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STORMWATER REPORT

For

Definitive Subdivision "Rinta's Way"

36, 44, 48 North Carver Road
Wareham, MA 02571

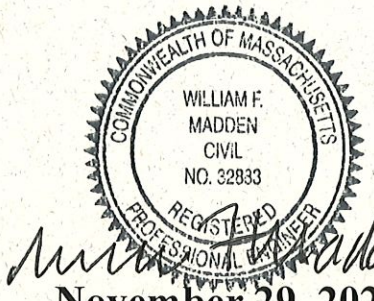
Prepared for

LSE Hydra, LLC

40 Tower Lane, Suite 201
Avon, CT 06001

Prepared by

G.A.F. Engineering, Inc.
266 Main Street
Wareham, MA 02571



November 29, 2021

G.A.F. Job No.: 20-9568

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DRAINAGE NARRATIVE

General Description

This project consists of the construction of a Definitive Subdivision road for the purpose of providing access to three lots on a 45.7 acre parcel of land owned by Linda Rinta. The road has been designed in compliance with the design criteria for a non-residential standard dead-end street as listed in the Town of Wareham Rules and Regulations Governing the Subdivision of Land.

Future development on the lots has not been defined at this time. The stormwater management system and calculations are based solely on the construction of the road. Future lot development will require additional stormwater mitigation as regulated under Site Plan Review.

This project is considered new construction under the Massachusetts Stormwater Handbook. The stormwater management system has been designed to collect, treat, store, and infiltrate the runoff in accordance with the applicable standards.

Existing Conditions

The land where the road will be constructed is currently a gravel road of variable width that provides access to cranberry bogs and a maintenance building. The intersection with North Carver Road is the high point of the property in this area. There are cranberry bogs on the north and south sides of the gravel road. The low point is adjacent to the cranberry bog on the north side.

Soils in the area of the proposed road, as mapped by the USDA Natural Resources Conservation Service, are classified as Udipsamments, wet substratum, 0 to 3 percent slopes. This soil has a Hydrologic Soil Group rating of A/D. Soils assigned a dual rating are assigned the first letter for drained areas and the second letter for undrained areas. Since the cranberry bog ditches are used to drain the bogs, the HSG A designation was used for the drainage calculations and required infiltration volume.

The existing conditions drainage analysis is limited to the area comprising the limit of work with a design point at the northerly cranberry bog. Sub-catchment 1S is the gravel access road and open space areas of lawn in good condition with HSG A soils that directs runoff toward the bogs.

The rainfall volumes used in the program were taken from the information available online using NOAA Atlas 14, Volume 10, Version 3.

Proposed Conditions

The proposed road is approximately two-hundred fifty feet long. The pavement is twenty-four feet wide with a six-inch precast concrete curb. There is proposed five-foot wide paved sidewalk on the north side which transitions to the south side just before the cul-de-sac. The cul-de-sac has a paved radius of one-hundred feet.

The drainage collection system consists of a proprietary water quality catch basin. This has been specified to provide the required minimum forty-four percent total suspended solids removal prior to infiltration in the basin where the soils are HSG A and highly pervious. An infiltration rate of 2.41 inches per hour was utilized in the calculations for the surface of the basin which will be loamed and seeded.

Sub-catchment 1S is the limit of work area which is collected, treated, and conveyed to the proposed infiltration basin, Pond 1P.

The infiltration basin has been sized to provide a volume sufficient to store and infiltrate all storm events.

The summary table which follows lists the comparison of peak flow rates and volumes resulting from the construction of the subdivision road and stormwater management system.

In our opinion the successful development of this project in compliance with the design will not result in any adverse impacts to the environment or adjacent properties with respect to stormwater runoff thereby providing compliance with the Massachusetts Stormwater Handbook.

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Drainage Summary

Table 1 – Pre-Development vs. Post-Development to Cranberry Bog

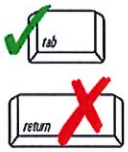
Storm Event	Pre		Post		Pre vs. Post changes	
	Peak Discharge (cfs)	Volume (ac-ft.)	Peak Discharge (cfs)	Volume (ac-ft.)	Peak Discharge (cfs)	Volume (ac-ft.)
2 yr	0	0.002	0.00	0.000	0	-0.002
10 yr	0.07	0.016	0.00	0.000	-0.07	-0.016
25 yr	0.21	0.030	0.00	0.000	-0.21	-0.030
100 yr	0.62	0.059	0.00	0.000	-0.62	-0.059

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

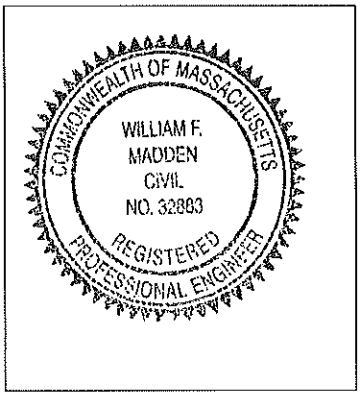
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



William F Madden 11/29/21
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 Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

COMPLIANCE WITH THE STORMWATER MANAGEMENT STANDARDS

The Stormwater Management Standards

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

    - *This project does not include any drainage outfalls. The infiltration basin has been sized to store and infiltrate all storm events up to and including the 100-year storm. Pretreatment is provided by the proprietary catch basin.*

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

    - *The drainage calculations confirm that the proposed project matches or reduces the rate of runoff for all design storms.*

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

    - *Recharge is enhanced with the collection and infiltration of the runoff in the infiltration basin. Volume calculations are included in the report and confirm that this standard is met.*

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

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

c. Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.

