs, Volume= 11,771 cf, Depth= 1.57"

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=3.15"

| | Area (sf) | CN | Description |
|---|-----------|----|--|
| * | 56,428 | 98 | Impervious - HSG A |
| * | 19,094 | 77 | Open Space - HSG A |
| * | 14,549 | 30 | Woods and Forest - HSG A - undisturbed |
| | 90,071 | 83 | Weighted Average |
| | 33,643 | | 37.35% Pervious Area |
| | 56,428 | | 62.65% Impervious Area |

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

Summary for Pond P1: Pervious Pavement

Inflow Area = 30,756 sf, 80.48% Impervious, Inflow Depth = 2.30" for 2-YEAR event
 Inflow = 1.86 cfs @ 12.09 hrs, Volume= 5,903 cf
 Outflow = 1.00 cfs @ 12.09 hrs, Volume= 5,911 cf, Atten= 46%, Lag= 0.3 min
 Discarded = 1.00 cfs @ 12.09 hrs, Volume= 5,911 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 95.80' @ 12.21 hrs Surf.Area= 18,000 sf Storage= 384 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 1.3 min (799.6 - 798.3)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|--------|---------------|---|
| #1 | 95.75' | 16,200 cf | 24.00'W x 750.00'L x 2.25'H Prismatic 40,500 cf Overall x 40.0% Voids |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|---|
| #1 | Primary | 97.90' | 750.0' long Sharp-Crested Vee/Trap Weir Cv= 2.62 (C= 3.28) |
| #2 | Discarded | 95.75' | 2.410 in/hr Exfiltration over Surface area |

Discarded OutFlow Max=1.00 cfs @ 12.09 hrs HW=95.78' (Free Discharge)
 ↖**2=Exfiltration** (Exfiltration Controls 1.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=95.75' TW=0.00' (Dynamic Tailwater)
 ↖**1=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond P2: Infiltration Basin

Inflow Area = 322,893 sf, 82.15% Impervious, Inflow Depth = 2.45" for 2-YEAR event
 Inflow = 20.16 cfs @ 12.09 hrs, Volume= 65,841 cf
 Outflow = 1.37 cfs @ 13.54 hrs, Volume= 65,842 cf, Atten= 93%, Lag= 87.5 min
 Discarded = 1.28 cfs @ 13.54 hrs, Volume= 63,813 cf
 Primary = 0.09 cfs @ 13.54 hrs, Volume= 2,030 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 93.99' @ 13.54 hrs Surf.Area= 22,938 sf Storage= 28,006 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 181.9 min (966.6 - 784.6)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|--------|---------------|--|
| #1 | 92.67' | 108,964 cf | Custom Stage Data (Irregular) Listed below (Recalc) |

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| Elevation (feet) | Surf.Area (sq-ft) | Perim. (feet) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | Wet.Area (sq-ft) |
|------------------|-------------------|---------------|------------------------|------------------------|------------------|
| 92.67 | 19,632 | 822.0 | 0 | 0 | 19,632 |
| 93.00 | 20,458 | 829.0 | 6,614 | 6,614 | 20,591 |
| 94.00 | 22,973 | 847.0 | 21,703 | 28,318 | 23,134 |
| 95.00 | 25,545 | 866.0 | 24,248 | 52,565 | 25,862 |
| 96.00 | 28,174 | 885.0 | 26,849 | 79,414 | 28,650 |
| 97.00 | 30,947 | 904.0 | 29,550 | 108,964 | 31,499 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|--|
| #1 | Primary | 93.00' | 12.0" Round Culvert L= 27.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.00' / 91.45' S= 0.0574 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf |
| #2 | Device 1 | 93.15' | 2.0" Vert. Orifice/Grate C= 0.600 |
| #3 | Device 1 | 96.25' | 48.0" x 48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads |
| #4 | Primary | 96.40' | 30.0' 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 |
| #5 | Discarded | 92.67' | 2.410 in/hr Exfiltration over Surface area |

Discarded OutFlow Max=1.28 cfs @ 13.54 hrs HW=93.99' (Free Discharge)
 ↳ **5=Exfiltration** (Exfiltration Controls 1.28 cfs)

Primary OutFlow Max=0.09 cfs @ 13.54 hrs HW=93.99' TW=0.00' (Dynamic Tailwater)
 ↳ **1=Culvert** (Passes 0.09 cfs of 2.65 cfs potential flow)
 ↳ **2=Orifice/Grate** (Orifice Controls 0.09 cfs @ 4.18 fps)
 ↳ **3=Orifice/Grate** (Controls 0.00 cfs)
 ↳ **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P3: Infiltration Basin

Inflow Area = 90,071 sf, 62.65% Impervious, Inflow Depth = 1.57" for 2-YEAR event
 Inflow = 3.80 cfs @ 12.09 hrs, Volume= 11,771 cf
 Outflow = 0.30 cfs @ 13.59 hrs, Volume= 11,773 cf, Atten= 92%, Lag= 90.2 min
 Discarded = 0.30 cfs @ 13.59 hrs, Volume= 11,773 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 97.87' @ 13.59 hrs Surf.Area= 5,392 sf Storage= 4,860 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 154.9 min (988.6 - 833.7)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|--------|---------------|--|
| #1 | 96.90' | 34,920 cf | Custom Stage Data (Conic) Listed below (Recalc) |

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Type III 24-hr 2-YEAR Rainfall=3.15"

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| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | Wet.Area (sq-ft) |
|------------------|-------------------|------------------------|------------------------|------------------|
| 96.90 | 4,600 | 0 | 0 | 4,600 |
| 97.00 | 4,680 | 464 | 464 | 4,684 |
| 98.00 | 5,499 | 5,084 | 5,548 | 5,541 |
| 99.00 | 6,374 | 5,931 | 11,479 | 6,457 |
| 100.00 | 7,306 | 6,835 | 18,314 | 7,434 |
| 101.00 | 8,294 | 7,795 | 26,109 | 8,471 |
| 102.00 | 9,339 | 8,811 | 34,920 | 9,567 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|---------|--|
| #1 | Primary | 97.90' | 12.0" Round RCP_Round 12" L= 22.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 97.90' / 97.80' S= 0.0045 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf |
| #2 | Device 1 | 101.80' | 48.0" x 48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads |
| #3 | Discarded | 96.90' | 2.410 in/hr Exfiltration over Surface area |
| #4 | Primary | 97.90' | 2.0" Vert. Low Flow Orifice C= 0.600 |

Discarded OutFlow Max=0.30 cfs @ 13.59 hrs HW=97.87' (Free Discharge)
 ↳ **3=Exfiltration** (Exfiltration Controls 0.30 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=96.90' TW=0.00' (Dynamic Tailwater)
 ↳ **1=RCP_Round 12"** (Controls 0.00 cfs)
 ↳ **2=Orifice/Grate** (Controls 0.00 cfs)
 ↳ **4=Low Flow Orifice** (Controls 0.00 cfs)

Summary for Pond P4: Infiltration Basin

Inflow Area = 142,335 sf, 62.41% Impervious, Inflow Depth = 1.57" for 2-YEAR event
 Inflow = 6.00 cfs @ 12.09 hrs, Volume= 18,601 cf
 Outflow = 0.46 cfs @ 13.71 hrs, Volume= 18,606 cf, Atten= 92%, Lag= 96.9 min
 Discarded = 0.45 cfs @ 13.71 hrs, Volume= 18,574 cf
 Primary = 0.01 cfs @ 13.71 hrs, Volume= 32 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 94.56' @ 13.71 hrs Surf.Area= 8,063 sf Storage= 7,873 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 170.8 min (1,004.5 - 833.7)

| Volume | Invert | Avail.Storage | Storage Description | | |
|------------------|-------------------|---------------|--|------------------------|------------------|
| #1 | 93.50' | 43,368 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) |
| 93.50 | 6,773 | 396.0 | 0 | 0 | 6,773 |
| 94.00 | 7,375 | 406.0 | 3,536 | 3,536 | 7,442 |
| 95.00 | 8,621 | 425.0 | 7,990 | 11,526 | 8,765 |
| 96.00 | 9,923 | 443.0 | 9,264 | 20,790 | 10,082 |
| 97.00 | 11,282 | 462.0 | 10,595 | 31,385 | 11,523 |
| 98.00 | 12,697 | 481.0 | 11,983 | 43,368 | 13,025 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|--|
| #1 | Primary | 94.50' | 12.0" Round Culvert L= 27.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 94.50' / 94.35' S= 0.0056 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf |
| #2 | Device 1 | 94.50' | 2.0" Vert. Orifice/Grate C= 0.600 |
| #3 | Device 1 | 95.50' | 36.0" W x 21.0" H Vert. Orifice/Grate C= 0.600 |
| #4 | Device 1 | 97.25' | 48.0" x 48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads |
| #5 | Primary | 97.50' | 30.0' 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 |
| #6 | Discarded | 93.50' | 2.410 in/hr Exfiltration over Surface area |

Discarded OutFlow Max=0.45 cfs @ 13.71 hrs HW=94.56' (Free Discharge)

6=Exfiltration (Exfiltration Controls 0.45 cfs)

Primary OutFlow Max=0.01 cfs @ 13.71 hrs HW=94.56' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 0.01 cfs of 0.01 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 0.01 cfs @ 0.85 fps)
- 3=Orifice/Grate (Controls 0.00 cfs)
- 4=Orifice/Grate (Controls 0.00 cfs)
- 5=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond SF21: P2 Forebay

| Volume | Invert | Avail.Storage | Storage Description | | |
|------------------|-------------------|---------------|--|------------------------|------------------|
| #1 | 92.67' | 1,828 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) |
| 92.67 | 1,316 | 80.0 | 0 | 0 | 1,316 |
| 93.67 | 2,394 | 102.0 | 1,828 | 1,828 | 1,647 |

Summary for Pond SF31: P3 Forebay

| Volume | Invert | Avail.Storage | Storage Description | |
|------------------|-------------------|------------------------|--|--|
| #1 | 96.90' | 619 cf | Custom Stage Data (Prismatic) Listed below (Recalc) | |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | |
| 96.90 | 416 | 0 | 0 | |
| 97.90 | 822 | 619 | 619 | |

Summary for Pond SF41: P4 Forebay

| Volume | Invert | Avail.Storage | Storage Description | |
|--------|--------|---------------|--|--|
| #1 | 93.50' | 1,024 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) |
|---------------------|----------------------|------------------|---------------------------|---------------------------|---------------------|
| 93.50 | 520 | 78.0 | 0 | 0 | 520 |
| 94.80 | 1,091 | 100.0 | 1,024 | 1,024 | 852 |

Summary for Link DP1: Discharge Point 1

Inflow Area = 51,021 sf, 0.00% Impervious, Inflow Depth = 0.46" for 2-YEAR event
 Inflow = 0.35 cfs @ 12.19 hrs, Volume= 1,955 cf
 Primary = 0.35 cfs @ 12.19 hrs, Volume= 1,955 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP2: Discharge Point 2

Inflow Area = 68,794 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-YEAR event
 Inflow = 0.00 cfs @ 24.05 hrs, Volume= 0 cf
 Primary = 0.00 cfs @ 24.05 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP3: Discharge Point 3

Inflow Area = 639,126 sf, 68.10% Impervious, Inflow Depth = 0.10" for 2-YEAR event
 Inflow = 0.65 cfs @ 12.42 hrs, Volume= 5,385 cf
 Primary = 0.65 cfs @ 12.42 hrs, Volume= 5,385 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Subcatchment PR-101: undisturbed area

Runoff = 1.40 cfs @ 12.16 hrs, Volume= 5,572 cf, Depth= 1.31"

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=4.79"

| Area (sf) | CN | Description |
|-----------|----|--------------------------------|
| * 27,051 | 68 | Open Space - undisturbed |
| * 9,290 | 30 | Woods and Forest - undisturbed |
| * 14,680 | 72 | Dirt Road - undisturbed |
| 51,021 | 62 | Weighted Average |
| 51,021 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 9.8 | 50 | 0.0350 | 0.08 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 0.7 | 141 | 0.0455 | 3.43 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 10.5 | 191 | Total | | | |

Summary for Subcatchment PR-201: undisturbed area

Runoff = 0.04 cfs @ 13.75 hrs, Volume= 915 cf, Depth= 0.16"

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=4.79"

| Area (sf) | CN | Description |
|-----------|----|--------------------------|
| * 13,983 | 68 | Open space - HSG A |
| * 52,546 | 30 | Woods and Forest - HSG A |
| * 2,265 | 72 | Dirt Road - HSG A |
| 68,794 | 39 | Weighted Average |
| 68,794 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 9.7 | 50 | 0.0358 | 0.09 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 1.6 | 156 | 0.0108 | 1.67 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 11.3 | 206 | Total | | | |

Summary for Subcatchment PR-301: Grass area at limits of work

Runoff = 1.54 cfs @ 12.37 hrs, Volume= 7,988 cf, Depth= 1.81"

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=4.79"

| | Area (sf) | CN | Description |
|---|-----------|----|-----------------------|
| * | 46,391 | 68 | Open Space, HSG A |
| * | 6,462 | 79 | Open Space - HSG B |
| * | 218 | 89 | Open Space - HSG D |
| | 53,071 | 69 | Weighted Average |
| | 53,071 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 0.5 | 36 | 0.0200 | 1.13 | | Sheet Flow, Smooth surfaces n= 0.011 P2= 3.23" |
| 2.7 | 14 | 0.0100 | 0.09 | | Sheet Flow, Grass: Short n= 0.150 P2= 3.23" |
| 15.3 | 676 | 0.0110 | 0.73 | | Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps |
| 6.4 | 210 | 0.0120 | 0.55 | | Shallow Concentrated Flow, Woodland Kv= 5.0 fps |
| 24.9 | 936 | Total | | | |

Summary for Subcatchment PR-302: Pervious Pave & Banked Parking

Runoff = 3.06 cfs @ 12.08 hrs, Volume= 9,956 cf, Depth= 3.88"

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=4.79"

| | Area (sf) | CN | Description |
|---|-----------|----|------------------------|
| | 24,753 | 98 | Paved parking, HSG A |
| * | 6,003 | 68 | Open Space, HSG A |
| | 30,756 | 92 | Weighted Average |
| | 6,003 | | 19.52% Pervious Area |
| | 24,753 | | 80.48% Impervious Area |

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

Summary for Subcatchment PR-303: Warehouse #1

Runoff = 11.58 cfs @ 12.08 hrs, Volume= 40,860 cf, Depth= 4.55"

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=4.79"

| | Area (sf) | CN | Description |
|--|-----------|----|-------------------------|
| | 107,680 | 98 | Roofs, HSG A |
| | 107,680 | | 100.00% Impervious Area |

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

Summary for Subcatchment PR-304: Pavement Area

Runoff = 21.01 cfs @ 12.08 hrs, Volume= 67,764 cf, Depth= 3.78"

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=4.79"

| | Area (sf) | CN | Description |
|---|-----------|----|------------------------|
| * | 45,292 | 68 | Open Space - HSG A |
| * | 157,576 | 98 | Paved parking - HSG A |
| * | 12,345 | 79 | Open Space - HSG B |
| | 215,213 | 91 | Weighted Average |
| | 57,637 | | 26.78% Pervious Area |
| | 157,576 | | 73.22% Impervious Area |

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

Summary for Subcatchment PR-305: Pavement, Roof, and Undisturbed

Runoff = 11.40 cfs @ 12.09 hrs, Volume= 35,403 cf, Depth= 2.98"

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=4.79"

| | Area (sf) | CN | Description |
|---|-----------|----|--|
| * | 88,827 | 98 | Impervious - HSG A |
| * | 33,775 | 68 | Open Space - HSG A |
| * | 13,112 | 30 | Woods and Forest - HSG A - undisturbed |
| * | 6,447 | 68 | Open Space - HSG A - undisturbed |
| * | 174 | 72 | Dirt Road - HSG A - undisturbed |
| | 142,335 | 83 | Weighted Average |
| | 53,508 | | 37.59% Pervious Area |
| | 88,827 | | 62.41% Impervious Area |

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

Summary for Subcatchment PR-306: Access Road and Parking

Runoff = 7.21 cfs @ 12.09 hrs, Volume= 22,403 cf, Depth= 2.98"

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=4.79"

| | Area (sf) | CN | Description |
|---|-----------|----|--|
| * | 56,428 | 98 | Impervious - HSG A |
| * | 19,094 | 77 | Open Space - HSG A |
| * | 14,549 | 30 | Woods and Forest - HSG A - undisturbed |
| | 90,071 | 83 | Weighted Average |
| | 33,643 | | 37.35% Pervious Area |
| | 56,428 | | 62.65% Impervious Area |

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

Summary for Pond P1: Pervious Pavement

Inflow Area = 30,756 sf, 80.48% Impervious, Inflow Depth = 3.88" for 10-YEAR event
 Inflow = 3.06 cfs @ 12.08 hrs, Volume= 9,956 cf
 Outflow = 1.00 cfs @ 12.00 hrs, Volume= 9,966 cf, Atten= 67%, Lag= 0.0 min
 Discarded = 1.00 cfs @ 12.00 hrs, Volume= 9,966 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 95.95' @ 12.38 hrs Surf.Area= 18,000 sf Storage= 1,437 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 6.1 min (790.1 - 784.1)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|--------|---------------|---|
| #1 | 95.75' | 16,200 cf | 24.00'W x 750.00'L x 2.25'H Prismatic 40,500 cf Overall x 40.0% Voids |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|---|
| #1 | Primary | 97.90' | 750.0' long Sharp-Crested Vee/Trap Weir Cv= 2.62 (C= 3.28) |
| #2 | Discarded | 95.75' | 2.410 in/hr Exfiltration over Surface area |

Discarded OutFlow Max=1.00 cfs @ 12.00 hrs HW=95.77' (Free Discharge)
 ↖**2=Exfiltration** (Exfiltration Controls 1.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=95.75' TW=0.00' (Dynamic Tailwater)
 ↖**1=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond P2: Infiltration Basin

Inflow Area = 322,893 sf, 82.15% Impervious, Inflow Depth = 4.04" for 10-YEAR event
 Inflow = 32.59 cfs @ 12.08 hrs, Volume= 108,624 cf
 Outflow = 1.58 cfs @ 14.40 hrs, Volume= 108,630 cf, Atten= 95%, Lag= 139.2 min
 Discarded = 1.44 cfs @ 14.40 hrs, Volume= 102,717 cf
 Primary = 0.14 cfs @ 14.40 hrs, Volume= 5,913 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 95.07' @ 14.40 hrs Surf.Area= 25,723 sf Storage= 54,344 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 330.2 min (1,103.6 - 773.4)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|--------|---------------|--|
| #1 | 92.67' | 108,964 cf | Custom Stage Data (Irregular) Listed below (Recalc) |

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Type III 24-hr 10-YEAR Rainfall=4.79"

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| Elevation (feet) | Surf.Area (sq-ft) | Perim. (feet) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | Wet.Area (sq-ft) |
|------------------|-------------------|---------------|------------------------|------------------------|------------------|
| 92.67 | 19,632 | 822.0 | 0 | 0 | 19,632 |
| 93.00 | 20,458 | 829.0 | 6,614 | 6,614 | 20,591 |
| 94.00 | 22,973 | 847.0 | 21,703 | 28,318 | 23,134 |
| 95.00 | 25,545 | 866.0 | 24,248 | 52,565 | 25,862 |
| 96.00 | 28,174 | 885.0 | 26,849 | 79,414 | 28,650 |
| 97.00 | 30,947 | 904.0 | 29,550 | 108,964 | 31,499 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|--|
| #1 | Primary | 93.00' | 12.0" Round Culvert L= 27.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.00' / 91.45' S= 0.0574 ' / Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf |
| #2 | Device 1 | 93.15' | 2.0" Vert. Orifice/Grate C= 0.600 |
| #3 | Device 1 | 96.25' | 48.0" x 48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads |
| #4 | Primary | 96.40' | 30.0' 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 |
| #5 | Discarded | 92.67' | 2.410 in/hr Exfiltration over Surface area |

Discarded OutFlow Max=1.44 cfs @ 14.40 hrs HW=95.07' (Free Discharge)
 ↳ **5=Exfiltration** (Exfiltration Controls 1.44 cfs)

Primary OutFlow Max=0.14 cfs @ 14.40 hrs HW=95.07' TW=0.00' (Dynamic Tailwater)
 ↳ **1=Culvert** (Passes 0.14 cfs of 4.74 cfs potential flow)
 ↳ **2=Orifice/Grate** (Orifice Controls 0.14 cfs @ 6.52 fps)
 ↳ **3=Orifice/Grate** (Controls 0.00 cfs)
 ↳ **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P3: Infiltration Basin

Inflow Area = 90,071 sf, 62.65% Impervious, Inflow Depth = 2.98" for 10-YEAR event
 Inflow = 7.21 cfs @ 12.09 hrs, Volume= 22,403 cf
 Outflow = 0.45 cfs @ 13.95 hrs, Volume= 22,406 cf, Atten= 94%, Lag= 112.0 min
 Discarded = 0.35 cfs @ 13.95 hrs, Volume= 19,899 cf
 Primary = 0.10 cfs @ 13.95 hrs, Volume= 2,507 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 98.89' @ 13.95 hrs Surf.Area= 6,272 sf Storage= 10,769 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 266.7 min (1,081.9 - 815.2)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|--------|---------------|--|
| #1 | 96.90' | 34,920 cf | Custom Stage Data (Conic) Listed below (Recalc) |

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Type III 24-hr 10-YEAR Rainfall=4.79"

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| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | Wet.Area (sq-ft) |
|------------------|-------------------|------------------------|------------------------|------------------|
| 96.90 | 4,600 | 0 | 0 | 4,600 |
| 97.00 | 4,680 | 464 | 464 | 4,684 |
| 98.00 | 5,499 | 5,084 | 5,548 | 5,541 |
| 99.00 | 6,374 | 5,931 | 11,479 | 6,457 |
| 100.00 | 7,306 | 6,835 | 18,314 | 7,434 |
| 101.00 | 8,294 | 7,795 | 26,109 | 8,471 |
| 102.00 | 9,339 | 8,811 | 34,920 | 9,567 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|---------|--|
| #1 | Primary | 97.90' | 12.0" Round RCP_Round 12" L= 22.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 97.90' / 97.80' S= 0.0045 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf |
| #2 | Device 1 | 101.80' | 48.0" x 48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads |
| #3 | Discarded | 96.90' | 2.410 in/hr Exfiltration over Surface area |
| #4 | Primary | 97.90' | 2.0" Vert. Low Flow Orifice C= 0.600 |

Discarded OutFlow Max=0.35 cfs @ 13.95 hrs HW=98.89' (Free Discharge)
 ↳ **3=Exfiltration** (Exfiltration Controls 0.35 cfs)

Primary OutFlow Max=0.10 cfs @ 13.95 hrs HW=98.89' TW=0.00' (Dynamic Tailwater)
 ↳ **1=RCP_Round 12"** (Passes 0.00 cfs of 2.06 cfs potential flow)
 ↳ **2=Orifice/Grate** (Controls 0.00 cfs)
 ↳ **4=Low Flow Orifice** (Orifice Controls 0.10 cfs @ 4.58 fps)

Summary for Pond P4: Infiltration Basin

Inflow Area = 142,335 sf, 62.41% Impervious, Inflow Depth = 2.98" for 10-YEAR event
 Inflow = 11.40 cfs @ 12.09 hrs, Volume= 35,403 cf
 Outflow = 0.89 cfs @ 13.39 hrs, Volume= 35,407 cf, Atten= 92%, Lag= 78.0 min
 Discarded = 0.52 cfs @ 13.39 hrs, Volume= 31,060 cf
 Primary = 0.36 cfs @ 13.39 hrs, Volume= 4,348 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 95.59' @ 13.39 hrs Surf.Area= 9,378 sf Storage= 16,830 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 279.4 min (1,094.6 - 815.2)

| Volume | Invert | Avail.Storage | Storage Description | | |
|------------------|-------------------|---------------|--|------------------------|------------------|
| #1 | 93.50' | 43,368 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) |
| 93.50 | 6,773 | 396.0 | 0 | 0 | 6,773 |
| 94.00 | 7,375 | 406.0 | 3,536 | 3,536 | 7,442 |
| 95.00 | 8,621 | 425.0 | 7,990 | 11,526 | 8,765 |
| 96.00 | 9,923 | 443.0 | 9,264 | 20,790 | 10,082 |
| 97.00 | 11,282 | 462.0 | 10,595 | 31,385 | 11,523 |
| 98.00 | 12,697 | 481.0 | 11,983 | 43,368 | 13,025 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|--|
| #1 | Primary | 94.50' | 12.0" Round Culvert L= 27.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 94.50' / 94.35' S= 0.0056 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf |
| #2 | Device 1 | 94.50' | 2.0" Vert. Orifice/Grate C= 0.600 |
| #3 | Device 1 | 95.50' | 36.0" W x 21.0" H Vert. Orifice/Grate C= 0.600 |
| #4 | Device 1 | 97.25' | 48.0" x 48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads |
| #5 | Primary | 97.50' | 30.0' 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 |
| #6 | Discarded | 93.50' | 2.410 in/hr Exfiltration over Surface area |

Discarded OutFlow Max=0.52 cfs @ 13.39 hrs HW=95.59' (Free Discharge)

6=Exfiltration (Exfiltration Controls 0.52 cfs)

Primary OutFlow Max=0.36 cfs @ 13.39 hrs HW=95.59' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 0.36 cfs of 2.44 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 0.11 cfs @ 4.83 fps)
- 3=Orifice/Grate (Orifice Controls 0.26 cfs @ 0.96 fps)
- 4=Orifice/Grate (Controls 0.00 cfs)
- 5=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond SF21: P2 Forebay

| Volume | Invert | Avail.Storage | Storage Description | | |
|------------------|-------------------|---------------|--|------------------------|------------------|
| #1 | 92.67' | 1,828 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) |
| 92.67 | 1,316 | 80.0 | 0 | 0 | 1,316 |
| 93.67 | 2,394 | 102.0 | 1,828 | 1,828 | 1,647 |

Summary for Pond SF31: P3 Forebay

| Volume | Invert | Avail.Storage | Storage Description | |
|------------------|-------------------|------------------------|--|--|
| #1 | 96.90' | 619 cf | Custom Stage Data (Prismatic) Listed below (Recalc) | |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | |
| 96.90 | 416 | 0 | 0 | |
| 97.90 | 822 | 619 | 619 | |

Summary for Pond SF41: P4 Forebay

| Volume | Invert | Avail.Storage | Storage Description | |
|--------|--------|---------------|--|--|
| #1 | 93.50' | 1,024 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) |
|---------------------|----------------------|------------------|---------------------------|---------------------------|---------------------|
| 93.50 | 520 | 78.0 | 0 | 0 | 520 |
| 94.80 | 1,091 | 100.0 | 1,024 | 1,024 | 852 |

Summary for Link DP1: Discharge Point 1

Inflow Area = 51,021 sf, 0.00% Impervious, Inflow Depth = 1.31" for 10-YEAR event
 Inflow = 1.40 cfs @ 12.16 hrs, Volume= 5,572 cf
 Primary = 1.40 cfs @ 12.16 hrs, Volume= 5,572 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP2: Discharge Point 2

Inflow Area = 68,794 sf, 0.00% Impervious, Inflow Depth = 0.16" for 10-YEAR event
 Inflow = 0.04 cfs @ 13.75 hrs, Volume= 915 cf
 Primary = 0.04 cfs @ 13.75 hrs, Volume= 915 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP3: Discharge Point 3

Inflow Area = 639,126 sf, 68.10% Impervious, Inflow Depth = 0.39" for 10-YEAR event
 Inflow = 1.83 cfs @ 12.37 hrs, Volume= 20,756 cf
 Primary = 1.83 cfs @ 12.37 hrs, Volume= 20,756 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Subcatchment PR-101: undisturbed area

Runoff = 2.43 cfs @ 12.15 hrs, Volume= 9,151 cf, Depth= 2.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YEAR Rainfall=6.09"

| Area (sf) | CN | Description |
|-----------|----|--------------------------------|
| * 27,051 | 68 | Open Space - undisturbed |
| * 9,290 | 30 | Woods and Forest - undisturbed |
| * 14,680 | 72 | Dirt Road - undisturbed |
| 51,021 | 62 | Weighted Average |
| 51,021 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 9.8 | 50 | 0.0350 | 0.08 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 0.7 | 141 | 0.0455 | 3.43 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 10.5 | 191 | Total | | | |

Summary for Subcatchment PR-201: undisturbed area

Runoff = 0.29 cfs @ 12.42 hrs, Volume= 2,703 cf, Depth= 0.47"

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=6.09"

| Area (sf) | CN | Description |
|-----------|----|--------------------------|
| * 13,983 | 68 | Open space - HSG A |
| * 52,546 | 30 | Woods and Forest - HSG A |
| * 2,265 | 72 | Dirt Road - HSG A |
| 68,794 | 39 | Weighted Average |
| 68,794 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 9.7 | 50 | 0.0358 | 0.09 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 1.6 | 156 | 0.0108 | 1.67 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 11.3 | 206 | Total | | | |

Summary for Subcatchment PR-301: Grass area at limits of work

Runoff = 2.42 cfs @ 12.36 hrs, Volume= 12,308 cf, Depth= 2.78"

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=6.09"

| | Area (sf) | CN | Description |
|---|-----------|----|-----------------------|
| * | 46,391 | 68 | Open Space, HSG A |
| * | 6,462 | 79 | Open Space - HSG B |
| * | 218 | 89 | Open Space - HSG D |
| | 53,071 | 69 | Weighted Average |
| | 53,071 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 0.5 | 36 | 0.0200 | 1.13 | | Sheet Flow, Smooth surfaces n= 0.011 P2= 3.23" |
| 2.7 | 14 | 0.0100 | 0.09 | | Sheet Flow, Grass: Short n= 0.150 P2= 3.23" |
| 15.3 | 676 | 0.0110 | 0.73 | | Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps |
| 6.4 | 210 | 0.0120 | 0.55 | | Shallow Concentrated Flow, Woodland Kv= 5.0 fps |
| 24.9 | 936 | Total | | | |

Summary for Subcatchment PR-302: Pervious Pave & Banked Parking

Runoff = 4.00 cfs @ 12.08 hrs, Volume= 13,220 cf, Depth= 5.16"

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=6.09"

| | Area (sf) | CN | Description |
|---|-----------|----|------------------------|
| | 24,753 | 98 | Paved parking, HSG A |
| * | 6,003 | 68 | Open Space, HSG A |
| | 30,756 | 92 | Weighted Average |
| | 6,003 | | 19.52% Pervious Area |
| | 24,753 | | 80.48% Impervious Area |

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

Summary for Subcatchment PR-303: Warehouse #1

Runoff = 14.76 cfs @ 12.08 hrs, Volume= 52,510 cf, Depth= 5.85"

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=6.09"

| | Area (sf) | CN | Description |
|--|-----------|----|-------------------------|
| | 107,680 | 98 | Roofs, HSG A |
| | 107,680 | | 100.00% Impervious Area |

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

Summary for Subcatchment PR-304: Pavement Area

Runoff = 27.61 cfs @ 12.08 hrs, Volume= 90,485 cf, Depth= 5.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YEAR Rainfall=6.09"

| | Area (sf) | CN | Description |
|---|-----------|----|------------------------|
| * | 45,292 | 68 | Open Space - HSG A |
| * | 157,576 | 98 | Paved parking - HSG A |
| * | 12,345 | 79 | Open Space - HSG B |
| | 215,213 | 91 | Weighted Average |
| | 57,637 | | 26.78% Pervious Area |
| | 157,576 | | 73.22% Impervious Area |

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

Summary for Subcatchment PR-305: Pavement, Roof, and Undisturbed

Runoff = 15.80 cfs @ 12.09 hrs, Volume= 49,520 cf, Depth= 4.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YEAR Rainfall=6.09"

| | Area (sf) | CN | Description |
|---|-----------|----|--|
| * | 88,827 | 98 | Impervious - HSG A |
| * | 33,775 | 68 | Open Space - HSG A |
| * | 13,112 | 30 | Woods and Forest - HSG A - undisturbed |
| * | 6,447 | 68 | Open Space - HSG A - undisturbed |
| * | 174 | 72 | Dirt Road - HSG A - undisturbed |
| | 142,335 | 83 | Weighted Average |
| | 53,508 | | 37.59% Pervious Area |
| | 88,827 | | 62.41% Impervious Area |

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

Summary for Subcatchment PR-306: Access Road and Parking

Runoff = 10.00 cfs @ 12.09 hrs, Volume= 31,337 cf, Depth= 4.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 25-YEAR Rainfall=6.09"

| | Area (sf) | CN | Description |
|---|-----------|----|--|
| * | 56,428 | 98 | Impervious - HSG A |
| * | 19,094 | 77 | Open Space - HSG A |
| * | 14,549 | 30 | Woods and Forest - HSG A - undisturbed |
| | 90,071 | 83 | Weighted Average |
| | 33,643 | | 37.35% Pervious Area |
| | 56,428 | | 62.65% Impervious Area |

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

Summary for Pond P1: Pervious Pavement

Inflow Area = 30,756 sf, 80.48% Impervious, Inflow Depth = 5.16" for 25-YEAR event
 Inflow = 4.00 cfs @ 12.08 hrs, Volume= 13,220 cf
 Outflow = 1.00 cfs @ 11.91 hrs, Volume= 13,229 cf, Atten= 75%, Lag= 0.0 min
 Discarded = 1.00 cfs @ 11.91 hrs, Volume= 13,229 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 96.11' @ 12.46 hrs Surf.Area= 18,000 sf Storage= 2,567 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 11.9 min (788.6 - 776.7)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|--------|---------------|---|
| #1 | 95.75' | 16,200 cf | 24.00'W x 750.00'L x 2.25'H Prismatic 40,500 cf Overall x 40.0% Voids |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|---|
| #1 | Primary | 97.90' | 750.0' long Sharp-Crested Vee/Trap Weir Cv= 2.62 (C= 3.28) |
| #2 | Discarded | 95.75' | 2.410 in/hr Exfiltration over Surface area |

Discarded OutFlow Max=1.00 cfs @ 11.91 hrs HW=95.77' (Free Discharge)
 ↳2=Exfiltration (Exfiltration Controls 1.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=95.75' TW=0.00' (Dynamic Tailwater)
 ↳1=Sharp-Crested Vee/Trap Weir (Controls 0.00 cfs)

Summary for Pond P2: Infiltration Basin

Inflow Area = 322,893 sf, 82.15% Impervious, Inflow Depth = 5.31" for 25-YEAR event
 Inflow = 42.36 cfs @ 12.08 hrs, Volume= 142,995 cf
 Outflow = 1.74 cfs @ 14.98 hrs, Volume= 143,007 cf, Atten= 96%, Lag= 173.5 min
 Discarded = 1.56 cfs @ 14.98 hrs, Volume= 133,716 cf
 Primary = 0.17 cfs @ 14.98 hrs, Volume= 9,290 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 95.94' @ 14.98 hrs Surf.Area= 28,006 sf Storage= 77,656 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 439.9 min (1,207.4 - 767.5)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|--------|---------------|--|
| #1 | 92.67' | 108,964 cf | Custom Stage Data (Irregular) Listed below (Recalc) |

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Type III 24-hr 25-YEAR Rainfall=6.09"

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| Elevation (feet) | Surf.Area (sq-ft) | Perim. (feet) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | Wet.Area (sq-ft) |
|------------------|-------------------|---------------|------------------------|------------------------|------------------|
| 92.67 | 19,632 | 822.0 | 0 | 0 | 19,632 |
| 93.00 | 20,458 | 829.0 | 6,614 | 6,614 | 20,591 |
| 94.00 | 22,973 | 847.0 | 21,703 | 28,318 | 23,134 |
| 95.00 | 25,545 | 866.0 | 24,248 | 52,565 | 25,862 |
| 96.00 | 28,174 | 885.0 | 26,849 | 79,414 | 28,650 |
| 97.00 | 30,947 | 904.0 | 29,550 | 108,964 | 31,499 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|--|
| #1 | Primary | 93.00' | 12.0" Round Culvert L= 27.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.00' / 91.45' S= 0.0574 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf |
| #2 | Device 1 | 93.15' | 2.0" Vert. Orifice/Grate C= 0.600 |
| #3 | Device 1 | 96.25' | 48.0" x 48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads |
| #4 | Primary | 96.40' | 30.0' 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 |
| #5 | Discarded | 92.67' | 2.410 in/hr Exfiltration over Surface area |

Discarded OutFlow Max=1.56 cfs @ 14.98 hrs HW=95.94' (Free Discharge)
 ↳ **5=Exfiltration** (Exfiltration Controls 1.56 cfs)

Primary OutFlow Max=0.17 cfs @ 14.98 hrs HW=95.94' TW=0.00' (Dynamic Tailwater)
 ↳ **1=Culvert** (Passes 0.17 cfs of 5.90 cfs potential flow)
 ↳ **2=Orifice/Grate** (Orifice Controls 0.17 cfs @ 7.92 fps)
 ↳ **3=Orifice/Grate** (Controls 0.00 cfs)
 ↳ **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond P3: Infiltration Basin

Inflow Area = 90,071 sf, 62.65% Impervious, Inflow Depth = 4.17" for 25-YEAR event
 Inflow = 10.00 cfs @ 12.09 hrs, Volume= 31,337 cf
 Outflow = 0.53 cfs @ 14.33 hrs, Volume= 31,340 cf, Atten= 95%, Lag= 134.8 min
 Discarded = 0.39 cfs @ 14.33 hrs, Volume= 26,230 cf
 Primary = 0.14 cfs @ 14.33 hrs, Volume= 5,111 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 99.72' @ 14.33 hrs Surf.Area= 7,042 sf Storage= 16,330 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 344.0 min (1,149.7 - 805.7)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|--------|---------------|--|
| #1 | 96.90' | 34,920 cf | Custom Stage Data (Conic) Listed below (Recalc) |

