

Stormwater Management Report

Bud's Goods Cultivation & Product Manufacturing Farm

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Halifax, Massachusetts**

Prepared for:

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Presented by:



BEALS + THOMAS

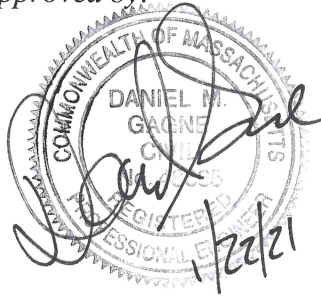
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1.0 INTRODUCTION

The proposed project includes a stormwater management system designed to mitigate potential impacts the proposed project could have on the existing watershed. Stormwater controls have been proposed to control peak runoff rates, provide water quality, promote groundwater recharge and sediment removal. The proposed system has been designed to comply with:

- The 2008 Massachusetts Department of Environmental Protection (DEP) Stormwater Management Handbook,
- The Massachusetts Wetland Protection Act (310 CMR 10.00)

The pre- and post-development hydrologic conditions were modeled using HydroCAD™ version 10.10 to demonstrate that post-development stormwater runoff rates will be less than or equal to the pre-development rates. Watershed maps with soil types as well as detailed analysis of the model results are also included. The following table summarizes the peak runoff rates for the pre- and post-development conditions.

Table 1: Pre- & Post-development Peak Runoff Rate Comparison, units are in cubic feet per second (cfs).

Storm Event	2 Year		10 Year		25 Year		100 Year	
	<i>Pre</i>	Post	<i>Pre</i>	Post	<i>Pre</i>	Post	<i>Pre</i>	Post
Design Point 1	65.0	61.8	95.2	90.4	115.9	110.1	147.9	140.9

2.0 **PRE-DEVELOPMENT CONDITIONS**

2.1 **Site Conditions**

The Site is currently undeveloped and is primarily farmland. The site is surrounded by existing farm ditches which drain to Bartlett Brook. The Property is mapped by Natural Heritage & Endangered Species Program (NHESP) as Estimated Habitats of Rare Wildlife and Priority Habitats of Rare Species and contains Bordering Vegetated Wetlands (BVW) and a perennial stream identified as Bartlett Brook. The Applicant has preliminarily met with NHESP on July 24, 2020 where it was concluded that NHESP confirmed that during review on another portion of the larger property, that the species the site is mapped for does not use this area. The Applicant anticipates submitting a copy of this NOI to NHESP concurrent with the date of this submission and will continue to coordinate on whether a MESA filing is necessary.

2.1.1 **Critical Areas**

The site does not contain, nor is it tributary to any Critical Areas.

2.2 **Soil Description**

The Natural Resources Conservation Service (NRCS) lists the on-site soils as Scio very fine sandy loam, a moderately well drained soil consisting of 85% Scio soils and 15% minor components, Eldridge fine sandy loam, a moderately well drained soil consisting of 85% Eldridge soils and 15% minor components, and Raynham silt loam, a poorly drained soil consisting of 85% Raynham soils and 15% minor components. Generally, this soil is located in areas of lake plains and terraces, and has two layers of fine sand extending down approximately 38-inches below the surface, and then continues as silt. NRCS classifies this type of soil as hydrologic class C/D soil.

A Competent Soils Individual conducted a site visit on May 22, 2020 to verify the NRCS classification.

2.3 **Hydrologic Analysis**

Sub-catchment areas were delineated based on existing runoff patterns and topographic information. This information is shown on the *Pre-Development Conditions Hydrologic Areas Map* included in Attachment 2. Summaries of each area with respect to Curve Number and Time of Concentration calculations can be found in the model results also in Attachment 2.

3.0 POST-DEVELOPMENT CONDITIONS

3.1 Design Strategy

During the design phase of the site layout, consideration was given to conserving environmentally sensitive features and minimizing impact on the existing hydrology. The buildings have been located at the highest existing grades on the site while limiting work within the local 50' buffer zone to the agricultural ditches. Minimizing earthwork helps to maintain the existing drainage patterns to the maximum extent practicable under post-development conditions. Through careful site planning proposed impervious surfaces are limited to building rooftops, reducing the impact the project may have on the existing watershed. This minimization of impervious surfaces was achieved without compromising compliance to local bylaw requirements.

To mitigate increased stormwater flow rates associated with the proposed development, two detention basins have been proposed. Based on the data presented in the Soil Test Pit Logs included in Attachment 1, the detention basins have been sited in the central portion of the site, where seasonal high groundwater and bedrock are approximately 32" below the existing grade. The detention basins will discharge to the wetland system, consistent with the existing hydrology of the site.

3.2 Hydrologic Analysis

The established design points used in the pre-development conditions analysis were used in the post-development analysis for direct comparison. The tributary areas and flow paths were modified to reflect post-development conditions. See Attachment 3 for the *Post-Development Conditions Hydrologic Areas Map*. Summaries of each area with respect to Curve Number and Time of Concentration calculations can be found in the model results in Attachment 3.

3.3 Stormwater Management Controls Sizing

Detention Basins

The Detention Basins have been designed to reduce post-development runoff up to the 100-year storm event. The outlet structure has been designed as a multi-stage outlet to provide control for a variety of storm events. The outlet will direct stormwater towards the Bordering Vegetated Wetlands (BVW). In the event of overtopping, an emergency spillway has been provided to direct the excess flow towards the BVW, consistent with the existing drainage pattern. The basins have been designed so that it will fully dewater within 72 hours.

3.4 Compliance with DEP Stormwater Management Standards

The proposed stormwater management system was designed in compliance with the ten (10) DEP Stormwater Management Standards. The following summary provides key information related to the proposed stormwater management system, its design elements, and mitigation measures for potential impacts.

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

There will be no direct discharge of untreated stormwater to nearby wetlands or waters of the Commonwealth. Runoff from all impervious areas of the site will be conveyed to stormwater management controls for and runoff rate attenuation prior to discharge to adjacent wetlands.

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

The stormwater management design will control post-development peak discharge rates for the 2-, 10-, 25-, and 100-year, 24-hour storms so as to maintain pre-development peak discharge rates. Refer to Section 1.0 Introduction for a summary of the peak runoff rates.

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

The project site is located entirely within C or D soils. All proposed impervious are located in areas of D soils. Accordingly, this standard applies only to the maximum amount practicable. As a result, annual recharge from the post-development site will approximate the annual recharge from the site under pre-development conditions.

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

No new paved impervious areas are proposed as part of the Project. Additionally, the proposed gravel access driveway and parking area will not be sanded or salted during winter months eliminating the TSS load for the Project. Accordingly, this standard does not apply.

The Site Owner's Manual complies with the Long-Term Pollution Prevention Plan (Standard 4) and the Long-Term Operation and Maintenance Plan (Standard 9) requirements of the 2008 Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Standards. The Manual outlines source control and pollution prevention measures and maintenance requirements of stormwater best management practices (BMPs) associated with the proposed development. Please refer to the Manual enclosed in Attachment 5.

STANDARD 5: For land uses with higher potential pollutant loads (LUHPPLs), source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.

The proposed project is not associated with stormwater discharges from land uses with higher potential pollutant loads.

STANDARD 6: Stormwater discharges to critical areas must utilize certain stormwater management BMPs approved for critical areas. Critical areas are Outstanding Resource Waters, shellfish beds, swimming beaches, coldwater fisheries and recharge areas for public water supplies.

There are no stormwater discharges to critical areas associated with this project.

STANDARD 7: Redevelopment of previously developed sites must meet the Stormwater Management Standards to the maximum extent practicable. However, if it is not practicable to meet all the Standards, new (retrofitted or expanded) stormwater management systems must be designed to improve existing conditions.

The proposed project is new development, and therefore this standard does not apply.

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

A Stormwater Pollution Prevention Plan (SWPPP) will be developed and submitted to the Commission prior to construction to comply with Section 3 of the NPDES Construction General Permit for Stormwater Discharges; therefore the requirements of Standard 8 are fulfilled.

STANDARD 9: A Long-Term Operation and Maintenance (O&M) Plan shall be developed and implemented to ensure that stormwater management systems function as designed.

The Site Owner's Manual complies with the Long-Term Pollution Prevention Plan (Standard 4) and the Long-Term Operation and Maintenance Plan (Standard 9) requirements of the 2008 Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Standards. The Manual outlines source control and pollution prevention measures and maintenance requirements of the stormwater best management practices (BMPs) associated with the proposed development.

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

There will be no illicit discharges to the proposed stormwater management system associated with the proposed project. An Illicit Discharge Compliance Statement will be submitted prior to any discharge to the stormwater BMPs.

3.6 Sample - Illicit Discharge Compliance Statement

An illicit discharge is any discharge to a stormwater management system that is not comprised entirely of stormwater, discharges from fire-fighting activities, and certain non-designated non-stormwater discharges.

To the best of my knowledge, no detectable illicit discharge exists on site. The site plans included with this report detail the storm sewers that convey stormwater on the site and demonstrate that these systems do not include the entry of an illicit discharge. A Site Owner's Manual is also included, which contains the Long Term Pollution Plan that outlines measures to prevent future illicit discharges. As the Site Owner, I will ultimately be responsible for implementing the Long Term Pollution Prevention Plan.

Signature: _____
Owner's Name

To be submitted prior to discharge to the stormwater BMPs



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

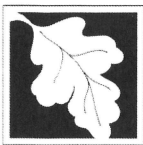
In addition to all plans and supporting information, the Stormwater Report must include a brief narrative describing stormwater management practices, including environmentally sensitive site design and LID techniques, along with a diagram depicting runoff through the proposed BMP treatment train. Plans 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.