- *This project includes a proprietary treatment structure in order to provide more than the required 44% pretreatment prior to infiltration. Subsequent treatment within the infiltration basin results in greater than 80% annual TSS removal.*

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

   - *This project is not considered a land use with higher potential pollutant loads.*

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

   - *This project is not located within a Zone II of a public water supply.*

7. A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice

requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

- *This project is considered new development. Full compliance with the standards is provided by the stormwater management system design.*

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

    - *Construction period erosion and sedimentation control measures are included on the design plans and in this report.*

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

    - *A long-term operation and maintenance plan is included on the design plans and in this report.*

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

    - *An illicit discharge compliance statement is included in the drainage report.*

Date: November 24th, 2021

To whom it may concern:

I hereby certify that no illicit discharge connections will be constructed or allowed at the subdivision road shown as "Rinta's Way" proposed to be constructed at 36, 44, 48 North Carver Road in Wareham, Mass.

LSE Hydra, LLC

Jeffrey J. Macel
Its: Manager

Long Term Operation and Maintenance Plan

Responsible Party: LSE Hydra, LLC
40 Tower Lane, Suite 201
Avon, CT 06001

The developer and future owner of the facilities accessed by the road is responsible for the inspection, operation and maintenance of the Stormwater Management System. The responsible person within the company will be provided with copies of the approved site design and as-built plans to make them aware of the locations of system components. A copy of this Operation and Maintenance (O & M) Plan should also be provided.

System Description: The drainage system consists of two Best Management Practices, BMPs, which collect, treat, and infiltrate stormwater runoff from all storm events up to and including the 100-year storm event. The collection and conveyance system consists of a proprietary catch basin located at the end of the cul-de-sac. The catch basin outlet pipe discharges runoff to the infiltration basin. The infiltration basin provides the final treatment prior to discharge to groundwater.

Street Sweeping: Street sweeping is an effective non-structural source control that will remove sediment from paved surfaces. Sweeping should be done with a high efficiency vacuum sweeper or regenerative air sweeper. Sweeping should be done twice per year. Once removed from paved surfaces, the sweepings must be handled and disposed of properly in one of the ways approved by MassDEP. (See Policy #BAW-18-001: Reuse and Disposal of Street Sweepings)

Proprietary Catch Basin: Proprietary drainage structures are underground retention systems designed to remove trash, debris, and coarse sediment from stormwater runoff and serve as temporary spill containment devices for floatables such as oils and grease. Inspect the units monthly, clean at least two times a year at the end of the foliage and snow removal seasons. Sediments must also be removed when sediment has reached the depth recommended for cleanout by the manufacturer's specifications. Sediment must be handled and disposed of in the same manner as listed above for deep sump catch basins.

Infiltration Basins: The basin should be inspected monthly for bare spots and re-seeded if necessary. Any debris, trash, or sediment should be removed. Mowing of the basin will be infrequent, once or twice a year, primarily to prevent the growth of undesirable weeds, trees, and shrubs. Check the emergency outlet spillway for erosion and reset the stone and concrete curb if necessary. Remove any sediment which has entered the basin. Dispose of any sediment in accordance with local, state, and federal guidelines and regulations.

Public Safety Features: The infiltration basin has been specified with 3:1 side slopes. The depth is only 1.5 feet. It will drain quickly after major storm events due to the pervious soils. It is located in close proximity to the road for easy inspection and maintenance.

Operation and Maintenance Budget: The estimated annual cost for inspection, mowing, and sediment removal associated with the maintenance of the Stormwater Management System is $2,500.

Reference: For full details on drainage system Construction, Operation and Maintenance refer to the current edition of the Massachusetts Stormwater Handbook.

Construction Period Pollution Prevention and

Erosion & Sedimentation Control Plan

Narrative: This project consists of construction of a two-hundred fifty-foot long dead-end non-residential subdivision roadway with associated drainage system.

Responsible Parties: The site contractor and the developer.

Construction Period Operation / Maintenance Plan:

- Provide sufficient refuse containers and empty as needed.
- Inspect erosion controls daily. Repair or replace as needed.
- Police the area for safety hazards and trash on a daily basis.
- Store materials away from drainage and resource areas.
- Provide or receive only the materials which can be installed promptly.
- Inspect vehicles for leaks and repair or replace when necessary.
- Provide dust control with watering.
- Maintain truck runoff pads.
- Provide a contact person for complaints and to receive notification of problems.
- Direct dewatering to adequately sized containment areas.

Construction Sequence:

- Install erosion controls per the plans.
- Place and compact fill where specified and rough grade.
- Install the roadway base.
- Install drainage structures and utilities.
- Install base course of pavement.
- Install top course pavement.
- Install landscaping. Loam & seed disturbed areas.
- Install permanent pavement markings.
- Remove erosion controls.