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Type III 24-hr 25-YEAR Rainfall=6.09"

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| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | Wet.Area (sq-ft) |
|------------------|-------------------|------------------------|------------------------|------------------|
| 96.90 | 4,600 | 0 | 0 | 4,600 |
| 97.00 | 4,680 | 464 | 464 | 4,684 |
| 98.00 | 5,499 | 5,084 | 5,548 | 5,541 |
| 99.00 | 6,374 | 5,931 | 11,479 | 6,457 |
| 100.00 | 7,306 | 6,835 | 18,314 | 7,434 |
| 101.00 | 8,294 | 7,795 | 26,109 | 8,471 |
| 102.00 | 9,339 | 8,811 | 34,920 | 9,567 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|---------|--|
| #1 | Primary | 97.90' | 12.0" Round RCP_Round 12" L= 22.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 97.90' / 97.80' S= 0.0045 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf |
| #2 | Device 1 | 101.80' | 48.0" x 48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads |
| #3 | Discarded | 96.90' | 2.410 in/hr Exfiltration over Surface area |
| #4 | Primary | 97.90' | 2.0" Vert. Low Flow Orifice C= 0.600 |

Discarded OutFlow Max=0.39 cfs @ 14.33 hrs HW=99.72' (Free Discharge)
 ↳ **3=Exfiltration** (Exfiltration Controls 0.39 cfs)

Primary OutFlow Max=0.14 cfs @ 14.33 hrs HW=99.72' TW=0.00' (Dynamic Tailwater)
 ↳ **1=RCP_Round 12"** (Passes 0.00 cfs of 4.09 cfs potential flow)
 ↳ **2=Orifice/Grate** (Controls 0.00 cfs)
 ↳ **4=Low Flow Orifice** (Orifice Controls 0.14 cfs @ 6.35 fps)

Summary for Pond P4: Infiltration Basin

Inflow Area = 142,335 sf, 62.41% Impervious, Inflow Depth = 4.17" for 25-YEAR event
 Inflow = 15.80 cfs @ 12.09 hrs, Volume= 49,520 cf
 Outflow = 3.73 cfs @ 12.49 hrs, Volume= 49,521 cf, Atten= 76%, Lag= 24.0 min
 Discarded = 0.55 cfs @ 12.49 hrs, Volume= 34,530 cf
 Primary = 3.18 cfs @ 12.49 hrs, Volume= 14,992 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 95.97' @ 12.49 hrs Surf.Area= 9,876 sf Storage= 20,448 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 232.3 min (1,038.0 - 805.7)

| Volume | Invert | Avail.Storage | Storage Description | | |
|------------------|-------------------|---------------|--|------------------------|------------------|
| #1 | 93.50' | 43,368 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) |
| 93.50 | 6,773 | 396.0 | 0 | 0 | 6,773 |
| 94.00 | 7,375 | 406.0 | 3,536 | 3,536 | 7,442 |
| 95.00 | 8,621 | 425.0 | 7,990 | 11,526 | 8,765 |
| 96.00 | 9,923 | 443.0 | 9,264 | 20,790 | 10,082 |
| 97.00 | 11,282 | 462.0 | 10,595 | 31,385 | 11,523 |
| 98.00 | 12,697 | 481.0 | 11,983 | 43,368 | 13,025 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|--|
| #1 | Primary | 94.50' | 12.0" Round Culvert L= 27.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 94.50' / 94.35' S= 0.0056 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf |
| #2 | Device 1 | 94.50' | 2.0" Vert. Orifice/Grate C= 0.600 |
| #3 | Device 1 | 95.50' | 36.0" W x 21.0" H Vert. Orifice/Grate C= 0.600 |
| #4 | Device 1 | 97.25' | 48.0" x 48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads |
| #5 | Primary | 97.50' | 30.0' 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 |
| #6 | Discarded | 93.50' | 2.410 in/hr Exfiltration over Surface area |

Discarded OutFlow Max=0.55 cfs @ 12.49 hrs HW=95.97' (Free Discharge)

6=Exfiltration (Exfiltration Controls 0.55 cfs)

Primary OutFlow Max=3.18 cfs @ 12.49 hrs HW=95.97' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 3.18 cfs of 3.23 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 0.12 cfs @ 5.66 fps)
- 3=Orifice/Grate (Orifice Controls 3.06 cfs @ 2.19 fps)
- 4=Orifice/Grate (Controls 0.00 cfs)
- 5=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond SF21: P2 Forebay

| Volume | Invert | Avail.Storage | Storage Description | | |
|------------------|-------------------|---------------|--|------------------------|------------------|
| #1 | 92.67' | 1,828 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) |
| 92.67 | 1,316 | 80.0 | 0 | 0 | 1,316 |
| 93.67 | 2,394 | 102.0 | 1,828 | 1,828 | 1,647 |

Summary for Pond SF31: P3 Forebay

| Volume | Invert | Avail.Storage | Storage Description | |
|------------------|-------------------|------------------------|--|--|
| #1 | 96.90' | 619 cf | Custom Stage Data (Prismatic) Listed below (Recalc) | |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | |
| 96.90 | 416 | 0 | 0 | |
| 97.90 | 822 | 619 | 619 | |

Summary for Pond SF41: P4 Forebay

| Volume | Invert | Avail.Storage | Storage Description | |
|--------|--------|---------------|--|--|
| #1 | 93.50' | 1,024 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) |
|---------------------|----------------------|------------------|---------------------------|---------------------------|---------------------|
| 93.50 | 520 | 78.0 | 0 | 0 | 520 |
| 94.80 | 1,091 | 100.0 | 1,024 | 1,024 | 852 |

Summary for Link DP1: Discharge Point 1

Inflow Area = 51,021 sf, 0.00% Impervious, Inflow Depth = 2.15" for 25-YEAR event
 Inflow = 2.43 cfs @ 12.15 hrs, Volume= 9,151 cf
 Primary = 2.43 cfs @ 12.15 hrs, Volume= 9,151 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP2: Discharge Point 2

Inflow Area = 68,794 sf, 0.00% Impervious, Inflow Depth = 0.47" for 25-YEAR event
 Inflow = 0.29 cfs @ 12.42 hrs, Volume= 2,703 cf
 Primary = 0.29 cfs @ 12.42 hrs, Volume= 2,703 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP3: Discharge Point 3

Inflow Area = 639,126 sf, 68.10% Impervious, Inflow Depth = 0.78" for 25-YEAR event
 Inflow = 5.68 cfs @ 12.44 hrs, Volume= 41,701 cf
 Primary = 5.68 cfs @ 12.44 hrs, Volume= 41,701 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Subcatchment PR-101: undisturbed area

Runoff = 4.90 cfs @ 12.15 hrs, Volume= 17,732 cf, Depth= 4.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-YEAR Rainfall=8.78"

| Area (sf) | CN | Description |
|-----------|----|--------------------------------|
| * 27,051 | 68 | Open Space - undisturbed |
| * 9,290 | 30 | Woods and Forest - undisturbed |
| * 14,680 | 72 | Dirt Road - undisturbed |
| 51,021 | 62 | Weighted Average |
| 51,021 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 9.8 | 50 | 0.0350 | 0.08 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 0.7 | 141 | 0.0455 | 3.43 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 10.5 | 191 | Total | | | |

Summary for Subcatchment PR-201: undisturbed area

Runoff = 1.69 cfs @ 12.19 hrs, Volume= 8,600 cf, Depth= 1.50"

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=8.78"

| Area (sf) | CN | Description |
|-----------|----|--------------------------|
| * 13,983 | 68 | Open space - HSG A |
| * 52,546 | 30 | Woods and Forest - HSG A |
| * 2,265 | 72 | Dirt Road - HSG A |
| 68,794 | 39 | Weighted Average |
| 68,794 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 9.7 | 50 | 0.0358 | 0.09 | | Sheet Flow, Woods: Light underbrush n= 0.400 P2= 3.23" |
| 1.6 | 156 | 0.0108 | 1.67 | | Shallow Concentrated Flow, Unpaved Kv= 16.1 fps |
| 11.3 | 206 | Total | | | |

Summary for Subcatchment PR-301: Grass area at limits of work

Runoff = 4.40 cfs @ 12.34 hrs, Volume= 22,201 cf, Depth= 5.02"

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=8.78"

| | Area (sf) | CN | Description |
|---|-----------|----|-----------------------|
| * | 46,391 | 68 | Open Space, HSG A |
| * | 6,462 | 79 | Open Space - HSG B |
| * | 218 | 89 | Open Space - HSG D |
| | 53,071 | 69 | Weighted Average |
| | 53,071 | | 100.00% Pervious Area |

| Tc (min) | Length (feet) | Slope (ft/ft) | Velocity (ft/sec) | Capacity (cfs) | Description |
|----------|---------------|---------------|-------------------|----------------|--|
| 0.5 | 36 | 0.0200 | 1.13 | | Sheet Flow, Smooth surfaces n= 0.011 P2= 3.23" |
| 2.7 | 14 | 0.0100 | 0.09 | | Sheet Flow, Grass: Short n= 0.150 P2= 3.23" |
| 15.3 | 676 | 0.0110 | 0.73 | | Shallow Concentrated Flow, Short Grass Pasture Kv= 7.0 fps |
| 6.4 | 210 | 0.0120 | 0.55 | | Shallow Concentrated Flow, Woodland Kv= 5.0 fps |
| 24.9 | 936 | Total | | | |

Summary for Subcatchment PR-302: Pervious Pave & Banked Parking

Runoff = 5.92 cfs @ 12.08 hrs, Volume= 20,033 cf, Depth= 7.82"

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=8.78"

| | Area (sf) | CN | Description |
|---|-----------|----|------------------------|
| | 24,753 | 98 | Paved parking, HSG A |
| * | 6,003 | 68 | Open Space, HSG A |
| | 30,756 | 92 | Weighted Average |
| | 6,003 | | 19.52% Pervious Area |
| | 24,753 | | 80.48% Impervious Area |

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

Summary for Subcatchment PR-303: Warehouse #1

Runoff = 21.32 cfs @ 12.08 hrs, Volume= 76,630 cf, Depth= 8.54"

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=8.78"

| | Area (sf) | CN | Description |
|--|-----------|----|-------------------------|
| | 107,680 | 98 | Roofs, HSG A |
| | 107,680 | | 100.00% Impervious Area |

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

Summary for Subcatchment PR-304: Pavement Area

Runoff = 41.11 cfs @ 12.08 hrs, Volume= 138,012 cf, Depth= 7.70"

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=8.78"

| | Area (sf) | CN | Description |
|---|-----------|----|------------------------|
| * | 45,292 | 68 | Open Space - HSG A |
| * | 157,576 | 98 | Paved parking - HSG A |
| * | 12,345 | 79 | Open Space - HSG B |
| | 215,213 | 91 | Weighted Average |
| | 57,637 | | 26.78% Pervious Area |
| | 157,576 | | 73.22% Impervious Area |

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

Summary for Subcatchment PR-305: Pavement, Roof, and Undisturbed

Runoff = 24.93 cfs @ 12.09 hrs, Volume= 79,765 cf, Depth= 6.72"

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=8.78"

| | Area (sf) | CN | Description |
|---|-----------|----|--|
| * | 88,827 | 98 | Impervious - HSG A |
| * | 33,775 | 68 | Open Space - HSG A |
| * | 13,112 | 30 | Woods and Forest - HSG A - undisturbed |
| * | 6,447 | 68 | Open Space - HSG A - undisturbed |
| * | 174 | 72 | Dirt Road - HSG A - undisturbed |
| | 142,335 | 83 | Weighted Average |
| | 53,508 | | 37.59% Pervious Area |
| | 88,827 | | 62.41% Impervious Area |

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

Summary for Subcatchment PR-306: Access Road and Parking

Runoff = 15.78 cfs @ 12.09 hrs, Volume= 50,476 cf, Depth= 6.72"

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=8.78"

| | Area (sf) | CN | Description |
|---|-----------|----|--|
| * | 56,428 | 98 | Impervious - HSG A |
| * | 19,094 | 77 | Open Space - HSG A |
| * | 14,549 | 30 | Woods and Forest - HSG A - undisturbed |
| | 90,071 | 83 | Weighted Average |
| | 33,643 | | 37.35% Pervious Area |
| | 56,428 | | 62.65% Impervious Area |

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

Summary for Pond P1: Pervious Pavement

Inflow Area = 30,756 sf, 80.48% Impervious, Inflow Depth = 7.82" for 100-YEAR event
 Inflow = 5.92 cfs @ 12.08 hrs, Volume= 20,033 cf
 Outflow = 1.00 cfs @ 11.79 hrs, Volume= 20,036 cf, Atten= 83%, Lag= 0.0 min
 Discarded = 1.00 cfs @ 11.79 hrs, Volume= 20,036 cf
 Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 96.47' @ 12.54 hrs Surf.Area= 18,000 sf Storage= 5,198 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 27.9 min (794.5 - 766.7)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|--------|---------------|---|
| #1 | 95.75' | 16,200 cf | 24.00'W x 750.00'L x 2.25'H Prismatic 40,500 cf Overall x 40.0% Voids |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|---|
| #1 | Primary | 97.90' | 750.0' long Sharp-Crested Vee/Trap Weir Cv= 2.62 (C= 3.28) |
| #2 | Discarded | 95.75' | 2.410 in/hr Exfiltration over Surface area |

Discarded OutFlow Max=1.00 cfs @ 11.79 hrs HW=95.78' (Free Discharge)
 ↖**2=Exfiltration** (Exfiltration Controls 1.00 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=95.75' TW=0.00' (Dynamic Tailwater)
 ↖**1=Sharp-Crested Vee/Trap Weir** (Controls 0.00 cfs)

Summary for Pond P2: Infiltration Basin

Inflow Area = 322,893 sf, 82.15% Impervious, Inflow Depth = 7.98" for 100-YEAR event
 Inflow = 62.42 cfs @ 12.08 hrs, Volume= 214,642 cf
 Outflow = 16.16 cfs @ 12.44 hrs, Volume= 214,658 cf, Atten= 74%, Lag= 21.6 min
 Discarded = 1.67 cfs @ 12.44 hrs, Volume= 158,659 cf
 Primary = 14.49 cfs @ 12.44 hrs, Volume= 55,998 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 96.62' @ 12.44 hrs Surf.Area= 29,882 sf Storage= 97,451 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 394.7 min (1,154.1 - 759.3)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|--------|---------------|--|
| #1 | 92.67' | 108,964 cf | Custom Stage Data (Irregular) Listed below (Recalc) |

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Type III 24-hr 100-YEAR Rainfall=8.78"

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| Elevation (feet) | Surf.Area (sq-ft) | Perim. (feet) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | Wet.Area (sq-ft) |
|------------------|-------------------|---------------|------------------------|------------------------|------------------|
| 92.67 | 19,632 | 822.0 | 0 | 0 | 19,632 |
| 93.00 | 20,458 | 829.0 | 6,614 | 6,614 | 20,591 |
| 94.00 | 22,973 | 847.0 | 21,703 | 28,318 | 23,134 |
| 95.00 | 25,545 | 866.0 | 24,248 | 52,565 | 25,862 |
| 96.00 | 28,174 | 885.0 | 26,849 | 79,414 | 28,650 |
| 97.00 | 30,947 | 904.0 | 29,550 | 108,964 | 31,499 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|--|
| #1 | Primary | 93.00' | 12.0" Round Culvert L= 27.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.00' / 91.45' S= 0.0574 ' / Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf |
| #2 | Device 1 | 93.15' | 2.0" Vert. Orifice/Grate C= 0.600 |
| #3 | Device 1 | 96.25' | 48.0" x 48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads |
| #4 | Primary | 96.40' | 30.0' 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 |
| #5 | Discarded | 92.67' | 2.410 in/hr Exfiltration over Surface area |

Discarded OutFlow Max=1.67 cfs @ 12.44 hrs HW=96.62' (Free Discharge)
 ↳ **5=Exfiltration** (Exfiltration Controls 1.67 cfs)

Primary OutFlow Max=14.49 cfs @ 12.44 hrs HW=96.62' TW=0.00' (Dynamic Tailwater)
 ↳ **1=Culvert** (Inlet Controls 6.68 cfs @ 8.51 fps)
 ↳ **2=Orifice/Grate** (Passes < 0.19 cfs potential flow)
 ↳ **3=Orifice/Grate** (Passes < 11.84 cfs potential flow)
 ↳ **4=Broad-Crested Rectangular Weir** (Weir Controls 7.80 cfs @ 1.18 fps)

Summary for Pond P3: Infiltration Basin

Inflow Area = 90,071 sf, 62.65% Impervious, Inflow Depth = 6.72" for 100-YEAR event
 Inflow = 15.78 cfs @ 12.09 hrs, Volume= 50,476 cf
 Outflow = 0.68 cfs @ 14.97 hrs, Volume= 50,476 cf, Atten= 96%, Lag= 172.8 min
 Discarded = 0.48 cfs @ 14.97 hrs, Volume= 39,965 cf
 Primary = 0.19 cfs @ 14.97 hrs, Volume= 10,511 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 101.37' @ 14.97 hrs Surf.Area= 8,672 sf Storage= 29,233 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 489.1 min (1,281.4 - 792.4)

| Volume | Invert | Avail.Storage | Storage Description |
|--------|--------|---------------|--|
| #1 | 96.90' | 34,920 cf | Custom Stage Data (Conic) Listed below (Recalc) |

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Type III 24-hr 100-YEAR Rainfall=8.78"

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| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | Wet.Area (sq-ft) |
|------------------|-------------------|------------------------|------------------------|------------------|
| 96.90 | 4,600 | 0 | 0 | 4,600 |
| 97.00 | 4,680 | 464 | 464 | 4,684 |
| 98.00 | 5,499 | 5,084 | 5,548 | 5,541 |
| 99.00 | 6,374 | 5,931 | 11,479 | 6,457 |
| 100.00 | 7,306 | 6,835 | 18,314 | 7,434 |
| 101.00 | 8,294 | 7,795 | 26,109 | 8,471 |
| 102.00 | 9,339 | 8,811 | 34,920 | 9,567 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|---------|--|
| #1 | Primary | 97.90' | 12.0" Round RCP_Round 12" L= 22.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 97.90' / 97.80' S= 0.0045 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf |
| #2 | Device 1 | 101.80' | 48.0" x 48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads |
| #3 | Discarded | 96.90' | 2.410 in/hr Exfiltration over Surface area |
| #4 | Primary | 97.90' | 2.0" Vert. Low Flow Orifice C= 0.600 |

Discarded OutFlow Max=0.48 cfs @ 14.97 hrs HW=101.37' (Free Discharge)
 ↳ **3=Exfiltration** (Exfiltration Controls 0.48 cfs)

Primary OutFlow Max=0.19 cfs @ 14.97 hrs HW=101.37' TW=0.00' (Dynamic Tailwater)
 ↳ **1=RCP_Round 12"** (Passes 0.00 cfs of 6.52 cfs potential flow)
 ↳ **2=Orifice/Grate** (Controls 0.00 cfs)
 ↳ **4=Low Flow Orifice** (Orifice Controls 0.19 cfs @ 8.86 fps)

Summary for Pond P4: Infiltration Basin

Inflow Area = 142,335 sf, 62.41% Impervious, Inflow Depth = 6.72" for 100-YEAR event
 Inflow = 24.93 cfs @ 12.09 hrs, Volume= 79,765 cf
 Outflow = 6.04 cfs @ 12.47 hrs, Volume= 79,768 cf, Atten= 76%, Lag= 23.2 min
 Discarded = 0.64 cfs @ 12.47 hrs, Volume= 40,241 cf
 Primary = 5.41 cfs @ 12.47 hrs, Volume= 39,526 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 3
 Peak Elev= 97.08' @ 12.47 hrs Surf.Area= 11,390 sf Storage= 32,278 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 185.2 min (977.6 - 792.4)

| Volume | Invert | Avail.Storage | Storage Description | | |
|------------------|-------------------|---------------|--|------------------------|------------------|
| #1 | 93.50' | 43,368 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) |
| 93.50 | 6,773 | 396.0 | 0 | 0 | 6,773 |
| 94.00 | 7,375 | 406.0 | 3,536 | 3,536 | 7,442 |
| 95.00 | 8,621 | 425.0 | 7,990 | 11,526 | 8,765 |
| 96.00 | 9,923 | 443.0 | 9,264 | 20,790 | 10,082 |
| 97.00 | 11,282 | 462.0 | 10,595 | 31,385 | 11,523 |
| 98.00 | 12,697 | 481.0 | 11,983 | 43,368 | 13,025 |

| Device | Routing | Invert | Outlet Devices |
|--------|-----------|--------|--|
| #1 | Primary | 94.50' | 12.0" Round Culvert L= 27.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 94.50' / 94.35' S= 0.0056 '/' Cc= 0.900 n= 0.013 Concrete pipe, bends & connections, Flow Area= 0.79 sf |
| #2 | Device 1 | 94.50' | 2.0" Vert. Orifice/Grate C= 0.600 |
| #3 | Device 1 | 95.50' | 36.0" W x 21.0" H Vert. Orifice/Grate C= 0.600 |
| #4 | Device 1 | 97.25' | 48.0" x 48.0" Horiz. Orifice/Grate C= 0.600 Limited to weir flow at low heads |
| #5 | Primary | 97.50' | 30.0' 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 |
| #6 | Discarded | 93.50' | 2.410 in/hr Exfiltration over Surface area |

Discarded OutFlow Max=0.64 cfs @ 12.47 hrs HW=97.08' (Free Discharge)

↳ **6=Exfiltration** (Exfiltration Controls 0.64 cfs)

Primary OutFlow Max=5.41 cfs @ 12.47 hrs HW=97.08' TW=0.00' (Dynamic Tailwater)

- ↳ **1=Culvert** (Barrel Controls 5.41 cfs @ 6.89 fps)
- ↳ **2=Orifice/Grate** (Passes < 0.17 cfs potential flow)
- ↳ **3=Orifice/Grate** (Passes < 19.10 cfs potential flow)
- ↳ **4=Orifice/Grate** (Controls 0.00 cfs)
- ↳ **5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond SF21: P2 Forebay

| Volume | Invert | Avail.Storage | Storage Description | | |
|------------------|-------------------|---------------|--|------------------------|------------------|
| #1 | 92.67' | 1,828 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) |
| 92.67 | 1,316 | 80.0 | 0 | 0 | 1,316 |
| 93.67 | 2,394 | 102.0 | 1,828 | 1,828 | 1,647 |

Summary for Pond SF31: P3 Forebay

| Volume | Invert | Avail.Storage | Storage Description | |
|------------------|-------------------|------------------------|--|--|
| #1 | 96.90' | 619 cf | Custom Stage Data (Prismatic) Listed below (Recalc) | |
| Elevation (feet) | Surf.Area (sq-ft) | Inc.Store (cubic-feet) | Cum.Store (cubic-feet) | |
| 96.90 | 416 | 0 | 0 | |
| 97.90 | 822 | 619 | 619 | |

Summary for Pond SF41: P4 Forebay

| Volume | Invert | Avail.Storage | Storage Description | |
|--------|--------|---------------|--|--|
| #1 | 93.50' | 1,024 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) |
|---------------------|----------------------|------------------|---------------------------|---------------------------|---------------------|
| 93.50 | 520 | 78.0 | 0 | 0 | 520 |
| 94.80 | 1,091 | 100.0 | 1,024 | 1,024 | 852 |

Summary for Link DP1: Discharge Point 1

Inflow Area = 51,021 sf, 0.00% Impervious, Inflow Depth = 4.17" for 100-YEAR event
 Inflow = 4.90 cfs @ 12.15 hrs, Volume= 17,732 cf
 Primary = 4.90 cfs @ 12.15 hrs, Volume= 17,732 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP2: Discharge Point 2

Inflow Area = 68,794 sf, 0.00% Impervious, Inflow Depth = 1.50" for 100-YEAR event
 Inflow = 1.69 cfs @ 12.19 hrs, Volume= 8,600 cf
 Primary = 1.69 cfs @ 12.19 hrs, Volume= 8,600 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Link DP3: Discharge Point 3

Inflow Area = 639,126 sf, 68.10% Impervious, Inflow Depth = 2.41" for 100-YEAR event
 Inflow = 24.18 cfs @ 12.43 hrs, Volume= 128,236 cf
 Primary = 24.18 cfs @ 12.43 hrs, Volume= 128,236 cf, Atten= 0%, Lag= 0.0 min

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

Storm Drainage Computations

Name Burt Road Development
 Client MCP/Howland Burt Owner, LLC
 Subject Proposed Conditions

Proj. No. T1126
 Date 8/24/2022
 Comp. Definitive
 Check

Design Parameters
10 Year Storm
12" Min. Pipe Size
 Project File:

Location in Massachusetts

1 (1-Boston, 2-Barnstable, 3-Worcester, 4-Springfield, 5-Pittsfield)

Manning's roughness coefficient

0.013

(NOTE ENTER CELLS AS HIGHLIGHTED IN FIRST ROW)

ENGLISH

Rainfall Data is For Boston

| LOCATION FROM DRAINAGE NO. | TO DRAINAGE NO. | RAINFALL CONCENTRATION PERIOD IN MINUTES | | COMBINED RUNOFF COEFF. | TRIBUTARY AREA IN ACRES | | C X A | | RAINFALL INTENSIT (i) | PEAK FLOW | PIPE | | | | | | PROFILE | | | | Qf/Qd | | |
|----------------------------|-----------------|--|-------|------------------------|-------------------------|-------|-------|-------|-----------------------|-----------|-------|-------|---------|---------|-------------|-----------|------------------|--------------------|----------------------|-----------|--------|------------------|-------------|
| | | PIPE | TOTAL | | INC | TOTAL | INC | TOTAL | | | IN/HR | CFS | SIZE IN | n VALUE | SLOPE FT/FT | LENGTH FT | FULL CAPACIT CFS | FULL VELOCITY FT/S | PEAK FLOW CONDITIONS | | | INVERT ELEVATION | |
| | | | | VELOCITY FT/S | | | | | d/D | UPPER END | | | | | | | | | LOWER END | UPPER RIM | | DEPTH | |
| DCB 1 | DMH 3 | | 5.00 | 0.90 | 0.500 | 0.500 | 0.45 | 0.45 | 5.40 | 2.43 | 12 | 0.013 | 0.005 | 200 | 2.52 | 3.2 | 3.6 | 0.78 | 96.42 | 95.42 | 100.25 | 2.83 | 0.964902947 |
| RD 1 | DMH 3 | | 5.00 | 0.90 | 1.580 | 1.580 | 1.42 | 1.42 | 5.40 | 7.68 | 18 | 0.013 | 0.014 | 44 | 12.26 | 6.9 | 7.3 | 0.57 | 98.00 | 97.40 | 102.00 | 2.50 | 0.626224046 |
| CB 2 | DMH 3 | | 5.00 | 0.90 | 0.310 | 0.310 | 0.28 | 0.28 | 5.40 | 1.51 | 12 | 0.013 | 0.010 | 18 | 3.61 | 4.6 | 4.4 | 0.45 | 95.60 | 95.42 | 100.32 | 3.72 | 0.417102791 |
| DMH 3 | DMH 5 | 0.07 | 5.91 | | | 2.390 | 0.00 | 2.15 | 5.40 | 11.62 | 24 | 0.013 | 0.005 | 194 | 16.01 | 5.1 | 5.5 | 0.63 | 95.32 | 94.35 | 100.66 | 3.34 | 0.725632433 |
| CB 4 | DMH 5 | | 5.00 | 0.90 | 0.480 | 0.480 | 0.43 | 0.43 | 5.40 | 2.33 | 12 | 0.013 | 0.005 | 28 | 2.54 | 3.2 | 3.7 | 0.75 | 94.49 | 94.35 | 98.00 | 2.51 | 0.917998977 |
| DMH 5 | DMH 8 | | 6.50 | | | 2.870 | 0.00 | 2.58 | 5.20 | 13.43 | 24 | 0.013 | 0.005 | 187 | 16.02 | 5.1 | 5.7 | 0.70 | 94.25 | 93.31 | 98.62 | 2.37 | 0.838416875 |
| TD-1 | DMH 8 | | 5.00 | 0.90 | 0.320 | 0.320 | 0.29 | 0.29 | 5.40 | 1.56 | 12 | 0.013 | 0.005 | 97 | 2.61 | 3.3 | 3.5 | 0.55 | 93.83 | 93.31 | 98.00 | 3.17 | 0.595624322 |
| DCB 7 | DMH 8 | | 5.00 | 0.90 | 0.480 | 0.480 | 0.43 | 0.43 | 5.40 | 2.33 | 12 | 0.013 | 0.005 | 54 | 2.52 | 3.2 | 3.6 | 0.76 | 93.58 | 93.31 | 97.15 | 2.57 | 0.926306829 |
| DMH 8 | FES | 0.25 | 7.04 | | | 3.670 | 0.00 | 3.30 | 5.00 | 16.52 | 30 | 0.013 | 0.005 | 108 | 29.02 | 5.9 | 6.1 | 0.54 | 93.21 | 92.67 | 98.70 | 2.99 | 0.569088859 |
| RD 2 | FES | | 5.00 | 0.90 | 2.250 | 2.250 | 2.03 | 2.03 | 5.40 | 10.94 | 18 | 0.013 | 0.053 | 82 | 24.09 | 13.6 | 13.3 | 0.47 | 97.00 | 92.67 | 101.50 | 3.00 | 0.453977199 |
| CB 9 | DMH 11 | | 5.00 | 0.90 | 0.200 | 0.200 | 0.18 | 0.18 | 5.40 | 0.97 | 12 | 0.013 | 0.005 | 90 | 2.52 | 3.2 | 3.0 | 0.43 | 96.29 | 95.84 | 100.42 | 3.13 | 0.385102532 |
| CB 10 | DMH 11 | | 5.00 | 0.90 | 0.380 | 0.380 | 0.34 | 0.34 | 5.40 | 1.85 | 12 | 0.013 | 0.005 | 110 | 2.51 | 3.2 | 3.5 | 0.63 | 96.39 | 95.84 | 101.00 | 3.61 | 0.73465835 |
| DMH 11 | DMH 14 | 0.53 | 5.53 | | | 0.580 | 0.00 | 0.52 | 5.40 | 2.82 | 18 | 0.013 | 0.005 | 165 | 7.44 | 4.2 | 3.9 | 0.42 | 95.74 | 94.91 | 101.94 | 4.70 | 0.378947145 |
| DCB 12 | DMH 14 | | 5.00 | 0.90 | 0.600 | 0.600 | 0.54 | 0.54 | 5.40 | 2.92 | 12 | 0.013 | 0.005 | 52 | 2.51 | 3.2 | 3.7 | 1.00 | 95.17 | 94.91 | 98.30 | 2.13 | 1.160663573 |
| DCB 13 | DMH 14 | | 5.00 | 0.90 | 0.470 | 0.470 | 0.42 | 0.42 | 5.40 | 2.28 | 12 | 0.013 | 0.005 | 88 | 2.50 | 3.2 | 3.6 | 0.75 | 95.34 | 94.91 | 99.74 | 3.40 | 0.914884537 |
| DMH 14 | DMH 17 | 0.40 | 6.24 | | | 1.650 | 0.00 | 1.49 | 5.20 | 7.72 | 24 | 0.013 | 0.005 | 215 | 16.02 | 5.1 | 5.0 | 0.48 | 94.81 | 93.73 | 98.90 | 2.09 | 0.482008569 |
| CB 15 | DMH 17 | | 5.00 | 0.90 | 0.330 | 0.330 | 0.30 | 0.30 | 5.40 | 1.60 | 12 | 0.013 | 0.010 | 46 | 3.58 | 4.6 | 4.4 | 0.46 | 93.19 | 92.73 | 98.30 | 4.11 | 0.448127587 |
| CB 16 | DMH 17 | | 5.00 | 0.90 | 0.280 | 0.280 | 0.25 | 0.25 | 5.40 | 1.36 | 12 | 0.013 | 0.010 | 43 | 3.55 | 4.5 | 4.2 | 0.42 | 94.16 | 93.73 | 98.99 | 3.83 | 0.3835454 |
| DMH 17 | FES | | 6.96 | | | 2.260 | 0.00 | 2.03 | 5.20 | 10.58 | 24 | 0.013 | 0.005 | 25 | 16.23 | 5.2 | 5.5 | 0.58 | 93.63 | 93.50 | 98.99 | 3.36 | 0.6515638 |
| DCB 20 | FES | | 5.00 | 0.90 | 0.580 | 0.580 | 0.52 | 0.52 | 5.40 | 2.82 | 12 | 0.013 | 0.005 | 132 | 2.52 | 3.2 | 3.6 | 1.00 | 97.56 | 96.90 | 100.85 | 2.29 | 1.119287418 |
| DMH 40 | DMH 19 | | 5.00 | 0.90 | 0.330 | 0.330 | 0.30 | 0.30 | 5.40 | 1.60 | 12 | 0.013 | 0.011 | 146 | 3.67 | 4.7 | 4.5 | 0.46 | 99.15 | 97.60 | 102.93 | 2.78 | 0.437041974 |
| CB 18 | DMH 19 | | 5.00 | 0.90 | 0.230 | 0.230 | 0.21 | 0.21 | 5.40 | 1.12 | 12 | 0.013 | 0.005 | 21 | 2.49 | 3.2 | 3.1 | 0.46 | 97.70 | 97.60 | 101.14 | 2.44 | 0.449369298 |
| DMH 19 | FES | 0.11 | 5.54 | | | 0.560 | 0.00 | 0.50 | 5.40 | 2.72 | 12 | 0.013 | 0.010 | 61 | 3.53 | 4.5 | 4.9 | 0.65 | 97.50 | 96.90 | 101.58 | 3.08 | 0.770379544 |

B

Water Quality Data

Location: Treatment Train #1

| A BMP ¹ | B TSS Removal Rate ¹ | 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 |
| Infiltration Basin (w/ Sediment Forebay) | 0.80 | 0.75 | 0.60 | 0.15 |
| | | | | |
| | | | | |

**TSS Removal
Calculation
Worksheet**

Total TSS Removal = 85%

Project: Burtt Road
 Prepared By: TEC, Inc.
 Date: 2/27/2020

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

Location: Treatment Train #2

| A BMP ¹ | B TSS Removal Rate ¹ | C Starting TSS Load* | D Amount Removed (B*C) | E Remaining Load (C-D) |
|---|---------------------------------------|----------------------------|------------------------------|------------------------------|
| Infiltration Basin (w/ Sediment Forebay) | 0.80 | 1.00 | 0.80 | 0.20 |
| | | | | |
| | | | | |
| | | | | |

**TSS Removal
Calculation
Worksheet**

Total TSS Removal = 80%

Project: Burtt Road
Prepared By: TEC, Inc.
Date: 2/27/2020

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

Location: Treatment Train #3

| A BMP ¹ | B TSS Removal Rate ¹ | C Starting TSS Load* | D Amount Removed (B*C) | E Remaining Load (C-D) |
|-----------------------|---------------------------------------|----------------------------|------------------------------|------------------------------|
| Pervious Pavement | 0.80 | 1.00 | 0.80 | 0.20 |
| | | | | |
| | | | | |
| | | | | |

**TSS Removal
Calculation
Worksheet**

Total TSS Removal = 80%

Project: Burt Road
Prepared By: TEC, Inc.
Date: 2/27/2020

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

Stage-Area-Storage for Pond P1: Pervious Pavement

| Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) | Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) |
|---------------------|--------------------|-------------------------|---------------------|--------------------|-------------------------|
| 95.75 | 18,000 | 0 | 96.33 | 18,000 | 4,176 |
| 95.76 | 18,000 | 72 | 96.34 | 18,000 | 4,248 |
| 95.77 | 18,000 | 144 | 96.35 | 18,000 | 4,320 |
| 95.78 | 18,000 | 216 | 96.36 | 18,000 | 4,392 |
| 95.79 | 18,000 | 288 | 96.37 | 18,000 | 4,464 |
| 95.80 | 18,000 | 360 | 96.38 | 18,000 | 4,536 |
| 95.81 | 18,000 | 432 | 96.39 | 18,000 | 4,608 |
| 95.82 | 18,000 | 504 | 96.40 | 18,000 | 4,680 |
| 95.83 | 18,000 | 576 | 96.41 | 18,000 | 4,752 |
| 95.84 | 18,000 | 648 | 96.42 | 18,000 | 4,824 |
| 95.85 | 18,000 | 720 | 96.43 | 18,000 | 4,896 |
| 95.86 | 18,000 | 792 | 96.44 | 18,000 | 4,968 |
| 95.87 | 18,000 | 864 | 96.45 | 18,000 | 5,040 |
| 95.88 | 18,000 | 936 | 96.46 | 18,000 | 5,112 |
| 95.89 | 18,000 | 1,008 | 96.47 | 18,000 | 5,184 |
| 95.90 | 18,000 | 1,080 | 96.48 | 18,000 | 5,256 |
| 95.91 | 18,000 | 1,152 | 96.49 | 18,000 | 5,328 |
| 95.92 | 18,000 | 1,224 | 96.50 | 18,000 | 5,400 |
| 95.93 | 18,000 | 1,296 | 96.51 | 18,000 | 5,472 |
| 95.94 | 18,000 | 1,368 | 96.52 | 18,000 | 5,544 |
| 95.95 | 18,000 | 1,440 | 96.53 | 18,000 | 5,616 |
| 95.96 | 18,000 | 1,512 | 96.54 | 18,000 | 5,688 |
| 95.97 | 18,000 | 1,584 | 96.55 | 18,000 | 5,760 |
| 95.98 | 18,000 | 1,656 | 96.56 | 18,000 | 5,832 |
| 95.99 | 18,000 | 1,728 | 96.57 | 18,000 | 5,904 |
| 96.00 | 18,000 | 1,800 | 96.58 | 18,000 | 5,976 |
| 96.01 | 18,000 | 1,872 | 96.59 | 18,000 | 6,048 |
| 96.02 | 18,000 | 1,944 | 96.60 | 18,000 | 6,120 |
| 96.03 | 18,000 | 2,016 | 96.61 | 18,000 | 6,192 |
| 96.04 | 18,000 | 2,088 | 96.62 | 18,000 | 6,264 |
| 96.05 | 18,000 | 2,160 | 96.63 | 18,000 | 6,336 |
| 96.06 | 18,000 | 2,232 | 96.64 | 18,000 | 6,408 |
| 96.07 | 18,000 | 2,304 | 96.65 | 18,000 | 6,480 |
| 96.08 | 18,000 | 2,376 | 96.66 | 18,000 | 6,552 |
| 96.09 | 18,000 | 2,448 | 96.67 | 18,000 | 6,624 |
| 96.10 | 18,000 | 2,520 | 96.68 | 18,000 | 6,696 |
| 96.11 | 18,000 | 2,592 | 96.69 | 18,000 | 6,768 |
| 96.12 | 18,000 | 2,664 | 96.70 | 18,000 | 6,840 |
| 96.13 | 18,000 | 2,736 | 96.71 | 18,000 | 6,912 |
| 96.14 | 18,000 | 2,808 | 96.72 | 18,000 | 6,984 |
| 96.15 | 18,000 | 2,880 | 96.73 | 18,000 | 7,056 |
| 96.16 | 18,000 | 2,952 | 96.74 | 18,000 | 7,128 |
| 96.17 | 18,000 | 3,024 | 96.75 | 18,000 | 7,200 |
| 96.18 | 18,000 | 3,096 | 96.76 | 18,000 | 7,272 |
| 96.19 | 18,000 | 3,168 | 96.77 | 18,000 | 7,344 |
| 96.20 | 18,000 | 3,240 | 96.78 | 18,000 | 7,416 |
| 96.21 | 18,000 | 3,312 | 96.79 | 18,000 | 7,488 |
| 96.22 | 18,000 | 3,384 | 96.80 | 18,000 | 7,560 |
| 96.23 | 18,000 | 3,456 | 96.81 | 18,000 | 7,632 |
| 96.24 | 18,000 | 3,528 | 96.82 | 18,000 | 7,704 |
| 96.25 | 18,000 | 3,600 | 96.83 | 18,000 | 7,776 |
| 96.26 | 18,000 | 3,672 | 96.84 | 18,000 | 7,848 |
| 96.27 | 18,000 | 3,744 | 96.85 | 18,000 | 7,920 |
| 96.28 | 18,000 | 3,816 | 96.86 | 18,000 | 7,992 |
| 96.29 | 18,000 | 3,888 | 96.87 | 18,000 | 8,064 |
| 96.30 | 18,000 | 3,960 | 96.88 | 18,000 | 8,136 |
| 96.31 | 18,000 | 4,032 | 96.89 | 18,000 | 8,208 |
| 96.32 | 18,000 | 4,104 | 96.90 | 18,000 | 8,280 |