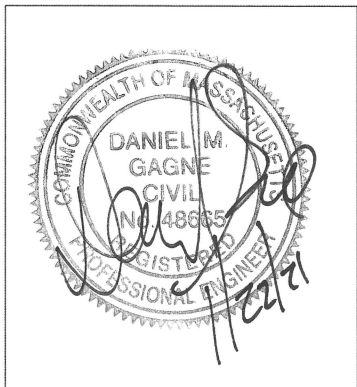
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the 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] 1/22/21
Signature and Date

Checklist

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

- ☒ New development
- ☐ Redevelopment
- ☐ Mix of New Development and Redevelopment



Checklist for Stormwater Report

Checklist (continued)

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

- ☐ No disturbance to any Wetland Resource Areas
- ☐ Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- ☐ Reduced Impervious Area (Redevelopment Only)
- ☐ Minimizing disturbance to existing trees and shrubs
- ☐ LID Site Design Credit Requested:
 - ☐ Credit 1
 - ☐ Credit 2
 - ☐ Credit 3
- ☐ Use of "country drainage" versus curb and gutter conveyance and pipe
- ☐ Bioretention Cells (includes Rain Gardens)
- ☐ Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- ☐ Treebox Filter
- ☐ Water Quality Swale
- ☐ Grass Channel
- ☐ Green Roof
- ☐ Other (describe): _____

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

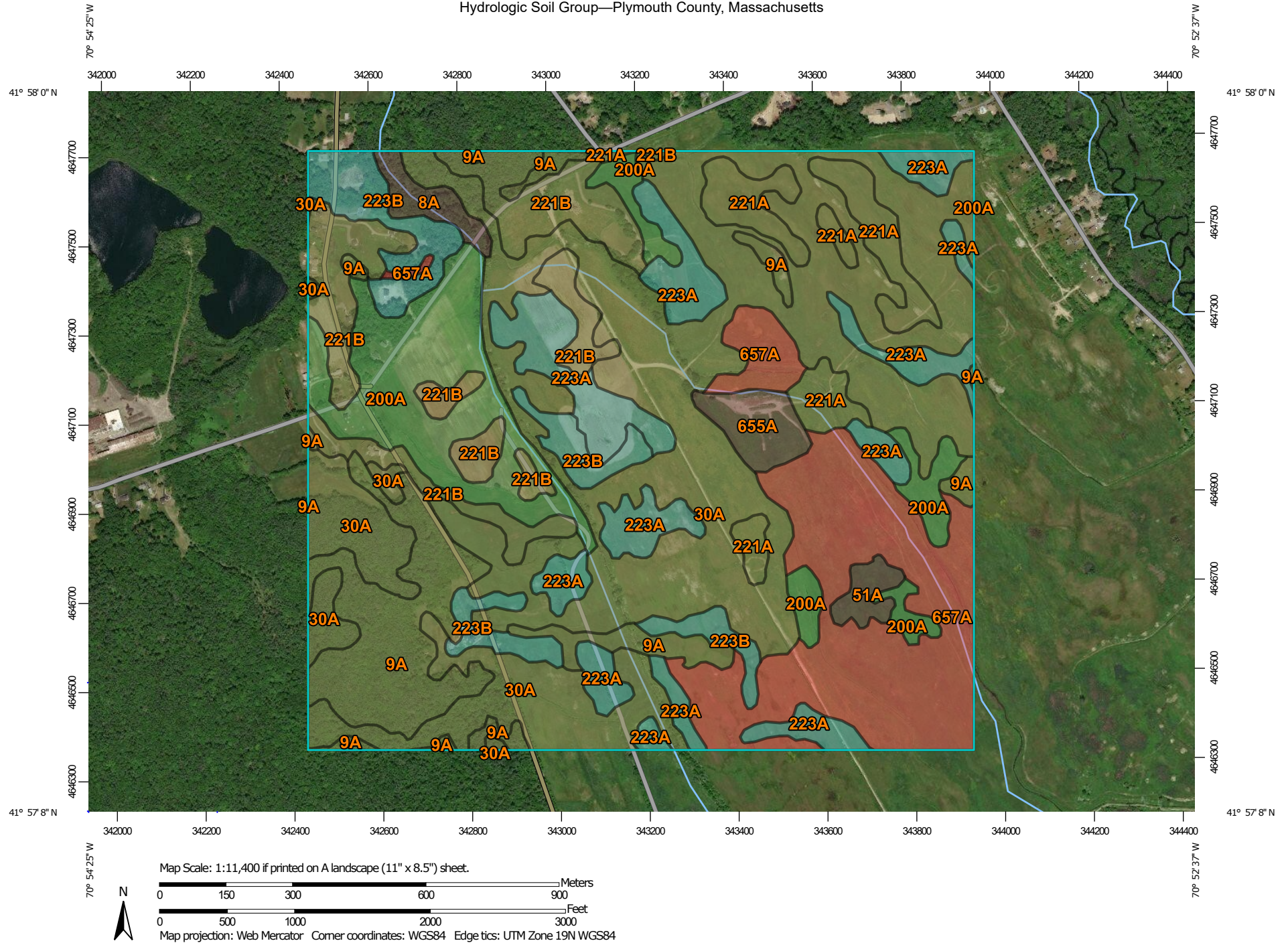
- ☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
 - ☒ Name of the stormwater management system owners;
 - ☒ Party responsible for operation and maintenance;
 - ☒ Schedule for implementation of routine and non-routine 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.

Attachment 1
Soil Data

Hydrologic Soil Group—Plymouth County, Massachusetts



**Natural Resources
Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

12/4/2020
Page 1 of 4

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

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: Plymouth County, Massachusetts

Survey Area Data: Version 13, Jun 9, 2020

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

Date(s) aerial images were photographed: Dec 31, 2009—Jul 3, 2017

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8A	Limerick silt loam, 0 to 3 percent slopes	B/D	5.2	1.0%
9A	Birdsall silt loam, 0 to 3 percent slopes	C/D	43.7	8.8%
30A	Raynham silt loam, 0 to 3 percent slopes	C/D	176.3	35.3%
51A	Swansea muck, 0 to 1 percent slopes	B/D	3.8	0.8%
200A	Squamscott fine sandy loam, 0 to 3 percent slopes	A/D	50.1	10.0%
221A	Eldridge fine sandy loam, 0 to 3 percent slopes	C/D	23.5	4.7%
221B	Eldridge fine sandy loam, 3 to 8 percent slopes	C/D	44.1	8.8%
223A	Scio very fine sandy loam, 0 to 3 percent slopes	C	49.0	9.8%
223B	Scio very fine sandy loam, 3 to 8 percent slopes	C	26.4	5.3%
655A	Udorthents, wet substratum, 0 to 3 percent slopes	B/D	7.7	1.5%
657A	Aquepts, 0 to 3 percent slopes	D	70.1	14.0%
Totals for Area of Interest			499.9	100.0%

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



BEALS + THOMAS

Soil Test Pit Log

3169.00– Halifax, MA

Date: 5/21/2020

Deep Observation Hole Number: TP-1

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-32	Ap	10YR 3/1				Loam			Granular	Friable	
32-34	Bw	10YR 6/4				Loam			Massive	Friable	
34-80	C1d	10YR 7/2	34	7.5YR 4/6	20%	SL			Massive	Friable	
80-120	C2d	Gley1 6/10GY				Silt Clay Loam			Massive	Firm	

Additional Notes:

East stormwater basin weeping water @ 66"



BEALS + THOMAS

Soil Test Pit Log

3169.00– Halifax, MA

Date: 5/21/2020

Deep Observation Hole Number: TP-2

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-10	Ap	10YR 3/1				Loam			Granular	Friable	
10-12	Bw	10YR 6/4				Loam			Massive	Friable	
12-110	C1d	10YR 7/2	38	7.5YR 4/6	20%	SL			Massive	Friable	
110-120	C2d	Gley1 6/10GY				Silt Clay Loam			Massive	Firm	

Additional Notes:

West stormwater basin weeping water @ 80"



BEALS + THOMAS

Soil Test Pit Log

3169.00– Halifax, MA

Date: 5/21/2020

Deep Observation Hole Number: TP-3

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-14	Ap	10YR 3/1				Loam			Granular	Friable	
14-16	Bw	10YR 6/4				Loam			Massive	Friable	
16-40	C1d	10YR 7/2	32	7.5YR 4/6	20%	SL			Massive	Friable	
40-110	C2d	10YR 5/4				Silt Loam			Massive	Firm	
110-120	C3d	Gley1 6/10GY ⁺				Silt Clay Loam ⁺			Massive	Firm	

Additional Notes:

West of parking lot weeping water @ 80"



BEALS + THOMAS

Soil Test Pit Log

3169.00– Halifax, MA

Date: 5/21/2020

Deep Observation Hole Number: TP-4

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-10	Ap	10YR 3/1				SL			Granular	Friable	
10-30	Bw	10YR 6/4				SL			Massive	Friable	
30-78	Fill										
78-84	Cd	Gley1 6/10GY				Silt Clay Loam			Massive	Firm	

Additional Notes:

Northeast of parking lot



BEALS + THOMAS

Soil Test Pit Log

3169.00– Halifax, MA

Date: 5/21/2020

Deep Observation Hole Number: TP-5

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-8	Ap	10YR 3/1				SL			Granular	Friable	
8-62	Fill										

Additional Notes:

Northwest of parking lot



BEALS + THOMAS

Soil Test Pit Log

3169.00– Halifax, MA

Date: 5/21/2020

Deep Observation Hole Number: TP-6

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0-8	Ap	10YR 3/1				Loam			Granular	Friable	
8-12	Bw	10YR 6/4				Loam			Massive	Friable	
12-96	Cd	10YR 7/2	14	7.5YR 4/6	20%	SL			Massive	Friable	

Additional Notes:

Center of parcel weeping water @ 64"