Maintenance Schedule:

- Erosion controls are to be inspected daily and repaired or replaced as needed.
- Trash is to be picked up daily.
- Water shall be used for dust control as needed.
- Silt sacks shall be emptied or replaced when full.
- Vehicles shall be inspected daily for any leaks and repaired or replaced as needed.

To Bog

Subcat Reach Pond Link

Routing Diagram for 9568 Def Pre
Prepared by G.A.F. Engineering, Inc., Printed 11/24/2021

Project Notes

Rainfall events imported from "9568 Def Post.hcp"

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2 Year Event	Type III 24-hr		Default	24.00	1	3.43	2
2	10 Year Event	Type III 24-hr		Default	24.00	1	5.04	2
3	25 Year Event	Type III 24-hr		Default	24.00	1	6.04	2
4	100 Year Event	Type III 24-hr		Default	24.00	1	7.59	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.491	39	>75% Grass cover, Good, HSG A (1S)
0.036	96	Gravel surface, HSG B (1S)
0.526	**43**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.491	HSG A	1S
0.036	HSG B	1S
0.000	HSG C	
0.000	HSG D	
0.000	Other	
0.526		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.491	0.000	0.000	0.000	0.000	0.491	>75% Grass cover, Good	1S
0.000	0.036	0.000	0.000	0.000	0.036	Gravel surface	1S
0.491	**0.036**	**0.000**	**0.000**	**0.000**	**0.526**	**TOTAL AREA**	

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

Subcatchment 1S: To Bog Runoff Area=22,930 sf 0.00% Impervious Runoff Depth=0.04"
Tc=6.0 min CN=43 Runoff=0.00 cfs 0.002 af

Total Runoff Area = 0.526 ac Runoff Volume = 0.002 af Average Runoff Depth = 0.04"
100.00% Pervious = 0.526 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: To Bog

Runoff = 0.00 cfs @ 15.44 hrs, Volume= 0.002 af, Depth= 0.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Event Rainfall=3.43"

Area (sf)	CN	Description
1,550	96	Gravel surface, HSG B
21,380	39	>75% Grass cover, Good, HSG A
22,930	43	Weighted Average
22,930		100.00% Pervious Area

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

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

Subcatchment 1S: To Bog Runoff Area=22,930 sf 0.00% Impervious Runoff Depth=0.36"
Tc=6.0 min CN=43 Runoff=0.07 cfs 0.016 af

Total Runoff Area = 0.526 ac Runoff Volume = 0.016 af Average Runoff Depth = 0.36"
100.00% Pervious = 0.526 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: To Bog

Runoff = 0.07 cfs @ 12.35 hrs, Volume= 0.016 af, Depth= 0.36"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Event Rainfall=5.04"

Area (sf)	CN	Description
1,550	96	Gravel surface, HSG B
21,380	39	>75% Grass cover, Good, HSG A
22,930	43	Weighted Average
22,930		100.00% Pervious Area

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

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

Subcatchment 1S: To Bog Runoff Area=22,930 sf 0.00% Impervious Runoff Depth=0.69"
Tc=6.0 min CN=43 Runoff=0.21 cfs 0.030 af

Total Runoff Area = 0.526 ac Runoff Volume = 0.030 af Average Runoff Depth = 0.69"
100.00% Pervious = 0.526 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: To Bog

Runoff = 0.21 cfs @ 12.16 hrs, Volume= 0.030 af, Depth= 0.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Event Rainfall=6.04"

Area (sf)	CN	Description
1,550	96	Gravel surface, HSG B
21,380	39	>75% Grass cover, Good, HSG A
22,930	43	Weighted Average
22,930		100.00% Pervious Area

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

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

Subcatchment 1S: To Bog Runoff Area=22,930 sf 0.00% Impervious Runoff Depth=1.34"
Tc=6.0 min CN=43 Runoff=0.62 cfs 0.059 af

Total Runoff Area = 0.526 ac Runoff Volume = 0.059 af Average Runoff Depth = 1.34"
100.00% Pervious = 0.526 ac 0.00% Impervious = 0.000 ac

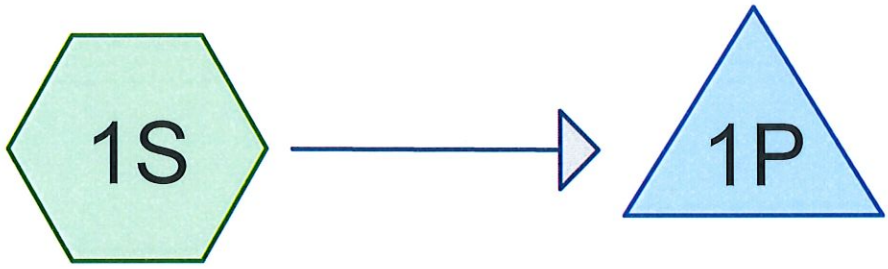
Summary for Subcatchment 1S: To Bog

Runoff = 0.62 cfs @ 12.11 hrs, Volume= 0.059 af, Depth= 1.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Event Rainfall=7.59"

Area (sf)	CN	Description
1,550	96	Gravel surface, HSG B
21,380	39	>75% Grass cover, Good, HSG A
22,930	43	Weighted Average
22,930		100.00% Pervious Area