Stage-Area-Storage for Pond P1: Pervious Pavement (continued)

| Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) | Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) |
|---------------------|--------------------|-------------------------|---------------------|--------------------|-------------------------|
| 96.91 | 18,000 | 8,352 | 97.49 | 18,000 | 12,528 |
| 96.92 | 18,000 | 8,424 | 97.50 | 18,000 | 12,600 |
| 96.93 | 18,000 | 8,496 | 97.51 | 18,000 | 12,672 |
| 96.94 | 18,000 | 8,568 | 97.52 | 18,000 | 12,744 |
| 96.95 | 18,000 | 8,640 | 97.53 | 18,000 | 12,816 |
| 96.96 | 18,000 | 8,712 | 97.54 | 18,000 | 12,888 |
| 96.97 | 18,000 | 8,784 | 97.55 | 18,000 | 12,960 |
| 96.98 | 18,000 | 8,856 | 97.56 | 18,000 | 13,032 |
| 96.99 | 18,000 | 8,928 | 97.57 | 18,000 | 13,104 |
| 97.00 | 18,000 | 9,000 | 97.58 | 18,000 | 13,176 |
| 97.01 | 18,000 | 9,072 | 97.59 | 18,000 | 13,248 |
| 97.02 | 18,000 | 9,144 | 97.60 | 18,000 | 13,320 |
| 97.03 | 18,000 | 9,216 | 97.61 | 18,000 | 13,392 |
| 97.04 | 18,000 | 9,288 | 97.62 | 18,000 | 13,464 |
| 97.05 | 18,000 | 9,360 | 97.63 | 18,000 | 13,536 |
| 97.06 | 18,000 | 9,432 | 97.64 | 18,000 | 13,608 |
| 97.07 | 18,000 | 9,504 | 97.65 | 18,000 | 13,680 |
| 97.08 | 18,000 | 9,576 | 97.66 | 18,000 | 13,752 |
| 97.09 | 18,000 | 9,648 | 97.67 | 18,000 | 13,824 |
| 97.10 | 18,000 | 9,720 | 97.68 | 18,000 | 13,896 |
| 97.11 | 18,000 | 9,792 | 97.69 | 18,000 | 13,968 |
| 97.12 | 18,000 | 9,864 | 97.70 | 18,000 | 14,040 |
| 97.13 | 18,000 | 9,936 | 97.71 | 18,000 | 14,112 |
| 97.14 | 18,000 | 10,008 | 97.72 | 18,000 | 14,184 |
| 97.15 | 18,000 | 10,080 | 97.73 | 18,000 | 14,256 |
| 97.16 | 18,000 | 10,152 | 97.74 | 18,000 | 14,328 |
| 97.17 | 18,000 | 10,224 | 97.75 | 18,000 | 14,400 |
| 97.18 | 18,000 | 10,296 | 97.76 | 18,000 | 14,472 |
| 97.19 | 18,000 | 10,368 | 97.77 | 18,000 | 14,544 |
| 97.20 | 18,000 | 10,440 | 97.78 | 18,000 | 14,616 |
| 97.21 | 18,000 | 10,512 | 97.79 | 18,000 | 14,688 |
| 97.22 | 18,000 | 10,584 | 97.80 | 18,000 | 14,760 |
| 97.23 | 18,000 | 10,656 | 97.81 | 18,000 | 14,832 |
| 97.24 | 18,000 | 10,728 | 97.82 | 18,000 | 14,904 |
| 97.25 | 18,000 | 10,800 | 97.83 | 18,000 | 14,976 |
| 97.26 | 18,000 | 10,872 | 97.84 | 18,000 | 15,048 |
| 97.27 | 18,000 | 10,944 | 97.85 | 18,000 | 15,120 |
| 97.28 | 18,000 | 11,016 | 97.86 | 18,000 | 15,192 |
| 97.29 | 18,000 | 11,088 | 97.87 | 18,000 | 15,264 |
| 97.30 | 18,000 | 11,160 | 97.88 | 18,000 | 15,336 |
| 97.31 | 18,000 | 11,232 | 97.89 | 18,000 | 15,408 |
| 97.32 | 18,000 | 11,304 | 97.90 | 18,000 | 15,480 |
| 97.33 | 18,000 | 11,376 | 97.91 | 18,000 | 15,552 |
| 97.34 | 18,000 | 11,448 | 97.92 | 18,000 | 15,624 |
| 97.35 | 18,000 | 11,520 | 97.93 | 18,000 | 15,696 |
| 97.36 | 18,000 | 11,592 | 97.94 | 18,000 | 15,768 |
| 97.37 | 18,000 | 11,664 | 97.95 | 18,000 | 15,840 |
| 97.38 | 18,000 | 11,736 | 97.96 | 18,000 | 15,912 |
| 97.39 | 18,000 | 11,808 | 97.97 | 18,000 | 15,984 |
| 97.40 | 18,000 | 11,880 | 97.98 | 18,000 | 16,056 |
| 97.41 | 18,000 | 11,952 | 97.99 | 18,000 | 16,128 |
| 97.42 | 18,000 | 12,024 | 98.00 | 18,000 | 16,200 |
| 97.43 | 18,000 | 12,096 | | | |
| 97.44 | 18,000 | 12,168 | | | |
| 97.45 | 18,000 | 12,240 | | | |
| 97.46 | 18,000 | 12,312 | | | |
| 97.47 | 18,000 | 12,384 | | | |
| 97.48 | 18,000 | 12,456 | | | |

Lowest Outlet

Stage-Area-Storage for Pond P2: Infiltration Basin

| Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) | Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) |
|----------------------------|--------------------|-------------------------|---------------------|--------------------|-------------------------|
| 92.67 | 19,632 | 0 | 93.25 | 21,073 | 11,806 |
| 92.68 | 19,657 | 196 | 93.26 | 21,098 | 12,016 |
| 92.69 | 19,682 | 393 | 93.27 | 21,123 | 12,228 |
| 92.70 | 19,706 | 590 | 93.28 | 21,148 | 12,439 |
| 92.71 | 19,731 | 787 | 93.29 | 21,172 | 12,650 |
| 92.72 | 19,756 | 985 | 93.30 | 21,197 | 12,862 |
| 92.73 | 19,781 | 1,182 | 93.31 | 21,222 | 13,074 |
| 92.74 | 19,806 | 1,380 | 93.32 | 21,247 | 13,287 |
| 92.75 | 19,831 | 1,579 | 93.33 | 21,272 | 13,499 |
| 92.76 | 19,856 | 1,777 | 93.34 | 21,297 | 13,712 |
| 92.77 | 19,881 | 1,976 | 93.35 | 21,322 | 13,925 |
| 92.78 | 19,905 | 2,175 | 93.36 | 21,347 | 14,139 |
| 92.79 | 19,930 | 2,374 | 93.37 | 21,372 | 14,352 |
| 92.80 | 19,955 | 2,573 | 93.38 | 21,397 | 14,566 |
| 92.81 | 19,980 | 2,773 | 93.39 | 21,422 | 14,780 |
| 92.82 | 20,005 | 2,973 | 93.40 | 21,447 | 14,995 |
| 92.83 | 20,030 | 3,173 | 93.41 | 21,472 | 15,209 |
| 92.84 | 20,055 | 3,373 | 93.42 | 21,497 | 15,424 |
| 92.85 | 20,080 | 3,574 | 93.43 | 21,522 | 15,639 |
| 92.86 | 20,105 | 3,775 | 93.44 | 21,547 | 15,854 |
| 92.87 | 20,131 | 3,976 | 93.45 | 21,572 | 16,070 |
| 92.88 | 20,156 | 4,178 | 93.46 | 21,597 | 16,286 |
| 92.89 | 20,181 | 4,379 | 93.47 | 21,622 | 16,502 |
| 92.90 | 20,206 | 4,581 | 93.48 | 21,647 | 16,718 |
| 92.91 | 20,231 | 4,783 | 93.49 | 21,672 | 16,935 |
| 92.92 | 20,256 | 4,986 | 93.50 | 21,697 | 17,152 |
| 92.93 | 20,281 | 5,189 | 93.51 | 21,722 | 17,369 |
| 92.94 | 20,307 | 5,391 | 93.52 | 21,748 | 17,586 |
| 92.95 | 20,332 | 5,595 | 93.53 | 21,773 | 17,804 |
| 92.96 | 20,357 | 5,798 | 93.54 | 21,798 | 18,022 |
| 92.97 | 20,382 | 6,002 | 93.55 | 21,823 | 18,240 |
| 92.98 | 20,407 | 6,206 | 93.56 | 21,848 | 18,458 |
| 92.99 | 20,433 | 6,410 | 93.57 | 21,874 | 18,677 |
| 93.00 | 20,458 | 6,614 | 93.58 | 21,899 | 18,896 |
| 93.01 | 20,482 | 6,819 | 93.59 | 21,924 | 19,115 |
| 93.02 | 20,507 | 7,024 | 93.60 | 21,950 | 19,334 |
| 93.03 | 20,531 | 7,229 | 93.61 | 21,975 | 19,554 |
| 93.04 | 20,556 | 7,435 | 93.62 | 22,000 | 19,774 |
| 93.05 | 20,580 | 7,640 | 93.63 | 22,025 | 19,994 |
| 93.06 | 20,605 | 7,846 | 93.64 | 22,051 | 20,214 |
| 93.07 | 20,629 | 8,052 | 93.65 | 22,076 | 20,435 |
| 93.08 | 20,654 | 8,259 | 93.66 | 22,102 | 20,656 |
| 93.09 | 20,678 | 8,466 | 93.67 | 22,127 | 20,877 |
| 93.10 | 20,703 | 8,672 | 93.68 | 22,152 | 21,098 |
| 93.11 | 20,728 | 8,880 | 93.69 | 22,178 | 21,320 |
| 93.12 | 20,752 | 9,087 | 93.70 | 22,203 | 21,542 |
| 93.13 | 20,777 | 9,295 | 93.71 | 22,229 | 21,764 |
| 93.14 | 20,801 | 9,503 | 93.72 | 22,254 | 21,986 |
| Lowest Outlet 93.15 | 20,826 | 9,711 | 93.73 | 22,280 | 22,209 |
| 93.16 | 20,851 | 9,919 | 93.74 | 22,305 | 22,432 |
| 93.17 | 20,875 | 10,128 | 93.75 | 22,331 | 22,655 |
| 93.18 | 20,900 | 10,337 | 93.76 | 22,356 | 22,878 |
| 93.19 | 20,925 | 10,546 | 93.77 | 22,382 | 23,102 |
| 93.20 | 20,949 | 10,755 | 93.78 | 22,407 | 23,326 |
| 93.21 | 20,974 | 10,965 | 93.79 | 22,433 | 23,550 |
| 93.22 | 20,999 | 11,174 | 93.80 | 22,458 | 23,775 |
| 93.23 | 21,024 | 11,385 | 93.81 | 22,484 | 23,999 |
| 93.24 | 21,048 | 11,595 | 93.82 | 22,510 | 24,224 |

Stage-Area-Storage for Pond P2: Infiltration Basin (continued)

| Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) | Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) |
|---------------------|--------------------|-------------------------|---------------------|--------------------|-------------------------|
| 93.83 | 22,535 | 24,450 | 94.41 | 24,011 | 37,949 |
| 93.84 | 22,561 | 24,675 | 94.42 | 24,037 | 38,189 |
| 93.85 | 22,586 | 24,901 | 94.43 | 24,062 | 38,429 |
| 93.86 | 22,612 | 25,127 | 94.44 | 24,088 | 38,670 |
| 93.87 | 22,638 | 25,353 | 94.45 | 24,114 | 38,911 |
| 93.88 | 22,664 | 25,580 | 94.46 | 24,139 | 39,152 |
| 93.89 | 22,689 | 25,806 | 94.47 | 24,165 | 39,394 |
| 93.90 | 22,715 | 26,033 | 94.48 | 24,191 | 39,636 |
| 93.91 | 22,741 | 26,261 | 94.49 | 24,216 | 39,878 |
| 93.92 | 22,766 | 26,488 | 94.50 | 24,242 | 40,120 |
| 93.93 | 22,792 | 26,716 | 94.51 | 24,268 | 40,363 |
| 93.94 | 22,818 | 26,944 | 94.52 | 24,293 | 40,605 |
| 93.95 | 22,844 | 27,172 | 94.53 | 24,319 | 40,848 |
| 93.96 | 22,870 | 27,401 | 94.54 | 24,345 | 41,092 |
| 93.97 | 22,895 | 27,630 | 94.55 | 24,371 | 41,335 |
| 93.98 | 22,921 | 27,859 | 94.56 | 24,397 | 41,579 |
| 93.99 | 22,947 | 28,088 | 94.57 | 24,422 | 41,823 |
| 94.00 | 22,973 | 28,318 | 94.58 | 24,448 | 42,068 |
| 94.01 | 22,998 | 28,548 | 94.59 | 24,474 | 42,312 |
| 94.02 | 23,023 | 28,778 | 94.60 | 24,500 | 42,557 |
| 94.03 | 23,048 | 29,008 | 94.61 | 24,526 | 42,802 |
| 94.04 | 23,073 | 29,239 | 94.62 | 24,552 | 43,048 |
| 94.05 | 23,098 | 29,470 | 94.63 | 24,577 | 43,293 |
| 94.06 | 23,123 | 29,701 | 94.64 | 24,603 | 43,539 |
| 94.07 | 23,149 | 29,932 | 94.65 | 24,629 | 43,785 |
| 94.08 | 23,174 | 30,164 | 94.66 | 24,655 | 44,032 |
| 94.09 | 23,199 | 30,395 | 94.67 | 24,681 | 44,278 |
| 94.10 | 23,224 | 30,628 | 94.68 | 24,707 | 44,525 |
| 94.11 | 23,249 | 30,860 | 94.69 | 24,733 | 44,773 |
| 94.12 | 23,274 | 31,093 | 94.70 | 24,759 | 45,020 |
| 94.13 | 23,300 | 31,325 | 94.71 | 24,785 | 45,268 |
| 94.14 | 23,325 | 31,559 | 94.72 | 24,811 | 45,516 |
| 94.15 | 23,350 | 31,792 | 94.73 | 24,837 | 45,764 |
| 94.16 | 23,375 | 32,026 | 94.74 | 24,863 | 46,013 |
| 94.17 | 23,401 | 32,259 | 94.75 | 24,889 | 46,261 |
| 94.18 | 23,426 | 32,494 | 94.76 | 24,915 | 46,510 |
| 94.19 | 23,451 | 32,728 | 94.77 | 24,941 | 46,760 |
| 94.20 | 23,476 | 32,963 | 94.78 | 24,967 | 47,009 |
| 94.21 | 23,502 | 33,197 | 94.79 | 24,994 | 47,259 |
| 94.22 | 23,527 | 33,433 | 94.80 | 25,020 | 47,509 |
| 94.23 | 23,552 | 33,668 | 94.81 | 25,046 | 47,759 |
| 94.24 | 23,578 | 33,904 | 94.82 | 25,072 | 48,010 |
| 94.25 | 23,603 | 34,140 | 94.83 | 25,098 | 48,261 |
| 94.26 | 23,629 | 34,376 | 94.84 | 25,124 | 48,512 |
| 94.27 | 23,654 | 34,612 | 94.85 | 25,151 | 48,763 |
| 94.28 | 23,679 | 34,849 | 94.86 | 25,177 | 49,015 |
| 94.29 | 23,705 | 35,086 | 94.87 | 25,203 | 49,267 |
| 94.30 | 23,730 | 35,323 | 94.88 | 25,229 | 49,519 |
| 94.31 | 23,756 | 35,560 | 94.89 | 25,255 | 49,771 |
| 94.32 | 23,781 | 35,798 | 94.90 | 25,282 | 50,024 |
| 94.33 | 23,807 | 36,036 | 94.91 | 25,308 | 50,277 |
| 94.34 | 23,832 | 36,274 | 94.92 | 25,334 | 50,530 |
| 94.35 | 23,858 | 36,513 | 94.93 | 25,361 | 50,784 |
| 94.36 | 23,883 | 36,751 | 94.94 | 25,387 | 51,037 |
| 94.37 | 23,909 | 36,990 | 94.95 | 25,413 | 51,291 |
| 94.38 | 23,934 | 37,229 | 94.96 | 25,440 | 51,546 |
| 94.39 | 23,960 | 37,469 | 94.97 | 25,466 | 51,800 |
| 94.40 | 23,985 | 37,709 | 94.98 | 25,492 | 52,055 |

Stage-Area-Storage for Pond P2: Infiltration Basin (continued)

| Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) | Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) |
|---------------------|--------------------|-------------------------|---------------------|--------------------|-------------------------|
| 94.99 | 25,519 | 52,310 | 95.57 | 27,028 | 67,547 |
| 95.00 | 25,545 | 52,565 | 95.58 | 27,054 | 67,817 |
| 95.01 | 25,571 | 52,821 | 95.59 | 27,081 | 68,088 |
| 95.02 | 25,596 | 53,077 | 95.60 | 27,107 | 68,359 |
| 95.03 | 25,622 | 53,333 | 95.61 | 27,133 | 68,630 |
| 95.04 | 25,648 | 53,589 | 95.62 | 27,160 | 68,901 |
| 95.05 | 25,673 | 53,846 | 95.63 | 27,186 | 69,173 |
| 95.06 | 25,699 | 54,103 | 95.64 | 27,213 | 69,445 |
| 95.07 | 25,725 | 54,360 | 95.65 | 27,239 | 69,717 |
| 95.08 | 25,751 | 54,617 | 95.66 | 27,266 | 69,990 |
| 95.09 | 25,776 | 54,875 | 95.67 | 27,292 | 70,263 |
| 95.10 | 25,802 | 55,133 | 95.68 | 27,319 | 70,536 |
| 95.11 | 25,828 | 55,391 | 95.69 | 27,345 | 70,809 |
| 95.12 | 25,854 | 55,649 | 95.70 | 27,372 | 71,083 |
| 95.13 | 25,879 | 55,908 | 95.71 | 27,398 | 71,356 |
| 95.14 | 25,905 | 56,167 | 95.72 | 27,425 | 71,631 |
| 95.15 | 25,931 | 56,426 | 95.73 | 27,451 | 71,905 |
| 95.16 | 25,957 | 56,685 | 95.74 | 27,478 | 72,180 |
| 95.17 | 25,983 | 56,945 | 95.75 | 27,505 | 72,454 |
| 95.18 | 26,009 | 57,205 | 95.76 | 27,531 | 72,730 |
| 95.19 | 26,035 | 57,465 | 95.77 | 27,558 | 73,005 |
| 95.20 | 26,061 | 57,726 | 95.78 | 27,585 | 73,281 |
| 95.21 | 26,086 | 57,987 | 95.79 | 27,611 | 73,557 |
| 95.22 | 26,112 | 58,248 | 95.80 | 27,638 | 73,833 |
| 95.23 | 26,138 | 58,509 | 95.81 | 27,665 | 74,110 |
| 95.24 | 26,164 | 58,770 | 95.82 | 27,691 | 74,386 |
| 95.25 | 26,190 | 59,032 | 95.83 | 27,718 | 74,663 |
| 95.26 | 26,216 | 59,294 | 95.84 | 27,745 | 74,941 |
| 95.27 | 26,242 | 59,556 | 95.85 | 27,771 | 75,218 |
| 95.28 | 26,268 | 59,819 | 95.86 | 27,798 | 75,496 |
| 95.29 | 26,294 | 60,082 | 95.87 | 27,825 | 75,774 |
| 95.30 | 26,320 | 60,345 | 95.88 | 27,852 | 76,053 |
| 95.31 | 26,346 | 60,608 | 95.89 | 27,879 | 76,331 |
| 95.32 | 26,372 | 60,872 | 95.90 | 27,905 | 76,610 |
| 95.33 | 26,398 | 61,136 | 95.91 | 27,932 | 76,889 |
| 95.34 | 26,424 | 61,400 | 95.92 | 27,959 | 77,169 |
| 95.35 | 26,451 | 61,664 | 95.93 | 27,986 | 77,449 |
| 95.36 | 26,477 | 61,929 | 95.94 | 28,013 | 77,729 |
| 95.37 | 26,503 | 62,194 | 95.95 | 28,039 | 78,009 |
| 95.38 | 26,529 | 62,459 | 95.96 | 28,066 | 78,289 |
| 95.39 | 26,555 | 62,724 | 95.97 | 28,093 | 78,570 |
| 95.40 | 26,581 | 62,990 | 95.98 | 28,120 | 78,851 |
| 95.41 | 26,607 | 63,256 | 95.99 | 28,147 | 79,133 |
| 95.42 | 26,633 | 63,522 | 96.00 | 28,174 | 79,414 |
| 95.43 | 26,660 | 63,789 | 96.01 | 28,201 | 79,696 |
| 95.44 | 26,686 | 64,055 | 96.02 | 28,228 | 79,978 |
| 95.45 | 26,712 | 64,322 | 96.03 | 28,255 | 80,261 |
| 95.46 | 26,738 | 64,589 | 96.04 | 28,282 | 80,543 |
| 95.47 | 26,765 | 64,857 | 96.05 | 28,310 | 80,826 |
| 95.48 | 26,791 | 65,125 | 96.06 | 28,337 | 81,109 |
| 95.49 | 26,817 | 65,393 | 96.07 | 28,364 | 81,393 |
| 95.50 | 26,843 | 65,661 | 96.08 | 28,391 | 81,677 |
| 95.51 | 26,870 | 65,930 | 96.09 | 28,418 | 81,961 |
| 95.52 | 26,896 | 66,199 | 96.10 | 28,445 | 82,245 |
| 95.53 | 26,922 | 66,468 | 96.11 | 28,473 | 82,530 |
| 95.54 | 26,949 | 66,737 | 96.12 | 28,500 | 82,815 |
| 95.55 | 26,975 | 67,007 | 96.13 | 28,527 | 83,100 |
| 95.56 | 27,001 | 67,276 | 96.14 | 28,554 | 83,385 |

Stage-Area-Storage for Pond P2: Infiltration Basin (continued)

| Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) | Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) |
|---------------------|--------------------|-------------------------|---------------------|--------------------|-------------------------|
| 96.15 | 28,582 | 83,671 | 96.73 | 30,185 | 100,711 |
| 96.16 | 28,609 | 83,957 | 96.74 | 30,214 | 101,013 |
| 96.17 | 28,636 | 84,243 | 96.75 | 30,242 | 101,315 |
| 96.18 | 28,664 | 84,529 | 96.76 | 30,270 | 101,618 |
| 96.19 | 28,691 | 84,816 | 96.77 | 30,298 | 101,921 |
| 96.20 | 28,718 | 85,103 | 96.78 | 30,326 | 102,224 |
| 96.21 | 28,746 | 85,391 | 96.79 | 30,354 | 102,527 |
| 96.22 | 28,773 | 85,678 | 96.80 | 30,382 | 102,831 |
| 96.23 | 28,800 | 85,966 | 96.81 | 30,410 | 103,135 |
| 96.24 | 28,828 | 86,254 | 96.82 | 30,438 | 103,439 |
| 96.25 | 28,855 | 86,543 | 96.83 | 30,466 | 103,744 |
| 96.26 | 28,882 | 86,831 | 96.84 | 30,495 | 104,049 |
| 96.27 | 28,910 | 87,120 | 96.85 | 30,523 | 104,354 |
| 96.28 | 28,937 | 87,409 | 96.86 | 30,551 | 104,659 |
| 96.29 | 28,965 | 87,699 | 96.87 | 30,579 | 104,965 |
| 96.30 | 28,992 | 87,989 | 96.88 | 30,607 | 105,271 |
| 96.31 | 29,020 | 88,279 | 96.89 | 30,636 | 105,577 |
| 96.32 | 29,047 | 88,569 | 96.90 | 30,664 | 105,883 |
| 96.33 | 29,075 | 88,860 | 96.91 | 30,692 | 106,190 |
| 96.34 | 29,102 | 89,151 | 96.92 | 30,720 | 106,497 |
| 96.35 | 29,130 | 89,442 | 96.93 | 30,749 | 106,804 |
| 96.36 | 29,157 | 89,733 | 96.94 | 30,777 | 107,112 |
| 96.37 | 29,185 | 90,025 | 96.95 | 30,805 | 107,420 |
| 96.38 | 29,212 | 90,317 | 96.96 | 30,834 | 107,728 |
| 96.39 | 29,240 | 90,609 | 96.97 | 30,862 | 108,037 |
| 96.40 | 29,268 | 90,902 | 96.98 | 30,890 | 108,345 |
| 96.41 | 29,295 | 91,195 | 96.99 | 30,919 | 108,654 |
| 96.42 | 29,323 | 91,488 | 97.00 | 30,947 | 108,964 |
| 96.43 | 29,350 | 91,781 | | | |
| 96.44 | 29,378 | 92,075 | | | |
| 96.45 | 29,406 | 92,369 | | | |
| 96.46 | 29,433 | 92,663 | | | |
| 96.47 | 29,461 | 92,957 | | | |
| 96.48 | 29,489 | 93,252 | | | |
| 96.49 | 29,517 | 93,547 | | | |
| 96.50 | 29,544 | 93,842 | | | |
| 96.51 | 29,572 | 94,138 | | | |
| 96.52 | 29,600 | 94,434 | | | |
| 96.53 | 29,627 | 94,730 | | | |
| 96.54 | 29,655 | 95,026 | | | |
| 96.55 | 29,683 | 95,323 | | | |
| 96.56 | 29,711 | 95,620 | | | |
| 96.57 | 29,739 | 95,917 | | | |
| 96.58 | 29,766 | 96,215 | | | |
| 96.59 | 29,794 | 96,513 | | | |
| 96.60 | 29,822 | 96,811 | | | |
| 96.61 | 29,850 | 97,109 | | | |
| 96.62 | 29,878 | 97,408 | | | |
| 96.63 | 29,906 | 97,707 | | | |
| 96.64 | 29,934 | 98,006 | | | |
| 96.65 | 29,962 | 98,305 | | | |
| 96.66 | 29,990 | 98,605 | | | |
| 96.67 | 30,018 | 98,905 | | | |
| 96.68 | 30,045 | 99,205 | | | |
| 96.69 | 30,073 | 99,506 | | | |
| 96.70 | 30,101 | 99,807 | | | |
| 96.71 | 30,129 | 100,108 | | | |
| 96.72 | 30,157 | 100,409 | | | |

Stage-Area-Storage for Pond P3: Infiltration Basin

| Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) | Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) |
|---------------------|--------------------|-------------------------|---------------------|--------------------|-------------------------|
| 96.90 | 4,600 | 0 | 98.06 | 5,550 | 5,879 |
| 96.92 | 4,616 | 92 | 98.08 | 5,567 | 5,991 |
| 96.94 | 4,632 | 185 | 98.10 | 5,584 | 6,102 |
| 96.96 | 4,648 | 277 | 98.12 | 5,601 | 6,214 |
| 96.98 | 4,664 | 371 | 98.14 | 5,618 | 6,326 |
| 97.00 | 4,680 | 464 | 98.16 | 5,635 | 6,439 |
| 97.02 | 4,696 | 558 | 98.18 | 5,652 | 6,552 |
| 97.04 | 4,711 | 652 | 98.20 | 5,669 | 6,665 |
| 97.06 | 4,727 | 746 | 98.22 | 5,686 | 6,778 |
| 97.08 | 4,743 | 841 | 98.24 | 5,703 | 6,892 |
| 97.10 | 4,759 | 936 | 98.26 | 5,720 | 7,006 |
| 97.12 | 4,775 | 1,031 | 98.28 | 5,737 | 7,121 |
| 97.14 | 4,791 | 1,127 | 98.30 | 5,755 | 7,236 |
| 97.16 | 4,807 | 1,223 | 98.32 | 5,772 | 7,351 |
| 97.18 | 4,823 | 1,319 | 98.34 | 5,789 | 7,467 |
| 97.20 | 4,839 | 1,416 | 98.36 | 5,807 | 7,583 |
| 97.22 | 4,855 | 1,513 | 98.38 | 5,824 | 7,699 |
| 97.24 | 4,871 | 1,610 | 98.40 | 5,841 | 7,816 |
| 97.26 | 4,887 | 1,708 | 98.42 | 5,859 | 7,933 |
| 97.28 | 4,903 | 1,805 | 98.44 | 5,876 | 8,050 |
| 97.30 | 4,919 | 1,904 | 98.46 | 5,893 | 8,168 |
| 97.32 | 4,935 | 2,002 | 98.48 | 5,911 | 8,286 |
| 97.34 | 4,951 | 2,101 | 98.50 | 5,928 | 8,404 |
| 97.36 | 4,967 | 2,200 | 98.52 | 5,946 | 8,523 |
| 97.38 | 4,983 | 2,300 | 98.54 | 5,963 | 8,642 |
| 97.40 | 5,000 | 2,400 | 98.56 | 5,981 | 8,761 |
| 97.42 | 5,016 | 2,500 | 98.58 | 5,999 | 8,881 |
| 97.44 | 5,032 | 2,600 | 98.60 | 6,016 | 9,001 |
| 97.46 | 5,049 | 2,701 | 98.62 | 6,034 | 9,122 |
| 97.48 | 5,065 | 2,802 | 98.64 | 6,052 | 9,243 |
| 97.50 | 5,081 | 2,904 | 98.66 | 6,069 | 9,364 |
| 97.52 | 5,098 | 3,005 | 98.68 | 6,087 | 9,486 |
| 97.54 | 5,114 | 3,108 | 98.70 | 6,105 | 9,607 |
| 97.56 | 5,131 | 3,210 | 98.72 | 6,122 | 9,730 |
| 97.58 | 5,147 | 3,313 | 98.74 | 6,140 | 9,852 |
| 97.60 | 5,163 | 3,416 | 98.76 | 6,158 | 9,975 |
| 97.62 | 5,180 | 3,519 | 98.78 | 6,176 | 10,099 |
| 97.64 | 5,197 | 3,623 | 98.80 | 6,194 | 10,222 |
| 97.66 | 5,213 | 3,727 | 98.82 | 6,212 | 10,346 |
| 97.68 | 5,230 | 3,832 | 98.84 | 6,230 | 10,471 |
| 97.70 | 5,246 | 3,936 | 98.86 | 6,248 | 10,596 |
| 97.72 | 5,263 | 4,041 | 98.88 | 6,266 | 10,721 |
| 97.74 | 5,280 | 4,147 | 98.90 | 6,284 | 10,846 |
| 97.76 | 5,296 | 4,253 | 98.92 | 6,302 | 10,972 |
| 97.78 | 5,313 | 4,359 | 98.94 | 6,320 | 11,098 |
| 97.80 | 5,330 | 4,465 | 98.96 | 6,338 | 11,225 |
| 97.82 | 5,347 | 4,572 | 98.98 | 6,356 | 11,352 |
| 97.84 | 5,364 | 4,679 | 99.00 | 6,374 | 11,479 |
| 97.86 | 5,380 | 4,786 | 99.02 | 6,392 | 11,607 |
| 97.88 | 5,397 | 4,894 | 99.04 | 6,410 | 11,735 |
| 97.90 | 5,414 | 5,002 | 99.06 | 6,428 | 11,863 |
| 97.92 | 5,431 | 5,111 | 99.08 | 6,446 | 11,992 |
| 97.94 | 5,448 | 5,220 | 99.10 | 6,464 | 12,121 |
| 97.96 | 5,465 | 5,329 | 99.12 | 6,482 | 12,250 |
| 97.98 | 5,482 | 5,438 | 99.14 | 6,501 | 12,380 |
| 98.00 | 5,499 | 5,548 | 99.16 | 6,519 | 12,511 |
| 98.02 | 5,516 | 5,658 | 99.18 | 6,537 | 12,641 |
| 98.04 | 5,533 | 5,769 | 99.20 | 6,555 | 12,772 |

Lowest Outlet

T1126_POST

Prepared by IO

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Type III 24-hr 100-YEAR Rainfall=8.78"

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Stage-Area-Storage for Pond P4: Infiltration Basin

| Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) | Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) |
|---------------------|--------------------|-------------------------|---------------------|--------------------|-------------------------|
| 93.50 | 6,773 | 0 | 94.08 | 7,471 | 4,130 |
| 93.51 | 6,785 | 68 | 94.09 | 7,483 | 4,205 |
| 93.52 | 6,797 | 136 | 94.10 | 7,495 | 4,279 |
| 93.53 | 6,808 | 204 | 94.11 | 7,507 | 4,354 |
| 93.54 | 6,820 | 272 | 94.12 | 7,519 | 4,430 |
| 93.55 | 6,832 | 340 | 94.13 | 7,531 | 4,505 |
| 93.56 | 6,844 | 409 | 94.14 | 7,544 | 4,580 |
| 93.57 | 6,856 | 477 | 94.15 | 7,556 | 4,656 |
| 93.58 | 6,868 | 546 | 94.16 | 7,568 | 4,731 |
| 93.59 | 6,879 | 614 | 94.17 | 7,580 | 4,807 |
| 93.60 | 6,891 | 683 | 94.18 | 7,592 | 4,883 |
| 93.61 | 6,903 | 752 | 94.19 | 7,604 | 4,959 |
| 93.62 | 6,915 | 821 | 94.20 | 7,616 | 5,035 |
| 93.63 | 6,927 | 890 | 94.21 | 7,629 | 5,111 |
| 93.64 | 6,939 | 960 | 94.22 | 7,641 | 5,188 |
| 93.65 | 6,951 | 1,029 | 94.23 | 7,653 | 5,264 |
| 93.66 | 6,963 | 1,099 | 94.24 | 7,665 | 5,341 |
| 93.67 | 6,975 | 1,169 | 94.25 | 7,677 | 5,417 |
| 93.68 | 6,987 | 1,238 | 94.26 | 7,690 | 5,494 |
| 93.69 | 6,999 | 1,308 | 94.27 | 7,702 | 5,571 |
| 93.70 | 7,011 | 1,378 | 94.28 | 7,714 | 5,648 |
| 93.71 | 7,023 | 1,448 | 94.29 | 7,726 | 5,725 |
| 93.72 | 7,035 | 1,519 | 94.30 | 7,739 | 5,803 |
| 93.73 | 7,047 | 1,589 | 94.31 | 7,751 | 5,880 |
| 93.74 | 7,059 | 1,660 | 94.32 | 7,763 | 5,958 |
| 93.75 | 7,071 | 1,730 | 94.33 | 7,775 | 6,035 |
| 93.76 | 7,083 | 1,801 | 94.34 | 7,788 | 6,113 |
| 93.77 | 7,095 | 1,872 | 94.35 | 7,800 | 6,191 |
| 93.78 | 7,107 | 1,943 | 94.36 | 7,812 | 6,269 |
| 93.79 | 7,119 | 2,014 | 94.37 | 7,825 | 6,347 |
| 93.80 | 7,131 | 2,085 | 94.38 | 7,837 | 6,426 |
| 93.81 | 7,143 | 2,157 | 94.39 | 7,849 | 6,504 |
| 93.82 | 7,155 | 2,228 | 94.40 | 7,862 | 6,583 |
| 93.83 | 7,167 | 2,300 | 94.41 | 7,874 | 6,661 |
| 93.84 | 7,180 | 2,372 | 94.42 | 7,886 | 6,740 |
| 93.85 | 7,192 | 2,443 | 94.43 | 7,899 | 6,819 |
| 93.86 | 7,204 | 2,515 | 94.44 | 7,911 | 6,898 |
| 93.87 | 7,216 | 2,588 | 94.45 | 7,924 | 6,977 |
| 93.88 | 7,228 | 2,660 | 94.46 | 7,936 | 7,057 |
| 93.89 | 7,240 | 2,732 | 94.47 | 7,949 | 7,136 |
| 93.90 | 7,253 | 2,805 | 94.48 | 7,961 | 7,216 |
| 93.91 | 7,265 | 2,877 | 94.49 | 7,973 | 7,295 |
| 93.92 | 7,277 | 2,950 | 94.50 | 7,986 | 7,375 |
| 93.93 | 7,289 | 3,023 | 94.51 | 7,998 | 7,455 |
| 93.94 | 7,301 | 3,096 | 94.52 | 8,011 | 7,535 |
| 93.95 | 7,314 | 3,169 | 94.53 | 8,023 | 7,615 |
| 93.96 | 7,326 | 3,242 | 94.54 | 8,036 | 7,696 |
| 93.97 | 7,338 | 3,315 | 94.55 | 8,048 | 7,776 |
| 93.98 | 7,350 | 3,389 | 94.56 | 8,061 | 7,857 |
| 93.99 | 7,363 | 3,462 | 94.57 | 8,073 | 7,937 |
| 94.00 | 7,375 | 3,536 | 94.58 | 8,086 | 8,018 |
| 94.01 | 7,387 | 3,610 | 94.59 | 8,098 | 8,099 |
| 94.02 | 7,399 | 3,684 | 94.60 | 8,111 | 8,180 |
| 94.03 | 7,411 | 3,758 | 94.61 | 8,123 | 8,261 |
| 94.04 | 7,423 | 3,832 | 94.62 | 8,136 | 8,342 |
| 94.05 | 7,435 | 3,906 | 94.63 | 8,149 | 8,424 |
| 94.06 | 7,447 | 3,981 | 94.64 | 8,161 | 8,505 |
| 94.07 | 7,459 | 4,055 | 94.65 | 8,174 | 8,587 |