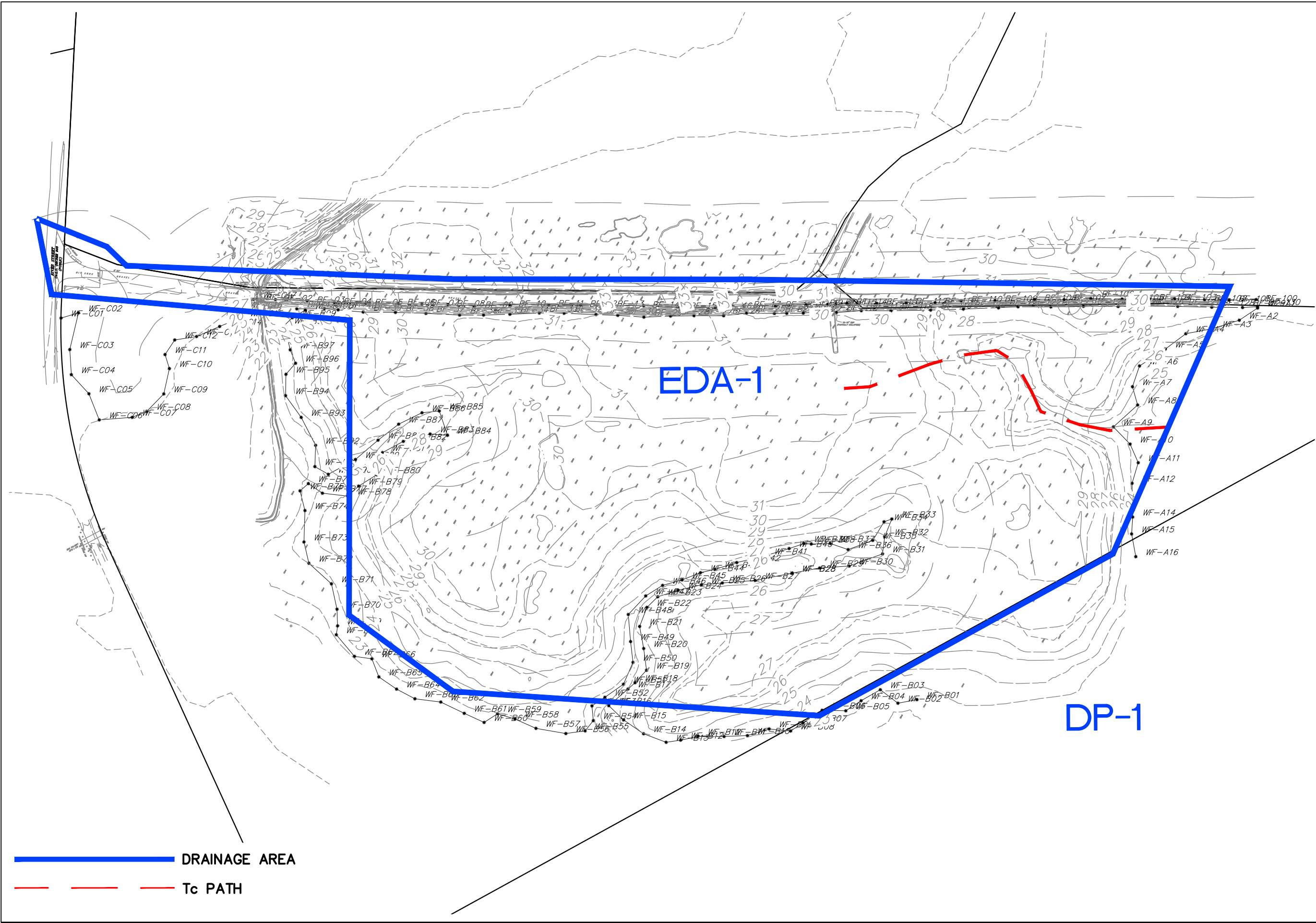
Attachment 2
Pre-Development Hydrologic Analysis



JOB NO./LOCATION:	3169.02 Halifax, MA										
CLIENT/PROJECT:	Bud's Goods & Provisions Corp. Bud's Goods Cultivation & Product Manufacturing Farm										
SUBJECT/TITLE:	Pre-Development Conditions Hydrology										
OBJECTIVE OF CALCULATION:	<ul style="list-style-type: none"> To determine the pre-development peak rates of runoff from the site for the 2, 10, 25, & 100-year storm events at the design points. 										
CALCULATION METHOD(S):	<ul style="list-style-type: none"> Runoff curve numbers (CN), time-of-concentration (Tc), and runoff rates were calculated based on TR-55 methodology. AutoCAD 2019 computer program was utilized for digitizing ground cover areas. Peak runoff rates were computed using HydroCAD version 10.00. 										
ASSUMPTIONS:	<ul style="list-style-type: none"> The ground cover types were determined using aerial imagery. Hydrologic soil groups based on United States Department of Agriculture, NRCS Soil Survey map information. Stormwater runoff from offsite tributary areas was included in the calculations. Wetlands were included for this calculation and classified as impervious. 										
SOURCES OF DATA/EQUATIONS:	<ul style="list-style-type: none"> Pre-Development Conditions Hydrologic Areas Map prepared by Beals and Thomas, Inc. File No. 316902P003A-001. NRCS Soil Survey for Plymouth County, hydrologic soil group report, downloaded from Web Soil Survey on 12/04/2020. TR-55 urban Hydrology for Small Watersheds, SCS, 1986. Massachusetts DEP Stormwater Management Handbook, February 2008. 										
CONCLUSIONS:	<p><i>Peak Runoff Rates (CFS):</i></p> <table border="1"> <thead> <tr> <th>Storm Event</th> <th>DP-1</th> </tr> </thead> <tbody> <tr> <td>2-Year</td> <td>65.0</td> </tr> <tr> <td>10-Year</td> <td>95.2</td> </tr> <tr> <td>25-Year</td> <td>115.9</td> </tr> <tr> <td>100-Year</td> <td>147.9</td> </tr> </tbody> </table>	Storm Event	DP-1	2-Year	65.0	10-Year	95.2	25-Year	115.9	100-Year	147.9
Storm Event	DP-1										
2-Year	65.0										
10-Year	95.2										
25-Year	115.9										
100-Year	147.9										

REV	CALC. BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE
0	DMG	01/20/2021	NBB	01/21/2021	DMG	01/22/2021





 DRAINAGE AREA
 Tc PATH



North Arrow
NORTH
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**Bud's Goods Cultivation &
Product Manufacturing Farm**
Halifax, Massachusetts
Bud's Goods & Provisions Corp.
54 West Boylston Street
Worcester, Massachusetts

**Pre-Development Conditions
Hydrologic Areas Map**
Figure Number 001
Scale: 1" = 180'
Date: 01/20/2021
Plan No. 316902P003A-001
B+T Project No. 3169.02

DRAINAGE AREA:

EDA-1

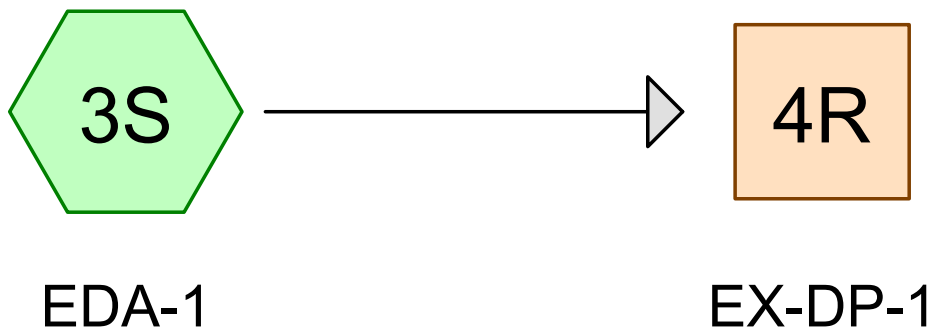
COVER DESCRIPTION	SOIL NAME & HYDROLOGIC GROUP	CN	AREA (Acres)
CROP RESIDUE POOR	D	93	11.5
CROP RESIDUE POOR	C	90	14.3
GRAVEL	D	91	0.8
GRAVEL	C	89	0.0
WETLAND	D	98	1.3
WETLAND	C	98	0.6
IMPERVIOUS	D	98	0.2

TOTAL AREA (Acres) = 28.66
AREA (Sq. Mi.) = 0.04478
WEIGHTED CN = 91.8

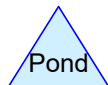
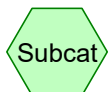
CLIENT Bud's Goods
PROJECT Halifax Farm
FILE 316900CN001A

JOB NO. 3169.02
COMPUTED BY DMG
DATE 1/19/2021

CHECKED BY NBB
DATE 1/21/2021
PAGE NO. 1



Existing Hydrology



Routing Diagram for 316901HC001A

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316901HC001A

Prepared by Beals and Thomas, Inc.

Printed 1/22/2021

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Page 2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
28.660	92	See CN Worksheet (3S)
28.660	92	TOTAL AREA

316901HC001A*Type III 24-hr 2-Year Rainfall=3.40"*

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Page 3

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 3S: EDA-1Runoff Area=28.660 ac 0.00% Impervious Runoff Depth=2.54"
Flow Length=715' Tc=13.6 min CN=92 Runoff=64.95 cfs 6.069 af**Reach 4R: EX-DP-1**Inflow=64.95 cfs 6.069 af
Outflow=64.95 cfs 6.069 af**Total Runoff Area = 28.660 ac Runoff Volume = 6.069 af Average Runoff Depth = 2.54"**
100.00% Pervious = 28.660 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 3S: EDA-1

Runoff = 64.95 cfs @ 12.18 hrs, Volume= 6.069 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
* 28.660	92	See CN Worksheet
28.660		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	50	0.0100	0.24		Sheet Flow, Sheet Flow
					Cultivated: Residue<=20% n= 0.060 P2= 3.40"
10.1	665	0.0120	1.10		Shallow Concentrated Flow, Shallow Concentrated
					Nearly Bare & Untilled Kv= 10.0 fps
13.6	715	Total			

Summary for Reach 4R: EX-DP-1

Inflow Area = 28.660 ac, 0.00% Impervious, Inflow Depth = 2.54" for 2-Year event

Inflow = 64.95 cfs @ 12.18 hrs, Volume= 6.069 af

Outflow = 64.95 cfs @ 12.18 hrs, Volume= 6.069 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

316901HC001A*Type III 24-hr 10-Year Rainfall=4.70"*

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 3S: EDA-1Runoff Area=28.660 ac 0.00% Impervious Runoff Depth=3.80"
Flow Length=715' Tc=13.6 min CN=92 Runoff=95.15 cfs 9.068 af**Reach 4R: EX-DP-1**Inflow=95.15 cfs 9.068 af
Outflow=95.15 cfs 9.068 af**Total Runoff Area = 28.660 ac Runoff Volume = 9.068 af Average Runoff Depth = 3.80"**
100.00% Pervious = 28.660 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 3S: EDA-1

Runoff = 95.15 cfs @ 12.18 hrs, Volume= 9.068 af, Depth= 3.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (ac)	CN	Description
* 28.660	92	See CN Worksheet
28.660		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	50	0.0100	0.24		Sheet Flow, Sheet Flow
					Cultivated: Residue<=20% n= 0.060 P2= 3.40"
10.1	665	0.0120	1.10		Shallow Concentrated Flow, Shallow Concentrated
					Nearly Bare & Untilled Kv= 10.0 fps
13.6	715	Total			

Summary for Reach 4R: EX-DP-1

Inflow Area = 28.660 ac, 0.00% Impervious, Inflow Depth = 3.80" for 10-Year event