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



To Basin

Basin

Subcat Reach Pond Link

Routing Diagram for 9568 Def Post
Prepared by G.A.F. Engineering, Inc., Printed 11/24/2021

Project Notes

Rainfall events imported from "9568 Post.hcp"

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2 Year Event	Type III 24-hr		Default	24.00	1	3.43	2
2	10 Year Event	Type III 24-hr		Default	24.00	1	5.04	2
3	25 Year Event	Type III 24-hr		Default	24.00	1	6.04	2
4	100 Year Event	Type III 24-hr		Default	24.00	1	7.59	2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.239	39	>75% Grass cover, Good, HSG A (1S)
0.287	98	Road and Sidewalks, HSG A (1S)
0.526	**71**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.526	HSG A	1S
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
0.526		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.239	0.000	0.000	0.000	0.000	0.239	>75% Grass cover, Good	1S
0.287	0.000	0.000	0.000	0.000	0.287	Road and Sidewalks	1S
0.526	**0.000**	**0.000**	**0.000**	**0.000**	**0.526**	**TOTAL AREA**	

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

Subcatchment 1S: To Basin Runoff Area=22,930 sf 54.58% Impervious Runoff Depth=1.02"
Tc=6.0 min CN=71 Runoff=0.58 cfs 0.045 af

Pond 1P: Basin Peak Elev=63.12' Storage=374 cf Inflow=0.58 cfs 0.045 af
Discarded=0.17 cfs 0.045 af Primary=0.00 cfs 0.000 af Outflow=0.17 cfs 0.045 af

Total Runoff Area = 0.526 ac Runoff Volume = 0.045 af Average Runoff Depth = 1.02"
45.42% Pervious = 0.239 ac 54.58% Impervious = 0.287 ac

Summary for Subcatchment 1S: To Basin

Runoff = 0.58 cfs @ 12.10 hrs, Volume= 0.045 af, Depth= 1.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 2 Year Event Rainfall=3.43"

	Area (sf)	CN	Description
*	12,515	98	Road and Sidewalks, HSG A
	10,415	39	>75% Grass cover, Good, HSG A
	22,930	71	Weighted Average
	10,415		45.42% Pervious Area
	12,515		54.58% Impervious Area

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

Summary for Pond 1P: Basin

Inflow Area = 0.526 ac, 54.58% Impervious, Inflow Depth = 1.02" for 2 Year Event event
Inflow = 0.58 cfs @ 12.10 hrs, Volume= 0.045 af
Outflow = 0.17 cfs @ 12.50 hrs, Volume= 0.045 af, Atten= 70%, Lag= 23.7 min
Discarded = 0.17 cfs @ 12.50 hrs, Volume= 0.045 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 63.12' @ 12.50 hrs Surf.Area= 3,131 sf Storage= 374 cf

Plug-Flow detention time= 13.7 min calculated for 0.045 af (100% of inflow)
Center-of-Mass det. time= 13.7 min (881.1 - 867.4)

Volume	Invert	Avail.Storage	Storage Description
#1	63.00'	5,725 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
63.00	3,000	0	0
64.00	4,076	3,538	3,538
64.50	4,672	2,187	5,725

Device	Routing	Invert	Outlet Devices
#1	Discarded	63.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	64.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.17 cfs @ 12.50 hrs HW=63.12' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=63.00' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

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

Subcatchment 1S: To Basin Runoff Area=22,930 sf 54.58% Impervious Runoff Depth=2.15"
Tc=6.0 min CN=71 Runoff=1.28 cfs 0.094 af

Pond 1P: Basin Peak Elev=63.40' Storage=1,301 cf Inflow=1.28 cfs 0.094 af
Discarded=0.19 cfs 0.094 af Primary=0.00 cfs 0.000 af Outflow=0.19 cfs 0.094 af

Total Runoff Area = 0.526 ac Runoff Volume = 0.094 af Average Runoff Depth = 2.15"
45.42% Pervious = 0.239 ac 54.58% Impervious = 0.287 ac

Summary for Subcatchment 1S: To Basin

Runoff = 1.28 cfs @ 12.10 hrs, Volume= 0.094 af, Depth= 2.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 10 Year Event Rainfall=5.04"

	Area (sf)	CN	Description
*	12,515	98	Road and Sidewalks, HSG A
	10,415	39	>75% Grass cover, Good, HSG A
	22,930	71	Weighted Average
	10,415		45.42% Pervious Area
	12,515		54.58% Impervious Area

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

Summary for Pond 1P: Basin

Inflow Area = 0.526 ac, 54.58% Impervious, Inflow Depth = 2.15" for 10 Year Event event
Inflow = 1.28 cfs @ 12.10 hrs, Volume= 0.094 af
Outflow = 0.19 cfs @ 12.70 hrs, Volume= 0.094 af, Atten= 85%, Lag= 36.0 min
Discarded = 0.19 cfs @ 12.70 hrs, Volume= 0.094 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 63.40' @ 12.70 hrs Surf.Area= 3,435 sf Storage= 1,301 cf