Lowest Outlet

Stage-Area-Storage for Pond P4: Infiltration Basin (continued)

| Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) | Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) |
|---------------------|--------------------|-------------------------|---------------------|--------------------|-------------------------|
| 94.66 | 8,186 | 8,669 | 95.24 | 8,925 | 13,631 |
| 94.67 | 8,199 | 8,751 | 95.25 | 8,938 | 13,721 |
| 94.68 | 8,212 | 8,833 | 95.26 | 8,951 | 13,810 |
| 94.69 | 8,224 | 8,915 | 95.27 | 8,964 | 13,900 |
| 94.70 | 8,237 | 8,997 | 95.28 | 8,976 | 13,989 |
| 94.71 | 8,250 | 9,080 | 95.29 | 8,989 | 14,079 |
| 94.72 | 8,262 | 9,162 | 95.30 | 9,002 | 14,169 |
| 94.73 | 8,275 | 9,245 | 95.31 | 9,015 | 14,259 |
| 94.74 | 8,288 | 9,328 | 95.32 | 9,028 | 14,349 |
| 94.75 | 8,300 | 9,411 | 95.33 | 9,041 | 14,440 |
| 94.76 | 8,313 | 9,494 | 95.34 | 9,053 | 14,530 |
| 94.77 | 8,326 | 9,577 | 95.35 | 9,066 | 14,621 |
| 94.78 | 8,339 | 9,660 | 95.36 | 9,079 | 14,712 |
| 94.79 | 8,351 | 9,744 | 95.37 | 9,092 | 14,802 |
| 94.80 | 8,364 | 9,827 | 95.38 | 9,105 | 14,893 |
| 94.81 | 8,377 | 9,911 | 95.39 | 9,118 | 14,984 |
| 94.82 | 8,390 | 9,995 | 95.40 | 9,131 | 15,076 |
| 94.83 | 8,402 | 10,079 | 95.41 | 9,144 | 15,167 |
| 94.84 | 8,415 | 10,163 | 95.42 | 9,157 | 15,259 |
| 94.85 | 8,428 | 10,247 | 95.43 | 9,170 | 15,350 |
| 94.86 | 8,441 | 10,332 | 95.44 | 9,183 | 15,442 |
| 94.87 | 8,454 | 10,416 | 95.45 | 9,196 | 15,534 |
| 94.88 | 8,466 | 10,501 | 95.46 | 9,209 | 15,626 |
| 94.89 | 8,479 | 10,585 | 95.47 | 9,222 | 15,718 |
| 94.90 | 8,492 | 10,670 | 95.48 | 9,235 | 15,810 |
| 94.91 | 8,505 | 10,755 | 95.49 | 9,248 | 15,903 |
| 94.92 | 8,518 | 10,840 | 95.50 | 9,261 | 15,995 |
| 94.93 | 8,531 | 10,926 | 95.51 | 9,274 | 16,088 |
| 94.94 | 8,543 | 11,011 | 95.52 | 9,287 | 16,181 |
| 94.95 | 8,556 | 11,096 | 95.53 | 9,300 | 16,274 |
| 94.96 | 8,569 | 11,182 | 95.54 | 9,313 | 16,367 |
| 94.97 | 8,582 | 11,268 | 95.55 | 9,326 | 16,460 |
| 94.98 | 8,595 | 11,354 | 95.56 | 9,339 | 16,553 |
| 94.99 | 8,608 | 11,440 | 95.57 | 9,352 | 16,647 |
| 95.00 | 8,621 | 11,526 | 95.58 | 9,365 | 16,740 |
| 95.01 | 8,634 | 11,612 | 95.59 | 9,378 | 16,834 |
| 95.02 | 8,646 | 11,699 | 95.60 | 9,391 | 16,928 |
| 95.03 | 8,659 | 11,785 | 95.61 | 9,404 | 17,022 |
| 95.04 | 8,671 | 11,872 | 95.62 | 9,417 | 17,116 |
| 95.05 | 8,684 | 11,958 | 95.63 | 9,431 | 17,210 |
| 95.06 | 8,697 | 12,045 | 95.64 | 9,444 | 17,305 |
| 95.07 | 8,709 | 12,132 | 95.65 | 9,457 | 17,399 |
| 95.08 | 8,722 | 12,220 | 95.66 | 9,470 | 17,494 |
| 95.09 | 8,734 | 12,307 | 95.67 | 9,483 | 17,588 |
| 95.10 | 8,747 | 12,394 | 95.68 | 9,496 | 17,683 |
| 95.11 | 8,760 | 12,482 | 95.69 | 9,510 | 17,778 |
| 95.12 | 8,772 | 12,569 | 95.70 | 9,523 | 17,874 |
| 95.13 | 8,785 | 12,657 | 95.71 | 9,536 | 17,969 |
| 95.14 | 8,798 | 12,745 | 95.72 | 9,549 | 18,064 |
| 95.15 | 8,810 | 12,833 | 95.73 | 9,562 | 18,160 |
| 95.16 | 8,823 | 12,921 | 95.74 | 9,576 | 18,256 |
| 95.17 | 8,836 | 13,010 | 95.75 | 9,589 | 18,351 |
| 95.18 | 8,849 | 13,098 | 95.76 | 9,602 | 18,447 |
| 95.19 | 8,861 | 13,187 | 95.77 | 9,615 | 18,543 |
| 95.20 | 8,874 | 13,275 | 95.78 | 9,629 | 18,640 |
| 95.21 | 8,887 | 13,364 | 95.79 | 9,642 | 18,736 |
| 95.22 | 8,900 | 13,453 | 95.80 | 9,655 | 18,832 |
| 95.23 | 8,912 | 13,542 | 95.81 | 9,669 | 18,929 |

Stage-Area-Storage for Pond P4: Infiltration Basin (continued)

| Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) | Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) |
|---------------------|--------------------|-------------------------|---------------------|--------------------|-------------------------|
| 95.82 | 9,682 | 19,026 | 96.40 | 10,456 | 24,866 |
| 95.83 | 9,695 | 19,123 | 96.41 | 10,470 | 24,970 |
| 95.84 | 9,709 | 19,220 | 96.42 | 10,483 | 25,075 |
| 95.85 | 9,722 | 19,317 | 96.43 | 10,497 | 25,180 |
| 95.86 | 9,735 | 19,414 | 96.44 | 10,510 | 25,285 |
| 95.87 | 9,749 | 19,512 | 96.45 | 10,524 | 25,390 |
| 95.88 | 9,762 | 19,609 | 96.46 | 10,537 | 25,495 |
| 95.89 | 9,775 | 19,707 | 96.47 | 10,551 | 25,601 |
| 95.90 | 9,789 | 19,805 | 96.48 | 10,564 | 25,706 |
| 95.91 | 9,802 | 19,903 | 96.49 | 10,578 | 25,812 |
| 95.92 | 9,815 | 20,001 | 96.50 | 10,592 | 25,918 |
| 95.93 | 9,829 | 20,099 | 96.51 | 10,605 | 26,024 |
| 95.94 | 9,842 | 20,197 | 96.52 | 10,619 | 26,130 |
| 95.95 | 9,856 | 20,296 | 96.53 | 10,632 | 26,236 |
| 95.96 | 9,869 | 20,394 | 96.54 | 10,646 | 26,343 |
| 95.97 | 9,883 | 20,493 | 96.55 | 10,660 | 26,449 |
| 95.98 | 9,896 | 20,592 | 96.56 | 10,673 | 26,556 |
| 95.99 | 9,910 | 20,691 | 96.57 | 10,687 | 26,663 |
| 96.00 | 9,923 | 20,790 | 96.58 | 10,701 | 26,770 |
| 96.01 | 9,936 | 20,890 | 96.59 | 10,714 | 26,877 |
| 96.02 | 9,949 | 20,989 | 96.60 | 10,728 | 26,984 |
| 96.03 | 9,963 | 21,088 | 96.61 | 10,742 | 27,091 |
| 96.04 | 9,976 | 21,188 | 96.62 | 10,755 | 27,199 |
| 96.05 | 9,989 | 21,288 | 96.63 | 10,769 | 27,306 |
| 96.06 | 10,002 | 21,388 | 96.64 | 10,783 | 27,414 |
| 96.07 | 10,015 | 21,488 | 96.65 | 10,796 | 27,522 |
| 96.08 | 10,029 | 21,588 | 96.66 | 10,810 | 27,630 |
| 96.09 | 10,042 | 21,689 | 96.67 | 10,824 | 27,738 |
| 96.10 | 10,055 | 21,789 | 96.68 | 10,838 | 27,847 |
| 96.11 | 10,068 | 21,890 | 96.69 | 10,851 | 27,955 |
| 96.12 | 10,081 | 21,990 | 96.70 | 10,865 | 28,064 |
| 96.13 | 10,095 | 22,091 | 96.71 | 10,879 | 28,172 |
| 96.14 | 10,108 | 22,192 | 96.72 | 10,893 | 28,281 |
| 96.15 | 10,121 | 22,294 | 96.73 | 10,906 | 28,390 |
| 96.16 | 10,135 | 22,395 | 96.74 | 10,920 | 28,499 |
| 96.17 | 10,148 | 22,496 | 96.75 | 10,934 | 28,609 |
| 96.18 | 10,161 | 22,598 | 96.76 | 10,948 | 28,718 |
| 96.19 | 10,175 | 22,699 | 96.77 | 10,962 | 28,828 |
| 96.20 | 10,188 | 22,801 | 96.78 | 10,976 | 28,937 |
| 96.21 | 10,201 | 22,903 | 96.79 | 10,989 | 29,047 |
| 96.22 | 10,214 | 23,005 | 96.80 | 11,003 | 29,157 |
| 96.23 | 10,228 | 23,107 | 96.81 | 11,017 | 29,267 |
| 96.24 | 10,241 | 23,210 | 96.82 | 11,031 | 29,377 |
| 96.25 | 10,255 | 23,312 | 96.83 | 11,045 | 29,488 |
| 96.26 | 10,268 | 23,415 | 96.84 | 11,059 | 29,598 |
| 96.27 | 10,281 | 23,518 | 96.85 | 11,073 | 29,709 |
| 96.28 | 10,295 | 23,621 | 96.86 | 11,086 | 29,820 |
| 96.29 | 10,308 | 23,724 | 96.87 | 11,100 | 29,931 |
| 96.30 | 10,322 | 23,827 | 96.88 | 11,114 | 30,042 |
| 96.31 | 10,335 | 23,930 | 96.89 | 11,128 | 30,153 |
| 96.32 | 10,348 | 24,033 | 96.90 | 11,142 | 30,264 |
| 96.33 | 10,362 | 24,137 | 96.91 | 11,156 | 30,376 |
| 96.34 | 10,375 | 24,241 | 96.92 | 11,170 | 30,487 |
| 96.35 | 10,389 | 24,344 | 96.93 | 11,184 | 30,599 |
| 96.36 | 10,402 | 24,448 | 96.94 | 11,198 | 30,711 |
| 96.37 | 10,416 | 24,552 | 96.95 | 11,212 | 30,823 |
| 96.38 | 10,429 | 24,657 | 96.96 | 11,226 | 30,935 |
| 96.39 | 10,443 | 24,761 | 96.97 | 11,240 | 31,048 |

Stage-Area-Storage for Pond P4: Infiltration Basin (continued)

| Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) | Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) |
|---------------------|--------------------|-------------------------|---------------------|--------------------|-------------------------|
| 96.98 | 11,254 | 31,160 | 97.56 | 12,064 | 37,921 |
| 96.99 | 11,268 | 31,273 | 97.57 | 12,078 | 38,042 |
| 97.00 | 11,282 | 31,385 | 97.58 | 12,093 | 38,163 |
| 97.01 | 11,296 | 31,498 | 97.59 | 12,107 | 38,284 |
| 97.02 | 11,309 | 31,611 | 97.60 | 12,121 | 38,405 |
| 97.03 | 11,323 | 31,725 | 97.61 | 12,135 | 38,526 |
| 97.04 | 11,337 | 31,838 | 97.62 | 12,149 | 38,648 |
| 97.05 | 11,351 | 31,951 | 97.63 | 12,164 | 38,769 |
| 97.06 | 11,365 | 32,065 | 97.64 | 12,178 | 38,891 |
| 97.07 | 11,378 | 32,179 | 97.65 | 12,192 | 39,013 |
| 97.08 | 11,392 | 32,292 | 97.66 | 12,207 | 39,135 |
| 97.09 | 11,406 | 32,406 | 97.67 | 12,221 | 39,257 |
| 97.10 | 11,420 | 32,521 | 97.68 | 12,235 | 39,379 |
| 97.11 | 11,434 | 32,635 | 97.69 | 12,249 | 39,501 |
| 97.12 | 11,447 | 32,749 | 97.70 | 12,264 | 39,624 |
| 97.13 | 11,461 | 32,864 | 97.71 | 12,278 | 39,747 |
| 97.14 | 11,475 | 32,978 | 97.72 | 12,292 | 39,870 |
| 97.15 | 11,489 | 33,093 | 97.73 | 12,307 | 39,993 |
| 97.16 | 11,503 | 33,208 | 97.74 | 12,321 | 40,116 |
| 97.17 | 11,517 | 33,323 | 97.75 | 12,335 | 40,239 |
| 97.18 | 11,531 | 33,439 | 97.76 | 12,350 | 40,362 |
| 97.19 | 11,544 | 33,554 | 97.77 | 12,364 | 40,486 |
| 97.20 | 11,558 | 33,669 | 97.78 | 12,379 | 40,610 |
| 97.21 | 11,572 | 33,785 | 97.79 | 12,393 | 40,734 |
| 97.22 | 11,586 | 33,901 | 97.80 | 12,407 | 40,858 |
| 97.23 | 11,600 | 34,017 | 97.81 | 12,422 | 40,982 |
| 97.24 | 11,614 | 34,133 | 97.82 | 12,436 | 41,106 |
| 97.25 | 11,628 | 34,249 | 97.83 | 12,451 | 41,230 |
| 97.26 | 11,642 | 34,365 | 97.84 | 12,465 | 41,355 |
| 97.27 | 11,656 | 34,482 | 97.85 | 12,479 | 41,480 |
| 97.28 | 11,670 | 34,599 | 97.86 | 12,494 | 41,605 |
| 97.29 | 11,684 | 34,715 | 97.87 | 12,508 | 41,730 |
| 97.30 | 11,698 | 34,832 | 97.88 | 12,523 | 41,855 |
| 97.31 | 11,712 | 34,949 | 97.89 | 12,537 | 41,980 |
| 97.32 | 11,726 | 35,066 | 97.90 | 12,552 | 42,106 |
| 97.33 | 11,740 | 35,184 | 97.91 | 12,566 | 42,231 |
| 97.34 | 11,754 | 35,301 | 97.92 | 12,581 | 42,357 |
| 97.35 | 11,768 | 35,419 | 97.93 | 12,595 | 42,483 |
| 97.36 | 11,782 | 35,537 | 97.94 | 12,610 | 42,609 |
| 97.37 | 11,796 | 35,654 | 97.95 | 12,624 | 42,735 |
| 97.38 | 11,810 | 35,773 | 97.96 | 12,639 | 42,861 |
| 97.39 | 11,824 | 35,891 | 97.97 | 12,653 | 42,988 |
| 97.40 | 11,838 | 36,009 | 97.98 | 12,668 | 43,114 |
| 97.41 | 11,852 | 36,127 | 97.99 | 12,682 | 43,241 |
| 97.42 | 11,866 | 36,246 | 98.00 | 12,697 | 43,368 |
| 97.43 | 11,880 | 36,365 | | | |
| 97.44 | 11,894 | 36,484 | | | |
| 97.45 | 11,908 | 36,603 | | | |
| 97.46 | 11,923 | 36,722 | | | |
| 97.47 | 11,937 | 36,841 | | | |
| 97.48 | 11,951 | 36,961 | | | |
| 97.49 | 11,965 | 37,080 | | | |
| 97.50 | 11,979 | 37,200 | | | |
| 97.51 | 11,993 | 37,320 | | | |
| 97.52 | 12,007 | 37,440 | | | |
| 97.53 | 12,022 | 37,560 | | | |
| 97.54 | 12,036 | 37,680 | | | |
| 97.55 | 12,050 | 37,801 | | | |

Stage-Area-Storage for Pond P3: Infiltration Basin (continued)

| Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) | Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) |
|---------------------|--------------------|-------------------------|---------------------|--------------------|-------------------------|
| 99.22 | 6,574 | 12,903 | 100.38 | 7,674 | 21,160 |
| 99.24 | 6,592 | 13,035 | 100.40 | 7,694 | 21,313 |
| 99.26 | 6,610 | 13,167 | 100.42 | 7,713 | 21,467 |
| 99.28 | 6,629 | 13,299 | 100.44 | 7,733 | 21,622 |
| 99.30 | 6,647 | 13,432 | 100.46 | 7,753 | 21,777 |
| 99.32 | 6,665 | 13,565 | 100.48 | 7,772 | 21,932 |
| 99.34 | 6,684 | 13,699 | 100.50 | 7,792 | 22,088 |
| 99.36 | 6,702 | 13,833 | 100.52 | 7,812 | 22,244 |
| 99.38 | 6,721 | 13,967 | 100.54 | 7,832 | 22,400 |
| 99.40 | 6,739 | 14,101 | 100.56 | 7,852 | 22,557 |
| 99.42 | 6,758 | 14,236 | 100.58 | 7,871 | 22,714 |
| 99.44 | 6,776 | 14,372 | 100.60 | 7,891 | 22,872 |
| 99.46 | 6,795 | 14,507 | 100.62 | 7,911 | 23,030 |
| 99.48 | 6,813 | 14,644 | 100.64 | 7,931 | 23,188 |
| 99.50 | 6,832 | 14,780 | 100.66 | 7,951 | 23,347 |
| 99.52 | 6,851 | 14,917 | 100.68 | 7,971 | 23,506 |
| 99.54 | 6,869 | 15,054 | 100.70 | 7,991 | 23,666 |
| 99.56 | 6,888 | 15,192 | 100.72 | 8,011 | 23,826 |
| 99.58 | 6,907 | 15,330 | 100.74 | 8,031 | 23,986 |
| 99.60 | 6,926 | 15,468 | 100.76 | 8,051 | 24,147 |
| 99.62 | 6,944 | 15,607 | 100.78 | 8,071 | 24,308 |
| 99.64 | 6,963 | 15,746 | 100.80 | 8,091 | 24,470 |
| 99.66 | 6,982 | 15,885 | 100.82 | 8,112 | 24,632 |
| 99.68 | 7,001 | 16,025 | 100.84 | 8,132 | 24,795 |
| 99.70 | 7,020 | 16,165 | 100.86 | 8,152 | 24,957 |
| 99.72 | 7,039 | 16,306 | 100.88 | 8,172 | 25,121 |
| 99.74 | 7,058 | 16,447 | 100.90 | 8,192 | 25,284 |
| 99.76 | 7,077 | 16,588 | 100.92 | 8,213 | 25,448 |
| 99.78 | 7,096 | 16,730 | 100.94 | 8,233 | 25,613 |
| 99.80 | 7,115 | 16,872 | 100.96 | 8,253 | 25,778 |
| 99.82 | 7,134 | 17,014 | 100.98 | 8,274 | 25,943 |
| 99.84 | 7,153 | 17,157 | 101.00 | 8,294 | 26,109 |
| 99.86 | 7,172 | 17,300 | 101.02 | 8,314 | 26,275 |
| 99.88 | 7,191 | 17,444 | 101.04 | 8,335 | 26,441 |
| 99.90 | 7,210 | 17,588 | 101.06 | 8,355 | 26,608 |
| 99.92 | 7,229 | 17,732 | 101.08 | 8,375 | 26,775 |
| 99.94 | 7,248 | 17,877 | 101.10 | 8,396 | 26,943 |
| 99.96 | 7,267 | 18,022 | 101.12 | 8,416 | 27,111 |
| 99.98 | 7,287 | 18,168 | 101.14 | 8,437 | 27,280 |
| 100.00 | 7,306 | 18,314 | 101.16 | 8,457 | 27,449 |
| 100.02 | 7,325 | 18,460 | 101.18 | 8,478 | 27,618 |
| 100.04 | 7,344 | 18,607 | 101.20 | 8,498 | 27,788 |
| 100.06 | 7,364 | 18,754 | 101.22 | 8,519 | 27,958 |
| 100.08 | 7,383 | 18,901 | 101.24 | 8,539 | 28,129 |
| 100.10 | 7,402 | 19,049 | 101.26 | 8,560 | 28,299 |
| 100.12 | 7,421 | 19,197 | 101.28 | 8,580 | 28,471 |
| 100.14 | 7,441 | 19,346 | 101.30 | 8,601 | 28,643 |
| 100.16 | 7,460 | 19,495 | 101.32 | 8,622 | 28,815 |
| 100.18 | 7,479 | 19,644 | 101.34 | 8,642 | 28,988 |
| 100.20 | 7,499 | 19,794 | 101.36 | 8,663 | 29,161 |
| 100.22 | 7,518 | 19,944 | 101.38 | 8,684 | 29,334 |
| 100.24 | 7,537 | 20,095 | 101.40 | 8,705 | 29,508 |
| 100.26 | 7,557 | 20,246 | 101.42 | 8,725 | 29,682 |
| 100.28 | 7,576 | 20,397 | 101.44 | 8,746 | 29,857 |
| 100.30 | 7,596 | 20,549 | 101.46 | 8,767 | 30,032 |
| 100.32 | 7,615 | 20,701 | 101.48 | 8,788 | 30,208 |
| 100.34 | 7,635 | 20,854 | 101.50 | 8,809 | 30,384 |
| 100.36 | 7,654 | 21,006 | 101.52 | 8,830 | 30,560 |

Stage-Area-Storage for Pond P3: Infiltration Basin (continued)

| Elevation (feet) | Surface (sq-ft) | Storage (cubic-feet) |
|---------------------|--------------------|-------------------------|
| 101.54 | 8,851 | 30,737 |
| 101.56 | 8,872 | 30,914 |
| 101.58 | 8,893 | 31,092 |
| 101.60 | 8,914 | 31,270 |
| 101.62 | 8,935 | 31,448 |
| 101.64 | 8,956 | 31,627 |
| 101.66 | 8,977 | 31,806 |
| 101.68 | 8,998 | 31,986 |
| 101.70 | 9,019 | 32,166 |
| 101.72 | 9,040 | 32,347 |
| 101.74 | 9,061 | 32,528 |
| 101.76 | 9,083 | 32,709 |
| 101.78 | 9,104 | 32,891 |
| 101.80 | 9,125 | 33,074 |
| 101.82 | 9,146 | 33,256 |
| 101.84 | 9,168 | 33,439 |
| 101.86 | 9,189 | 33,623 |
| 101.88 | 9,210 | 33,807 |
| 101.90 | 9,232 | 33,991 |
| 101.92 | 9,253 | 34,176 |
| 101.94 | 9,275 | 34,362 |
| 101.96 | 9,296 | 34,547 |
| 101.98 | 9,317 | 34,733 |
| 102.00 | 9,339 | 34,920 |

T0778.01 Riprap Sizing Computation for South Hunt Drainage Outlet

Taken from FHWA Hydraulic Design of Energy Dissipators for Culverts and Channels (Chapter 10)
FHWA-NHI-06-086 July 2006

By: J. McIntire - TEC, Inc. 8/24/2022

$$D_{50} = 0.2D \left(\frac{Q}{\sqrt{gD^{2.5}}} \right)^{4/3} \left(\frac{D}{TW} \right)$$

D_{50} = riprap size (ft)

Q = design discharge ($\frac{ft^3}{s}$)

Used 10 year storm peak flow from drainage calculations

D = culvert diameter (ft)

TW = tailwater depth (ft)

Use 0.4D as minimum

g = acceleration due to gravity ($32.2 \frac{ft}{s^2}$)

Table 10.1. Example Riprap Classes and Apron Dimensions

| Class | D_{50} (mm) | D_{50} (in) | Apron Length ¹ | Apron Depth |
|-------|---------------|---------------|---------------------------|--------------|
| 1 | 125 | 5 | 4D | 3.5 D_{50} |
| 2 | 150 | 6 | 4D | 3.3 D_{50} |
| 3 | 250 | 10 | 5D | 2.4 D_{50} |
| 4 | 350 | 14 | 6D | 2.2 D_{50} |
| 5 | 500 | 20 | 7D | 2.0 D_{50} |
| 6 | 550 | 22 | 8D | 2.0 D_{50} |

¹D is the culvert rise.

Proposed Outfall – Pond 2

$$D_{50} = 0.2(1.0 ft) \left(\frac{0.14 \frac{ft^3}{s}}{\sqrt{(32.2 \frac{ft}{s^2})(1.0 ft)^{2.5}}} \right)^{4/3} \left(\frac{1.0 ft}{0.4 ft} \right) =$$

0.04 inches = Class 1 (Table 10.1) -> Class 1 min. = 5"

Length = 4D = 4(1.0 ft) = 4.0 ft

Depth = 3.5(D_{50}) = 3.5(5 in) = 17.5 inches

TEC recommends an upsize to 8' long x 2' deep.

Proposed Outfall – Pond 3

$$D_{50} = 0.2(1.0ft) \left(\frac{0.0 \frac{ft^3}{s}}{\sqrt{(32.2 \frac{ft}{s^2})(1.0ft)^{2.5}}} \right)^{4/3} \left(\frac{1.0ft}{0.4ft} \right) =$$

0.0 inches = Class 1 (Table 10.1) → Class 1 min. = 5"

Length = 4D = 4(1.0 ft) = 4.0 ft

Depth = 3.5(D₅₀) = 3.5(5 in) = 17.5 inches

TEC recommends an upsize to 8' long x 2' deep.

Proposed Outfall – Pond 4

$$D_{50} = 0.2(1.0 ft) \left(\frac{0.36 \frac{ft^3}{s}}{\sqrt{(32.2 \frac{ft}{s^2})(1.0ft)^{2.5}}} \right)^{4/3} \left(\frac{1.0ft}{0.4ft} \right) =$$

0.2 inches = Class 1 (Table 10.1) → Class 1 min. = 5"

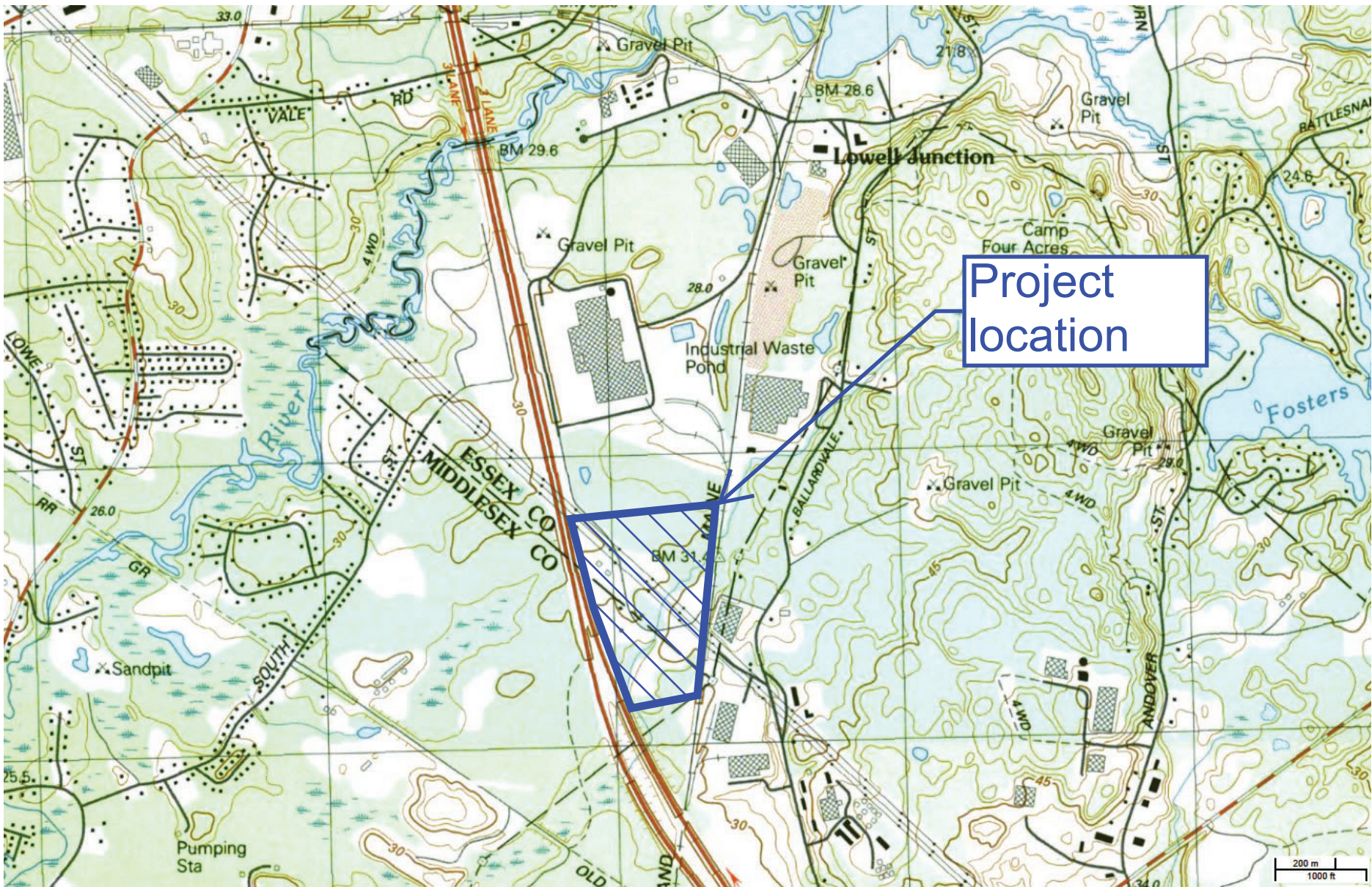
Length = 4D = 4(1.0 ft) = 4.0 ft

Depth = 3.5(D₅₀) = 3.5(5 in) = 17.5 inches

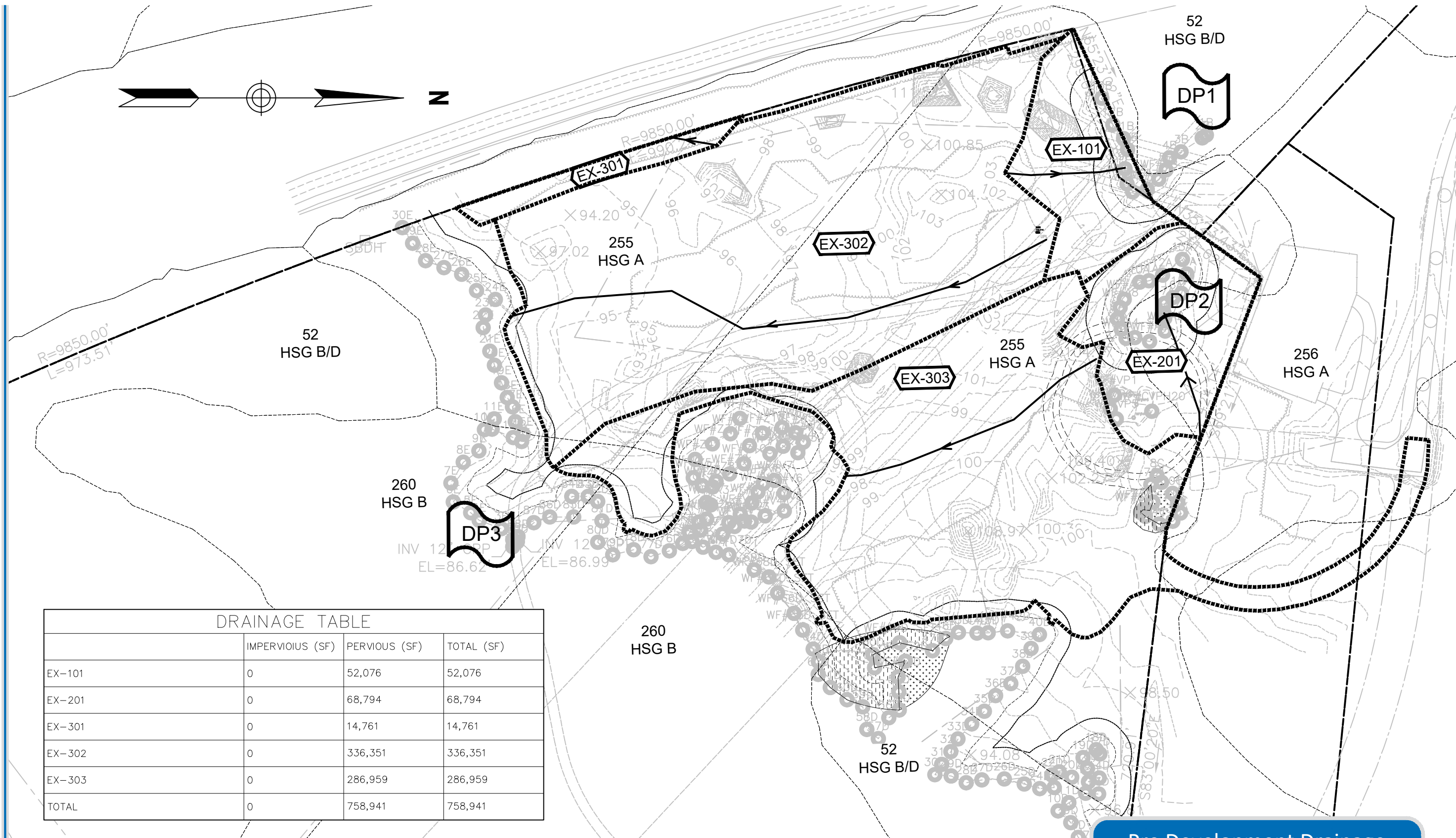
TEC recommends an upsize to 8' long x 2' deep.