Inflow = 95.15 cfs @ 12.18 hrs, Volume= 9.068 af

Outflow = 95.15 cfs @ 12.18 hrs, Volume= 9.068 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

316901HC001A*Type III 24-hr 25-Year Rainfall=5.60"*

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 3S: EDA-1

Runoff Area=28.660 ac 0.00% Impervious Runoff Depth=4.68"

Flow Length=715' Tc=13.6 min CN=92 Runoff=115.90 cfs 11.169 af

Reach 4R: EX-DP-1

Inflow=115.90 cfs 11.169 af

Outflow=115.90 cfs 11.169 af

Total Runoff Area = 28.660 ac Runoff Volume = 11.169 af Average Runoff Depth = 4.68"
100.00% Pervious = 28.660 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 3S: EDA-1

Runoff = 115.90 cfs @ 12.18 hrs, Volume= 11.169 af, Depth= 4.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.60"

Area (ac)	CN	Description
* 28.660	92	See CN Worksheet
28.660		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	50	0.0100	0.24		Sheet Flow, Sheet Flow
					Cultivated: Residue<=20% n= 0.060 P2= 3.40"
10.1	665	0.0120	1.10		Shallow Concentrated Flow, Shallow Concentrated
					Nearly Bare & Untilled Kv= 10.0 fps
13.6	715	Total			

Summary for Reach 4R: EX-DP-1

Inflow Area = 28.660 ac, 0.00% Impervious, Inflow Depth = 4.68" for 25-Year event

Inflow = 115.90 cfs @ 12.18 hrs, Volume= 11.169 af

Outflow = 115.90 cfs @ 12.18 hrs, Volume= 11.169 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

316901HC001A*Type III 24-hr 100-Year Rainfall=7.00"*

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Printed 1/22/2021

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Page 9

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 3S: EDA-1

Runoff Area=28.660 ac 0.00% Impervious Runoff Depth=6.05"

Flow Length=715' Tc=13.6 min CN=92 Runoff=147.92 cfs 14.461 af

Reach 4R: EX-DP-1

Inflow=147.92 cfs 14.461 af

Outflow=147.92 cfs 14.461 af

Total Runoff Area = 28.660 ac Runoff Volume = 14.461 af Average Runoff Depth = 6.05"
100.00% Pervious = 28.660 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 3S: EDA-1

Runoff = 147.92 cfs @ 12.18 hrs, Volume= 14.461 af, Depth= 6.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
* 28.660	92	See CN Worksheet
28.660		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.5	50	0.0100	0.24		Sheet Flow, Sheet Flow
					Cultivated: Residue<=20% n= 0.060 P2= 3.40"
10.1	665	0.0120	1.10		Shallow Concentrated Flow, Shallow Concentrated
					Nearly Bare & Untilled Kv= 10.0 fps
13.6	715	Total			

Summary for Reach 4R: EX-DP-1

Inflow Area = 28.660 ac, 0.00% Impervious, Inflow Depth = 6.05" for 100-Year event
Inflow = 147.92 cfs @ 12.18 hrs, Volume= 14.461 af
Outflow = 147.92 cfs @ 12.18 hrs, Volume= 14.461 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

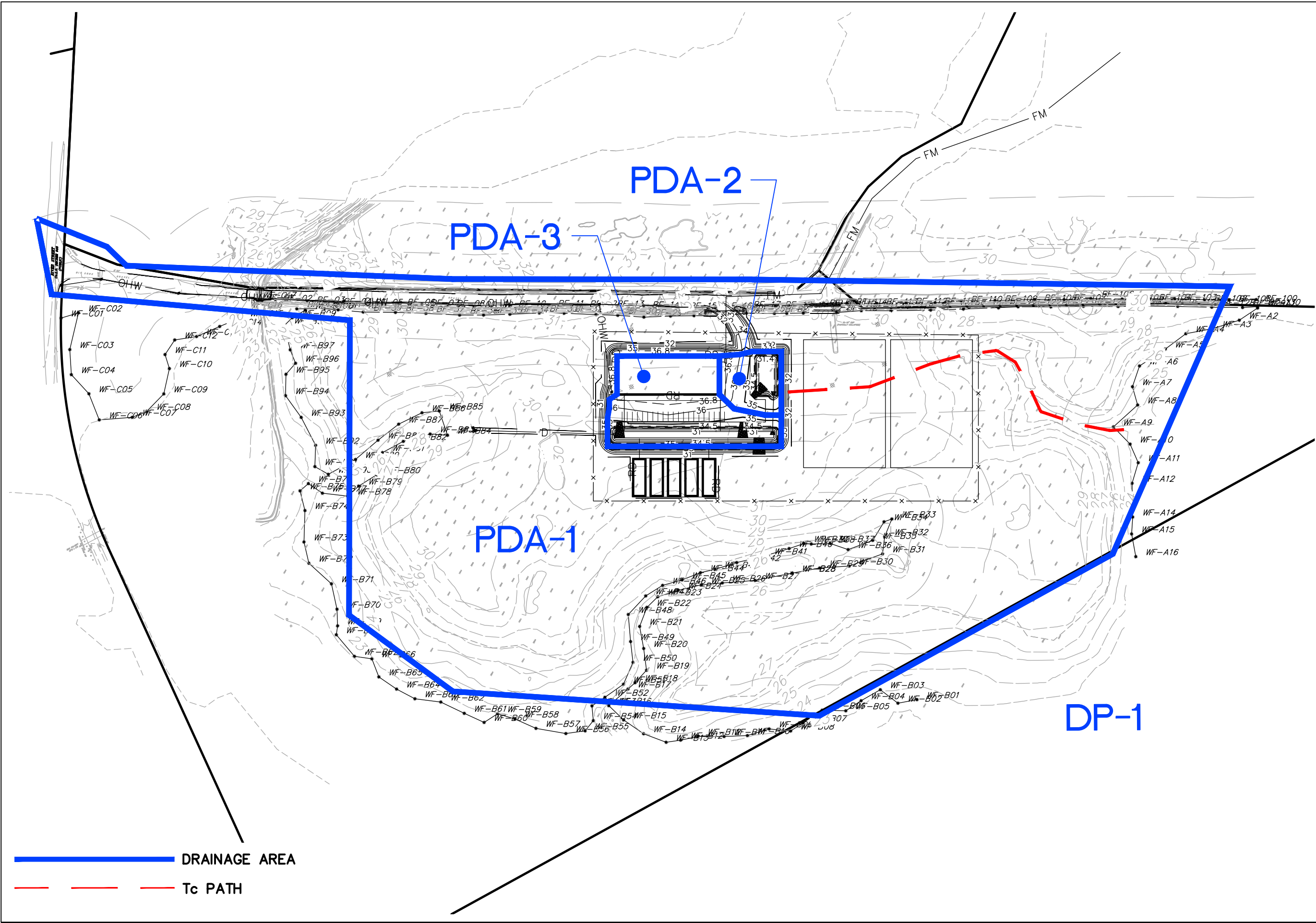
Attachment 3
Post-Development Hydrologic Analysis



JOB NO./LOCATION:	3169.02 Halifax, MA										
CLIENT/PROJECT:	Bud's Goods & Provisions Corp. Bud's Goods Cultivation & Product Manufacturing Farm										
SUBJECT/TITLE:	Post-Development Conditions Hydrology										
OBJECTIVE OF CALCULATION:	<ul style="list-style-type: none"> To determine the post-development peak rates of runoff from the site for the 2, 10, 25, & 100-year storm events at the design points. 										
CALCULATION METHOD(S):	<ul style="list-style-type: none"> Runoff curve numbers (CN), time-of-concentration (Tc), and runoff rates were calculated based on TR-55 methodology. AutoCAD 2019 computer program was utilized for digitizing ground cover areas. Peak runoff rates were computed using HydroCAD version 10.00. 										
ASSUMPTIONS:	<ul style="list-style-type: none"> The ground cover types were determined using aerial imagery. Hydrologic soil groups based on United States Department of Agriculture, NRCS Soil Survey map information. Stormwater runoff from offsite tributary areas was included in the calculations. Wetlands were included for this calculation and classified as impervious. 										
SOURCES OF DATA/EQUATIONS:	<ul style="list-style-type: none"> Post-Development Conditions Hydrologic Areas Map prepared by Beals and Thomas, Inc. File No. 316902P003A-002. NRCS Soil Survey for Plymouth County, hydrologic soil group report, downloaded from Web Soil Survey on 12/04/2020. TR-55 urban Hydrology for Small Watersheds, SCS, 1986. Massachusetts DEP Stormwater Management Handbook, February 2008. 										
CONCLUSIONS:	<p><i>Peak Runoff Rates (CFS):</i></p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Storm Event</th> <th style="text-align: center;">DP-1</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">2-Year</td> <td style="text-align: center;">61.8</td> </tr> <tr> <td style="text-align: center;">10-Year</td> <td style="text-align: center;">90.4</td> </tr> <tr> <td style="text-align: center;">25-Year</td> <td style="text-align: center;">110.0</td> </tr> <tr> <td style="text-align: center;">100-Year</td> <td style="text-align: center;">140.9</td> </tr> </tbody> </table> <p>Conclusion: Overall runoff rates from the project area will be less than existing conditions in accordance with Standard 2 of the MassDEP Stormwater Management Regulations.</p>	Storm Event	DP-1	2-Year	61.8	10-Year	90.4	25-Year	110.0	100-Year	140.9
Storm Event	DP-1										
2-Year	61.8										
10-Year	90.4										
25-Year	110.0										
100-Year	140.9										

REV	CALC. BY	DATE	CHECKED BY	DATE	APPROVED BY	DATE
0	DMG	01/20/2021	NBB	01/21/2021	DMG	01/22/2021





— DRAINAGE AREA
— Tc PATH



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Bud's Goods Cultivation & Product Manufacturing Farm
Halifax, Massachusetts
Bud's Goods & Provisions Corp.
54 West Boylston Street
Worcester, Massachusetts

Post-Development Conditions Hydrologic Areas Map
Figure Number 002
Scale: 1" = 180'
Date: 01/20/2021
Plan No. 316902P003A-002
B+T Project No. 3169.02

DRAINAGE AREA:

PDA-1

COVER DESCRIPTION	SOIL NAME & HYDROLOGIC GROUP	CN	AREA (Acres)
CROP RESIDUE POOR	D	93	9.5
CROP RESIDUE POOR	C	90	14.2
GRAVEL	D	91	0.8
GRAVEL	C	89	0.0
WETLAND	D	98	1.3
WETLAND	C	98	0.6
IMPERVIOUS	D	98	0.2
GRASS (GOOD)	D	80	0.5
GRASS (GOOD)	C	74	0.1
GREENHOUSE	D	98	0.0

TOTAL AREA (Acres) = 27.11
AREA (Sq. Mi.) = 0.04235
WEIGHTED CN = 91.5

CLIENT Bud's Goods
PROJECT Halifax Farm
FILE 316900CN001A

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PAGE NO. 2

DRAINAGE AREA:

PDA-2

COVER DESCRIPTION	SOIL NAME & HYDROLOGIC GROUP	CN	AREA (Acres)
CROP RESIDUE POOR	D	93	0.0
CROP RESIDUE POOR	C	90	0.0
GRAVEL	D	91	0.2
GRAVEL	C	89	0.0
WETLAND	D	98	0.0
WETLAND	C	98	0.0
IMPERVIOUS	D	98	0.0
GRASS (GOOD)	D	80	0.2

TOTAL AREA (Acres) = 0.31
AREA (Sq. Mi.) = 0.00048
WEIGHTED CN = 85.6

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DRAINAGE AREA:

PDA-3

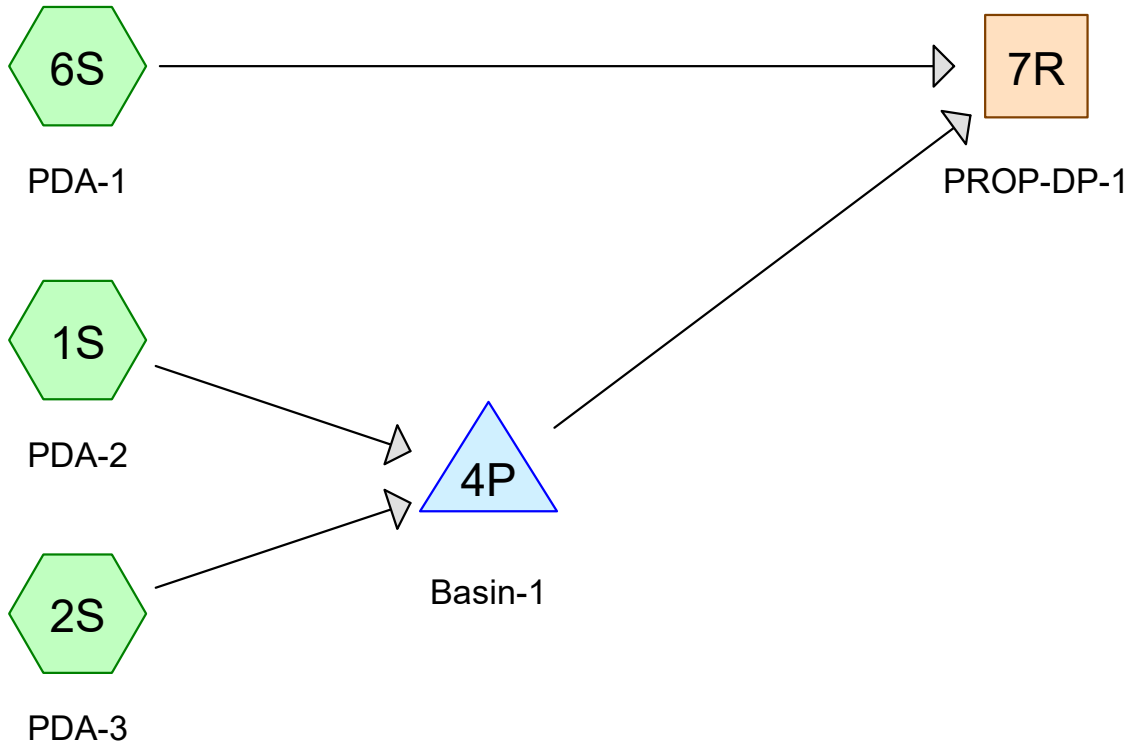
COVER DESCRIPTION	SOIL NAME & HYDROLOGIC GROUP	CN	AREA (Acres)
CROP RESIDUE POOR	D	93	0.0
CROP RESIDUE POOR	C	90	0.0
GRAVEL	D	91	0.3
GRAVEL	C	89	0.0
WETLAND	D	98	0.0
WETLAND	C	98	0.0
GRASS (GOOD)	D	80	0.4
GRASS (GOOD)	C	74	0.0
BUILDING	D	98	0.3
GREENHOUSE	D	98	0.2

TOTAL AREA (Acres) = 1.24
AREA (Sq. Mi.) = 0.00194
WEIGHTED CN = 90.3

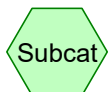
CLIENT Bud's Goods
PROJECT Halifax Farm
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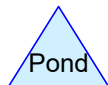
Proposed Hydrology



Subcat



Reach



Pond



Link

Routing Diagram for 316901HC001A

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316901HC001A

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Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.310	86	See CN Worksheet (1S)
1.240	90	See CN Worksheet (2S)
27.110	92	See CN Worksheet (6S)
28.660	92	TOTAL AREA

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: PDA-2

Runoff Area=0.310 ac 0.00% Impervious Runoff Depth=2.01"
Tc=6.0 min CN=86 Runoff=0.72 cfs 0.052 af

Subcatchment 2S: PDA-3

Runoff Area=1.240 ac 0.00% Impervious Runoff Depth=2.35"
Tc=6.0 min CN=90 Runoff=3.30 cfs 0.243 af

Subcatchment 6S: PDA-1

Runoff Area=27.110 ac 0.00% Impervious Runoff Depth=2.54"
Flow Length=819' Tc=13.6 min CN=92 Runoff=61.44 cfs 5.741 af

Reach 7R: PROP-DP-1

Inflow=61.78 cfs 6.017 af
Outflow=61.78 cfs 6.017 af

Pond 4P: Basin-1

Peak Elev=32.02' Storage=6,206 cf Inflow=4.02 cfs 0.295 af
Discarded=0.01 cfs 0.016 af Primary=0.39 cfs 0.276 af Outflow=0.40 cfs 0.292 af

Total Runoff Area = 28.660 ac Runoff Volume = 6.036 af Average Runoff Depth = 2.53"
100.00% Pervious = 28.660 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: PDA-2

Runoff = 0.72 cfs @ 12.09 hrs, Volume= 0.052 af, Depth= 2.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
* 0.310	86	See CN Worksheet
0.310		100.00% Pervious Area

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

Summary for Subcatchment 2S: PDA-3

Runoff = 3.30 cfs @ 12.09 hrs, Volume= 0.243 af, Depth= 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
* 1.240	90	See CN Worksheet
1.240		100.00% Pervious Area

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

Summary for Subcatchment 6S: PDA-1

Runoff = 61.44 cfs @ 12.18 hrs, Volume= 5.741 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Year Rainfall=3.40"

Area (ac)	CN	Description
* 27.110	92	See CN Worksheet
27.110		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	9	0.3300	0.23		Sheet Flow, Sheet Flow Grass: Dense n= 0.240 P2= 3.40"
12.9	810	0.0110	1.05		Shallow Concentrated Flow, Shallow Concentrated Nearly Bare & Untilled Kv= 10.0 fps
13.6	819	Total			

Summary for Reach 7R: PROP-DP-1

Inflow Area = 28.660 ac, 0.00% Impervious, Inflow Depth = 2.52" for 2-Year event
 Inflow = 61.78 cfs @ 12.18 hrs, Volume= 6.017 af
 Outflow = 61.78 cfs @ 12.18 hrs, Volume= 6.017 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Pond 4P: Basin-1

Inflow Area = 1.550 ac, 0.00% Impervious, Inflow Depth = 2.29" for 2-Year event
 Inflow = 4.02 cfs @ 12.09 hrs, Volume= 0.295 af
 Outflow = 0.40 cfs @ 12.95 hrs, Volume= 0.292 af, Atten= 90%, Lag= 51.5 min
 Discarded = 0.01 cfs @ 12.95 hrs, Volume= 0.016 af
 Primary = 0.39 cfs @ 12.95 hrs, Volume= 0.276 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Peak Elev= 32.02' @ 12.95 hrs Surf.Area= 8,110 sf Storage= 6,206 cf

Plug-Flow detention time= 195.1 min calculated for 0.291 af (99% of inflow)
 Center-of-Mass det. time= 188.7 min (996.0 - 807.3)

Volume	Invert	Avail.Storage	Storage Description
#1	31.00'	31,919 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
#2	31.40'	9,062 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
		40,980 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
31.00	3,830	0	0
32.00	5,780	4,805	4,805
33.00	7,786	6,783	11,588
34.00	9,850	8,818	20,406
34.50	10,900	5,188	25,594
35.00	14,400	6,325	31,919

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
31.40	1,925	0	0
32.00	2,285	1,263	1,263
33.00	2,930	2,608	3,871
34.00	3,633	3,282	7,152
34.50	4,005	1,910	9,062

Device	Routing	Invert	Outlet Devices
#1	Discarded	31.00'	0.060 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 28.70'
#2	Primary	29.60'	12.0" Round Culvert L= 270.0' Ke= 0.200 Inlet / Outlet Invert= 29.60' / 28.50' S= 0.0041 ' / Cc= 0.900 n= 0.100, Flow Area= 0.79 sf
#3	Device 2	31.00'	4.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads

316901HC001A

Type III 24-hr 2-Year Rainfall=3.40"

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#4	Primary	32.50'	18.0" W x 6.0" H Vert. Orifice/Grate	C= 0.600
			Limited to weir flow at low heads	
#5	Primary	34.50'	20.0' long x 8.0' breadth Broad-Crested Rectangular Weir	
			Head (feet)	0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00
				2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English)	2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64
				2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Discarded OutFlow Max=0.01 cfs @ 12.95 hrs HW=32.02' (Free Discharge)↑ **1=Exfiltration** (Controls 0.01 cfs)**Primary OutFlow** Max=0.39 cfs @ 12.95 hrs HW=32.02' (Free Discharge)↑ **2=Culvert** (Passes 0.39 cfs of 0.45 cfs potential flow)↑ **3=Orifice/Grate** (Orifice Controls 0.39 cfs @ 4.44 fps)↑ **4=Orifice/Grate** (Controls 0.00 cfs)↑ **5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: PDA-2