Plug-Flow detention time= 54.0 min calculated for 0.094 af (100% of inflow)
Center-of-Mass det. time= 53.9 min (898.6 - 844.7)

Volume	Invert	Avail.Storage	Storage Description
#1	63.00'	5,725 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
63.00	3,000	0	0
64.00	4,076	3,538	3,538
64.50	4,672	2,187	5,725

Device	Routing	Invert	Outlet Devices
#1	Discarded	63.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	64.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.19 cfs @ 12.70 hrs HW=63.40' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=63.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

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

Subcatchment 1S: To Basin Runoff Area=22,930 sf 54.58% Impervious Runoff Depth=2.93"
Tc=6.0 min CN=71 Runoff=1.77 cfs 0.129 af

Pond 1P: Basin Peak Elev=63.61' Storage=2,031 cf Inflow=1.77 cfs 0.129 af
Discarded=0.20 cfs 0.129 af Primary=0.00 cfs 0.000 af Outflow=0.20 cfs 0.129 af

Total Runoff Area = 0.526 ac Runoff Volume = 0.129 af Average Runoff Depth = 2.93"
45.42% Pervious = 0.239 ac 54.58% Impervious = 0.287 ac

Summary for Subcatchment 1S: To Basin

Runoff = 1.77 cfs @ 12.09 hrs, Volume= 0.129 af, Depth= 2.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 25 Year Event Rainfall=6.04"

	Area (sf)	CN	Description
*	12,515	98	Road and Sidewalks, HSG A
	10,415	39	>75% Grass cover, Good, HSG A
	22,930	71	Weighted Average
	10,415		45.42% Pervious Area
	12,515		54.58% Impervious Area

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

Summary for Pond 1P: Basin

Inflow Area = 0.526 ac, 54.58% Impervious, Inflow Depth = 2.93" for 25 Year Event event
Inflow = 1.77 cfs @ 12.09 hrs, Volume= 0.129 af
Outflow = 0.20 cfs @ 12.93 hrs, Volume= 0.129 af, Atten= 88%, Lag= 49.8 min
Discarded = 0.20 cfs @ 12.93 hrs, Volume= 0.129 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 63.61' @ 12.93 hrs Surf.Area= 3,656 sf Storage= 2,031 cf

Plug-Flow detention time= 87.4 min calculated for 0.128 af (100% of inflow)
Center-of-Mass det. time= 87.3 min (922.9 - 835.6)

Volume	Invert	Avail.Storage	Storage Description
#1	63.00'	5,725 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
63.00	3,000	0	0
64.00	4,076	3,538	3,538
64.50	4,672	2,187	5,725

Device	Routing	Invert	Outlet Devices
#1	Discarded	63.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	64.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.20 cfs @ 12.93 hrs HW=63.61' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.20 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=63.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

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

Subcatchment 1S: To Basin Runoff Area=22,930 sf 54.58% Impervious Runoff Depth=4.23"
Tc=6.0 min CN=71 Runoff=2.56 cfs 0.185 af

Pond 1P: Basin Peak Elev=63.94' Storage=3,308 cf Inflow=2.56 cfs 0.185 af
Discarded=0.22 cfs 0.185 af Primary=0.00 cfs 0.000 af Outflow=0.22 cfs 0.185 af

Total Runoff Area = 0.526 ac Runoff Volume = 0.185 af Average Runoff Depth = 4.23"
45.42% Pervious = 0.239 ac 54.58% Impervious = 0.287 ac

Summary for Subcatchment 1S: To Basin

Runoff = 2.56 cfs @ 12.09 hrs, Volume= 0.185 af, Depth= 4.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Type III 24-hr 100 Year Event Rainfall=7.59"

	Area (sf)	CN	Description
*	12,515	98	Road and Sidewalks, HSG A
	10,415	39	>75% Grass cover, Good, HSG A
	22,930	71	Weighted Average
	10,415		45.42% Pervious Area
	12,515		54.58% Impervious Area

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

Summary for Pond 1P: Basin

Inflow Area = 0.526 ac, 54.58% Impervious, Inflow Depth = 4.23" for 100 Year Event event
Inflow = 2.56 cfs @ 12.09 hrs, Volume= 0.185 af
Outflow = 0.22 cfs @ 13.22 hrs, Volume= 0.185 af, Atten= 91%, Lag= 67.9 min
Discarded = 0.22 cfs @ 13.22 hrs, Volume= 0.185 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
Peak Elev= 63.94' @ 13.22 hrs Surf.Area= 4,015 sf Storage= 3,308 cf

Plug-Flow detention time= 141.0 min calculated for 0.185 af (100% of inflow)
Center-of-Mass det. time= 140.9 min (966.0 - 825.0)

Volume	Invert	Avail.Storage	Storage Description
#1	63.00'	5,725 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
63.00	3,000	0	0
64.00	4,076	3,538	3,538
64.50	4,672	2,187	5,725

Device	Routing	Invert	Outlet Devices
#1	Discarded	63.00'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	64.00'	**10.0' long x 5.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.34 2.50 2.70 2.68 2.68 2.66 2.65 2.65 2.65 2.65 2.67 2.66 2.68 2.70 2.74 2.79 2.88