C

Supporting Figures



Project location






DRAINAGE TABLE

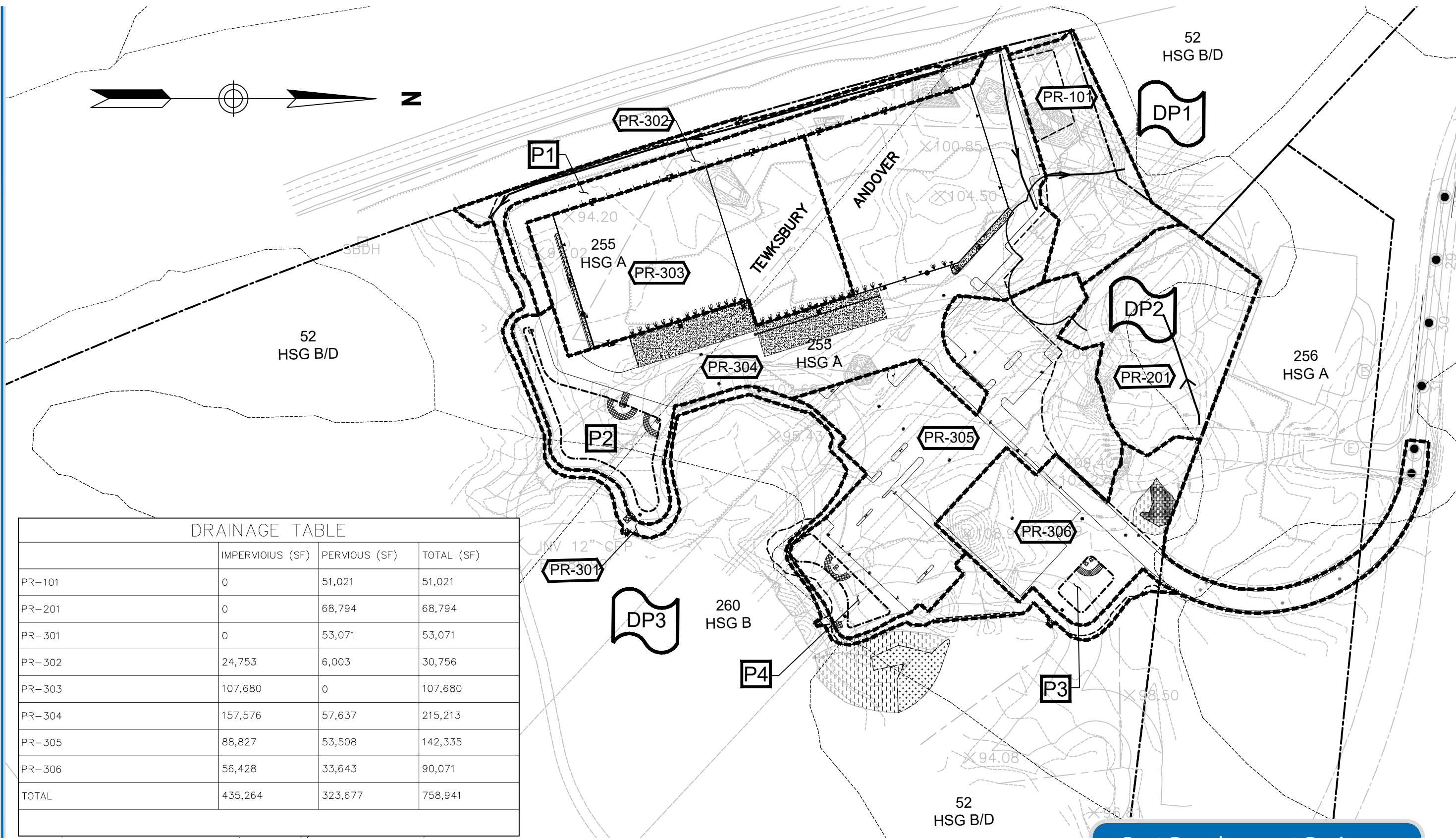
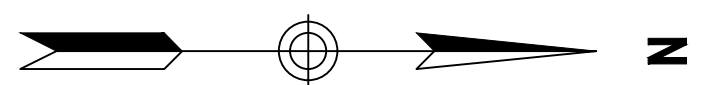
| | IMPERVIOUS (SF) | PERVIOUS (SF) | TOTAL (SF) |
|--------|-----------------|---------------|------------|
| EX-101 | 0 | 52,076 | 52,076 |
| EX-201 | 0 | 68,794 | 68,794 |
| EX-301 | 0 | 14,761 | 14,761 |
| EX-302 | 0 | 336,351 | 336,351 |
| EX-303 | 0 | 286,959 | 286,959 |
| TOTAL | 0 | 758,941 | 758,941 |

Pre Development Drainage

3, 3R, 4 Executive Place
 Andover, Massachusetts
 Scale: 1" = 100'

LEGEND

-  SUBCATCHMENT AREA
-  DESIGN POINT
-  DRAINAGE AREA BOUNDARY



DRAINAGE TABLE

| | IMPERVIOUS (SF) | PERVIOUS (SF) | TOTAL (SF) |
|--------|-----------------|---------------|------------|
| PR-101 | 0 | 51,021 | 51,021 |
| PR-201 | 0 | 68,794 | 68,794 |
| PR-301 | 0 | 53,071 | 53,071 |
| PR-302 | 24,753 | 6,003 | 30,756 |
| PR-303 | 107,680 | 0 | 107,680 |
| PR-304 | 157,576 | 57,637 | 215,213 |
| PR-305 | 88,827 | 53,508 | 142,335 |
| PR-306 | 56,428 | 33,643 | 90,071 |
| TOTAL | 435,264 | 323,677 | 758,941 |

Post Development Drainage

3, 3R, 4 Executive Place
Andover, Massachusetts
Scale: 1" = 100'

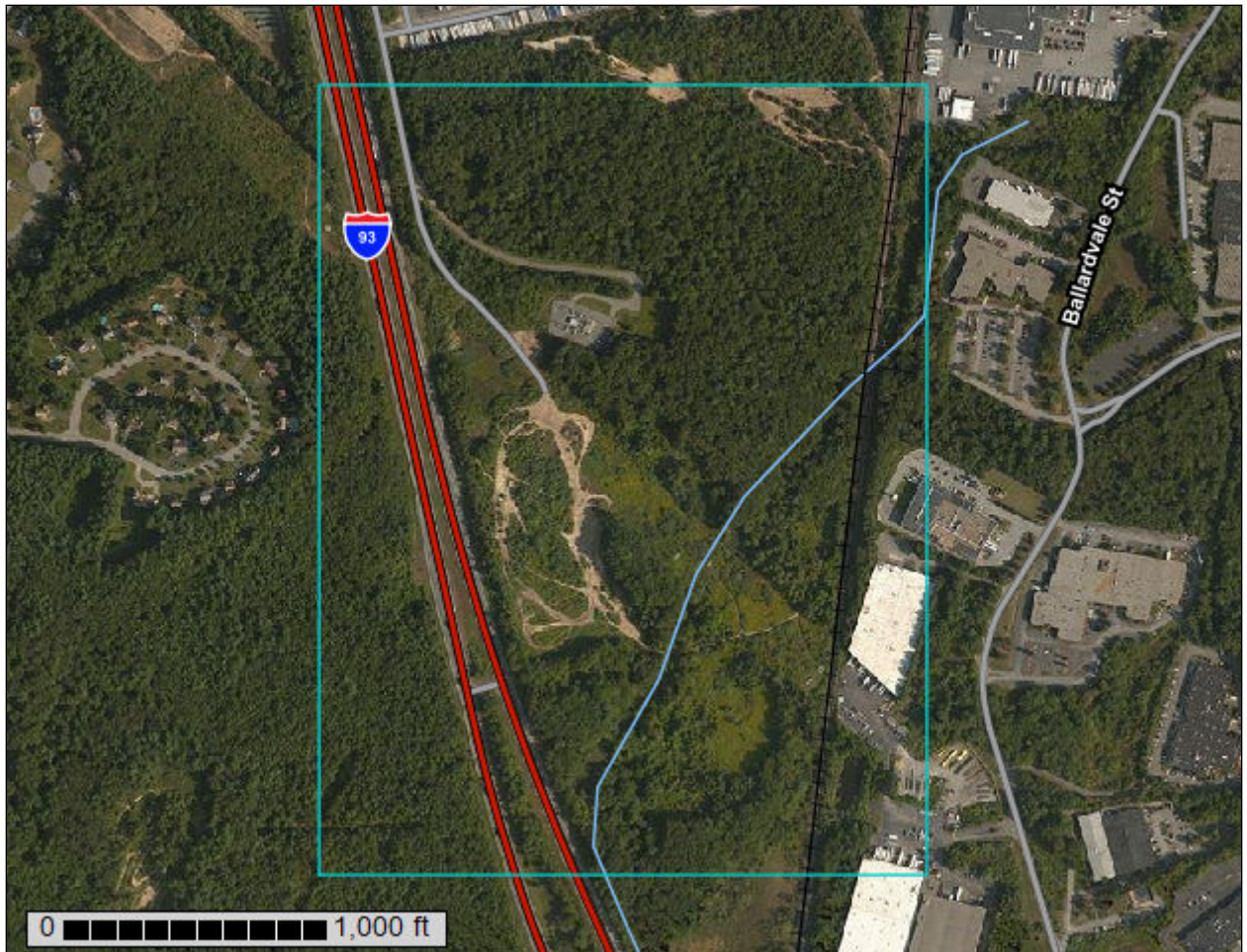


LEGEND

- SUBCATCHMENT AREA
- DESIGN POINT
- DRAINAGE AREA BOUNDARY

Custom Soil Resource Report for Essex County, Massachusetts, Northern Part; and Middlesex County, Massachusetts

Burt Road Extension Site Development project



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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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

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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

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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: 1:5,440 if printed on A portrait (8.5" x 11") sheet.

0 50 100 200 300 Meters


0 250 500 1000 1500 Feet

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 scales ranging from 1:15,800 to 1:25,000.

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

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

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

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

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

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

Soil Survey Area: Essex County, Massachusetts, Northern Part
 Survey Area Data: Version 14, Sep 7, 2018

Soil Survey Area: Middlesex County, Massachusetts
 Survey Area Data: Version 18, Sep 7, 2018

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

MAP LEGEND

MAP INFORMATION

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

Date(s) aerial images were photographed: Aug 29, 2014—Sep 19, 2014

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

Map Unit Legend

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|---------------------------------------|--|--------------|----------------|
| 52A | Freetown muck, 0 to 1 percent slopes | 11.9 | 7.5% |
| 255A | Windsor loamy sand, 0 to 3 percent slopes | 20.4 | 12.9% |
| 255B | Windsor loamy sand, 3 to 8 percent slopes | 26.2 | 16.6% |
| 256A | Deerfield loamy fine sand, 0 to 3 percent slopes | 9.9 | 6.3% |
| 260A | Sudbury fine sandy loam, 0 to 3 percent slopes | 14.9 | 9.4% |
| 602 | Urban land | 13.7 | 8.7% |
| Subtotals for Soil Survey Area | | 97.0 | 61.3% |
| Totals for Area of Interest | | 158.3 | 100.0% |

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|---------------------------------------|--|--------------|----------------|
| 51A | Swansea muck, 0 to 1 percent slopes | 1.8 | 1.1% |
| 52A | Freetown muck, 0 to 1 percent slopes | 10.7 | 6.7% |
| 255A | Windsor loamy sand, 0 to 3 percent slopes | 0.7 | 0.5% |
| 255B | Windsor loamy sand, 3 to 8 percent slopes | 14.0 | 8.8% |
| 256A | Deerfield loamy fine sand, 0 to 3 percent slopes | 10.0 | 6.3% |
| 260B | Sudbury fine sandy loam, 3 to 8 percent slopes | 7.3 | 4.6% |
| 602 | Urban land | 5.9 | 3.8% |
| 656 | Udorthents-Urban land complex | 10.9 | 6.9% |
| Subtotals for Soil Survey Area | | 61.3 | 38.7% |
| Totals for Area of Interest | | 158.3 | 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

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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.

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

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

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

Essex County, Massachusetts, Northern Part

52A—Freetown muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2t2q9
Elevation: 0 to 1,110 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 unique importance

Map Unit Composition

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

Description of Freetown

Setting

Landform: Depressions, depressions, bogs, marshes, kettles, swamps
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material

Typical profile

Oe - 0 to 2 inches: mucky peat
Oa - 2 to 79 inches: muck

Properties and qualities

Slope: 0 to 1 percent
Percent of area covered with surface fragments: 0.0 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Runoff class: Negligible
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: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water storage in profile: Very high (about 19.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Scarboro

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope

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Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 5 percent
Landform: Depressions, depressions, marshes, swamps, bogs, kettles
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

255A—Windsor loamy sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2svkg
Elevation: 0 to 990 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

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

Description of Windsor, Loamy Sand

Setting

Landform: Outwash terraces, outwash plains, dunes, deltas
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Parent material: Loose sandy glaciofluvial deposits derived from granite and/or loose sandy glaciofluvial deposits derived from schist and/or loose sandy glaciofluvial deposits derived from gneiss

Typical profile

O - 0 to 1 inches: moderately decomposed plant material

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A - 1 to 3 inches: loamy sand
Bw - 3 to 25 inches: loamy sand
C - 25 to 65 inches: sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Deerfield, loamy sand

Percent of map unit: 10 percent
Landform: Terraces, deltas, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Hinckley, loamy sand

Percent of map unit: 5 percent
Landform: Deltas, outwash plains, eskers, kames
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

255B—Windsor loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2svkf
Elevation: 0 to 1,210 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F

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Frost-free period: 140 to 240 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Windsor, loamy sand, and similar soils: 85 percent

Minor components: 15 percent

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

Description of Windsor, Loamy Sand

Setting

Landform: Deltas, outwash plains, dunes, outwash terraces

Landform position (three-dimensional): Riser, tread

Down-slope shape: Linear, convex

Across-slope shape: Linear, convex

Parent material: Loose sandy glaciofluvial deposits derived from granite and/or loose sandy glaciofluvial deposits derived from schist and/or loose sandy glaciofluvial deposits derived from gneiss

Typical profile

O - 0 to 1 inches: moderately decomposed plant material

A - 1 to 3 inches: loamy sand

Bw - 3 to 25 inches: loamy sand

C - 25 to 65 inches: sand

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Excessively drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)

Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2s

Hydrologic Soil Group: A

Hydric soil rating: No

Minor Components

Hinckley, loamy sand

Percent of map unit: 10 percent

Landform: Kames, deltas, outwash plains, eskers

Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise

Down-slope shape: Convex

Across-slope shape: Convex, linear

Hydric soil rating: No

Deerfield, loamy sand

Percent of map unit: 5 percent
Landform: Outwash plains, terraces, deltas
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

256A—Deerfield loamy fine sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2xfg8
Elevation: 0 to 1,100 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: Farmland of statewide importance

Map Unit Composition

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

Description of Deerfield

Setting

Landform: Kame terraces, outwash plains, outwash deltas, outwash terraces
Landform position (three-dimensional): Tread
Down-slope shape: Convex, linear, concave
Across-slope shape: Concave, linear, convex
Parent material: Sandy outwash derived from granite, gneiss, and/or quartzite

Typical profile

Ap - 0 to 9 inches: loamy fine sand
Bw - 9 to 25 inches: loamy fine sand
BC - 25 to 33 inches: fine sand
Cg - 33 to 60 inches: sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: About 15 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)

Custom Soil Resource Report

Sodium adsorption ratio, maximum in profile: 11.0
Available water storage in profile: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 7 percent
Landform: Kame terraces, outwash terraces, outwash plains, outwash deltas
Landform position (three-dimensional): Tread
Down-slope shape: Convex, linear, concave
Across-slope shape: Concave, linear, convex
Hydric soil rating: No

Wareham

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

Sudbury

Percent of map unit: 2 percent
Landform: Outwash terraces, outwash deltas, kame terraces, outwash plains
Landform position (three-dimensional): Tread
Down-slope shape: Convex, linear, concave
Across-slope shape: Concave, linear, convex
Hydric soil rating: No

Ninigret

Percent of map unit: 1 percent
Landform: Kame terraces, outwash terraces, outwash plains
Landform position (three-dimensional): Tread
Down-slope shape: Convex, linear
Across-slope shape: Convex, concave
Hydric soil rating: No

260A—Sudbury fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: vjsk
Elevation: 0 to 2,100 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Sudbury and similar soils: 80 percent

Minor components: 20 percent

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

Description of Sudbury

Setting

Landform: Flats

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Rise

Down-slope shape: Concave

Across-slope shape: Concave

Parent material: Friable loamy eolian deposits over loose sandy glaciofluvial deposits derived from granite and gneiss

Typical profile

O - 0 to 1 inches: muck

H2 - 1 to 5 inches: fine sandy loam

H3 - 5 to 21 inches: sandy loam

H4 - 21 to 27 inches: loamy sand

H5 - 27 to 60 inches: Error

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Moderately well drained

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

Depth to water table: About 18 to 36 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2w

Hydrologic Soil Group: B

Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 15 percent

Hydric soil rating: No

Walpole

Percent of map unit: 5 percent

Landform: Terraces

Hydric soil rating: Yes

602—Urban land

Map Unit Setting

National map unit symbol: vjx3

Frost-free period: 125 to 165 days

Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 80 percent

Minor components: 20 percent

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

Description of Urban Land

Setting

Parent material: Excavated and filled land

Minor Components

Udorthents

Percent of map unit: 10 percent

Hydric soil rating: No

Charlton

Percent of map unit: 2 percent

Hydric soil rating: No

Hinckley

Percent of map unit: 2 percent

Hydric soil rating: No

Merrimac

Percent of map unit: 2 percent

Hydric soil rating: No

Paxton

Percent of map unit: 2 percent

Hydric soil rating: No

Windsor

Percent of map unit: 2 percent

Hydric soil rating: No

Middlesex County, Massachusetts

51A—Swansea muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2trl2
Elevation: 0 to 1,140 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 unique importance

Map Unit Composition

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

Description of Swansea

Setting

Landform: Bogs, swamps
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material over loose sandy and gravelly glaciofluvial deposits

Typical profile

Oa1 - 0 to 24 inches: muck
Oa2 - 24 to 34 inches: muck
Cg - 34 to 79 inches: coarse sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Runoff class: Negligible
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: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water storage in profile: Very high (about 16.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Freetown

Percent of map unit: 10 percent
Landform: Bogs, swamps
Landform position (three-dimensional): Dip

Custom Soil Resource Report

Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

52A—Freetown muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2t2q9
Elevation: 0 to 1,110 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 unique importance

Map Unit Composition

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

Description of Freetown

Setting

Landform: Swamps, depressions, depressions, bogs, marshes, kettles
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material

Typical profile

Oe - 0 to 2 inches: mucky peat
Oa - 2 to 79 inches: muck

Custom Soil Resource Report

Properties and qualities

Slope: 0 to 1 percent
Percent of area covered with surface fragments: 0.0 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Runoff class: Negligible
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: About 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water storage in profile: Very high (about 19.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Scarboro

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 5 percent
Landform: Bogs, kettles, depressions, depressions, marshes, swamps
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

255A—Windsor loamy sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2svkg

Elevation: 0 to 990 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

Windsor, loamy sand, and similar soils: 85 percent

Minor components: 15 percent

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

Description of Windsor, Loamy Sand

Setting

Landform: Dunes, deltas, outwash terraces, outwash plains

Landform position (three-dimensional): Tread, riser

Down-slope shape: Convex, linear

Across-slope shape: Convex, linear

Parent material: Loose sandy glaciofluvial deposits derived from granite and/or loose sandy glaciofluvial deposits derived from schist and/or loose sandy glaciofluvial deposits derived from gneiss

Typical profile

O - 0 to 1 inches: moderately decomposed plant material

A - 1 to 3 inches: loamy sand

Bw - 3 to 25 inches: loamy sand

C - 25 to 65 inches: sand

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Excessively drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)

Available water storage in profile: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2s

Hydrologic Soil Group: A

Hydric soil rating: No

Minor Components

Deerfield, loamy sand

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

Hinckley, loamy sand

Percent of map unit: 5 percent
Landform: Outwash plains, eskers, kames, deltas
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

255B—Windsor loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2svkf
Elevation: 0 to 1,210 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

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

Description of Windsor, Loamy Sand

Setting

Landform: Outwash terraces, deltas, outwash plains, dunes
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Parent material: Loose sandy glaciofluvial deposits derived from granite and/or loose sandy glaciofluvial deposits derived from schist and/or loose sandy glaciofluvial deposits derived from gneiss

Typical profile

O - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: loamy sand

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Bw - 3 to 25 inches: loamy sand

C - 25 to 65 inches: sand

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Excessively drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)

Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2s

Hydrologic Soil Group: A

Hydric soil rating: No

Minor Components

Hinckley, loamy sand

Percent of map unit: 10 percent

Landform: Outwash plains, eskers, kames, deltas

Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise

Down-slope shape: Convex

Across-slope shape: Linear, convex

Hydric soil rating: No

Deerfield, loamy sand

Percent of map unit: 5 percent

Landform: Terraces, deltas, outwash plains

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Tread, tal

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

256A—Deerfield loamy fine sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2xfg8

Elevation: 0 to 1,100 feet

Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F

Frost-free period: 145 to 240 days

Custom Soil Resource Report

Farmland classification: Farmland of statewide importance

Map Unit Composition

Deerfield and similar soils: 85 percent

Minor components: 15 percent

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

Description of Deerfield

Setting

Landform: Outwash terraces, outwash deltas, outwash plains, kame terraces

Landform position (three-dimensional): Tread

Down-slope shape: Convex, linear, concave

Across-slope shape: Concave, linear, convex

Parent material: Sandy outwash derived from granite, gneiss, and/or quartzite

Typical profile

Ap - 0 to 9 inches: loamy fine sand

Bw - 9 to 25 inches: loamy fine sand

BC - 25 to 33 inches: fine sand

Cg - 33 to 60 inches: sand

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Moderately well drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)

Depth to water table: About 15 to 37 inches

Frequency of flooding: None

Frequency of ponding: None

Salinity, maximum in profile: Nonsaline (0.0 to 1.9 mmhos/cm)

Sodium adsorption ratio, maximum in profile: 11.0

Available water storage in profile: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2w

Hydrologic Soil Group: A

Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 7 percent

Landform: Outwash terraces, kame terraces, outwash deltas, outwash plains

Landform position (three-dimensional): Tread

Down-slope shape: Linear, convex, concave

Across-slope shape: Concave, linear, convex

Hydric soil rating: No

Wareham

Percent of map unit: 5 percent

Landform: Drainageways, depressions

Down-slope shape: Concave

Across-slope shape: Concave

Custom Soil Resource Report

Hydric soil rating: Yes

Sudbury

Percent of map unit: 2 percent

Landform: Kame terraces, outwash deltas, outwash terraces, outwash plains

Landform position (three-dimensional): Tread

Down-slope shape: Convex, linear, concave

Across-slope shape: Concave, linear, convex

Hydric soil rating: No

Ninigret

Percent of map unit: 1 percent

Landform: Kame terraces, outwash plains, outwash terraces

Landform position (three-dimensional): Tread

Down-slope shape: Convex, linear

Across-slope shape: Convex, concave

Hydric soil rating: No

260B—Sudbury fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 9915

Elevation: 0 to 2,100 feet

Mean annual precipitation: 45 to 54 inches

Mean annual air temperature: 43 to 54 degrees F

Frost-free period: 145 to 240 days

Farmland classification: All areas are prime farmland

Map Unit Composition

Sudbury and similar soils: 85 percent

Minor components: 15 percent

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

Description of Sudbury

Setting

Landform: Plains, terraces

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Tread, dip

Down-slope shape: Linear

Across-slope shape: Concave

Parent material: Friable loamy eolian deposits over loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 8 inches: fine sandy loam

H2 - 8 to 20 inches: fine sandy loam

H3 - 20 to 27 inches: loamy sand

H4 - 27 to 65 inches: stratified gravelly coarse sand to sand

Custom Soil Resource Report

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 8 percent
Landform: Plains, terraces
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Wareham

Percent of map unit: 4 percent
Landform: Depressions, terraces, deltas
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Windsor

Percent of map unit: 2 percent
Landform: Terraces, deltas, flats
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Unnamed

Percent of map unit: 1 percent

602—Urban land

Map Unit Setting

National map unit symbol: 9950
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 50 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 110 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

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

Minor Components

Udorthents, wet substratum

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

Rock outcrop

Percent of map unit: 5 percent
Landform: Ledges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Head slope
Down-slope shape: Concave
Across-slope shape: Concave

Udorthents, loamy

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

656—Udorthents-Urban land complex

Map Unit Setting

National map unit symbol: 995k
Elevation: 0 to 3,000 feet
Mean annual precipitation: 32 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 40 percent
Urban land: 40 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

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

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: More than 80 inches
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Description of Urban Land

Setting

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

Minor Components

Canton

Percent of map unit: 10 percent
Landform: Hills
Landform position (two-dimensional): Backslope, toeslope
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Linear
Across-slope shape: Convex
Hydric soil rating: No

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Paxton

Percent of map unit: 5 percent

Landform: Hillslopes

Landform position (two-dimensional): Backslope, summit

Landform position (three-dimensional): Head slope, side slope

Down-slope shape: Convex

Across-slope shape: Convex

Hydric soil rating: No

Merrimac

Percent of map unit: 5 percent

Landform: Terraces, plains

Landform position (two-dimensional): Shoulder

Landform position (three-dimensional): Tread, rise

Down-slope shape: Convex

Across-slope shape: Convex

Hydric soil rating: No

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NOTES TO USERS

is for use in administering the National Flood Insurance Program. It does not identify all areas subject to flooding, particularly from local drainage of small size. The community map repository should be consulted for updated or additional flood hazard information.

more detailed information in areas where **Base Flood Elevations (BFEs)** have been determined, users are encouraged to consult the Flood and Floodway Data and/or Summary of Stillwater Elevations tables contained in the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users aware that BFEs shown on the FIRM represent rounded whole-foot values. These BFEs are intended for flood insurance rating purposes only and are not to be used as the sole source of flood elevation information. Accordingly, elevation data presented in the FIS Report should be utilized in conjunction with the FIS Report for purposes of construction and/or floodplain management.

Base Flood Elevations shown on this map apply only to landward of 0.0' vertical datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations in the Flood Insurance Study Report for this jurisdiction. Elevations in the Summary of Stillwater Elevations table should be used for construction and floodplain management purposes when they are higher than the elevations shown on this FIRM.

of the floodways were computed at cross sections and interpolated cross sections. The floodways were based on hydraulic considerations with requirements of the National Flood Insurance Program. Floodway widths and pertinent floodway data are provided in the Flood Insurance Study Report.

areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

information used in the preparation of this map was Massachusetts State Plane Zone (FIPS zone 2001). The horizontal datum was NAD 83. CRS 1983. Differences in datum, spheroid, projection or UTM zones used in the preparation of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

ations on this map are referenced to the North American Vertical Datum of 1988. Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations in the Flood Insurance Study Report for this jurisdiction. Elevations in the Summary of Stillwater Elevations table should be used for construction and floodplain management purposes when they are higher than the elevations shown on this FIRM.

ation Services
NGS12
Geodetic Survey
#9202
West Highway
ing, Maryland 20910-3282
-3242

current elevation, description, and/or location information for **bench marks** on this map, please contact the Information Services Branch of the National Survey at (301) 713-3242, or visit its website at <http://www.ngs.noaa.gov>.

information shown on this FIRM was derived from digital orthophotography by the Massachusetts Geographic Information System. This information was from photography dated 2005.

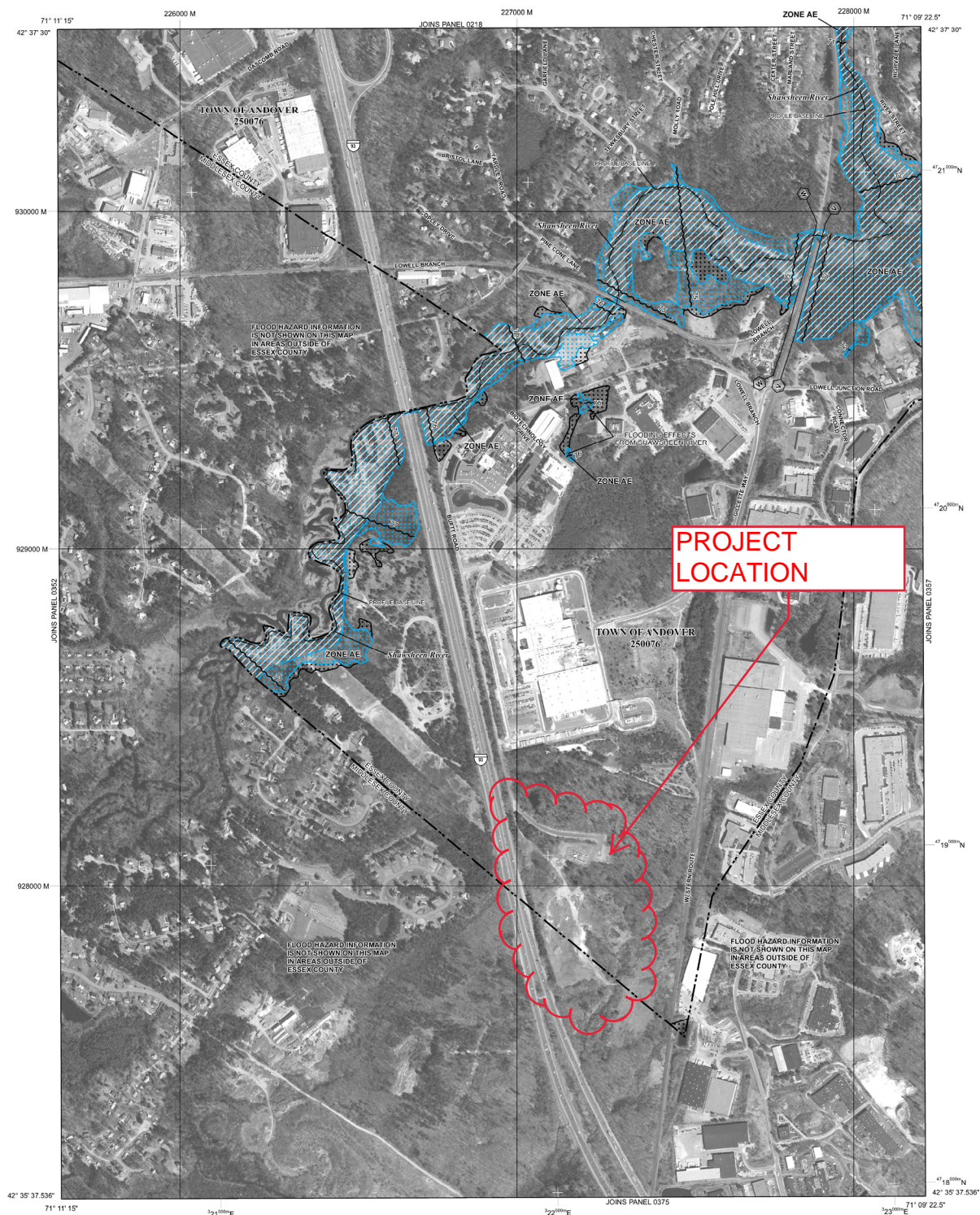
Hydraulic baselines depicted on this map represent the hydraulic modeling baselines used to compute the flood profiles in the FIS report. As a result of improved topographic data, **baselines**, in some cases, may deviate significantly from the channel or appear outside the SFHA.

updated topographic information this map reflects more detailed and stream channel configurations and floodplain delineations than shown on the previous FIRM for this jurisdiction. As a result, the Flood and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect areal distances that differ from what is shown on the map. Also, the floodplain relationships for unreviewed streams may differ from what is shown on previous maps.

limits shown on this map are based on the best data available at the time. Because changes due to annexations or de-annexations may have occurred since this map was published, map users should contact appropriate officials to verify current corporate limit locations.

Refer to the separately printed **Map Index** for an overview map of the following the layout of map panels; community map repository addresses; listing of Communities table containing National Flood Insurance Program information for each community as well as a listing of the panels on which each community information on available products associated with this FIRM visit the **Map Center (MSC)** website at <http://msc.fema.gov>. Available products may be reissued Letters of Map Change, a Flood Insurance Study Report, digital versions of this map. Many of these products can be ordered or directly from the MSC website.

For **more questions about this map**, how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information Center (FMIC)** at 1-877-FEMA-MAP (1-877-326-6227) or visit the FEMA website at <http://www.fema.gov/business/info>.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood with a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Areas (SFHAs) are the areas subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zone A, AE, AH, AO, A99, V, and VE. The Base Flood Elevation is the water's elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevation determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); Base Flood Elevation determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently identified. Zone AR indicates that the former flood control system is being restored to protection from the 1% annual chance or greater flood.

ZONE A99 Areas to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevation determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevation determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be incorporated so that the 1% annual chance flood can be carried without substantial loss of flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood, areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile, and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% Annual Chance Floodplain Boundary

0.2% Annual Chance Floodplain Boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and bounding Special Flood Hazard Areas of different Base Flood flood depths, or flood velocities.

Base Flood Elevation line and value; elevation in feet* (EL 987)

Base flood elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

(A) - (B) Cross section line

Client Transsect line

Bridge Client

Geographic coordinates referenced to the North American 1983 (NAD 83) Western Hemisphere

4989000 M 1000-meter UTM; Massachusetts State Plane NAD 83 (FIPS Zone 2001), Lambert Conformal Conic projection

49° 00' 00" N 1000-meter Universal Transverse Mercator grid values, zone 18N

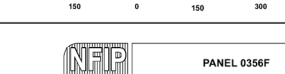
DM5510 X Bench mark (see explanation in Notes to Users section of this panel)

M1.5 River Mile

MAP REPOSITORIES Refer to Map Repositories list or Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP July 3, 2012.

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL



NFIP

PANEL 0356F

FIRM

FLOOD INSURANCE RATE MAP

ESSEX COUNTY, MASSACHUSETTS (ALL JURISDICTIONS)

PANEL 356 OF 600
(SEE MAP INDEX FOR FIRM PANEL LIST)

CONTAINS:

| COMMUNITY | NUMBER | PANEL |
|------------------|--------|-------|
| ANDOVER, TOWN OF | 250076 | 0356 |

Notice to User: The **Map Number** should be used when placing map or Community Number shown above as used on insurance applications for the community.