Runoff Area=0.310 ac 0.00% Impervious Runoff Depth=3.19"
Tc=6.0 min CN=86 Runoff=1.12 cfs 0.082 af

Subcatchment 2S: PDA-3

Runoff Area=1.240 ac 0.00% Impervious Runoff Depth=3.59"
Tc=6.0 min CN=90 Runoff=4.94 cfs 0.371 af

Subcatchment 6S: PDA-1

Runoff Area=27.110 ac 0.00% Impervious Runoff Depth=3.80"
Flow Length=819' Tc=13.6 min CN=92 Runoff=90.01 cfs 8.577 af

Reach 7R: PROP-DP-1

Inflow=90.42 cfs 9.005 af
Outflow=90.42 cfs 9.005 af

Pond 4P: Basin-1

Peak Elev=32.45' Storage=9,986 cf Inflow=6.06 cfs 0.453 af
Discarded=0.02 cfs 0.020 af Primary=0.48 cfs 0.428 af Outflow=0.49 cfs 0.448 af

Total Runoff Area = 28.660 ac Runoff Volume = 9.030 af Average Runoff Depth = 3.78"
100.00% Pervious = 28.660 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: PDA-2

Runoff = 1.12 cfs @ 12.09 hrs, Volume= 0.082 af, Depth= 3.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (ac)	CN	Description
* 0.310	86	See CN Worksheet
0.310		100.00% Pervious Area

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

Summary for Subcatchment 2S: PDA-3

Runoff = 4.94 cfs @ 12.09 hrs, Volume= 0.371 af, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (ac)	CN	Description
* 1.240	90	See CN Worksheet
1.240		100.00% Pervious Area

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

Summary for Subcatchment 6S: PDA-1

Runoff = 90.01 cfs @ 12.18 hrs, Volume= 8.577 af, Depth= 3.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (ac)	CN	Description
* 27.110	92	See CN Worksheet
27.110		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	9	0.3300	0.23		Sheet Flow, Sheet Flow Grass: Dense n= 0.240 P2= 3.40"
12.9	810	0.0110	1.05		Shallow Concentrated Flow, Shallow Concentrated Nearly Bare & Untilled Kv= 10.0 fps
13.6	819	Total			

Summary for Reach 7R: PROP-DP-1

Inflow Area = 28.660 ac, 0.00% Impervious, Inflow Depth = 3.77" for 10-Year event
 Inflow = 90.42 cfs @ 12.18 hrs, Volume= 9.005 af
 Outflow = 90.42 cfs @ 12.18 hrs, Volume= 9.005 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Pond 4P: Basin-1

Inflow Area = 1.550 ac, 0.00% Impervious, Inflow Depth = 3.51" for 10-Year event
 Inflow = 6.06 cfs @ 12.09 hrs, Volume= 0.453 af
 Outflow = 0.49 cfs @ 13.13 hrs, Volume= 0.448 af, Atten= 92%, Lag= 62.5 min
 Discarded = 0.02 cfs @ 13.13 hrs, Volume= 0.020 af
 Primary = 0.48 cfs @ 13.13 hrs, Volume= 0.428 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Peak Elev= 32.45' @ 13.13 hrs Surf.Area= 9,264 sf Storage= 9,986 cf

Plug-Flow detention time= 243.8 min calculated for 0.448 af (99% of inflow)
 Center-of-Mass det. time= 237.0 min (1,032.4 - 795.4)

Volume	Invert	Avail.Storage	Storage Description
#1	31.00'	31,919 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
#2	31.40'	9,062 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
		40,980 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
31.00	3,830	0	0
32.00	5,780	4,805	4,805
33.00	7,786	6,783	11,588
34.00	9,850	8,818	20,406
34.50	10,900	5,188	25,594
35.00	14,400	6,325	31,919

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
31.40	1,925	0	0
32.00	2,285	1,263	1,263
33.00	2,930	2,608	3,871
34.00	3,633	3,282	7,152
34.50	4,005	1,910	9,062

Device	Routing	Invert	Outlet Devices
#1	Discarded	31.00'	0.060 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 28.70'
#2	Primary	29.60'	12.0" Round Culvert L= 270.0' Ke= 0.200 Inlet / Outlet Invert= 29.60' / 28.50' S= 0.0041 ' / Cc= 0.900 n= 0.100, Flow Area= 0.79 sf
#3	Device 2	31.00'	4.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads

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Type III 24-hr 10-Year Rainfall=4.70"

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#4	Primary	32.50'	18.0" W x 6.0" H Vert. Orifice/Grate	C= 0.600
			Limited to weir flow at low heads	
#5	Primary	34.50'	20.0' long x 8.0' breadth Broad-Crested Rectangular Weir	
			Head (feet)	0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00
				2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English)	2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64
				2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Discarded OutFlow Max=0.02 cfs @ 13.13 hrs HW=32.45' (Free Discharge)↑ **1=Exfiltration** (Controls 0.02 cfs)**Primary OutFlow** Max=0.48 cfs @ 13.13 hrs HW=32.45' (Free Discharge)↑ **2=Culvert** (Passes 0.48 cfs of 0.48 cfs potential flow)↑ **3=Orifice/Grate** (Orifice Controls 0.48 cfs @ 5.46 fps)↑ **4=Orifice/Grate** (Controls 0.00 cfs)↑ **5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

316901HC001A*Type III 24-hr 25-Year Rainfall=5.60"*

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Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: PDA-2

Runoff Area=0.310 ac 0.00% Impervious Runoff Depth=4.03"
Tc=6.0 min CN=86 Runoff=1.40 cfs 0.104 af

Subcatchment 2S: PDA-3

Runoff Area=1.240 ac 0.00% Impervious Runoff Depth=4.46"
Tc=6.0 min CN=90 Runoff=6.06 cfs 0.461 af

Subcatchment 6S: PDA-1

Runoff Area=27.110 ac 0.00% Impervious Runoff Depth=4.68"
Flow Length=819' Tc=13.6 min CN=92 Runoff=109.63 cfs 10.565 af

Reach 7R: PROP-DP-1

Inflow=110.09 cfs 11.101 af
Outflow=110.09 cfs 11.101 af

Pond 4P: Basin-1

Peak Elev=32.68' Storage=12,119 cf Inflow=7.47 cfs 0.565 af
Discarded=0.02 cfs 0.023 af Primary=0.85 cfs 0.536 af Outflow=0.88 cfs 0.558 af

Total Runoff Area = 28.660 ac Runoff Volume = 11.130 af Average Runoff Depth = 4.66"
100.00% Pervious = 28.660 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: PDA-2

Runoff = 1.40 cfs @ 12.09 hrs, Volume= 0.104 af, Depth= 4.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.60"

Area (ac)	CN	Description
* 0.310	86	See CN Worksheet
0.310		100.00% Pervious Area

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

Summary for Subcatchment 2S: PDA-3

Runoff = 6.06 cfs @ 12.09 hrs, Volume= 0.461 af, Depth= 4.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.60"

Area (ac)	CN	Description
* 1.240	90	See CN Worksheet
1.240		100.00% Pervious Area

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

Summary for Subcatchment 6S: PDA-1

Runoff = 109.63 cfs @ 12.18 hrs, Volume= 10.565 af, Depth= 4.68"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.60"

Area (ac)	CN	Description
* 27.110	92	See CN Worksheet
27.110		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	9	0.3300	0.23		Sheet Flow, Sheet Flow Grass: Dense n= 0.240 P2= 3.40"
12.9	810	0.0110	1.05		Shallow Concentrated Flow, Shallow Concentrated Nearly Bare & Untilled Kv= 10.0 fps
13.6	819	Total			

Summary for Reach 7R: PROP-DP-1

Inflow Area = 28.660 ac, 0.00% Impervious, Inflow Depth > 4.65" for 25-Year event
 Inflow = 110.09 cfs @ 12.18 hrs, Volume= 11.101 af
 Outflow = 110.09 cfs @ 12.18 hrs, Volume= 11.101 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Pond 4P: Basin-1

Inflow Area = 1.550 ac, 0.00% Impervious, Inflow Depth = 4.37" for 25-Year event
 Inflow = 7.47 cfs @ 12.09 hrs, Volume= 0.565 af
 Outflow = 0.88 cfs @ 12.74 hrs, Volume= 0.558 af, Atten= 88%, Lag= 38.8 min
 Discarded = 0.02 cfs @ 12.74 hrs, Volume= 0.023 af
 Primary = 0.85 cfs @ 12.74 hrs, Volume= 0.536 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Peak Elev= 32.68' @ 12.74 hrs Surf.Area= 9,855 sf Storage= 12,119 cf

Plug-Flow detention time= 244.1 min calculated for 0.557 af (99% of inflow)
 Center-of-Mass det. time= 237.4 min (1,026.8 - 789.4)

Volume	Invert	Avail.Storage	Storage Description
#1	31.00'	31,919 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
#2	31.40'	9,062 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
		40,980 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
31.00	3,830	0	0
32.00	5,780	4,805	4,805
33.00	7,786	6,783	11,588
34.00	9,850	8,818	20,406
34.50	10,900	5,188	25,594
35.00	14,400	6,325	31,919

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
31.40	1,925	0	0
32.00	2,285	1,263	1,263
33.00	2,930	2,608	3,871
34.00	3,633	3,282	7,152
34.50	4,005	1,910	9,062

Device	Routing	Invert	Outlet Devices
#1	Discarded	31.00'	0.060 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 28.70'
#2	Primary	29.60'	12.0" Round Culvert L= 270.0' Ke= 0.200 Inlet / Outlet Invert= 29.60' / 28.50' S= 0.0041 ' / Cc= 0.900 n= 0.100, Flow Area= 0.79 sf
#3	Device 2	31.00'	4.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads

316901HC001A

Type III 24-hr 25-Year Rainfall=5.60"

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#4	Primary	32.50'	18.0" W x 6.0" H Vert. Orifice/Grate	C= 0.600
			Limited to weir flow at low heads	
#5	Primary	34.50'	20.0' long x 8.0' breadth Broad-Crested Rectangular Weir	
			Head (feet)	0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00
				2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English)	2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64
				2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Discarded OutFlow Max=0.02 cfs @ 12.74 hrs HW=32.68' (Free Discharge)↑ **1=Exfiltration** (Controls 0.02 cfs)**Primary OutFlow** Max=0.85 cfs @ 12.74 hrs HW=32.68' (Free Discharge)↑ **2=Culvert** (Barrel Controls 0.50 cfs @ 0.64 fps)↑ **3=Orifice/Grate** (Passes 0.50 cfs of 0.52 cfs potential flow)↑ **4=Orifice/Grate** (Orifice Controls 0.35 cfs @ 1.34 fps)↑ **5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=0.00-30.00 hrs, dt=0.05 hrs, 601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: PDA-2