Discarded OutFlow Max=0.22 cfs @ 13.22 hrs HW=63.94' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.22 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=63.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

INSTRUCTIONS:

Non-automated: Mar. 4, 2008

1. Sheet is nonautomated. Print sheet and complete using hand calculations. Column A and B: See MassDEP Structural BMP Table
2. The calculations must be completed using the Column Headings specified in Chart and Not the Excel Column Headings
3. To complete Chart Column D, multiple Column B value within Row x Column C value within Row
4. To complete Chart Column E value, subtract Column D value within Row from Column C within Row
5. Total TSS Removal = Sum All Values in Column D

Location: 36, 44, 48 North Carver Road

TSS Removal Calculation Worksheet

A BMP[1]	B TSS Removal Rate[1]	C Starting TSS Load*	D Amount Removed (B*C)	E Remaining Load (C-D)
Proprietary Catch Basin	0.80	1.00	0.80	0.20
Infiltration Basin	0.80	0.20	0.16	0.04

Total TSS Removal = 96%

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: Rintas Way

Prepared By: G.A.F. Engineering

Date: 11-29-21

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

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed

1. From MassDEP Stormwater Handbook Vol. 1

Recharge Volume Calculation

Required Recharge Depth = 0.60 inch volume from impervious surfaces (HSG A Soil)

The 1.00 inch water quality volume calculations confirm that the capacity of the infiltration basin exceed that required volume therefore they also exceed the 0.60 inch required recharge volume. The system drawdown calculations are as follows. The storage volume input is based on the 100-year volume listed in the HydroCAD calculations.

Recharge System Drawdown time (72 hrs. max.)

$$\text{Time} = \frac{\text{Storage Volume}}{(\text{Rawls Rate})\ (\text{Bottom Area})}$$

Infiltration Basin - Pond 1P:

$$\text{Time} = \frac{3{,}308\ \text{cf}}{(2.41\ \text{inches/hour})(1\ \text{ft}/12\ \text{inches})(3{,}000\ \text{sf})}$$

5.5 hours < 72 hours – OK

Water Quality Volume Calculation

Required Water Quality Depth = 1.00 inch volume from impervious surfaces.

Contech WQS #1 provides pretreatment of the 1" WQV.

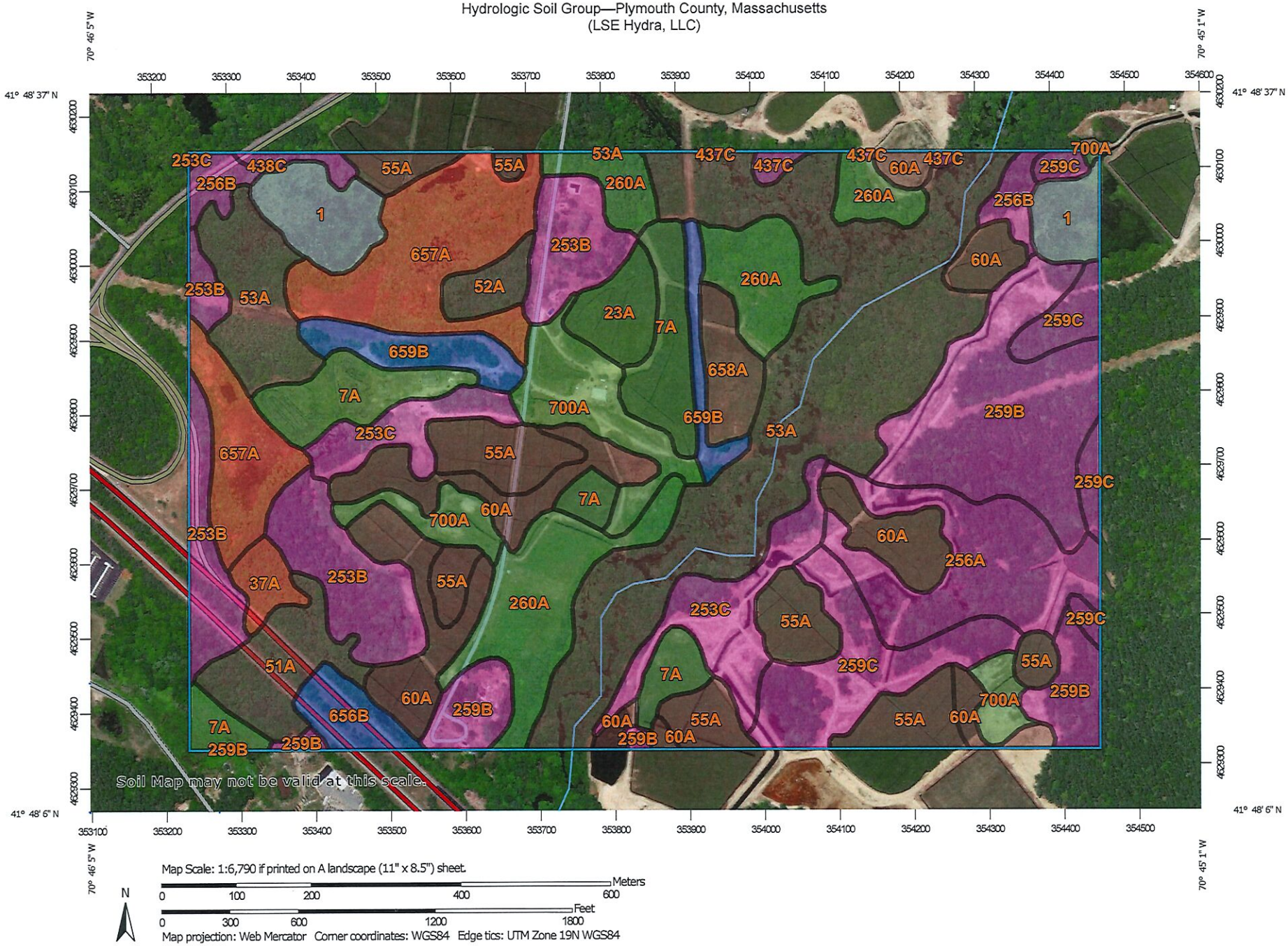
Impervious Pavement and sidewalks to Infiltration Basin 1P = 12,515 sf