FEDERAL EMERGENCY MANAGEMENT AGENCY

MAP NUMBER 250090C

EFFECTIVE DATE JULY 3

Extreme Precipitation Tables

Northeast Regional Climate Center

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

| | |
|------------------|---------------------------------|
| Smoothing | Yes |
| State | Massachusetts |
| Location | |
| Longitude | 71.167 degrees West |
| Latitude | 42.600 degrees North |
| Elevation | 0 feet |
| Date/Time | Mon, 11 Nov 2019 14:44:08 -0500 |

Extreme Precipitation Estimates

| | 5min | 10min | 15min | 30min | 60min | 120min | | 1hr | 2hr | 3hr | 6hr | 12hr | 24hr | 48hr | | 1day | 2day | 4day | 7day | 10day | |
|--------------|------|-------|-------|-------|-------|--------|--------------|------|------|------|------|-------|-------|-------|--------------|-------|-------|-------|-------|-------|--------------|
| 1yr | 0.28 | 0.42 | 0.52 | 0.69 | 0.86 | 1.08 | 1yr | 0.74 | 1.02 | 1.26 | 1.60 | 2.04 | 2.62 | 2.85 | 1yr | 2.32 | 2.74 | 3.18 | 3.86 | 4.51 | 1yr |
| 2yr | 0.34 | 0.52 | 0.65 | 0.86 | 1.08 | 1.36 | 2yr | 0.93 | 1.25 | 1.58 | 1.98 | 2.50 | 3.15 | 3.48 | 2yr | 2.79 | 3.34 | 3.86 | 4.58 | 5.22 | 2yr |
| 5yr | 0.40 | 0.62 | 0.78 | 1.05 | 1.34 | 1.71 | 5yr | 1.16 | 1.56 | 2.00 | 2.52 | 3.18 | 4.00 | 4.44 | 5yr | 3.54 | 4.27 | 4.89 | 5.81 | 6.56 | 5yr |
| 10yr | 0.45 | 0.71 | 0.90 | 1.22 | 1.59 | 2.04 | 10yr | 1.37 | 1.85 | 2.39 | 3.03 | 3.81 | 4.80 | 5.34 | 10yr | 4.24 | 5.14 | 5.86 | 6.95 | 7.81 | 10yr |
| 25yr | 0.54 | 0.85 | 1.08 | 1.49 | 1.98 | 2.58 | 25yr | 1.71 | 2.32 | 3.02 | 3.85 | 4.86 | 6.10 | 6.83 | 25yr | 5.40 | 6.57 | 7.44 | 8.83 | 9.83 | 25yr |
| 50yr | 0.60 | 0.97 | 1.24 | 1.74 | 2.35 | 3.09 | 50yr | 2.03 | 2.76 | 3.64 | 4.64 | 5.85 | 7.32 | 8.24 | 50yr | 6.48 | 7.92 | 8.91 | 10.58 | 11.70 | 50yr |
| 100yr | 0.69 | 1.12 | 1.44 | 2.04 | 2.78 | 3.68 | 100yr | 2.40 | 3.28 | 4.35 | 5.55 | 7.01 | 8.78 | 9.93 | 100yr | 7.77 | 9.55 | 10.68 | 12.68 | 13.93 | 100yr |
| 200yr | 0.79 | 1.28 | 1.67 | 2.39 | 3.30 | 4.40 | 200yr | 2.85 | 3.90 | 5.21 | 6.67 | 8.43 | 10.55 | 11.98 | 200yr | 9.33 | 11.52 | 12.80 | 15.21 | 16.60 | 200yr |
| 500yr | 0.95 | 1.56 | 2.03 | 2.95 | 4.14 | 5.56 | 500yr | 3.57 | 4.90 | 6.61 | 8.49 | 10.75 | 13.44 | 15.36 | 500yr | 11.90 | 14.77 | 16.28 | 19.34 | 20.94 | 500yr |

Lower Confidence Limits

| | 5min | 10min | 15min | 30min | 60min | 120min | | 1hr | 2hr | 3hr | 6hr | 12hr | 24hr | 48hr | | 1day | 2day | 4day | 7day | 10day | |
|--------------|------|-------|-------|-------|-------|--------|--------------|------|------|------|------|------|------|-------|--------------|------|------|-------|-------|-------|--------------|
| 1yr | 0.24 | 0.37 | 0.46 | 0.61 | 0.75 | 0.86 | 1yr | 0.65 | 0.84 | 1.14 | 1.39 | 1.71 | 2.40 | 2.44 | 1yr | 2.12 | 2.35 | 2.76 | 3.45 | 4.07 | 1yr |
| 2yr | 0.32 | 0.50 | 0.61 | 0.83 | 1.03 | 1.23 | 2yr | 0.89 | 1.20 | 1.41 | 1.86 | 2.39 | 3.04 | 3.35 | 2yr | 2.69 | 3.22 | 3.72 | 4.42 | 5.06 | 2yr |
| 5yr | 0.38 | 0.58 | 0.72 | 0.99 | 1.26 | 1.47 | 5yr | 1.08 | 1.44 | 1.67 | 2.17 | 2.78 | 3.65 | 4.05 | 5yr | 3.23 | 3.90 | 4.50 | 5.33 | 6.06 | 5yr |
| 10yr | 0.42 | 0.64 | 0.79 | 1.11 | 1.43 | 1.68 | 10yr | 1.24 | 1.64 | 1.91 | 2.45 | 3.12 | 4.19 | 4.64 | 10yr | 3.71 | 4.46 | 5.16 | 6.10 | 6.94 | 10yr |
| 25yr | 0.48 | 0.73 | 0.91 | 1.30 | 1.71 | 1.99 | 25yr | 1.47 | 1.94 | 2.26 | 2.86 | 3.63 | 5.00 | 5.56 | 25yr | 4.43 | 5.35 | 6.21 | 7.29 | 8.30 | 25yr |
| 50yr | 0.53 | 0.81 | 1.01 | 1.44 | 1.94 | 2.27 | 50yr | 1.68 | 2.22 | 2.56 | 3.23 | 4.08 | 5.71 | 6.38 | 50yr | 5.05 | 6.14 | 7.16 | 8.31 | 9.48 | 50yr |
| 100yr | 0.59 | 0.90 | 1.12 | 1.62 | 2.23 | 2.58 | 100yr | 1.92 | 2.52 | 2.91 | 3.65 | 4.58 | 6.51 | 7.34 | 100yr | 5.76 | 7.05 | 8.26 | 9.47 | 10.85 | 100yr |
| 200yr | 0.66 | 1.00 | 1.27 | 1.83 | 2.56 | 2.93 | 200yr | 2.21 | 2.87 | 3.29 | 4.12 | 5.17 | 7.40 | 8.44 | 200yr | 6.55 | 8.12 | 9.52 | 10.73 | 12.39 | 200yr |
| 500yr | 0.78 | 1.15 | 1.48 | 2.16 | 3.07 | 3.48 | 500yr | 2.65 | 3.40 | 3.89 | 4.85 | 6.06 | 8.73 | 10.17 | 500yr | 7.72 | 9.78 | 11.50 | 12.60 | 14.75 | 500yr |

Upper Confidence Limits

| | 5min | 10min | 15min | 30min | 60min | 120min | | 1hr | 2hr | 3hr | 6hr | 12hr | 24hr | 48hr | | 1day | 2day | 4day | 7day | 10day | |
|--------------|------|-------|-------|-------|-------|--------|--------------|------|------|------|------|-------|-------|-------|--------------|-------|-------|-------|-------|-------|--------------|
| 1yr | 0.31 | 0.47 | 0.57 | 0.77 | 0.95 | 1.11 | 1yr | 0.82 | 1.08 | 1.28 | 1.69 | 2.17 | 2.79 | 3.12 | 1yr | 2.47 | 3.00 | 3.43 | 4.16 | 4.91 | 1yr |
| 2yr | 0.35 | 0.54 | 0.67 | 0.91 | 1.12 | 1.32 | 2yr | 0.96 | 1.29 | 1.52 | 2.00 | 2.56 | 3.27 | 3.63 | 2yr | 2.89 | 3.49 | 4.01 | 4.77 | 5.41 | 2yr |
| 5yr | 0.44 | 0.68 | 0.84 | 1.15 | 1.46 | 1.72 | 5yr | 1.26 | 1.68 | 1.98 | 2.56 | 3.25 | 4.35 | 4.85 | 5yr | 3.85 | 4.66 | 5.34 | 6.31 | 7.09 | 5yr |
| 10yr | 0.53 | 0.82 | 1.01 | 1.42 | 1.83 | 2.10 | 10yr | 1.58 | 2.06 | 2.42 | 3.10 | 3.90 | 5.40 | 6.05 | 10yr | 4.78 | 5.81 | 6.61 | 7.83 | 8.69 | 10yr |
| 25yr | 0.69 | 1.05 | 1.31 | 1.87 | 2.46 | 2.75 | 25yr | 2.12 | 2.69 | 3.18 | 3.99 | 4.95 | 7.21 | 8.11 | 25yr | 6.38 | 7.80 | 8.79 | 10.43 | 11.42 | 25yr |
| 50yr | 0.83 | 1.27 | 1.58 | 2.27 | 3.06 | 3.38 | 50yr | 2.64 | 3.31 | 3.91 | 4.83 | 5.95 | 8.99 | 10.14 | 50yr | 7.95 | 9.75 | 10.87 | 12.99 | 14.04 | 50yr |
| 100yr | 1.02 | 1.54 | 1.94 | 2.80 | 3.83 | 4.15 | 100yr | 3.31 | 4.05 | 4.81 | 5.85 | 7.14 | 11.22 | 12.67 | 100yr | 9.93 | 12.19 | 13.49 | 16.20 | 17.28 | 100yr |
| 200yr | 1.24 | 1.87 | 2.37 | 3.43 | 4.79 | 5.09 | 200yr | 4.13 | 4.98 | 5.92 | 7.08 | 8.56 | 14.02 | 15.85 | 200yr | 12.41 | 15.24 | 16.72 | 20.19 | 21.29 | 200yr |
| 500yr | 1.62 | 2.42 | 3.11 | 4.51 | 6.42 | 6.69 | 500yr | 5.54 | 6.54 | 7.81 | 9.13 | 10.91 | 18.85 | 21.31 | 500yr | 16.68 | 20.49 | 22.22 | 27.06 | 28.07 | 500yr |



D

**Construction Period Pollution
Prevention and Erosion and
Sedimentation Control Plan**

**CONSTRUCTION PERIOD POLLUTION
PREVENTION AND EROSION AND
SEDIMENTATION CONTROL PLAN**

BURTT ROAD DEVELOPMENT

3, 3R, 4 Executive Road

ANDOVER, MASSACHUSETTS

Prepared for: **MCP/Howland Burtt Owner, LLC**
260 Franklin St.
Boston, MA 02110

Prepared by: **TEC, Inc.**
282 Merrimack St, Floor 2
Lawrence MA, 01843

August 28, 2019
Revised August 30, 2022

**CONSTRUCTION PERIOD POLLUTION PREVENTION AND
EROSION AND SEDIMENTATION CONTROL PLAN**
August 28, 2019

Name of Applicant: MCP/Howland Burttt Owner, LLC
Name of Facility: Burttt Road Development
Location: Burttt Road Extension
Andover, MA 01810

Good Housekeeping BMPs

Goals

Minimize the potential for contaminants to enter or runoff the site during construction activities. Fuel and other equipment related fluids will be properly stored. The Contractor shall establish secure storage areas that collect any spillage to meet requirements of the Town of Andover Fire Department regarding the storage of flammable materials. The Contractor shall complete and submit the plans to the Engineer.

General Requirements

The following presents a proactive approach to all of the best management practices, erosion and sedimentation controls, mitigation measures, and monitoring activities for this Project.

Compost Filter Sock

A compost filter sock is a type of contained compost filter berm. It is a mesh tube filled with composted material that is placed perpendicular to sheet-flow runoff to control erosion and retain sediment in disturbed areas. The filter sock can be used in place of a traditional sediment and erosion control tool such as a silt fence or straw bale barrier.

Compost filter socks are flexible and can be placed along the perimeter of a site, or at intervals along a slope, to capture and treat stormwater that runs off as sheet flow. Filter socks can also be used on pavement as inlet protection for storm drains and to slow water flow in small ditches. Filter socks used for erosion control are usually 12 inches in diameter, although 8 inch, 18 inch, and 24 inch– diameter socks are used in some applications. The smaller, 8 inch–diameter filter socks are commonly used for stormwater inlet protection. The outer shell of a compost filter sock is typically biodegradable and can remain on pervious surfaces post construction versus having to be removed as construction waste.

Temporary Stabilized Construction Vehicle Entrance/Exit

The purpose of stabilized entrances to a construction site is to minimize the amount of sediment leaving the area as mud and sediment attached to vehicles. Installing a pad of gravel over filter cloth where construction traffic leaves a site can help stabilize a construction entrance. As a vehicle drives over the pad, the pad removes mud and sediment from the wheels and reduces soil transport off the site. The filter cloth separates the gravel from the soil below, keeping the gravel from being ground into the soil. The fabric also reduces the amount of rutting caused by vehicle tires. It spreads the vehicle's weight over a soil area larger than the tire width.

Storm Drain Inlet Protection

Storm drain inlet protection measures prevent soil and debris from entering storm drain inlets. These measures will be implemented before the Site is disturbed by using silt sacks, compost filter socks, or staked bales in combination with silt fence. Storm drain inlet protection will be installed at all down gradient catch basins adjacent to the project site outside the protection of other erosion control barriers, all catch basins within the construction site, and at low points within the construction site that are connected to the storm drainage system.

General Maintenance

Refer to the Inspection and Maintenance Checklist (at the end of this section) identifying inspection and maintenance measures for each specific practice.

The contractor or subcontractor will be responsible for implementing each control shown on the Plan. In accordance with EPA regulations, the contractor must sign a copy of a certification to verify that a plan has been prepared and that permit regulations are understood.

The onsite contractor will inspect all sediment and erosion control structures weekly and after each rainfall event meeting the minimum requirements as defined in the Plan. Records of the inspections will be prepared and maintained onsite by the contractor as required by the Plan.

- Silt shall be removed from behind barriers if greater than 6-inches deep or as needed.
- Damaged or deteriorated items will be repaired immediately after identification.
- The underside of straw bales should be kept in close contact with the earth and reset as necessary.
- Sediment that is collected in structures shall be disposed of properly and covered if stored onsite.
- At a minimum establish good housekeeping BMPs for:
 - Material handling and waste management
 - Staging areas
 - Designate washout areas
 - Equipment vehicle fueling and maintenance
 - Spill prevention and control

Erosion control structures shall remain in place until all disturbed earth has been securely stabilized. After removal of structures, disturbed areas shall be regraded and stabilized as necessary.

Spill Prevention and Control

The Contractor will actively maintain and manage the site activities with the procedures outlined in this Plan. In the event of petroleum or other deleterious substance spill, action will be taken by the Contractor to contain and remove the spill. The Contractor will comply with the relevant section(s) of the Oil Pollution Prevention Act, 40 CFR 112.7.

Responsibility

All project personnel share the responsibility for the initial control and reporting of the oil and other substance spill, especially the personnel that first discover the spill. The Site Safety and Health Officer (SSHO) will be responsible for determining the necessary safety equipment and for establishing safety practices to be followed by the Contractor during the clean-up operations. All personnel will be trained in the use of and location of this equipment, prior to the commencement of the construction.

The Contractor's goal is to provide effective, efficient and coordinated action to minimize or mitigate damages to the environment and public health and welfare from oil or other substance discharges, conforming to applicable federal, state, and local regulations, as well as other provisions and restrictions. In the event of spills or releases that may occur during the Project, a representative on-site qualified by OSHA training requirements (29 CFR 1910.120) for a Level 3 Hazmat Technician will be provided and will have the responsibility and authority for supervising the cleanup. If the representative determines that the clean up operations are beyond the capacity of the Contractor, assistance shall be requested from its Subcontractor.

In the event of an emergency spill, the Contractor will be responsible for retaining the environmental Subcontractor. The selected environmental subcontractor will develop a Hazardous Materials Health and Safety Plan, which will be referenced when a spill or release is discovered, and the control of the spill or release is beyond the scope of the Spill Prevention Control and Countermeasure plan. The Contractor's Project Manager is responsible for giving the SSHO directions for initiating the Hazardous Materials Health and Safety Plan.

Alert and reporting procedures will become effective immediately upon observance and indication of a spill or discharge of oil or other substances on the project.

Reportable observations are:

1. Leaks or spills
2. Soils which are discolored or have an odor
3. Discharge of oil or other similar substances from drain pipes

The Engineer will be informed immediately of all substantial spills, releases, or other substance discharges. All telephone numbers for the Emergency Response agencies will be posted on site. The Contractor or its Subcontractors will implement control and countermeasures immediately.

Fuel and Oil Delivery Trucks

The equipment superintendent or designee will monitor all truck unloading procedures to verify all hoses are tight and do not leak, and if necessary, will tighten, adjust, or replace them to prevent a release of any kind. In the event of a major spill, alert and initial report procedures will be implemented, and an emergency response contractor will be called in to perform the cleanup.

Equipment

Motorized equipment that require fuel and oil to operate will be inspected prior to the start of each work shift by the operator (in the field) to ensure there is no leakage of oil, fuel, or other material. Trucks will be inspected prior to use for potential leaks or drips. If a leak is found, repairs will be made immediately, and spillage will be cleaned up manually using sorbent material. Vehicles that are found to be leaking will be immediately taken out of service until repairs can be made.

Drum Storage

Drum storage, if any, will be located in a secure area within the Project limits away from environmental areas of concern. Petroleum liquids and other substances stored in drums will be kept in a drum container that consists of a drum rack and drip containment pan that is capable of containing 110% of the stored volume should the drum rupture.

Lubrication / Oil Maintenance

Replacement lubrication will be directly deposited from the lubrication truck to the equipment lubrication reservoir. No other container system will be used to transport oil to the equipment. Mobile equipment will be serviced off site or in the lay-down area. Equipment that cannot be moved will be serviced in the field. The Contractor will place a containment pan or absorbent below the service area prior to initiating service activities in the field. Waste disposal will be completed by the Contractor or by a waste disposal firm. Miscellaneous lubricants for operating equipment will be limited to daily quantities.

Spent Oil

Oil that has already been used on the job will be disposed of via a certified waste disposal firm. Spent oil will be stored in a labeled (hazardous waste signs) and vented fuel storage cell located at the staging area awaiting disposal by a certified waste disposal firm (i.e. Enpro, Inc.). The staging area will be located within the boundary of the project and inspected daily for leaks or spills. The storage cell will be bermed to contain 110% of the largest container or 10% of the total volume in storage, whichever is greater.

Special Oil Spill Equipment

Sorbent Pads

Sorbent pads will be available to absorb oil and petroleum compounds. If necessary, the pads will be used to absorb oil spills or leaks by placing them on the oil and giving them antiquated time to absorb it. The sorbent pads will be stored in equipment box located in the maintenance area. The pads shall float and be water repellent, so they can absorb oil on water. Saturated/contaminated pads will be placed in an appropriate container and stored within the maintenance area. A certified waste disposal firm will dispose of the approved containers.

Sorbent Compound

The compound will be used for contaminants spilled on decks or hard surfaces. In most cases, it can be applied directly to spills, but if the spill is large, it can be used to form a dike around the spill to prevent further migration.

**Best Management Practices – Maintenance/Evaluation Checklist
Construction Practices**

| Best Management Practice | Inspection Frequency | Date Inspected | Inspector | Minimum Maintenance and Key Items to Check | Cleaning/Repair Needed | Date of Cleaning/Repair | Performed by |
|------------------------------|--|----------------|-----------|---|--|-------------------------|--------------|
| | | | | | <input type="checkbox"/> yes <input type="checkbox"/> no (List Items) | | |
| Compost Filter Sock | Inspect at least once per week and after each rainstorm of 0.25 inch or greater. | | | <ul style="list-style-type: none"> Ensure that compost filter sock is intact and the area behind the sock is not filled with sediment. If there is excessive ponding behind the filter sock or accumulated sediments reach the top of the sock, an additional sock should be added on top or in front of the existing filter sock in these areas, without disturbing the soil or accumulated sediment. If the filter sock was overtopped during a storm event, the operator should consider installing an additional filter sock on top of the original, placing an additional filter sock further up the slope. | | | |
| Catch Basin Inlet Protection | Inspect at least once per week and after each rainstorm of 0.25 inch or greater. | | | <ul style="list-style-type: none"> Check all temporary control measures after each storm event. To maintain the capacity, remove accumulated sediment when the capacity is reduced by half. | | | |
| Stabilized Construction Exit | Inspect at least once per week and after each rainstorm of 0.25 inch or greater. | | | <ul style="list-style-type: none"> The exit shall be maintained in a condition that will prevent tracking of sediment onto public rights-of-way. When the control pad becomes ineffective, the stone shall be removed along with the collected soil material and redistributed on site in a stable manner. The entrance should then be reconstructed. The contractor shall sweep or wash pavement at exits, which have experienced mud-tracking on to the pavement or traveled way. When washing is required, it shall be done on an area stabilized with aggregate, which drains into an approved sediment trapping device. All sediment shall be prevented from entering storm drains, ditches, or waterways | | | |

E

Operation & Maintenance Plan

STORMWATER MANAGEMENT OPERATIONS AND MAINTENANCE PLAN

Burt Road Development

**Burt Road, Andover,
MASSACHUSETTS**

Prepared for: **MCP/Howland Burt Owner, LLC**
260 Franklin St.
Boston, MA 02110

Prepared by: **TEC, Inc.**
282 Merrimack St, Floor 2
Lawrence MA, 01843

August 28, 2019
Revised November 12, 2019
Revised February 27, 2020
Revised January 19, 2021
Revised August 30, 2022

Stormwater Management Operation and Maintenance Plan
January 19, 2021

Name of Applicant: MCP/Howland Burt Owner, LLC
Name of Facility: Burt Road Development
Location: Burt Road, Andover, MA 01810

A detailed, written log of all scheduled preventative and corrective maintenance performed for the stormwater management measures must be kept on site, including a record of all inspections and copies of maintenance-related work orders.

Attachment 1, "Inspection and Maintenance Check List" shall be maintained as a record of regularly scheduled inspection and maintenance items as outlined below for every year. Maintenance required and actions taken shall be recorded in Attachment 2, Inspection and Maintenance Log". The funding, operation, and maintenance of all stormwater management Best Management Practices (BMPs) shall be provided by MCP/Howland Burt Owner, LLC or their appointee.

Maintenance routine and schedule: Routine inspections will be conducted on a monthly basis and thorough investigations will be conducted twice a year. Tasks that are common to all systems include regular removal of accumulated sediments, floatables and debris. Inspections will occur after every major storm event for the first six (6) months after construction. Inspections will be conducted by a person trained in stormwater management systems and experienced in drainage design.

Annual reports will be prepared detailing the status of the stormwater system and the maintenance performed. A copy of the annual report will be sent to the Town of Andover, if requested.

The owner agrees to comply with a minimum maintenance schedule as follows:

- 1. Monthly inspection for damaged or clogged catch basins.**
Catch basin grates shall be inspected and cleared of debris to maintain inlet capacity. Culvert shall also have outlet cleared of debris to maintain capacity.
- 2. Monthly sweeping of the parking lot.**
The parking lot shall be swept monthly. Sweepings should be concentrated in the late spring after winter sanding and late fall after the leaves have fallen.

3. Cleaning of catch basins

Sumps and inlets shall be cleaned four times per year and inspected on a monthly basis. All sediments shall be properly handled and disposed of in accordance with local, state and federal guidelines and regulations.

4. Inspection and cleaning of drainage pipes and manholes.

Drainage pipes and manhole structures shall be inspected and cleaned of sediment at least every five (5) years or as required to maintain adequate functionality of the stormwater conveyance system. All sediments shall be properly handled and disposed of in accordance with local, state and federal guidelines and regulations.

5. Sediment Forebays

The Sediment Forebays shall be inspected on a monthly basis, and accumulated sediment shall be quarterly, or when filled with at least 3-6 inches of sediment. All sediments shall be properly handled and disposed of in accordance with local, state and federal guidelines and regulations.

6. Infiltration Basins

As a minimum, the basin will be inspected after every major storm event greater than 0.5", for the first six months after construction, to ensure functionality and inspect for erosion. Thereafter, inspections will occur at twice per year and after every major storm event greater than the 2- year storm event (3.20").

At least twice during growing seasons, the infiltration basin side slopes, embankments, outlet structures, and emergency spillways will be cleared of accumulated sediment, grass clippings, leaves, and trash and then mowed. Sediment collected inside the basin will be removed at a minimum of once every ten (10) years by hand or mechanical equipment. Eroded areas and slopes will be loamed, seeded, and mulched or stabilized with rock rip-rap. All flared end sections and rock rip-rap will be cleaned of all sediment and debris and reset if necessary, to ensure that stormwater flows coming into the basin(s) are not being impeded. Outlet structures should have debris removed to maintain consistent release velocities. Collected debris will be properly disposed of, in accordance with state and federal requirements, at a local facility.

7. Grass Landscaping

The grass landscaping and plantings will be inspected after every major storm event for the two (2) months after seeding to ensure functionality. Thereafter, inspections should take place every six (6) months in the spring and fall and after severe storm events. Grass and

mulched landscaping showing signs of wear and erosion will be re-loamed/re-seeded or re-mulched as necessary to prevent further erosion from taking place.

8. Ernst Mesic to Dry Native Pollinator Mix Landscaping

The Ernst Mesic to Dry Native Pollinator Mix landscaping areas, as referenced in the attached Mowing Plan, will be inspected after every major storm event for the six (6) months following seeding to ensure functionality. Thereafter, inspections should take place every six (6) months in the spring and fall and after severe storm events. Mix landscaping showing signs of wear and erosion will be re-loamed/re-seeded as necessary to prevent further erosion from taking place. Mowing of these areas shall occur once a year, and between October 15th – April 15th for protection of ground nesting birds, pollinators, and other wildlife using these areas.

9. Snow Removal

Snow will be stored within the landscape islands onsite. During large storm events, snow will be trucked offsite.

10. Pervious Pavement

Pervious pavement shall be inspected monthly and cleaned as needed. All inspection and maintenance of pervious pavement shall follow the requirements of the attached Pervious Pavement Maintenance Guide.

11. Slopes adjacent to Pervious Pavement

Slopes adjacent to pervious pavement shall be inspected on a monthly basis to identify any areas of breakout or erosion. During construction, slopes will be stabilized with a combination of hydroseed and jute mesh erosion control. If erosion or breakout occurs, slopes shall be stabilized immediately with additional seeding and jute mesh. If long term erosion occurs, slopes will be stabilized with rip rap stone, minimum 6" diameter.

12. Grass Drainage Swales

Inspect channels monthly for first 6 months after construction and twice annually thereafter. Inspect to make sure vegetation is adequate and for signs of rilling and gullyng. Repair any rills or gullies. Replace dead vegetation. Mow swales as necessary to maintain a grass height less than 6 inches. Remove sediment and debris manually, by hand shovel, once per year. Reseed swales as necessary to maintain grass cover.

The Long-Term Pollution Prevention Plan

The Owner agrees to comply with the following Long-Term Pollution Prevention Plan to ensure long-term stormwater quality discharge from the site:

- Good housekeeping practices: The project will be maintained by the owner, including snow removal, de-icing, and BMP inspection and maintenance.
- Provisions for storing materials and waste products inside or under cover: No materials or waste products will be stored on-site.
- Vehicle washing controls: Vehicle washing is not anticipated as a reasonably foreseeable use of the site.
- Requirements for routine inspections and maintenance of stormwater BMPs: The owner will be responsible for providing the necessary inspections and maintenance for the stormwater BMPs.
- Spill prevention and response plans: There are no proposed uses at the site that would provide an opportunity for a spill of oil or hazardous materials, other than a sudden, catastrophic, vehicle failure. If a vehicle release is the result of an accident, the police and fire department will respond and address any release.
- Provisions for maintenance of lawns, gardens, and other landscaped areas: The owner will provide long-term maintenance for the landscaped areas.
- Requirements for storage and use of fertilizers, herbicides, and pesticides: At this time there would be no foreseeable need for fertilizers, herbicides, and pesticides.
- Provisions for operation and management of septic systems: The Owner will be responsible for the operation and management of the septic systems. The Owner will be required to follow Town of Andover standards for inspection and maintenance of the systems.
- Provisions for solid waste management: The development will have a private trash removal contractor that visits the site as needed. All trash will be stored within enclosed dumpsters with closed lids.

- Snow disposal and plowing plans relative to Wetland Resource Areas: Snow will be stored adjacent to the various islands onsite temporarily.
- Street sweeping schedules: The owner will be responsible for monthly street sweeping with sweepings concentrated in the Spring and Fall as stated in the Operations and Maintenance plan.
- Provisions for prevention of illicit discharges to the stormwater management system: Only stormwater is proposed to be conveyed through the stormwater management system. No illicit materials will be permitted. The owner will be responsible to maintain this 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: Not applicable
- Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan: Prior to implementation of the LTPPP, the owner shall provide an on-site meeting with the maintenance personnel to present the contents and requirements of the Stormwater Operation and Maintenance Plan and the LTPPP.
- List of Emergency contacts for implementing Long-Term Pollution Prevention Plan:

MCP/Howland Burt Owner, LLC
260 Franklin Street, Suite 620
Boston, MA 02110

**INSPECTION AND MAINTENANCE CHECK LIST –
BURTT ROAD DEVELOPMENT, ANDOVER, MA**

For Year: _____

| Inspection Item** | | Inspection Frequency* | | | | | | | | | | | |
|--------------------|--|---|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|-----|
| | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
| 1 | Drainage Pipes and Manholes | at least every 5 years | | | | | | | | | | | |
| 2 | Sediment Forebay | | | | | | | | | | | | |
| 3 | Infiltration Basin | | | | | | | | | | | | |
| 4 | Grass Landscaping | | | | | | | | | | | | |
| 5 | Pervious Pavement | | | | | | | | | | | | |
| 6 | Slopes adjacent to Pervious Pavement | | | | | | | | | | | | |
| 7 | Grass Drainage Swale | | | | | | | | | | | | |
| 8 | Mesic to Dry Native Pollinator Mix Landscaping | | | | | | | | | | | | |
| Maintenance Item** | | Maintenance Frequency* | | | | | | | | | | | |
| | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
| 1 | Parking Lot Sweeping | | | | | | | | | | | | |
| 2 | Catch Basin Cleaning | | | | | | | | | | | | |
| 3 | Drainage Pipes and Manholes | at least every 5 years | | | | | | | | | | | |
| 4 | Sediment Forebay | | | | | | | | | | | | |
| 5 | Infiltration Basin | | | | | | | | | | | | |
| 6 | Pervious Pavement | Refer to Pervious Pavement Maintenance Guide | | | | | | | | | | | |
| 7 | Slopes Adjacent to Pervious Pavement | Re-seed, add jute mesh as needed | | | | | | | | | | | |
| 8 | Grass Drainage Swale | | | | | | | | | | | | |
| 9 | Mesic to Dry Native Pollinator Mix Landscaping | Mow annually between Oct 15 th -April 15 th | | | | | | | | | | | |

- * Actual time of inspecting and maintaining items may vary. Chart shall be used to indicate frequency of events
- ** This chart shall be used in conjunction with the attached "Stormwater Management Operations and Maintenance Plan", dated January 19, 2021, and with the attached "Mowing Plan", dated January 19, 2021..

Name of Applicant: MCP/Howland Burt Owner, LLC
Name of Facility: Burt Road
Development Location: Burt Road, Andover, MA 01810

Inspection and Maintenance Log

| Inspection No. | Date | Inspections Performed | Maintenance Actions Taken |
|----------------|------|-----------------------|---------------------------|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
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| 21 | | | |

Additional Sheets shall be added as needed

F

Test Pit Data



146 Dascomb Road | 169 Ocean Blvd., Unit 101
 Andover, MA 01810 | PO Box 249
 Hampton, NH 03842
 978.794.1792 | 603.601.8154
 TheEngineeringCorp.com

Location: Burtt Road
 Andover MA

Client: Ballardvale, LLC
Address: 55 Cambridge Street, Burlington MA
Telephone:

Date: 10/22/2019 **Wetlands:** 95' +/- **Zone II:** N/A **Soil Symbol:** 255B **Soil Name:** Windsor Loamy Sand **Soil Class:** A

Test Pit: TP-101 **Elevation:** 100.5' **Start:** 0950 **End:** 1000

| Depth | Soil Horizon | Soil Matrix: Color-Moist (Munsell) | Redoximorphic Features | | | Soil Texture | Coarse Fragments % by Volume | | Soil Structure | Soil Consistence (Moist) | Other |
|--------|--------------|--|------------------------|------------|---------|--------------|------------------------------|------------------|----------------|--------------------------|-------|
| | | | Depth | Color | Percent | | Gravel | Cobbles & Stones | | | |
| 0-103" | C | 7.5 YR 6/4 | 52" | 7.5 YR 5/8 | 20% | LS | - | - | M | L | |
| | | | | | | | | | | | |
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Sandy
Parent Material: Glaciofluvial **Depth to Bedrock:** - **Standing Water:** 82" **ESHGW:** 52"

Additional Notes: 1.) Test Pit was witnessed by Thomas Carbone (Town of Andover) and Randy Burley (Town of Tewksbury).
 2.) Water was observed to weep from sidewalls at approximately 60"

Test Pit Performed by: D. Nader **Soil Evaluator Number:** SE 14257



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 978.794.1792 | Hampton, NH 03842
 TheEngineeringCorp.com | 603.601.8154

Location: Burtt Road
 Andover MA

Client: Ballardvale, LLC
Address: 55 Cambridge Street, Burlington MA
Telephone:

Date: 10/22/2019 **Wetlands:** >100' **Zone II:** N/A **Soil Symbol:** 255B **Soil Name:** Windsor Loamy Sand **Soil Class:** A

Test Pit: TP-102 **Elevation:** 101.2' **Start:** 0750 **End:** 0800

| Depth | Soil Horizon | Soil Matrix: Color-Moist (Munsell) | Redoximorphic Features | | | Soil Texture | Coarse Fragments % by Volume | | Soil Structure | Soil Consistence (Moist) | Other |
|---------|--------------|--|------------------------|------------|---------|--------------|------------------------------|------------------|----------------|--------------------------|-------|
| | | | Depth | Color | Percent | | Gravel | Cobbles & Stones | | | |
| 0-18" | Ap | 7.5 YR 2.5/1 | - | - | - | SL | - | - | Gr | F | |
| 18"-24" | Bw | 7.5 YR 5/8 | - | - | - | LS | - | - | M | L | |
| 24"-78" | C1 | 7.5 YR 6/4 | - | - | - | LS | - | - | M | L | |
| 78"-96" | C2 | 7.5 YR 5/1 | 78" | 7.5 YR 5/6 | 30 | LS | - | - | M | L | |
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Sandy
Parent Material: Glaciofluvial **Depth to Bedrock:** - **Standing Water:** 85" **ESHGW:** 78"

Additional Notes: 1.) Test Pit was witnessed by Thomas Carbone (Town of Andover) and Randy Burley (Town of Tewksbury).
 2.) Water was observed to weep from sidewalls at approximately 78"

Test Pit Performed by: D. Nader **Soil Evaluator Number:** SE 14257



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 TheEngineeringCorp.com | 603.601.8154

Location: Burt Road
 Andover MA

Client: Ballardvale, LLC
Address: 55 Cambridge Street, Burlington MA
Telephone:

Date: 10/22/2019 **Wetlands:** >100' **Zone II:** N/A **Soil Symbol:** 255B **Soil Name:** Windsor Loamy Sand **Soil Class:** A

Test Pit: TP-103 **Elevation:** 100.75' **Start:** 0800 **End:** 0815

| Depth | Soil Horizon | Soil Matrix: Color-Moist (Munsell) | Redoximorphic Features | | | Soil Texture | Coarse Fragments % by Volume | | Soil Structure | Soil Consistence (Moist) | Other |
|----------|--------------|--|------------------------|------------|---------|--------------|------------------------------|------------------|----------------|--------------------------|-------|
| | | | Depth | Color | Percent | | Gravel | Cobbles & Stones | | | |
| 0-12" | Ap | - | - | - | - | SL | - | - | Gr | F | |
| 12"-18" | Bw | 7.5 YR 4/6 | - | - | - | LS | - | - | M | L | |
| 18"-102" | C | 7.5 YR 6/3 | 70 | 7.5 YR 5/6 | 20% | LS | - | - | M | L | |
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Parent Material: Sandy Glaciofluvial **Depth to Bedrock:** - **Standing Water:** - **ESHGW:** 70"

- Additional Notes:**
- 1.) Test Pit was witnessed by Thomas Carbone (Town of Andover) and Randy Burley (Town of Tewksbury).
 - 2.) Water was observed to weep from sidewalls at approximately 78"
 - 3.) Significant amount of trash in Ap Layer.

Test Pit Performed by: D. Nader **Soil Evaluator Number:** SE 14257



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 978.794.1792 | 603.601.8154
 TheEngineeringCorp.com

Location: Burtt Road
 Andover MA

Client: Ballardvale, LLC
Address: 55 Cambridge Street, Burlington MA
Telephone:

Date: 10/22/2019 **Wetlands:** 85' +/- **Zone II:** N/A **Soil Symbol:** 255B **Soil Name:** Windsor Loamy Sand **Soil Class:** A

Test Pit: TP-104 **Elevation:** 98.6' **Start:** 0900 **End:** 0910

| Depth | Soil Horizon | Soil Matrix: Color-Moist (Munsell) | Redoximorphic Features | | | Soil Texture | Coarse Fragments % by Volume | | Soil Structure | Soil Consistence (Moist) | Other |
|----------|--------------|--|------------------------|------------|---------|--------------|------------------------------|------------------|----------------|--------------------------|-------|
| | | | Depth | Color | Percent | | Gravel | Cobbles & Stones | | | |
| 0-8" | A | - | - | - | - | SL | - | - | Gr | L | |
| 8"-24" | Bw | 7.5 YR 4/6 | - | - | - | FLS | - | - | M | L | |
| 24"-54" | C1 | 7.5 YR 5/1 | 52" | 7.5 YR 5/6 | 30% | FLS | - | - | M | L | |
| 54"-108" | C2 | 7.5 YR 6/2 | | 7.5 YR 5/7 | 30% | FSL | - | - | M | F | |
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Sandy
Parent Material: Glaciofluvial **Depth to Bedrock:** - **Standing Water:** - **ESHGW:** 52"

Additional Notes: 1.) Test Pit was witnessed by Thomas Carbone (Town of Andover).

Test Pit Performed by: D. Nader

Soil Evaluator Number: SE 14257



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Location: Burtt Road
 Andover MA

Client: Ballardvale, LLC
Address: 55 Cambridge Street, Burlington MA
Telephone:

Date: 10/22/2019 **Wetlands:** >100' **Zone II:** N/A **Soil Symbol:** 255/260 **Soil Name:** Windsor Loamy Sand/Sudbury fine Sandy Loam **Soil Class:** A/B

Test Pit: TP-105 **Elevation:** 94.75' **Start:** 0720 **End:** 0740

| Depth | Soil Horizon | Soil Matrix: Color-Moist (Munsell) | Redoximorphic Features | | | Soil Texture | Coarse Fragments % by Volume | | Soil Structure | Soil Consistence (Moist) | Other |
|----------|--------------|--|------------------------|------------|---------|--------------|------------------------------|------------------|----------------|--------------------------|-------|
| | | | Depth | Color | Percent | | Gravel | Cobbles & Stones | | | |
| 0-4" | A | - | - | - | - | SL | - | - | Gr | F | |
| 4"-60" | C1 | 7.5 YR 6/4 | 49" | 7.5 YR 5/8 | 20% | LS | - | - | M | L | |
| 60"-90" | C2 | 5 YR 6/1 | | 7.5 YR 5/8 | 20% | LS | - | - | M | L | |
| 90"-108" | C3 | 7.5 YR 5/2 | | 7.5 YR 5/8 | 60% | SL | - | - | M | F | |
| | | | | | | | | | | | |
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Sandy
 Glaciofluvial/E
 olian over

Parent Material: Glaciofluvial **Depth to Bedrock:** - **Standing Water:** 69" **ESHWG:** 49"

Additional Notes: 1.) Test Pit was witnessed by Thomas Carbone (Town of Andover) and Randy Burley (Town of Tewksbury).
 2.) Water was observed to weep from sidewalls at approximately 57"

Test Pit Performed by: D. Nader

Soil Evaluator Number: SE 14257



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Location: Burtt Road
 Andover MA

Client: Ballardvale, LLC
Address: 55 Cambridge Street, Burlington MA
Telephone:

Date: 10/22/2019 **Wetlands:** 46' +/- **Zone II:** N/A **Soil Symbol:** 260 **Soil Name:** Sudbury fine Sandy Loam **Soil Class:** B

Test Pit: TP-106 **Elevation:** 93.95' **Start:** 1115 **End:** 1130

| Depth | Soil Horizon | Soil Matrix: Color-Moist (Munsell) | Redoximorphic Features | | | Soil Texture | Coarse Fragments % by Volume | | Soil Structure | Soil Consistence (Moist) | Other |
|----------|--------------|--|------------------------|------------|---------|--------------|------------------------------|------------------|----------------|--------------------------|-------|
| | | | Depth | Color | Percent | | Gravel | Cobbles & Stones | | | |
| 0-12" | A | 10 YR 2/1 | - | - | - | SL | - | - | Gr | F | |
| 12"-24" | Bw | 7.5 YR 5/8 | - | - | - | SL | - | - | M | F | |
| 24"-104" | C | 5 YR 6/1 | 24" | 7.5 YR 5/8 | 30% | FSL | - | - | M | F | |
| | | | | | | | | | | | |
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| | | | | | | | | | | | |

Eolian over

Parent Material: Glaciofluvial **Depth to Bedrock:** - **Standing Water:** - **ESHGW:** 24"

Additional Notes: 1.) Test Pit was witnessed by Thomas Carbone (Town of Andover) and Randy Burley (Town of Tewksbury).
 2.) Water was observed to weep from sidewalls at approximately 60"

Test Pit Performed by: D. Nader

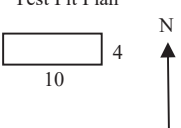
Soil Evaluator Number: SE 14257

GZA Rep. Brian Cantor Contractor New England Boring Contractors Date 12/11/2018
 Operator Dave Thompson Ground Elev. SEE PLAN
 Weather Sunny, 30s Make Kubota Model KX057-4 Time Started 1150
 Capacity 1 Reach 12 ft Time Completed 1220

| Depth | Soil Description | Sample No. | PID Reading (ppm) | Excav. Effort | Boulders: Count/Class | Note No. |
|-------|--|------------|-------------------|---------------|-----------------------|----------|
| 0' | Dark brown, fine to medium SAND, little Silt, trace Roots, trace Metal, trace Plastic. (Loamy Sand) | | | E | - | |
| 1.0' | | | | | | |
| 1.7' | Brown, fine to medium SAND, little Silt, trace Roots. (Loamy Sand) | | | E | - | |
| 2' | | | | E | - | |
| 3' | | | | E | - | |
| 4' | | | | E | - | |
| 5' | | | | E | - | |
| 6' | Light brown, fine to medium SAND, little Silt. (Loamy Sand) | | | E | - | |
| 7' | | | | E | - | |
| 8' | | | | E | - | |
| 9' | | | | M | - | |
| 10' | | | | M | - | 2 |
| 10' | Bottom of test pit at 10 feet Below Ground Surface (bgs) | | | | | |
| 11' | | | | | | |
| 12' | | | | | | |
| 13' | | | | | | |
| 14' | | | | | | |
| 15' | | | | | | |
| 16' | | | | | | |

Notes:

- Groundwater not encountered during excavation.
- Test pit terminated at approximately 10 feet bgs. Upon completion, test pit backfilled with excavated material and tamped in lifts with heel of excavator bucket.
- USDA soil textural classification indicated in ().

| | | | | | |
|--|--|---|--|---|-----------------------|
| Test Pit Plan  Volume = <u>14.8</u> cu. yd. | Boulder Class Letter Designation Size Range Classification A 6" - 17" B 18" - 36" C 36" and Larger Excavation Effort E-----Easy M-----Moderate D-----Difficult | Proportions Used TRACE (TR.) 0 - 10% LITTLE (LI.) 10 - 20% SOME (SO.) 20 - 35% AND 35 - 50% | Abbreviations F = Fine M = Medium C = Coarse V = Very F/M = Fine to medium F/C = Fine to coarse GR = Gray BN = Brown YEL = Yellow | GROUNDWATER | |
| | | | | () Encountered (x) Not Encountered Elapsed Time to Reading (Hours) Depth to Groundwater | 20 mins 6.0 feet |

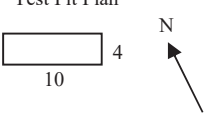
Stratification lines represent approximate boundaries between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.