Runoff Area=0.310 ac 0.00% Impervious Runoff Depth=5.37"
Tc=6.0 min CN=86 Runoff=1.84 cfs 0.139 af

Subcatchment 2S: PDA-3

Runoff Area=1.240 ac 0.00% Impervious Runoff Depth=5.82"
Tc=6.0 min CN=90 Runoff=7.80 cfs 0.602 af

Subcatchment 6S: PDA-1

Runoff Area=27.110 ac 0.00% Impervious Runoff Depth=6.05"
Flow Length=819' Tc=13.6 min CN=92 Runoff=139.92 cfs 13.679 af

Reach 7R: PROP-DP-1

Inflow=140.89 cfs 14.386 af
Outflow=140.89 cfs 14.386 af

Pond 4P: Basin-1

Peak Elev=32.94' Storage=14,851 cf Inflow=9.65 cfs 0.740 af
Discarded=0.02 cfs 0.025 af Primary=1.94 cfs 0.708 af Outflow=1.96 cfs 0.733 af

Total Runoff Area = 28.660 ac Runoff Volume = 14.419 af Average Runoff Depth = 6.04"
100.00% Pervious = 28.660 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: PDA-2

Runoff = 1.84 cfs @ 12.09 hrs, Volume= 0.139 af, Depth= 5.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
* 0.310	86	See CN Worksheet
0.310		100.00% Pervious Area

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

Summary for Subcatchment 2S: PDA-3

Runoff = 7.80 cfs @ 12.09 hrs, Volume= 0.602 af, Depth= 5.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
* 1.240	90	See CN Worksheet
1.240		100.00% Pervious Area

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

Summary for Subcatchment 6S: PDA-1

Runoff = 139.92 cfs @ 12.18 hrs, Volume= 13.679 af, Depth= 6.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Year Rainfall=7.00"

Area (ac)	CN	Description
* 27.110	92	See CN Worksheet
27.110		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	9	0.3300	0.23		Sheet Flow, Sheet Flow Grass: Dense n= 0.240 P2= 3.40"
12.9	810	0.0110	1.05		Shallow Concentrated Flow, Shallow Concentrated Nearly Bare & Untilled Kv= 10.0 fps
13.6	819	Total			

Summary for Reach 7R: PROP-DP-1

Inflow Area = 28.660 ac, 0.00% Impervious, Inflow Depth > 6.02" for 100-Year event
 Inflow = 140.89 cfs @ 12.18 hrs, Volume= 14.386 af
 Outflow = 140.89 cfs @ 12.18 hrs, Volume= 14.386 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Summary for Pond 4P: Basin-1

Inflow Area = 1.550 ac, 0.00% Impervious, Inflow Depth = 5.73" for 100-Year event
 Inflow = 9.65 cfs @ 12.09 hrs, Volume= 0.740 af
 Outflow = 1.96 cfs @ 12.52 hrs, Volume= 0.733 af, Atten= 80%, Lag= 25.7 min
 Discarded = 0.02 cfs @ 12.52 hrs, Volume= 0.025 af
 Primary = 1.94 cfs @ 12.52 hrs, Volume= 0.708 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Peak Elev= 32.94' @ 12.52 hrs Surf.Area= 10,565 sf Storage= 14,851 cf

Plug-Flow detention time= 218.2 min calculated for 0.733 af (99% of inflow)
 Center-of-Mass det. time= 211.5 min (993.7 - 782.2)

Volume	Invert	Avail.Storage	Storage Description
#1	31.00'	31,919 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
#2	31.40'	9,062 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
		40,980 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
31.00	3,830	0	0
32.00	5,780	4,805	4,805
33.00	7,786	6,783	11,588
34.00	9,850	8,818	20,406
34.50	10,900	5,188	25,594
35.00	14,400	6,325	31,919

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
31.40	1,925	0	0
32.00	2,285	1,263	1,263
33.00	2,930	2,608	3,871
34.00	3,633	3,282	7,152
34.50	4,005	1,910	9,062

Device	Routing	Invert	Outlet Devices
#1	Discarded	31.00'	0.060 in/hr Exfiltration over Surface area Conductivity to Groundwater Elevation = 28.70'
#2	Primary	29.60'	12.0" Round Culvert L= 270.0' Ke= 0.200 Inlet / Outlet Invert= 29.60' / 28.50' S= 0.0041 ' / Cc= 0.900 n= 0.100, Flow Area= 0.79 sf
#3	Device 2	31.00'	4.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads

#4	Primary	32.50'	18.0" W x 6.0" H Vert. Orifice/Grate	C= 0.600
			Limited to weir flow at low heads	
#5	Primary	34.50'	20.0' long x 8.0' breadth Broad-Crested Rectangular Weir	
			Head (feet)	0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00
				2.50 3.00 3.50 4.00 4.50 5.00 5.50
			Coef. (English)	2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64
				2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Discarded OutFlow Max=0.02 cfs @ 12.52 hrs HW=32.94' (Free Discharge)

↑ **1=Exfiltration** (Controls 0.02 cfs)

Primary OutFlow Max=1.94 cfs @ 12.52 hrs HW=32.94' (Free Discharge)

↑ **2=Culvert** (Barrel Controls 0.52 cfs @ 0.66 fps)

↑ **3=Orifice/Grate** (Passes 0.52 cfs of 0.56 cfs potential flow)

↑ **4=Orifice/Grate** (Orifice Controls 1.42 cfs @ 2.13 fps)

↑ **5=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Attachment 4
Recharge Calculations and Riprap Apron Sizing



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Standard 3: Groundwater Recharge

Groundwater Recharge Volume Required:

$R_v = F \times \text{Impervious Area}$, where:

R_v = Required Recharge Volume [Ac-ft]

F = Target Depth Factor associated with each Hydrologic Soil Group (HSG) [in]

Impervious Area = Total Pavement and Rooftop Area under Post-development Conditions [Ac]

			Impervious Area [Acres]	Required Recharge Volume [Ac-ft]
HSG "A", use F =	0.6	in	0.000	0.000
HSG "B", use F =	0.35	in	0.000	0.000
HSG "C", use F =	0.25	in	0.000	0.000
HSG "D", use F =	0.1	in	0.500	0.004
Total Required Recharge Volume (R_v) =				<u>0.004</u> Ac-ft

Capture Area Adjustment: (Ref: DEP Handbook V.3 Ch.1 P.27-28)

Total Site Impervious Area (Total) = 0.5 Acres

Impervious Area Draining to Infiltrative BMPs (infil) = 0.5 Acres (PDA-3 Impervious Area)

Percent Imp. Area Draining to Infiltrative BMPs = 100.0%

Capture Area Adjustment Factor = (Total)/(Infil) = C_a = 1.00

Adjusted Required Recharge Volume = $C_a \times R_v$ = 0.004 Ac-ft

ALL IMPERVIOUS AREA LOCATED WITHIN C/D SOILS. DE MINIMIS NET LOSS OF RECHARGE DUE TO DEVELOPMENT.

JOB NO. 3169

JOB: Bud's Halifax

COMPUTED BY: NBB

DATE: 01/22/21

CHECKED BY: DMG

DATE: 01/22/21



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Riprap Apron Sizing

Median Stone Sizing:

$$D_{50} = 0.2 D_0 \left(\frac{Q}{\sqrt{g} D_0^{2.5}} \right)^{\frac{3}{14}} \left(\frac{D_0}{TW} \right)$$

Where:

D_0 = Maximum Inside Pipe Diameter (ft)

D_{50} = Median Riprap Diameter (ft)

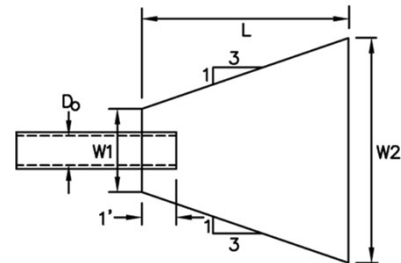
Q = Peak Discharge Rate from Hydraulic Design (cfs)

TW = Tailwater Depth (ft); (Use $0.4D_0$ if TW is unknown, max $1.0D_0$)

g = Gravitational Acceleration Constant = 32.2 ft/s^2

Apron Sizing:

D_{50} [In]	Apron Length (L) [ft]	Apron Depth [In]	Apron Width At Beginning (W_1) [ft]	Apron Width At End (W_2) [ft]
5	$4D_0$	$3.5D_{50}$	$3D_0$	$3D_0 + \frac{1}{3}L$
6	$4D_0$	$3.3D_{50}$	$3D_0$	$3D_0 + \frac{1}{3}L$
10	$5D_0$	$2.4D_{50}$	$3D_0$	$3D_0 + \frac{1}{3}L$
14	$6D_0$	$2.2D_{50}$	$3D_0$	$3D_0 + \frac{1}{3}L$
20	$7D_0$	$2.0D_{50}$	$3D_0$	$3D_0 + \frac{1}{3}L$
22	$8D_0$	$2.0D_{50}$	$3D_0$	$3D_0 + \frac{1}{3}L$



FLARED END SECTION	PIPE DIAMETER (D_0) (FEET)	100-YEAR STORM FLOW (Q) (CFS)	TAILWATER (TW) [ft]	MEDIAN STONE DIAMETER (D_{50}) (INCHES)	APRON LENGTH (L) (FEET)	APRON DEPTH [In]	APRON WIDTH AT BEGINNING (W_1) [ft]	APRON WIDTH AT END (W_2) [ft]
FE-01	1.5	10.00	0.6	5	6.00	17.5	4.5	8.5
FE-02	1.5	10.00	0.6	5	6.00	17.5	4.5	8.5
FE-03	1.0	2.00	0.4	5	4.00	17.5	3.0	5.7

Notes

[1] Calculations performed in accordance with Hydraulic Engineering Circular No. 14, Third Edition; Hydraulic Design of Energy Dissipaters for Culverts and Channels, dated July 2006.

[2] Pipe shall extend 1 foot into riprap.

[3] 100-YR Flows from HydroCAD 100-yr storm event.

JOB NO. 3169.02
JOB: Bud's Halifax

COMPUTED BY: DMG
DATE: 01/21/21

CHECKED BY: NBB
DATE: 1/21/2021

Attachment 5
Site Owner's Manual

Site Owner's Manual

Bud's Goods Cultivation & Product Manufacturing Farm

**11 River Street
Halifax, MA**

Prepared for:

**Bud's Goods and Provisions Corp.
54 West Boylston Street
Worcester, MA, 01606**

Presented by:



BEALS + THOMAS

BEALS AND THOMAS, INC.
32 Court Street
Plymouth, MA 02360

Date: January 22, 2021

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FIGURES

FIGURE 1: SITE PLANS

APPENDICES

APPENDIX A: OPERATION AND MAINTENANCE LOG

APPENDIX B: LIST OF EMERGENCY CONTACTS

1.0 INTRODUCTION

The Site Owner's Manual complies with the Long-Term Pollution Prevention Plan (Standard 4) and the Long-Term Operation and Maintenance Plan (Standard 9) requirements of the 2008 Massachusetts Department of Environmental Protection (DEP) Stormwater Handbook. The Manual outlines source control and pollution prevention measures and maintenance requirements of stormwater best management practices (BMPs) associated with the proposed development.

2.0 **SITE OWNER'S AGREEMENT**

2.1 **Operation and Maintenance Compliance Statement**

Site Owner: Bud's Goods and Provisions
54 West Boylston Street
Worcester, MA 01606

Responsible Party: TBD

Bud's Goods and Provisions or their successors shall maintain ownership of the on-site stormwater management system as well as the responsibility for operation and maintenance during the post-development stages of the project. The site has been inspected for erosion and appropriate measures have been taken to permanently stabilize any eroded areas. All aspects of stormwater best management practices (BMPs) have been inspected for damage, wear and malfunction, and appropriate steps have been taken to repair or replace the system or portions of the system so that the stormwater at the site may be managed in accordance with the Stormwater Management Standards. Future responsible parties shall be notified of their continuing legal responsibility to operate and maintain the BMPs. The operation and maintenance plan for the stormwater BMPs is being implemented.

Responsible Party Signature

Date

2.2 **Stormwater Maintenance Easements**

There are no off-site areas utilized for stormwater control, therefore no stormwater management easements are required. The Site Owner will have access to all stormwater practices for inspection and maintenance, including direct maintenance access by heavy equipment to structures requiring regular maintenance.

2.3 **Record Keeping**

The Site Owner shall maintain a rolling log in which all inspections and maintenance activities for the past three years shall be recorded. The Operation and Maintenance Log includes information pertaining to inspections, repairs, and disposal relevant to the project's stormwater management system. The Log is located in Appendix A.

The Operation and Maintenance Log shall be made available to the Conservation Commission and the DEP upon request. The Conservation Commission and the DEP shall be allowed to enter and inspect the premises to evaluate and ensure that the responsible party complies with the maintenance requirements for each BMP.

2.4 Training

Employees involved in grounds maintenance and emergency response will be educated on the general concepts of stormwater management and groundwater protection. The Site Owner's Manual will be reviewed with the maintenance staff. The staff will be trained on the proper course of action for specific events expected to be incurred during routine maintenance or emergency situations.

3.0 LONG-TERM POLLUTION PREVENTION PLAN

In compliance with Standard 4 of the 2008 DEP Stormwater Management Handbook, this section outlines source control and pollution prevention measures to be employed on-site after construction.

3.1 Storage of Materials and Waste

The site shall be kept clear of trash and debris at all times. Certain materials and waste products shall be stored inside or outside upon an impervious surface and covered, as required by local and state regulations.

3.2 Vehicle Washing

No commercial vehicle washing shall take place on site.

3.3 Routine Inspections and Maintenance of Stormwater BMPs

See Section 4.0 Long-Term Operation and Maintenance Plan, for routine inspection and maintenance requirements for all proposed stormwater BMPs.

3.4 Spill Prevention and Response

A contingency plan shall be implemented to address the spill or release of petroleum products and hazardous materials and will include the following measures:

1. Equipment necessary to quickly attend to inadvertent spills or leaks shall be stored on-site in a secure but accessible location. Such equipment shall include but not be limited to the following: safety goggles, chemically resistant gloves and overshoe boots, water and chemical fire extinguishers, sand and shovels, suitable absorbent materials, storage containers and first aid equipment (i.e. Indian Valley Industries, Inc. 55-gallon Spill Containment kit or approved equivalent).
2. Spills or leaks shall be treated properly according to material type, volume of spillage and location of spill. Mitigation shall include preventing further spillage, containing the spilled material in the smallest practical area, removing spilled material in a safe and environmentally-friendly manner, and remediation of any damage to the environment.
3. For large spills, Massachusetts DEP Hazardous Waste Incident Response Group shall be notified immediately at 888-304-1133 and an emergency response contractor shall be consulted.

3.5 Maintenance of Lawns, Gardens, and other Landscaped Areas

Lawns, gardens, and other landscaped areas shall be maintained regularly by the site owner. Vegetated and landscaped BMPs will be maintained as outlined in Section 4.0.

3.6 Storage and Use of Fertilizers, Herbicides, and Pesticides

All fertilizers, herbicides, and pesticides shall be stored in accordance with local, state, and federal regulations. The application rate and use of fertilizers, herbicides, and pesticides on the site shall at no time exceed local, state, or federal specifications.

3.7 Pet Waste Management

Pet owners shall be required to pick up after their animals and dispose of waste in the trash.

3.8 Snow and Deicing Chemical Management

Snow removal and use of deicing chemicals at the proposed development shall comply with the following requirements:

- Plowed snow shall be placed in the areas designated on the site plans and/or outside of wetland boundaries and stormwater best management practices. The following maintenance measures shall be undertaken at all snow disposal sites:
 - Debris shall be cleared from an area prior to using it for snow disposal.
 - Debris and accumulated sediments shall be cleared from the site and properly disposed of at the end of the snow season and no later than May 15.

3.9 Nutrient Management Plan

There are no TMDLs issued for the waterbodies downstream of the proposed project.

4.0 **LONG-TERM OPERATION AND MAINTENANCE PLAN**

This section outlines the stormwater best management practices (BMPs) associated with the proposed stormwater management system and identifies the long-term inspection and maintenance requirements for each BMP.

4.1 **Stormwater Management System Components**

The following table outlines the type and quantity of the BMPs and their general location. Please reference the site plan(s) provided in the Figures section for exact location. All basins are accessible for maintenance from either the development driveway or parking areas.

BMP Type	Quantity	Location
Detention Basin	2	Adjacent to Parking Areas

4.2 Inspection and Maintenance Schedules

4.2.1 General Maintenance for Mosquito Control

If necessary to minimize mosquito breeding, a licensed pesticide applicator shall apply larvicides, such as *Bacillus sphaericus* (Bs). Larvicides shall be applied in compliance with all pesticide label requirements, and will be applied during or immediately after wet weather, unless the product used can withstand extended dry periods. Ensure all manhole covers, and inspection ports are secure to reduce the likelihood of mosquitoes laying eggs in standing water.

4.2.2 Detention Basins

Detention basins shall be inspected and maintained after major storm events (rainfall totals greater than 2.5 inches in 24 hours) during the first three months of operation and twice a year and when there are discharges through the outlet control structure thereafter. Inspections shall include the following measures:

- During and after major storm events, the length of time standing water remains in the basin shall be recorded.
 - If the time is greater than 72 hours, thoroughly inspect the basin for signs of clogging.
- Examine the outlet structure for evidence of clogging or outflow release velocities that are greater than the design velocity.
- Identify areas of sediment accumulation, differential settlement, cracking, and erosion within the basin.
- Inspect embankments for leakage and tree growth.
- Examine the health of the vegetation within the basin and on the embankments.

Corrective measures shall be taken immediately as warranted by the inspections. If any evidence of hydrocarbons is found during inspection, the material shall be immediately removed using absorbent pads or other suitable measures and legally disposed.

Preventative maintenance shall include the following activities:

- Mow the buffer area and basin bottom and side slopes, if vegetated.
- Remove trash, debris, and accumulated organic matter.
- Remove clippings after mowing.

4.2.3 Stormwater Outfalls

Flared end sections and associated riprap spillways shall be inspected at least once per year and after major storm events (rainfall totals greater than 2.5 inches in 24 hours) to ensure that the stability of the outlet area is maintained. The outfall area shall be kept clear of debris such as trash, branches, and sediment. Repairs shall be made immediately if riprap displacement or downstream channel scour is observed.

4.3 Estimated Operation and Maintenance Budget

An operations and maintenance budget was prepared to approximate the annual cost of the inspections required in compliance with the DEP Stormwater Management Policy. The table below estimates the annual cost to inspect and maintain each proposed BMP, based on the requirements in Section 4.2.

BMP Type	# of BMPS	Annual O&M Cost (per BMP) ¹	Total Cost
Detention Basin	2	\$200 - \$400	\$400-\$800
Stormwater Outfalls	2	\$50-\$100	\$100-\$200
Total			\$500-\$1000

¹ Annual maintenance cost is based on estimate of the cost to complete all inspection and maintenance measures outlined in Section 4.2. For BMPs that require sediment removal at regular intervals (i.e. every 5 or 10 years), the annual cost includes the annual percentage of that cost.

Figures

Figure 1: Site Plans (See Site Plans)

Appendices

Appendix A

Operation and Maintenance Log

This template is intended to comply with the operation and maintenance log requirements of the 2008 DEP Stormwater Management Handbook. Copies of this log should be made for all inspections and kept on file for three years from the inspection date.

Name/Company of Inspector:
Date/Time of Inspection:
Weather Conditions: (Note current weather and any recent precipitation events)

[illegible]

Appendix B

List of Emergency Contacts

List of Emergency Contacts

Massachusetts DEP Hazardous Waste Incident Response Group
(617) 792-7653

Town of Halifax Fire Department
Emergencies: Dial 911
438 Plymouth Street
Halifax, MA 02338
Tel: (781) 293-1751
Fire Chief: Jason Viveiros

Town of Halifax Police Department
Emergencies: Dial 911
540 Plymouth Street
Halifax, MA 02338
Tel: (781) 293-5761
Police Chief: Joao A. Chaves