Water Quality Volume = 12,515 sf x 1.00"/12 = 1,043 cf

Total Storage = 5,725 cf

5,725 cf > 1,043 cf OK

Hydrologic Soil Group—Plymouth County, Massachusetts
(LSE Hydra, LLC)



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.

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

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

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

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

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

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

Soil Survey Area: 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
1	Water		7.0	2.9%
7A	Rainberry coarse sand, 0 to 3 percent slopes, sanded surface	A/D	13.4	5.5%
23A	Tihonet coarse sand, 0 to 3 percent slopes	A/D	3.2	1.3%
37A	Massasoit - Mashpee complex, 0 to 3 percent slopes	D	1.8	0.7%
51A	Swansea muck, 0 to 1 percent slopes	B/D	5.6	2.3%
52A	Freetown muck, 0 to 1 percent slopes	B/D	2.0	0.8%
53A	Freetown muck, ponded, 0 to 1 percent slopes	B/D	42.6	17.6%
55A	Freetown coarse sand, 0 to 3 percent slopes, sanded surface	B/D	14.8	6.1%
60A	Swansea coarse sand, 0 to 2 percent slopes	B/D	17.8	7.4%
253B	Hinckley loamy sand, 3 to 8 percent slopes	A	16.5	6.8%
253C	Hinckley loamy sand, 8 to 15 percent slopes	A	10.3	4.3%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	A	11.4	4.7%
256B	Deerfield loamy fine sand, 3 to 8 percent slopes	A	2.9	1.2%
259B	Carver loamy coarse sand, 3 to 8 percent slopes	A	21.6	8.9%
259C	Carver loamy coarse sand, 8 to 15 percent slopes	A	12.7	5.2%
260A	Sudbury fine sandy loam, 0 to 3 percent slopes	A/D	17.8	7.3%
437C	Plymouth loamy coarse sand, 8 to 15 percent slopes, bouldery	A	0.8	0.3%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
438C	Plymouth loamy coarse sand, 8 to 15 percent slopes, extremely bouldery	A	0.9	0.4%
656B	Udorthents - Urban land complex, 0 to 8 percent slopes	B	2.8	1.1%
657A	Aquepts, 0 to 3 percent slopes	D	17.4	7.2%
658A	Endoaquents, 0 to 3 percent slopes, sanded surface	B/D	3.2	1.3%
659B	Udorthents, 0 to 8 percent slopes, gravelly	B	5.5	2.3%
700A	Udipsamments, wet substratum, 0 to 3 percent slopes	A/D	10.3	4.3%
Totals for Area of Interest			**242.1**	**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.

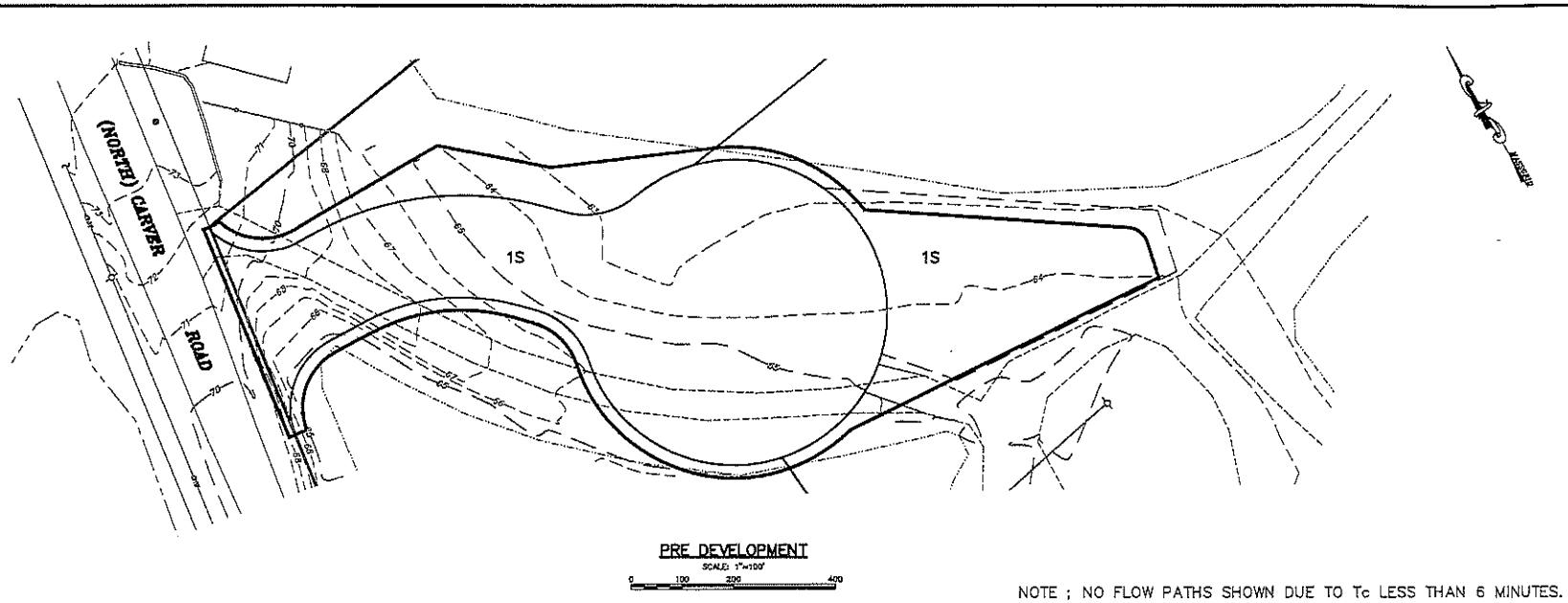
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