GZA Rep. Brian Cantor Contractor New England Boring Contractors Date 12/10/2018
 Operator Dave Thompson Ground Elev. SEE PLAN
 Weather Sunny, 30s Make Kubota Model KX057-4 Time Started 0930
 Capacity 1 Reach 12 ft Time Completed 1010

| Depth | Soil Description | Sample No. | PID Reading (ppm) | Excav. Effort | Boulders: Count/Class | Note No. |
|-------|--|------------|-------------------|---------------|-----------------------|----------|
| 0' | | | | | | |
| 1' | 0.9' Dark brown, fine to medium SAND, little Silt, trace Roots. (Loamy Sand) | | | E | - | |
| 2' | 2.0' Brown, fine to medium SAND, little Silt, trace Roots, trace Plastic. (Loamy Sand) | | | E | - | |
| 3' | | | | E | - | |
| 4' | | | | E | - | |
| 5' | | | | E | - | |
| 6' | Light brown, fine to medium SAND, little Silt. (Loamy Sand) | | | E | - | 1 |
| 7' | | | | E | - | |
| 8' | | | | E | - | 2 |
| 9' | | | | E | - | |
| 10' | 10' Bottom of test pit at 10 feet Below Ground Surface (bgs) | | | E | - | 3 |
| 11' | | | | | | |
| 12' | | | | | | |
| 13' | | | | | | |
| 14' | | | | | | |
| 15' | | | | | | |
| 16' | | | | | | |

Notes:

- Oxidation staining of soil observed from approximately 6 to 9 feet bgs.
- Water seeping through sidewalls into excavation at approximately 7.5 feet bgs.
- Test pit terminated at approximately 10 feet bgs. Upon completion, test pit backfilled with excavated material and tamped in lifts with heel of excavator bucket.
- USDA soil textural classification indicated in ().

| | | | | | |
|--|--|---|--|--|-----------------------|
| Test Pit Plan  Volume = <u>14.8</u> cu. yd. | Boulder Class Letter Designation Size Range Classification A 6" - 17" B 18" - 36" C 36" and Larger | Proportions Used TRACE (TR.) 0 - 10% LITTLE (LI.) 10 - 20% SOME (SO.) 20 - 35% AND 35 - 50% | Abbreviations F = Fine M = Medium C = Coarse V = Very F/M = Fine to medium F/C = Fine to coarse GR = Gray BN = Brown YEL = Yellow | GROUNDWATER () Encountered (x) Not Encountered Elapsed Time to Reading (Hours) Depth to Groundwater | |
| | | Excavation Effort E-----Easy M-----Moderate D-----Difficult | | | 20 mins 6.0 feet |

Stratification lines represent approximate boundaries between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.

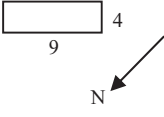
144 Elm Street
 Amesbury, Massachusetts

GZA Rep. Brian Cantor Contractor New England Boring Contractors Date 12/11/2018
 Operator Dave Thompson Ground Elev. SEE PLAN
 Weather Sunny, 30s Make Kubota Model KX057-4 Time Started 1420
 Capacity 1 Reach 12 ft Time Completed 1450

| Depth | Soil Description | Sample No. | PID Reading (ppm) | Excav. Effort | Boulders: Count/Class | Note No. |
|-------|--|------------|-------------------|---------------|-----------------------|----------|
| 0' | | | | | | |
| 1' | Dark brown, fine to medium SAND, little Silt, trace Roots, trace Plastic. (Loamy Sand) | | | E | - | |
| 2' | Brown, fine to medium SAND, trace Silt, trace Roots. (Loamy Sand) | | | E | - | |
| 3' | | | | E | - | |
| 4' | | | | E | - | |
| 5' | | | | E | - | |
| 6' | Light brown, fine to medium SAND, little Silt. (Loamy Sand) | | | E | - | |
| 7' | | | | E | - | |
| 8' | | | | E | - | |
| 9' | | | | E | - | |
| 10' | Bottom of test pit at 10 feet Below Ground Surface (bgs) | | | M | - | 2 |
| 11' | | | | | | |
| 12' | | | | | | |
| 13' | | | | | | |
| 14' | | | | | | |
| 15' | | | | | | |
| 16' | | | | | | |

Notes:

- Groundwater not encountered during excavation.
- Test pit terminated at approximately 10 feet bgs. Upon completion, test pit backfilled with excavated material and tamped in lifts with heel of excavator bucket.
- USDA soil textural classification indicated in ().

| | | | | | |
|--|--|---|--|--|--|
| Test Pit Plan  Volume = <u>13.3</u> cu. yd. | Boulder Class Letter Designation Size Range Classification A 6" - 17" B 18" - 36" C 36" and Larger | Proportions Used TRACE (TR.) 0 - 10% LITTLE (LI.) 10 - 20% SOME (SO.) 20 - 35% AND 35 - 50% | Abbreviations F = Fine M = Medium C = Coarse V = Very F/M = Fine to medium F/C = Fine to coarse GR = Gray BN = Brown YEL = Yellow | GROUNDWATER () Encountered (x) Not Encountered Elapsed Time to Reading (Hours) Depth to Groundwater | |
| | Excavation Effort E-----Easy M-----Moderate D-----Difficult | 20 mins 6.0 feet | | | |

Stratification lines represent approximate boundaries between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.

144 Elm Street
 Amesbury, Massachusetts

GZA Rep. Brian Cantor Contractor New England Boring Contractors Date 12/10/2018
 Operator Dave Thompson Ground Elev. SEE PLAN
 Weather Sunny, 30s Make Kubota Model KX057-4 Time Started 0830
 Capacity 1 Reach 12 ft Time Completed 0910

| Depth | Soil Description | Sample No. | PID Reading (ppm) | Excav. Effort | Boulders: Count/Class | Note No. |
|--|---|------------|-------------------|---------------|-----------------------|----------|
| 0' | Dark brown, fine to medium SAND, little Silt, trace Cobbles, trace Metal, trace Roots. (Loamy Sand) | | | E | 1A | |
| 1' | | | | | | |
| 2' | | | | | | |
| 3' | | | | | | |
| 4' | | | | | | |
| 5' | | | | | | |
| 6' | | | | | | |
| 7' | | | | | | |
| 8' | | | | | | |
| 9' | | | | | | |
| 10' | Light brown, fine to medium SAND, little Silt. (Loamy Sand) | | | E | - | 1 |
| 11' | | | | | | |
| 12' | | | | | | |
| 13' | | | | | | |
| 14' | | | | | | |
| 15' | | | | | | |
| 16' | | | | | | |
| Bottom of test pit at 10 feet Below Ground Surface (bgs) | | | | | | |

Notes:

- Water seeping through sidewalls into excavation at approximately 7 feet bgs.
- Test pit terminated at approximately 10 feet bgs. Upon completion, test pit backfilled with excavated material and tamped in lifts with heel of excavator bucket.
- USDA soil textural classification indicated in ().

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|--------------------|---------------------------|---|----------|---|-----------|---|----------------|--|-------------|---------|--------------|----------|------------|----------|-----|----------|---|---|--|---------------------------------|----------------------|----------------|-----------------|
| <p>Test Pit Plan</p> <p>Volume = <u>14.8</u> cu. yd.</p> | <p>Boulder Class</p> <table border="0"> <tr> <td>Letter Designation</td> <td>Size Range Classification</td> </tr> <tr> <td>A</td> <td>6" - 17"</td> </tr> <tr> <td>B</td> <td>18" - 36"</td> </tr> <tr> <td>C</td> <td>36" and Larger</td> </tr> </table> <p>Excavation Effort</p> <p>E-----Easy M-----Moderate D-----Difficult</p> | Letter Designation | Size Range Classification | A | 6" - 17" | B | 18" - 36" | C | 36" and Larger | <p>Proportions Used</p> <table border="0"> <tr> <td>TRACE (TR.)</td> <td>0 - 10%</td> </tr> <tr> <td>LITTLE (LI.)</td> <td>10 - 20%</td> </tr> <tr> <td>SOME (SO.)</td> <td>20 - 35%</td> </tr> <tr> <td>AND</td> <td>35 - 50%</td> </tr> </table> | TRACE (TR.) | 0 - 10% | LITTLE (LI.) | 10 - 20% | SOME (SO.) | 20 - 35% | AND | 35 - 50% | <p>Abbreviations</p> <p>F = Fine M = Medium C = Coarse V = Very F/M = Fine to medium F/C = Fine to coarse GR = Gray BN = Brown YEL = Yellow</p> | <p>GROUNDWATER</p> <p>() Encountered (x) Not Encountered</p> <table border="0"> <tr> <td>Elapsed Time to Reading (Hours)</td> <td>Depth to Groundwater</td> </tr> <tr> <td><u>20 mins</u></td> <td><u>6.0 feet</u></td> </tr> </table> | | Elapsed Time to Reading (Hours) | Depth to Groundwater | <u>20 mins</u> | <u>6.0 feet</u> |
| | | Letter Designation | Size Range Classification | | | | | | | | | | | | | | | | | | | | | | |
| A | 6" - 17" | | | | | | | | | | | | | | | | | | | | | | | | |
| B | 18" - 36" | | | | | | | | | | | | | | | | | | | | | | | | |
| C | 36" and Larger | | | | | | | | | | | | | | | | | | | | | | | | |
| TRACE (TR.) | 0 - 10% | | | | | | | | | | | | | | | | | | | | | | | | |
| LITTLE (LI.) | 10 - 20% | | | | | | | | | | | | | | | | | | | | | | | | |
| SOME (SO.) | 20 - 35% | | | | | | | | | | | | | | | | | | | | | | | | |
| AND | 35 - 50% | | | | | | | | | | | | | | | | | | | | | | | | |
| Elapsed Time to Reading (Hours) | Depth to Groundwater | | | | | | | | | | | | | | | | | | | | | | | | |
| <u>20 mins</u> | <u>6.0 feet</u> | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |

Stratification lines represent approximate boundaries between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.

GZA Rep. Brian Cantor Contractor New England Boring Contractors Date 12/10/2018
 Operator Dave Thompson Ground Elev. SEE PLAN
 Weather Sunny, 20s Make Kubota Model KX057-4 Time Started 0730
 Capacity 1 Reach 12 ft Time Completed 0815

| Depth | Soil Description | Sample No. | PID Reading (ppm) | Excav. Effort | Boulders: Count/Class | Note No. |
|-------|--|--|-------------------|---------------|-----------------------|----------|
| 0' | Dark brown, fine to medium SAND, some Silt, trace Roots. (Fine Sandy Loam) | | | E | - | |
| 1' | Brown, fine to medium SAND, little Silt, trace Roots. (Loamy Sand) | | | E | - | 1 |
| 2' | Light brown, fine to medium SAND, little Silt. (Loamy Sand) | | | E | - | |
| 3' | | | | E | - | |
| 4' | | | | E | - | |
| 5' | | | | E | - | |
| 6' | | | | E | - | 2 |
| 7' | Light brown to gray, fine to medium SAND, little Silt. (Loamy Sand) | | | M | - | |
| 8' | | | | E | - | |
| 9' | | | | E | - | |
| 10' | | | | E | - | 3 |
| 10' | | Bottom of test pit at 10 feet Below Ground Surface (bgs) | | | | |
| 11' | | | | | | |
| 12' | | | | | | |
| 13' | | | | | | |
| 14' | | | | | | |
| 15' | | | | | | |
| 16' | | | | | | |

Notes:

1. Water seeping through sidewalls into excavation from approximately 1 to 5 feet bgs.
2. Oxidation colored staining of soil observed from approximately 5 to 6 feet bgs.
3. Test pit terminated at approximately 10 feet bgs. Upon completion, test pit backfilled with excavated material and tamped in lifts with heel of excavator bucket.
4. USDA soil textural classification indicated in ().

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|--------------------|---------------------------|---|----------|---|-----------|---|----------------|--|-------------|---------|--------------|----------|------------|----------|-----|----------|---|---|--|---------------------------------|----------------------|----------------|-----------------|
| <p>Test Pit Plan</p> <p>Volume = <u>13.0</u> cu. yd.</p> | <p>Boulder Class</p> <table border="0"> <tr> <td>Letter Designation</td> <td>Size Range Classification</td> </tr> <tr> <td>A</td> <td>6" - 17"</td> </tr> <tr> <td>B</td> <td>18" - 36"</td> </tr> <tr> <td>C</td> <td>36" and Larger</td> </tr> </table> <p>Excavation Effort</p> <p>E-----Easy M-----Moderate D-----Difficult</p> | Letter Designation | Size Range Classification | A | 6" - 17" | B | 18" - 36" | C | 36" and Larger | <p>Proportions Used</p> <table border="0"> <tr> <td>TRACE (TR.)</td> <td>0 - 10%</td> </tr> <tr> <td>LITTLE (LI.)</td> <td>10 - 20%</td> </tr> <tr> <td>SOME (SO.)</td> <td>20 - 35%</td> </tr> <tr> <td>AND</td> <td>35 - 50%</td> </tr> </table> | TRACE (TR.) | 0 - 10% | LITTLE (LI.) | 10 - 20% | SOME (SO.) | 20 - 35% | AND | 35 - 50% | <p>Abbreviations</p> <p>F = Fine M = Medium C = Coarse V = Very F/M = Fine to medium F/C = Fine to coarse GR = Gray BN = Brown YEL = Yellow</p> | <p>GROUNDWATER</p> <p>() Encountered (x) Not Encountered</p> <table border="0"> <tr> <td>Elapsed Time to Reading (Hours)</td> <td>Depth to Groundwater</td> </tr> <tr> <td><u>20 mins</u></td> <td><u>6.0 feet</u></td> </tr> </table> | | Elapsed Time to Reading (Hours) | Depth to Groundwater | <u>20 mins</u> | <u>6.0 feet</u> |
| | | Letter Designation | Size Range Classification | | | | | | | | | | | | | | | | | | | | | | |
| A | 6" - 17" | | | | | | | | | | | | | | | | | | | | | | | | |
| B | 18" - 36" | | | | | | | | | | | | | | | | | | | | | | | | |
| C | 36" and Larger | | | | | | | | | | | | | | | | | | | | | | | | |
| TRACE (TR.) | 0 - 10% | | | | | | | | | | | | | | | | | | | | | | | | |
| LITTLE (LI.) | 10 - 20% | | | | | | | | | | | | | | | | | | | | | | | | |
| SOME (SO.) | 20 - 35% | | | | | | | | | | | | | | | | | | | | | | | | |
| AND | 35 - 50% | | | | | | | | | | | | | | | | | | | | | | | | |
| Elapsed Time to Reading (Hours) | Depth to Groundwater | | | | | | | | | | | | | | | | | | | | | | | | |
| <u>20 mins</u> | <u>6.0 feet</u> | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>Stratification lines represent approximate boundaries between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.</p> | | | | | | | | | | | | | | | | | | | | | | | | | |

GZA Rep. Brian Cantor Contractor New England Boring Contractors Date 12/10/2018
 Operator Dave Thompson Ground Elev. SEE PLAN
 Weather Sunny, 30s Make Kubota Model KX057-4 Time Started 1040
 Capacity 1 Reach 12 ft Time Completed 1120

| Depth | Soil Description | Sample No. | PID Reading (ppm) | Excav. Effort | Boulders: Count/Class | Note No. |
|-------|---|------------|-------------------|---------------|-----------------------|----------|
| 0' | Dark brown, fine to medium SAND, little Silt, trace Metal, trace Roots, trace Plastic. (Loamy Sand) | | | E | - | |
| 1' | | | | | | |
| 2' | Brown, fine to medium SAND, trace Silt, trace Roots. (Loamy Sand) | | | E | - | |
| 3' | | | | | | |
| 4' | | | | | | |
| 5' | Light brown, fine to medium SAND, little Silt. (Loamy Sand) | | | E | - | 1 |
| 6' | | | | | | |
| 7' | | | | | | |
| 8' | | | | | | |
| 9' | Light brown to gray, fine to medium SAND, trace Silt, trace(-) fine Gravel. (Loamy Sand) | | | E | - | |
| 10' | | | | | | |
| 10' | Bottom of test pit at 10 feet Below Ground Surface (bgs) | | | | | |
| 11' | | | | | | |
| 12' | | | | | | |
| 13' | | | | | | |
| 14' | | | | | | |
| 15' | | | | | | |
| 16' | | | | | | |

Notes:

1. Water seeping through sidewalls into excavation at approximately 6 feet bgs.
2. Test pit terminated at approximately 10 feet bgs. Upon completion, test pit backfilled with excavated material and tamped in lifts with heel of excavator bucket.
3. USDA soil textural classification indicated in ().

| | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|---------------------------|---------------------------|---|----------|---|-----------|---|----------------|--|-------------|---------|--------------|----------|------------|----------|-----|----------|---|--|---------------------------------|----------------------|----------------|-----------------|
| <p>Test Pit Plan</p> <p>Volume = <u>22.2</u> cu. yd.</p> | <p>Boulder Class</p> <table border="0"> <tr> <td>Letter Designation</td> <td>Size Range Classification</td> </tr> <tr> <td>A</td> <td>6" - 17"</td> </tr> <tr> <td>B</td> <td>18" - 36"</td> </tr> <tr> <td>C</td> <td>36" and Larger</td> </tr> </table> <p>Excavation Effort</p> <p>E-----Easy M-----Moderate D-----Difficult</p> | Letter Designation | Size Range Classification | A | 6" - 17" | B | 18" - 36" | C | 36" and Larger | <p>Proportions Used</p> <table border="0"> <tr> <td>TRACE (TR.)</td> <td>0 - 10%</td> </tr> <tr> <td>LITTLE (LI.)</td> <td>10 - 20%</td> </tr> <tr> <td>SOME (SO.)</td> <td>20 - 35%</td> </tr> <tr> <td>AND</td> <td>35 - 50%</td> </tr> </table> | TRACE (TR.) | 0 - 10% | LITTLE (LI.) | 10 - 20% | SOME (SO.) | 20 - 35% | AND | 35 - 50% | <p>Abbreviations</p> <p>F = Fine M = Medium C = Coarse V = Very F/M = Fine to medium F/C = Fine to coarse GR = Gray BN = Brown YEL = Yellow</p> | <p>GROUNDWATER</p> <p>() Encountered (x) Not Encountered</p> <table border="0"> <tr> <td>Elapsed Time to Reading (Hours)</td> <td>Depth to Groundwater</td> </tr> <tr> <td><u>20 mins</u></td> <td><u>6.0 feet</u></td> </tr> </table> | Elapsed Time to Reading (Hours) | Depth to Groundwater | <u>20 mins</u> | <u>6.0 feet</u> |
| | Letter Designation | Size Range Classification | | | | | | | | | | | | | | | | | | | | | | |
| A | 6" - 17" | | | | | | | | | | | | | | | | | | | | | | | |
| B | 18" - 36" | | | | | | | | | | | | | | | | | | | | | | | |
| C | 36" and Larger | | | | | | | | | | | | | | | | | | | | | | | |
| TRACE (TR.) | 0 - 10% | | | | | | | | | | | | | | | | | | | | | | | |
| LITTLE (LI.) | 10 - 20% | | | | | | | | | | | | | | | | | | | | | | | |
| SOME (SO.) | 20 - 35% | | | | | | | | | | | | | | | | | | | | | | | |
| AND | 35 - 50% | | | | | | | | | | | | | | | | | | | | | | | |
| Elapsed Time to Reading (Hours) | Depth to Groundwater | | | | | | | | | | | | | | | | | | | | | | | |
| <u>20 mins</u> | <u>6.0 feet</u> | | | | | | | | | | | | | | | | | | | | | | | |

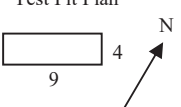
Stratification lines represent approximate boundaries between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.

GZA Rep. Brian Cantor Contractor New England Boring Contractors Date 12/10/2018
 Operator Dave Thompson Ground Elev. SEE PLAN
 Weather Sunny, 30s Make Kubota Model KX057-4 Time Started 0930
 Capacity 1 Reach 12 ft Time Completed 1010

| Depth | Soil Description | Sample No. | PID Reading (ppm) | Excav. Effort | Boulders: Count/Class | Note No. |
|-------|---|------------|-------------------|---------------|-----------------------|----------|
| 0' | | | | | | |
| 1' | 0.9' Dark brown, fine to medium SAND, little Silt, trace Roots, trace Plastic. (Loamy Sand) | | | E | - | |
| 2' | 2.0' Brown, fine to medium SAND, trace Silt, trace Roots. (Loamy Sand) | | | E | - | |
| 3' | Light brown, fine to medium SAND, little Silt. (Loamy Sand) | | | E | - | 1 |
| 4' | | | | E | - | |
| 5' | | | | E | - | |
| 6' | | | | E | - | |
| 7' | | 7.0' | | | E | - |
| 8' | Light brown to gray, fine to medium SAND, little Silt. (Loamy Sand) | | | E | - | 2 |
| 9' | | | | E | - | |
| 10' | | 10' | | | E | - |
| 11' | Bottom of test pit at 10 feet Below Ground Surface (bgs) | | | | | |
| 12' | | | | | | |
| 13' | | | | | | |
| 14' | | | | | | |
| 15' | | | | | | |
| 16' | | | | | | |

Notes:

1. Water seeping through sidewalls into excavation at approximately 3 feet bgs.
2. Oxidation colored staining of soil observed from approximately 7 to 7.5 feet bgs.
3. Test pit terminated at approximately 10 feet bgs. Upon completion, test pit backfilled with excavated material and tamped in lifts with heel of excavator bucket.
4. USDA soil textural classification indicated in ().

| | | | | | |
|--|--|---|--|--|-----------------------|
| Test Pit Plan  Volume = <u>13.3</u> cu. yd. | Boulder Class Letter Designation Size Range Classification A 6" - 17" B 18" - 36" C 36" and Larger | Proportions Used TRACE (TR.) 0 - 10% LITTLE (LI.) 10 - 20% SOME (SO.) 20 - 35% AND 35 - 50% | Abbreviations F = Fine M = Medium C = Coarse V = Very F/M = Fine to medium F/C = Fine to coarse GR = Gray BN = Brown YEL = Yellow | GROUNDWATER () Encountered (x) Not Encountered Elapsed Time to Reading (Hours) Depth to Groundwater | |
| | | Excavation Effort E-----Easy M-----Moderate D-----Difficult | | | 20 mins 6.0 feet |

Stratification lines represent approximate boundaries between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.

GZA Rep. Brian Cantor Contractor New England Boring Contractors Date 12/11/2018
 Operator Dave Thompson Ground Elev. SEE PLAN
 Weather Sunny, 30s Make Kubota Model KX057-4 Time Started 0920
 Capacity 1 Reach 12 ft Time Completed 1000

| Depth | Soil Description | Sample No. | PID Reading (ppm) | Excav. Effort | Boulders: Count/Class | Note No. |
|-------|---|------------|-------------------|---------------|-----------------------|----------|
| 0' | | | | E | - | |
| 1' | Dark brown to black, fine to medium SAND, some Silt, trace Roots. (Fine Sandy Loam) | | | E | - | |
| 2' | | | | E | - | |
| 2.4' | Brown, fine to medium SAND, little Silt, trace Roots. (Loamy Sand) | | | E | - | |
| 3' | | | | E | - | |
| 3.2' | Light brown, fine to medium SAND, little Silt. (Loamy Sand) | | | E | - | |
| 4' | | | | E | - | |
| 5' | | | | E | - | |
| 6' | | | | E | - | |
| 7' | | | | E | - | 1,2 |
| 8' | | | | E | - | |
| 9' | Bottom of test pit at 10 feet Below Ground Surface (bgs) | | | E | - | 3 |
| 10' | | | | | | |
| 11' | | | | | | |
| 12' | | | | | | |
| 13' | | | | | | |
| 14' | | | | | | |
| 15' | | | | | | |
| 16' | | | | | | |

Notes:

1. Water seeping through sidewalls into excavation at approximately 7 feet bgs.
2. Oxidation colored staining of soil observed from approximately 6 to 7 feet bgs.
3. Test pit terminated at approximately 10 feet bgs. Upon completion, test pit backfilled with excavated material and tamped in lifts with heel of excavator bucket.
4. USDA soil textural classification indicated in ().

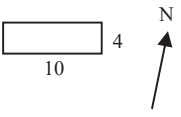
| | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|--------------------|---------------------------|---|----------|---|-----------|---|----------------|--|-------------|---------|--------------|----------|------------|----------|-----|----------|---|---|--|---------------------------------|----------------------|----------------|-----------------|
| <p>Test Pit Plan</p> <p>Volume = <u>18.5</u> cu. yd.</p> | <p>Boulder Class</p> <table border="0"> <tr> <td>Letter Designation</td> <td>Size Range Classification</td> </tr> <tr> <td>A</td> <td>6" - 17"</td> </tr> <tr> <td>B</td> <td>18" - 36"</td> </tr> <tr> <td>C</td> <td>36" and Larger</td> </tr> </table> <p>Excavation Effort</p> <p>E-----Easy M-----Moderate D-----Difficult</p> | Letter Designation | Size Range Classification | A | 6" - 17" | B | 18" - 36" | C | 36" and Larger | <p>Proportions Used</p> <table border="0"> <tr> <td>TRACE (TR.)</td> <td>0 - 10%</td> </tr> <tr> <td>LITTLE (LI.)</td> <td>10 - 20%</td> </tr> <tr> <td>SOME (SO.)</td> <td>20 - 35%</td> </tr> <tr> <td>AND</td> <td>35 - 50%</td> </tr> </table> | TRACE (TR.) | 0 - 10% | LITTLE (LI.) | 10 - 20% | SOME (SO.) | 20 - 35% | AND | 35 - 50% | <p>Abbreviations</p> <p>F = Fine M = Medium C = Coarse V = Very F/M = Fine to medium F/C = Fine to coarse GR = Gray BN = Brown YEL = Yellow</p> | <p>GROUNDWATER</p> <p>() Encountered (x) Not Encountered</p> <table border="0"> <tr> <td>Elapsed Time to Reading (Hours)</td> <td>Depth to Groundwater</td> </tr> <tr> <td><u>20 mins</u></td> <td><u>6.0 feet</u></td> </tr> </table> | | Elapsed Time to Reading (Hours) | Depth to Groundwater | <u>20 mins</u> | <u>6.0 feet</u> |
| | | Letter Designation | Size Range Classification | | | | | | | | | | | | | | | | | | | | | | |
| A | 6" - 17" | | | | | | | | | | | | | | | | | | | | | | | | |
| B | 18" - 36" | | | | | | | | | | | | | | | | | | | | | | | | |
| C | 36" and Larger | | | | | | | | | | | | | | | | | | | | | | | | |
| TRACE (TR.) | 0 - 10% | | | | | | | | | | | | | | | | | | | | | | | | |
| LITTLE (LI.) | 10 - 20% | | | | | | | | | | | | | | | | | | | | | | | | |
| SOME (SO.) | 20 - 35% | | | | | | | | | | | | | | | | | | | | | | | | |
| AND | 35 - 50% | | | | | | | | | | | | | | | | | | | | | | | | |
| Elapsed Time to Reading (Hours) | Depth to Groundwater | | | | | | | | | | | | | | | | | | | | | | | | |
| <u>20 mins</u> | <u>6.0 feet</u> | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>Stratification lines represent approximate boundaries between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.</p> | | | | | | | | | | | | | | | | | | | | | | | | | |

GZA Rep. Brian Cantor Contractor New England Boring Contractors Date 12/11/2018
 Operator Dave Thompson Ground Elev. SEE PLAN
 Weather Sunny, 30s Make Kubota Model KX057-4 Time Started 0830
 Capacity 1 Reach 12 ft Time Completed 0910

| Depth | Soil Description | Sample No. | PID Reading (ppm) | Excav. Effort | Boulders: Count/Class | Note No. | |
|-------|---|--|-------------------|---------------|-----------------------|----------|--|
| 0' | | | | | | | |
| 1' | 0.9' Dark brown, fine to medium SAND, some Silt, trace Roots. (Fine Sandy Loam) | | | E | - | | |
| 2' | 2.0' Brown, fine to medium SAND, little Silt, trace Roots. (Loamy Sand) | | | E | - | | |
| 3' | Light brown, fine to medium SAND, little Silt. (Loamy Sand) | | | E | - | | |
| 4' | | | | E | - | 1,2 | |
| 5' | | | | M | - | | |
| 6' | | | | M | - | | |
| 7' | | | | M | - | | |
| 8' | | | | M | - | | |
| 9' | | | | M | - | | |
| 10' | | | | M | - | 3 | |
| 10' | | Bottom of test pit at 10 feet Below Ground Surface (bgs) | | | | | |
| 11' | | | | | | | |
| 12' | | | | | | | |
| 13' | | | | | | | |
| 14' | | | | | | | |
| 15' | | | | | | | |
| 16' | | | | | | | |

Notes:

1. Water seeping through sidewalls into excavation at approximately 3.5 feet bgs.
2. Oxidation colored staining of soil observed from approximately 3.5 to 5 feet bgs.
3. Test pit terminated at approximately 10 feet bgs. Upon completion, test pit backfilled with excavated material and tamped in lifts with heel of excavator bucket.
4. USDA soil textural classification indicated in ().

| | | | | | |
|--|--|---|--|--|-----------------------|
| Test Pit Plan  Volume = <u>14.8</u> cu. yd. | Boulder Class Letter Designation Size Range Classification A 6" - 17" B 18" - 36" C 36" and Larger | Proportions Used TRACE (TR.) 0 - 10% LITTLE (LI.) 10 - 20% SOME (SO.) 20 - 35% AND 35 - 50% | Abbreviations F = Fine M = Medium C = Coarse V = Very F/M = Fine to medium F/C = Fine to coarse GR = Gray BN = Brown YEL = Yellow | GROUNDWATER () Encountered (x) Not Encountered Elapsed Time to Reading (Hours) Depth to Groundwater | |
| | | Excavation Effort E-----Easy M-----Moderate D-----Difficult | | | 20 mins 6.0 feet |

Stratification lines represent approximate boundaries between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.

144 Elm Street
 Amesbury, Massachusetts

GZA Rep. Brian Cantor Contractor New England Boring Contractors Date 12/10/2018
 Operator Dave Thompson Ground Elev. SEE PLAN
 Weather Sunny, 30s Make Kubota Model KX057-4 Time Started 1245
 Capacity 1 Reach 12 ft Time Completed 1330

| Depth | Soil Description | Sample No. | PID Reading (ppm) | Excav. Effort | Boulders: Count/Class | Note No. |
|-------|---|------------|-------------------|---------------|-----------------------|----------|
| 0' | | | | E | - | |
| 1' | Dark brown to black, fine to coarse SAND, some Silt, trace Roots, trace Plastic. (Sandy Loam) | | | E | - | |
| 2' | | | | E | - | |
| 2.5' | | | | E | - | |
| 3' | Brown, fine to medium SAND, little Silt. (Loamy Sand) | | | E | - | |
| 4' | | | | E | - | |
| 5' | | | | E | - | |
| 5.0' | Brown to orange-brown, fine to medium SAND, little Silt. (Loamy Sand) | | | M | - | 1,2 |
| 6' | | | | M | - | |
| 7' | | | | M | - | |
| 8' | Light gray, SILT, little fine Sand. (Silt) | | | M | - | |
| 9' | | | | M | - | |
| 10' | | | | M | - | 3 |
| 10' | Bottom of test pit at 10 feet Below Ground Surface (bgs) | | | | | |
| 11' | | | | | | |
| 12' | | | | | | |
| 13' | | | | | | |
| 14' | | | | | | |
| 15' | | | | | | |
| 16' | | | | | | |

Notes:

- Water seeping through sidewalls into excavation at approximately 5.5 feet bgs.
- Oxidation colored staining of soil observed from approximately 5 to 6 feet bgs.
- Test pit terminated at approximately 10 feet bgs. Upon completion, test pit backfilled with excavated material and tamped in lifts with heel of excavator bucket.
- USDA soil textural classification indicated in ().

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|--------------------|---------------------------|---|----------|---|-----------|---|----------------|--|-------------|---------|--------------|----------|------------|----------|-----|----------|---|---|--|---------------------------------|----------------------|----------------|-----------------|
| <p>Test Pit Plan</p> <p>Volume = <u>13.3</u> cu. yd.</p> | <p>Boulder Class</p> <table border="0"> <tr> <td>Letter Designation</td> <td>Size Range Classification</td> </tr> <tr> <td>A</td> <td>6" - 17"</td> </tr> <tr> <td>B</td> <td>18" - 36"</td> </tr> <tr> <td>C</td> <td>36" and Larger</td> </tr> </table> <p>Excavation Effort</p> <p>E-----Easy M-----Moderate D-----Difficult</p> | Letter Designation | Size Range Classification | A | 6" - 17" | B | 18" - 36" | C | 36" and Larger | <p>Proportions Used</p> <table border="0"> <tr> <td>TRACE (TR.)</td> <td>0 - 10%</td> </tr> <tr> <td>LITTLE (LI.)</td> <td>10 - 20%</td> </tr> <tr> <td>SOME (SO.)</td> <td>20 - 35%</td> </tr> <tr> <td>AND</td> <td>35 - 50%</td> </tr> </table> | TRACE (TR.) | 0 - 10% | LITTLE (LI.) | 10 - 20% | SOME (SO.) | 20 - 35% | AND | 35 - 50% | <p>Abbreviations</p> <p>F = Fine M = Medium C = Coarse V = Very F/M = Fine to medium F/C = Fine to coarse GR = Gray BN = Brown YEL = Yellow</p> | <p>GROUNDWATER</p> <p>() Encountered (x) Not Encountered</p> <table border="0"> <tr> <td>Elapsed Time to Reading (Hours)</td> <td>Depth to Groundwater</td> </tr> <tr> <td><u>20 mins</u></td> <td><u>6.0 feet</u></td> </tr> </table> | | Elapsed Time to Reading (Hours) | Depth to Groundwater | <u>20 mins</u> | <u>6.0 feet</u> |
| | | Letter Designation | Size Range Classification | | | | | | | | | | | | | | | | | | | | | | |
| A | 6" - 17" | | | | | | | | | | | | | | | | | | | | | | | | |
| B | 18" - 36" | | | | | | | | | | | | | | | | | | | | | | | | |
| C | 36" and Larger | | | | | | | | | | | | | | | | | | | | | | | | |
| TRACE (TR.) | 0 - 10% | | | | | | | | | | | | | | | | | | | | | | | | |
| LITTLE (LI.) | 10 - 20% | | | | | | | | | | | | | | | | | | | | | | | | |
| SOME (SO.) | 20 - 35% | | | | | | | | | | | | | | | | | | | | | | | | |
| AND | 35 - 50% | | | | | | | | | | | | | | | | | | | | | | | | |
| Elapsed Time to Reading (Hours) | Depth to Groundwater | | | | | | | | | | | | | | | | | | | | | | | | |
| <u>20 mins</u> | <u>6.0 feet</u> | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |

Stratification lines represent approximate boundaries between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.

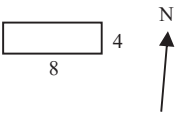
144 Elm Street
 Amesbury, Massachusetts

GZA Rep. Brian Cantor Contractor New England Boring Contractors Date 12/11/2018
 Operator Dave Thompson Ground Elev. SEE PLAN
 Weather Sunny, 20s Make Kubota Model KX057-4 Time Started 0730
 Capacity 1 Reach 12 ft Time Completed 0815

| Depth | Soil Description | Sample No. | PID Reading (ppm) | Excav. Effort | Boulders: Count/Class | Note No. |
|-------|--|------------|-------------------|---------------|-----------------------|----------|
| 0' | | | | | | |
| 0.9' | Dark brown, fine to medium SAND, some Silt, little Gravel, trace Roots. (Fine Sandy Loam) | | | E | 1A | |
| 2.5' | Brown, fine to medium SAND, little Gravel, little Silt, trace Roots. (Loamy Sand) | | | M | 2A | |
| 3' | | | | M | 2A | |
| 4' | | | | D | 3A | 1 |
| 5' | | | | D | 4A | |
| 6' | Light brown to brown, fine to coarse SAND, some Gravel, little Cobbles, little Silt. (Coarse Sand) | | | D | 4A | |
| 7' | | | | D | 3A | |
| 8' | | | | D | 3A | |
| 9' | | | | D | 3A | |
| 10' | | | | D | 2A | 2 |
| 10' | Bottom of test pit at 10 feet Below Ground Surface (bgs) | | | | | |
| 11' | | | | | | |
| 12' | | | | | | |
| 13' | | | | | | |
| 14' | | | | | | |
| 15' | | | | | | |
| 16' | | | | | | |

Notes:

1. Water seeping through sidewalls into excavation at approximately 4 feet bgs.
2. Test pit terminated at approximately 10 feet bgs. Upon completion, test pit backfilled with excavated material and tamped in lifts with heel of excavator bucket.
3. USDA soil textural classification indicated in ().

| | | | | | |
|--|--|---|--|--|-----------------------|
| Test Pit Plan  Volume = <u>11.9</u> cu. yd. | Boulder Class Letter Designation Size Range Classification A 6" - 17" B 18" - 36" C 36" and Larger | Proportions Used TRACE (TR.) 0 - 10% LITTLE (LI.) 10 - 20% SOME (SO.) 20 - 35% AND 35 - 50% | Abbreviations F = Fine M = Medium C = Coarse V = Very F/M = Fine to medium F/C = Fine to coarse GR = Gray BN = Brown YEL = Yellow | GROUNDWATER () Encountered (x) Not Encountered Elapsed Time to Reading (Hours) Depth to Groundwater | |
| | | Excavation Effort E-----Easy M-----Moderate D-----Difficult | | | 20 mins 6.0 feet |

Stratification lines represent approximate boundaries between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurements were made.

TEST BORING LOG



GZA
GeoEnvironmental, Inc.
Engineers and Scientists

TEC, Inc.
Burt Road Development
Andover, MA

BORING NO.: B-1
SHEET: 1 of 1
PROJECT NO: 18.0173996.00
REVIEWED BY: Z. Morris

| | | | |
|---|---|---|--------------------|
| Drilling Co.: New England Boring Contractors | Type of Rig: ATV | Boring Location: See Plan | H. Datum: - |
| Foreman: Ben Cross | Rig Model: Mobile B-53 | Ground Surface Elev. (ft.): | |
| Logged By: Brian Cantor | Drilling Method: Hollow Stem Auger | Final Boring Depth (ft.): 27 | V. Datum: - |
| | | Date Start - Finish: 12/14/2018 - 12/14/2018 | |

| | | | | |
|----------------------------------|-------------------------------------|--------------------------------|-------------|--------------------|
| Auger/Casing Type: HSA | Sampler Type: SS | Groundwater Depth (ft.) | | |
| I.D./O.D.(in): 4.25/7.625 | I.D./O.D. (in.): 1.375"/2" | Date | Time | Water Depth |
| Hammer Weight (lb.): - | Sampler Hmr Wt (lb): 140 lb. | 12/14/2018 | 10:00 | 5.7 |
| Hammer Fall (in.): - | Sampler Hmr Fall (in): 30" | | | Casing |
| Other: | Other: Safety Hammer | | | Stab. Time |
| | | | | 15 min. |

| Depth (ft) | Casing Blows/ Core Rate | Sample | | | | | SPT Value | Sample Description and Identification (Modified Burmister Procedure) | Remark | Field Test Data | Depth (ft.) | Stratum Description | Elev. (ft.) |
|------------------------------|-------------------------|--------|-------------|-----------|-----------|-------------------|-----------|--|--------|-----------------|-------------|---------------------|-------------|
| | | No. | Depth (ft.) | Pen. (in) | Rec. (in) | Blows (per 6 in.) | | | | | | | |
| 5 10 15 20 25 | | S-1 | 0-2 | 24 | 17 | 35 42 17 13 | 59 | S-1: Top 10": Brown to light brown, fine to medium SAND, trace Gravel, little Silt. Bottom 7": Light brown, fine to medium SAND, little Silt, trace Gravel. | 1 | | SAND & SILT | | |
| | | S-2 | 5-7 | 24 | 18 | 6 7 6 7 | 13 | S-2: Medium dense, light brown, fine to medium SAND, little Silt. | | | | | |
| | | S-3 | 10-12 | 24 | 16 | 4 4 5 7 | 9 | S-3: Loose, light brown to brown, fine SAND, some Silt. | | | | | |
| | | S-4 | 15-17 | 24 | 15 | 4 6 8 9 | 14 | S-4: Medium dense, light brown to brown, fine SAND, some Silt. | | | | | |
| | | S-5 | 20-22 | 24 | 17 | 10 10 10 11 | 20 | S-5: Medium dense, light brown to brown, fine SAND, some Silt. | | | | | |
| | | S-6 | 25-27 | 24 | 18 | 7 8 10 8 | 18 | S-6: Medium dense, light brown to brown, fine SAND, some Silt (piece of severely weathered rock 4.5 to 5 inches from bottom of spoon). | | | | | |
| 30 35 | | | | | | | | 2 | | 27' | | | |
| Bottom of boring at 27 feet. | | | | | | | | | | | | | |

| | |
|----------------|---|
| REMARKS | <ol style="list-style-type: none"> 1. Top 10-inches of S-1 frozen. 2. Upon completion, borehole backfilled with cuttings to existing grade. |
|----------------|---|

| | |
|--|----------------------------------|
| See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made. | Boring No.: B-1 |
|--|----------------------------------|

18.0173996.00.GPJ-STRATUM ONLY; 12/28/2018

TEST BORING LOG



GZA
GeoEnvironmental, Inc.
Engineers and Scientists

TEC, Inc.
 Burt Road Development
 Andover, MA

BORING NO.: B-2
SHEET: 1 of 1
PROJECT NO: 18.0173996.00
REVIEWED BY: Z. Morris

| | | | |
|---|---------------------------------|---|--------------------|
| Drilling Co.: New England Boring Contractors | Type of Rig: ATV | Boring Location: See Plan | H. Datum: - |
| Foreman: Ben Cross | Rig Model: Mobile B-53 | Ground Surface Elev. (ft.): | |
| Logged By: Brian Cantor | Drilling Method: HSA/D&W | Final Boring Depth (ft.): 31 | V. Datum: - |
| | | Date Start - Finish: 12/14/2018 - 12/14/2018 | |

| | | | | |
|--|-------------------------------------|--------------------------------|-------------|--------------------|
| Auger/Casing Type: HSA/HW | Sampler Type: SS | Groundwater Depth (ft.) | | |
| I.D./O.D.(in): 4.25/7.625 / 4.0/4.5 | I.D./O.D. (in.): 1.375"/2" | Date | Time | Water Depth |
| Hammer Weight (lb.): 300 lb. | Sampler Hmr Wt (lb): 140 lb. | 12/14/2018 | 13:15 | 6.2 |
| Hammer Fall (in.): 30 in. | Sampler Hmr Fall (in): 30" | | | Casing |
| Other: Safety Hammer | Other: Safety Hammer | | | Stab. Time |
| | | | | 15 min. |

| Depth (ft) | Casing Blows/ Core Rate | Sample | | | | | | SPT Value | Sample Description and Identification (Modified Burmister Procedure) | Remark | Field Test Data | Depth (ft.) | Stratum Description | Elev. (ft.) |
|---|-------------------------|--------|-------------|-----------|-----------|-------------------|----|--|--|--------|-----------------|-------------|---------------------|-------------|
| | | No. | Depth (ft.) | Pen. (in) | Rec. (in) | Blows (per 6 in.) | | | | | | | | |
| 5 10 15 20 25 30 | | S-1 | 0-2 | 24 | 16 | 8 7 6 6 | 13 | S-1: Top 6": Dark brown, fine to medium SAND, little Silt, trace Roots. Bottom 10": Dry, light brown, fine to medium SAND, little Silt. | | | 0.5' | TOPSOIL | | |
| | | S-2 | 5-7 | 24 | 18 | 3 4 6 6 | 10 | S-2: Moist, medium dense, light brown to gray, fine to medium SAND, little Silt. | | | | | | |
| | | S-3 | 10-12 | 24 | 19 | 4 6 10 27 | 16 | S-3: Top 13": Light brown, fine to medium SAND, little Silt. Bottom 6": Moist, light brown, fine to medium SAND, little Silt. | 1 | | | | | |
| | | S-4 | 15-17 | 24 | 17 | 7 8 8 12 | 16 | S-4: Light brown, fine to medium SAND, little Silt. | 2 | | | | | |
| | | S-5 | 19-21 | 24 | 16 | 6 8 8 8 | 16 | S-5: Medium dense, light brown, fine SAND, some Silt. | 3 | | | | | |
| | | S-6 | 24-25 | 24 | 16 | 7 8 5 6 | 13 | S-6: Medium dense, light brown, fine SAND, some Silt. | 4 | | | | | |
| | | S-7 | 29-31 | 24 | 15 | 8 9 8 8 | 17 | S-7: Medium dense, gray, fine SAND, some Silt. | | | | | | |
| 35 | | | | | | | | Bottom of boring at 31 feet. | 5 | | 31' | | | |

REMARKS

1. Oxidation staining observed in S-3 at approximate depth of 11.5 feet below ground surface.
2. Sand blowing into hole before attempting to sample from 15 to 17 feet below ground surface (S-4).
3. Prior to sampling S-4, driller removed the hollow stem augers. Driller advanced 4-inch casing to 15 feet below ground surface and then sampled from 15 to 17 feet.
4. Drilled open hole from 15 to 31 feet below ground surface.
5. Upon completion, borehole backfilled with cuttings to existing grade.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.:
B-2

18.0173996.00.GPJ; STRATUM ONLY; 12/28/2018

TEST BORING LOG



GZA
GeoEnvironmental, Inc.
Engineers and Scientists

TEC, Inc.
Burt Road Development
Andover, MA

BORING NO.: B-3
SHEET: 1 of 1
PROJECT NO: 18.0173996.00
REVIEWED BY: Z. Morris

| | | | |
|---|--------------------------------------|---|--------------------|
| Drilling Co.: New England Boring Contractors | Type of Rig: ATV | Boring Location: See Plan | H. Datum: - |
| Foreman: Ben Cross | Rig Model: Mobile B-53 | Ground Surface Elev. (ft.): | |
| Logged By: Brian Cantor | Drilling Method: Drive & Wash | Final Boring Depth (ft.): 31 | V. Datum: - |
| | | Date Start - Finish: 12/14/2018 - 12/14/2018 | |

| | | | | |
|-------------------------------------|-------------------------------------|--------------------------------|-------------|--------------------|
| Auger/Casing Type: HW | Sampler Type: SS | Groundwater Depth (ft.) | | |
| I.D./O.D.(in): 4.0/4.5 | I.D./O.D. (in.): 1.375"/2" | Date | Time | Water Depth |
| Hammer Weight (lb.): 300 lb. | Sampler Hmr Wt (lb): 140 lb. | 12/14/2018 | 14:40 | 4.8 |
| Hammer Fall (in.): 30 in. | Sampler Hmr Fall (in): 30" | | | Casing |
| Other: Safety Hammer | Other: Safety Hammer | | | Stab. Time |
| | | | | 15 min. |

| Depth (ft) | Casing Blows/ Core Rate | Sample | | | | | | SPT Value | Sample Description and Identification (Modified Burmister Procedure) | Remark | Field Test Data | Depth (ft.) | Stratum Description | Elev. (ft.) |
|---|-------------------------|--------|-------------|-----------|-----------|-------------------|----|---|--|--------|-----------------|-------------|---------------------|-------------|
| | | No. | Depth (ft.) | Pen. (in) | Rec. (in) | Blows (per 6 in.) | | | | | | | | |
| 5 10 15 20 25 30 | | S-1 | 0-2 | 24 | 18 | 9 7 7 7 | 14 | S-1: Top 8": Dark brown, fine to medium SAND, little Silt, trace Root. Bottom 10": Light brown to brown, fine to medium SAND, trace Gravel, little Silt. | | | 0.7' | TOPSOIL | | |
| | | S-2 | 4-6 | 24 | 13 | 6 8 10 10 | 18 | S-2: Medium dense, light brown to brown, fine to coarse SAND, trace Gravel, little Silt. | | | | | | |
| | | S-3 | 9-11 | 24 | 14 | 4 5 5 7 | 10 | S-3: Medium dense, light brown to brown, fine to coarse SAND, little Silt. | | | | | | |
| | | S-4 | 14-16 | 24 | 15 | 1 2 WOH 1 | 2 | S-4: Very loose, light brown, fine SAND, some Silt. | | | | | | |
| | | S-5 | 19-21 | 24 | 18 | 4 6 9 7 | 15 | S-5: Top 9": Light brown, fine to medium SAND, little Silt. Bottom 9": Gray, fine SAND, little Silt. | 1 | | | | | |
| | | S-6 | 24-26 | 24 | 19 | 9 11 8 8 | 19 | S-6: Top 13": Light brown, fine SAND, some Silt. Bottom 5": Gray, fine SAND, little Silt. | | | | | | |
| | | S-7 | 29-31 | 24 | 18 | 5 6 9 8 | 15 | S-7: Medium dense, gray, fine SAND, some Silt. | | | | | | |
| | | | | | | | | Bottom of boring at 31 feet. | 2 | | 31' | | | |

REMARKS

1. Drilled open hole from 19 to 31 feet below ground surface.
2. Upon completion, borehole backfilled with cuttings to existing grade.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.:
B-3

18.0173996.00.GPJ-STRATUM ONLY; 12/28/2018

TEST BORING LOG



GZA
GeoEnvironmental, Inc.
Engineers and Scientists

TEC, Inc.
Burtt Road Development
Andover, MA

BORING NO.: B-5
SHEET: 1 of 1
PROJECT NO: 18.0173996.00
REVIEWED BY: Z. Morris

| | | | |
|---|--------------------------------------|---|--------------------|
| Drilling Co.: New England Boring Contractors | Type of Rig: ATV | Boring Location: See Plan | H. Datum: - |
| Foreman: Ben Cross | Rig Model: Mobile B-53 | Ground Surface Elev. (ft.): | |
| Logged By: Brian Cantor | Drilling Method: Drive & Wash | Final Boring Depth (ft.): 31 | V. Datum: - |
| | | Date Start - Finish: 12/14/2018 - 12/14/2018 | |

| | | | | |
|-------------------------------------|-------------------------------------|--------------------------------|-------------|--------------------|
| Auger/Casing Type: HW | Sampler Type: SS | Groundwater Depth (ft.) | | |
| I.D./O.D.(in): 4.0/4.5 | I.D./O.D. (in.): 1.375"/2" | Date | Time | Water Depth |
| Hammer Weight (lb.): 300 lb. | Sampler Hmr Wt (lb): 140 lb. | 12/14/2018 | 15:45 | 2.2 |
| Hammer Fall (in.): 30 in. | Sampler Hmr Fall (in): 30" | | | Casing |
| Other: Safety Hammer | Other: Safety Hammer | | | Stab. Time |
| | | | | 10 min. |

| Depth (ft) | Casing Blows/ Core Rate | Sample | | | | | | SPT Value | Sample Description and Identification (Modified Burmister Procedure) | Remark | Field Test Data | Depth (ft.) | Stratum Description | Elev. (ft.) |
|------------|-------------------------|--------|-------------|-----------|-----------|-------------------|----|--|--|--------|-----------------|--------------|---------------------|-------------|
| | | No. | Depth (ft.) | Pen. (in) | Rec. (in) | Blows (per 6 in.) | | | | | | | | |
| | | S-1 | 0-2 | 24 | 18 | 3 4 5 8 | 9 | S-1: Top 12": Dark brown, fine to medium SAND, little Silt, trace Glass, trace Roots. Bottom 6": Brown, fine to medium SAND, little Silt. | | | 1' | TOPSOIL/FILL | | |
| 5 | | S-2 | 4-6 | 24 | 15 | 5 9 11 11 | 20 | S-2: Medium dense, light brown, fine to medium SAND, little Silt. | | | | | | |
| 10 | | S-3 | 9-11 | 24 | 16 | 4 5 5 5 | 10 | S-3: Loose, light brown to gray, fine to medium SAND, little Silt. | | | | | | |
| 15 | | S-4 | 14-16 | 24 | 14 | 3 4 4 5 | 8 | S-4: Loose, gray to light brown, fine SAND, some Silt. | | | | | | |
| 20 | | S-5 | 19-21 | 24 | 15 | 6 8 8 9 | 16 | S-5: Medium dense, light brown, fine SAND, some Silt. | | | | | | |
| 25 | | S-6 | 24-25 | 24 | 18 | 6 6 7 6 | 13 | S-6: Medium dense, gray, fine SAND, little Clayey Silt. | | | | | | |
| 30 | | S-7 | 29-31 | 24 | 19 | 4 3 4 4 | 7 | S-7: Loose, gray, SILT, trace fine Sand. | | | | | | |
| | | | | | | | | Bottom of boring at 31 feet. | 1 | | 31' | | | |
| 35 | | | | | | | | | | | | | | |

REMARKS

1. Upon completion, borehole backfilled with cuttings to existing grade.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.:
B-5

18.0173996.00.GPJ-STRATUM ONLY; 12/28/2018

TEST BORING LOG



GZA
GeoEnvironmental, Inc.
Engineers and Scientists

TEC, Inc.
Burt Road Development
Andover, MA

BORING NO.: B-8
SHEET: 1 of 1
PROJECT NO: 18.0173996.00
REVIEWED BY: Z. Morris

| | | | |
|---|--------------------------------------|---|--------------------|
| Drilling Co.: New England Boring Contractors | Type of Rig: ATV | Boring Location: See Plan | H. Datum: - |
| Foreman: Ben Cross | Rig Model: Mobile B-53 | Ground Surface Elev. (ft.): | |
| Logged By: Brian Cantor | Drilling Method: Drive & Wash | Final Boring Depth (ft.): 36 | V. Datum: - |
| | | Date Start - Finish: 12/14/2018 - 12/14/2018 | |

| | | | | |
|-------------------------------------|-------------------------------------|--------------------------------|-------------|--------------------|
| Auger/Casing Type: HW | Sampler Type: SS | Groundwater Depth (ft.) | | |
| I.D./O.D.(in): 4.0/4.5 | I.D./O.D. (in.): 1.375"/2" | Date | Time | Water Depth |
| Hammer Weight (lb.): 300 lb. | Sampler Hmr Wt (lb): 140 lb. | 12/17/2018 | 14:40 | 3.1 |
| Hammer Fall (in.): 30 in. | Sampler Hmr Fall (in): 30" | | | Casing |
| Other: Safety Hammer | Other: Safety Hammer | | | Stab. Time |
| | | | | 15 min. |

| Depth (ft) | Casing Blows/ Core Rate | Sample | | | | | | SPT Value | Sample Description and Identification (Modified Burmister Procedure) | Remark | Field Test Data | Depth (ft.) | Stratum Description | Elev. (ft.) |
|------------|-------------------------|------------------------------|-------------|-----------|-----------|-------------------|----|---|--|--------|-----------------|-------------|---------------------|-------------|
| | | No. | Depth (ft.) | Pen. (in) | Rec. (in) | Blows (per 6 in.) | | | | | | | | |
| 5 | | S-1 | 0-2 | 24 | 18 | 1 1 2 3 | 3 | S-1: Top 5": Dark brown to black, fine to medium SAND, some Silt, trace Roots. Bottom 13": Brown to light brown, fine to medium SAND, trace Gravel, little Silt. | | | | 0.7' | TOPSOIL | |
| | | S-2 | 4-6 | 24 | 18 | 6 5 8 9 | 13 | S-2: Medium dense, light brown, fine to medium SAND, trace Silt, trace Roots. | | | | | | |
| 10 | | S-3 | 9-11 | 24 | 16 | 8 6 7 8 | 13 | S-3: Stiff, light brown, Clayey SILT and fine SAND. | | | | | | |
| 15 | | S-4 | 14-16 | 24 | 18 | 3 5 5 5 | 10 | S-4: Medium dense, light brown, fine SAND and SILT. | 1 | | | | | |
| 20 | | S-5 | 19-21 | 24 | 18 | 3 5 5 5 | 10 | S-5: Medium dense, light brown, fine SAND and SILT. | 2 | | | | | |
| 25 | | S-6 | 24-26 | 24 | 21 | 2 1 2 5 | 3 | S-6: Very loose, gray, SILT and fine SAND. | | | | | | |
| 30 | | S-7 | 29-31 | 24 | 20 | 2 2 2 1 | 4 | S-7: Very loose, gray, SILT and fine SAND. | | | | | | |
| 35 | | S-8 | 34-36 | 24 | 21 | 22 17 18 35 | 35 | S-8: Dense, gray, SILT, some fine SAND, trace Gravel. | | | | | | |
| | | Bottom of boring at 36 feet. | | | | | | | | 3 | | | 36' | |

REMARKS

- Oxidation staining of soil observed from approximately 15 to 15.2 feet below ground surface.
- Drilled open hole from 19 to 36 feet below ground surface.
- Upon completion, borehole backfilled with cuttings to existing grade.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.:
B-8

18.0173996.00.GPJ-STRATUM ONLY; 12/28/2018

TEST BORING LOG



GZA
GeoEnvironmental, Inc.
Engineers and Scientists

TEC, Inc.
Burtt Road Development
Andover, MA

BORING NO.: B-9
SHEET: 1 of 1
PROJECT NO: 18.0173996.00
REVIEWED BY: Z. Morris

| | | | |
|---|--------------------------------------|---|--------------------|
| Drilling Co.: New England Boring Contractors | Type of Rig: ATV | Boring Location: See Plan | H. Datum: - |
| Foreman: Ben Cross | Rig Model: Mobile B-53 | Ground Surface Elev. (ft.): | |
| Logged By: Brian Cantor | Drilling Method: Drive & Wash | Final Boring Depth (ft.): 21 | V. Datum: - |
| | | Date Start - Finish: 12/14/2018 - 12/14/2018 | |

| | | | | |
|-------------------------------------|-------------------------------------|--------------------------------|-------------|--------------------|
| Auger/Casing Type: HW | Sampler Type: SS | Groundwater Depth (ft.) | | |
| I.D./O.D.(in): 4.0/4.5 | I.D./O.D. (in.): 1.375"/2" | Date | Time | Water Depth |
| Hammer Weight (lb.): 300 lb. | Sampler Hmr Wt (lb): 140 lb. | 12/17/2018 | 15:50 | 2.5 |
| Hammer Fall (in.): 30 in. | Sampler Hmr Fall (in): 30" | | | Casing |
| Other: Safety Hammer | Other: Safety Hammer | | | Stab. Time |
| | | | | 10 min. |

| Depth (ft) | Casing Blows/ Core Rate | Sample | | | | | SPT Value | Sample Description and Identification (Modified Burmister Procedure) | Remark | Field Test Data | Depth (ft.) | Stratum Description | Elev. (ft.) |
|------------|-------------------------|--------|-------------|-----------|-----------|-------------------|-----------|---|--------|-----------------|-------------|---------------------|-------------|
| | | No. | Depth (ft.) | Pen. (in) | Rec. (in) | Blows (per 6 in.) | | | | | | | |
| 5 | | S-1 | 0-2 | 24 | 17 | 2 1 2 2 | 3 | S-1: Top 7": Dark brown to black, fine to medium SAND, some Silt, trace Gravel, trace Roots. Bottom 10": Brown, fine to medium SAND, trace Silt. | | | 0.8' | TOPSOIL | |
| | | S-2 | 4-6 | 24 | 14 | 4 5 8 9 | 13 | S-2: Medium dense, light brown, fine to medium SAND, trace Silt. | | | | | |
| | | S-3 | 9-11 | 24 | 16 | 3 3 5 6 | 8 | S-3: Loose, light brown, fine to medium SAND, trace Silt. | | | | | |
| | | S-4 | 14-16 | 24 | 20 | 7 7 8 9 | 15 | S-4: Very stiff, light brown, Clayey SILT, little fine Sand. | | | | | |
| | | S-5 | 19-21 | 24 | 18 | 3 3 3 3 | 6 | S-5: Loose, light brown, SILT, little Sand. | | | | | |
| | | | | | | | | | | | 21' | | |
| | | | | | | | | Bottom of boring at 21 feet. | 1 | | | | |

REMARKS

1. Upon completion, borehole backfilled with cuttings to existing grade.

See Log Key for explanation of sample description and identification procedures. Stratification lines represent approximate boundaries between soil and bedrock types. Actual transitions may be gradual. Water level readings have been made at the times and under the conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the times the measurements were made.

Boring No.:
B-9

18.0173996.00.GPJ-STRATUM ONLY; 12/28/2018

Stormwater Basin P1 - Mounding Analysis

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.

Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. **The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed** otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Conversion Table

inch/hour feet/day

0.67 1.33

2.00 4.00

hours days

36 1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

Input Values

| |
|---------|
| 4.8200 |
| 0.320 |
| 48.20 |
| 12.000 |
| 375.000 |
| 0.188 |
| 30.000 |

R
Sy
K
x
y
t
hi(0)

Recharge (infiltration) rate (feet/day)
Specific yield, Sy (dimensionless, between 0 and 1)
Horizontal hydraulic conductivity, Kh (feet/day)*
1/2 length of basin (x direction, in feet)
1/2 width of basin (y direction, in feet)
duration of infiltration period (days)
initial thickness of saturated zone (feet)

| |
|--------|
| 31.084 |
| 1.084 |

h(max)
Δh(max)

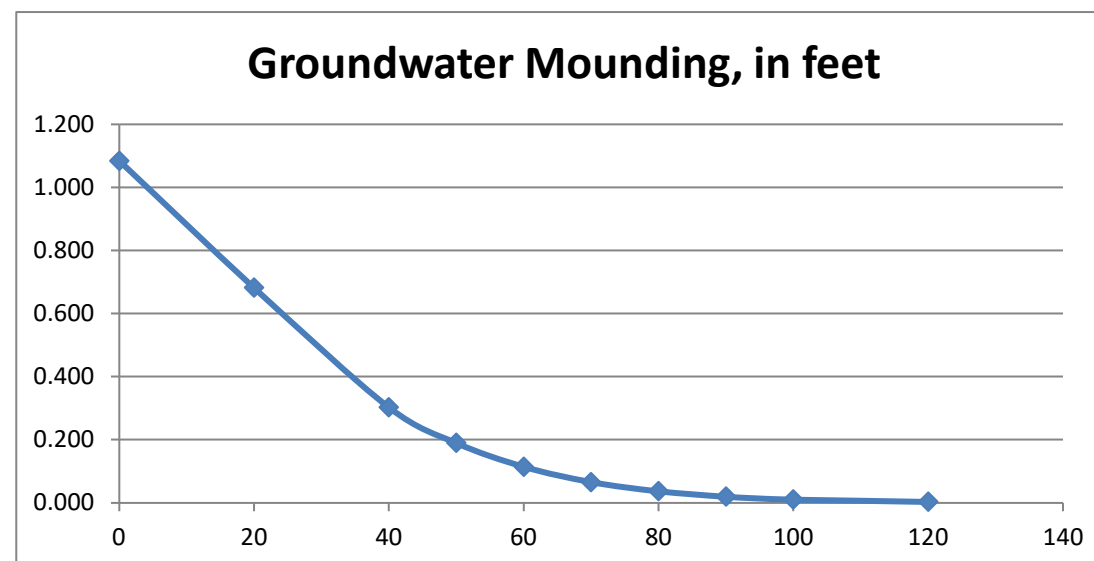
maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
maximum groundwater mounding (beneath center of basin at end of infiltration period)

Ground-water Mounding, in feet Distance from center of basin in x direction, in feet

| | |
|-------|-----|
| 1.084 | 0 |
| 0.682 | 20 |
| 0.303 | 40 |
| 0.190 | 50 |
| 0.114 | 60 |
| 0.066 | 70 |
| 0.036 | 80 |
| 0.019 | 90 |
| 0.010 | 100 |
| 0.003 | 120 |



Re-Calculate Now



Stormwater Basin P2 - Mounding Analysis

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.

Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. **The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed** otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Conversion Table

inch/hour feet/day

0.67 1.33

2.00 4.00

hours days

36 1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

Input Values

| |
|---------|
| 4.8200 |
| 0.320 |
| 48.20 |
| 60.000 |
| 177.500 |
| 0.104 |
| 30.000 |

R
Sy
K
x
y
t
hi(0)

Recharge (infiltration) rate (feet/day)
Specific yield, Sy (dimensionless, between 0 and 1)
Horizontal hydraulic conductivity, Kh (feet/day)*
1/2 length of basin (x direction, in feet)
1/2 width of basin (y direction, in feet)
duration of infiltration period (days)
initial thickness of saturated zone (feet)

| |
|--------|
| 31.547 |
| 1.547 |

h(max)
Δh(max)

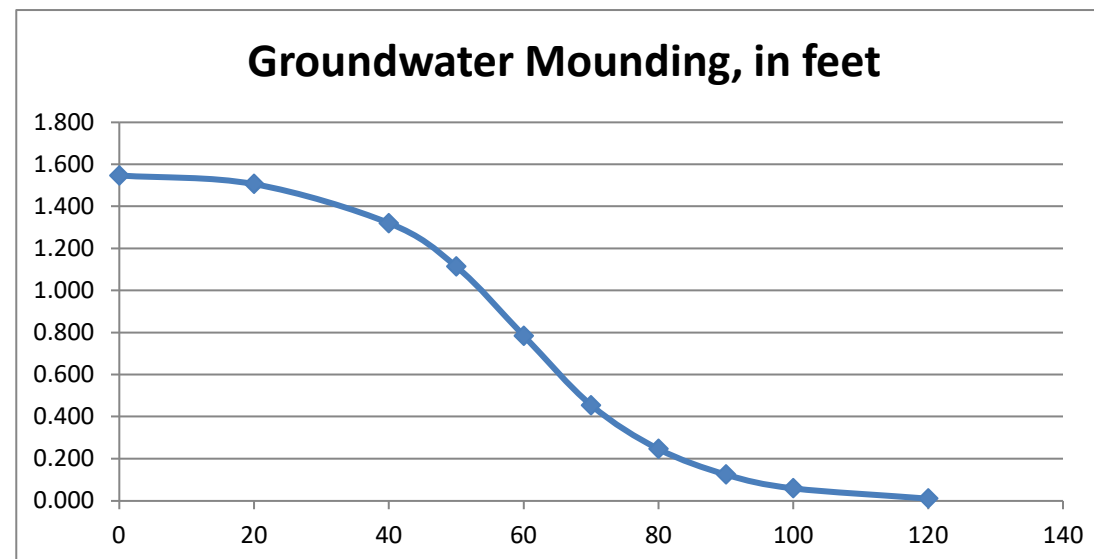
maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
maximum groundwater mounding (beneath center of basin at end of infiltration period)

Ground- Distance from
water center of basin
Mounding, in in x direction, in
feet feet

| | |
|-------|-----|
| 1.547 | 0 |
| 1.507 | 20 |
| 1.320 | 40 |
| 1.114 | 50 |
| 0.785 | 60 |
| 0.454 | 70 |
| 0.246 | 80 |
| 0.125 | 90 |
| 0.059 | 100 |
| 0.011 | 120 |



Re-Calculate Now



Stormwater Basin P3 - Mounding Analysis

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.

Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. **The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed** otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Conversion Table

| inch/hour | feet/day |
|-----------|----------|
| 0.67 | 1.33 |
| 2.00 | 4.00 |
| hours | days |
| 36 | 1.50 |

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

Input Values

| |
|--------|
| 4.8200 |
| 0.320 |
| 48.20 |
| 80.000 |
| 54.000 |
| 0.188 |
| 30.000 |

R
Sy
K
x
y
t
hi(0)

Recharge (infiltration) rate (feet/day)
Specific yield, Sy (dimensionless, between 0 and 1)
Horizontal hydraulic conductivity, Kh (feet/day)*
1/2 length of basin (x direction, in feet)
1/2 width of basin (y direction, in feet)
duration of infiltration period (days)
initial thickness of saturated zone (feet)

| |
|--------|
| 32.573 |
| 2.573 |

h(max)
Δh(max)

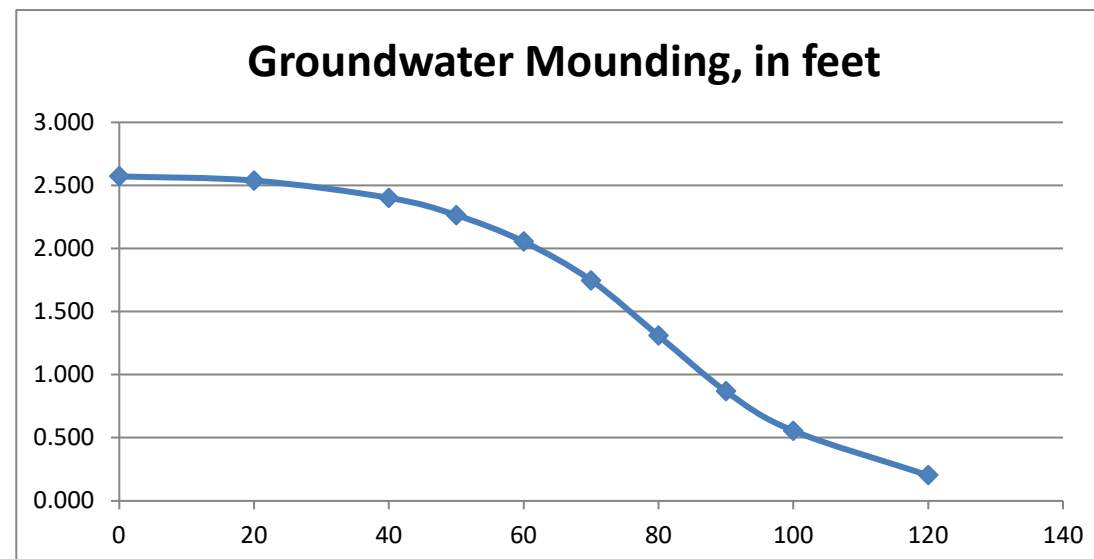
maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
maximum groundwater mounding (beneath center of basin at end of infiltration period)

Ground-water Mounding, in feet
Distance from center of basin in x direction, in feet

| | |
|-------|-----|
| 2.573 | 0 |
| 2.538 | 20 |
| 2.402 | 40 |
| 2.264 | 50 |
| 2.055 | 60 |
| 1.747 | 70 |
| 1.309 | 80 |
| 0.867 | 90 |
| 0.554 | 100 |
| 0.203 | 120 |



Re-Calculate Now



Stormwater Basin P4 - Mounding Analysis

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.

Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. **The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed** otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Conversion Table

inch/hour feet/day

0.67 1.33

2.00 4.00

hours days

36 1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

Input Values

| |
|--------|
| 4.8200 |
| 0.320 |
| 48.20 |
| 35.000 |
| 87.000 |
| 0.225 |
| 30.000 |

R
Sy
K
x
y
t
hi(0)

Recharge (infiltration) rate (feet/day)
Specific yield, Sy (dimensionless, between 0 and 1)
Horizontal hydraulic conductivity, Kh (feet/day)*
1/2 length of basin (x direction, in feet)
1/2 width of basin (y direction, in feet)
duration of infiltration period (days)
initial thickness of saturated zone (feet)

| |
|--------|
| 32.505 |
| 2.505 |

h(max)
Δh(max)

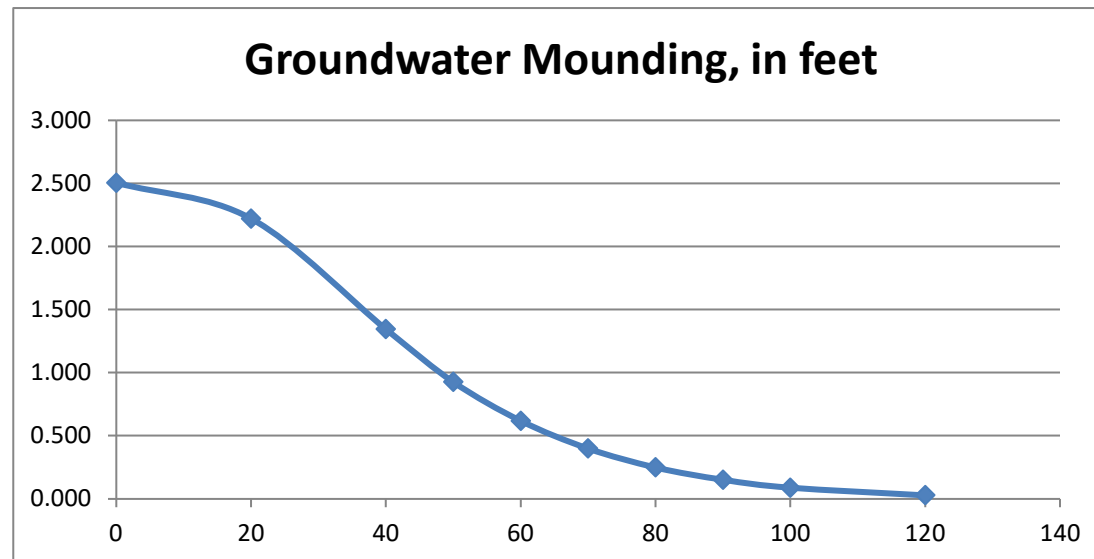
maximum thickness of saturated zone (beneath center of basin at end of infiltration period)
maximum groundwater mounding (beneath center of basin at end of infiltration period)

Ground- Distance from
water center of basin
Mounding, in in x direction, in
feet feet

| | |
|-------|-----|
| 2.505 | 0 |
| 2.221 | 20 |
| 1.345 | 40 |
| 0.926 | 50 |
| 0.618 | 60 |
| 0.399 | 70 |
| 0.249 | 80 |
| 0.150 | 90 |
| 0.088 | 100 |
| 0.027 | 120 |



Re-Calculate Now



G

Illicit Discharge Statement

Illicit Discharge Compliance Statement

Name of Owner: MCP/Howland Burtt Owner, LLC.
Name of Facility: Burtt Road Development
Location: Burtt Road, Andover, MA 01810

The Site Plans and Drainage Report for the Proposed warehouse, located at Burtt Road Extension, MA, meets the requirements of Standard 10 of the Massachusetts Stormwater Handbook.

The Site Plans were prepared by qualified personnel at the direction of **MCP/Howland Burtt Owner, LLC**. The Site Plans identify the location of stormwater management and utility systems. As designed, the systems do not allow for any connections between the stormwater management and sanitary sewer utilities.

All new utilities will service the proposed buildings.

Signature: _____
(To be signed prior to occupancy)