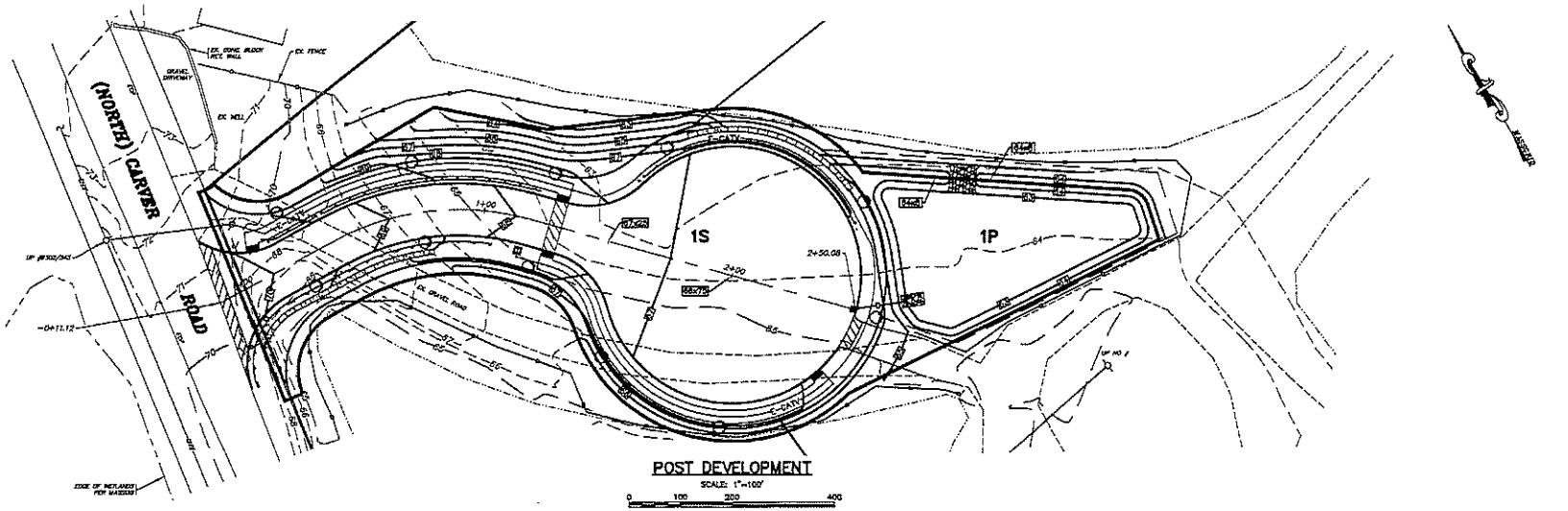


PRE DEVELOPMENT

SCALE: 1"=100'

0 100 200 400

NOTE ; NO FLOW PATHS SHOWN DUE TO Tc LESS THAN 6 MINUTES.



POST DEVELOPMENT

SCALE: 1"=100'

0 100 200 400

PRE & POST DEVELOPMENT WATERSHED MAP

NORTH CARVER ROAD MARSHALL, MA

PREPARED FOR: LSE HYDRA, LLC

40 TOWER LANE, SUITE 201 AVON, CT

JOB NO.: 20-9566

DWG. 1 OF 1

G.A.F. ENGINEERING, INC.
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358 MAIN STREET - MARSHALL, MA 02571
TEL: (508) 295-6600 FAX: (508) 295-6614

DATE: NOV. 23, 2020
DRAWN BY: MP
CHECKED BY: MJH
JOB NO.: 20-9566
SCALE: AS NOTED

NO.	DATE	BY	APP'D	DESCRIPTION

APPROVED BY:

APPROVED BY: