



ENGINEERING,  
INC.

ENGINEERS  
SURVEYORS

# STORMWATER REPORT

For

**Warren QOZB, LLC**

59 Main Street  
Wareham, MA 02571

Prepared for

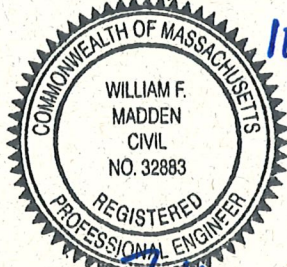
**Warren QOZB, LLC**

P.O. Box 1206  
Carver, MA 02330

Prepared by

**G.A.F. Engineering, Inc.**

266 Main Street  
Wareham, MA 02571



*William F. Madden*

**November 22, 2021**

G.A.F. Job No.: 20-9438

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WAREHAM, MA 02571

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## DRAINAGE NARRATIVE

### General Description

The project site is a 1.41 acre parcel of land located at 59 Main Street and shown as Lots 1124, 1125, and 1126 on Assessors Map 47.

The land has been previously developed as a lumberyard and later as a commercial marine services business. The current owner has demolished and removed the old buildings in anticipation of the proposed new uses.

The property is proposed to be developed as a restaurant. There will be an outdoor pavilion for gathering. The property has been approved for a commercial marina.

This project is required to comply with the Massachusetts Stormwater Management Standards to the maximum extent practicable because the project is considered a redevelopment project. Full compliance must be provided for standards 1, 8, 9, and 10. A detailed description of the system design and performance is provided as follows.

### Existing Conditions

This property, being adjacent to the Wareham River, is located within Land Subject to Coastal Storm Flowage (LSCSF). As such there is no requirement to mitigate potential increases in peak flow rates and storm volumes to the river.

The property is bounded by the Wareham River to the east, "British Landing" to the south, Main Street to the west, and "Besse Park" to the north. A small portion of the south end of the property is graded toward the south property line. This area will be landscaped with a raised berm to redirect any runoff away from the adjacent parking lot of the abutter.

The high point of the property is along Main Street. The topography drops from elevation 11 down to elevation 5 in the midpoint of the lot. From there to the concrete walkway along the river the land is flat. There are no existing drainage systems remaining from the prior developments.

Soils on the property as mapped by the USDA Natural Resources Conservation Service are classified as Udipsamments (656B), wet substratum, 0-3 percent slopes. This soil has a Hydrologic Soil Group rating of B. This has been used to establish the required infiltration volume and Rawl's rate for determination of drawdown time for the stormwater management system.

### Proposed Conditions

The project consists of the construction of the restaurant/function building, outdoor pavilion building, commercial building, and associated paved parking lot and utilities.

The parking lot grading has been designed such that all of the runoff from the pavement and adjacent sidewalks will flow into a peastone trench which provides initial removal of total suspended and conveys the runoff to two systems of underground storage chambers for final treatment and infiltration.

Roof runoff from the front half of the restaurant building will be piped to the chambers to prevent it from falling on the sidewalk.

Any overflow from the chambers will be dispersed onto the lawn area through emitters connected to the top of each system. Due to the location of the lot in LSCSF, further comparative analysis with past or present development of the land as relates to stormwater is not necessary.

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. Compliance with each of the standards listed within the Massachusetts Stormwater Management Handbook are included within this report.



# 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.<sup>1</sup> 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<sup>2</sup>
- 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.

<sup>1</sup> 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.

<sup>2</sup> 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.

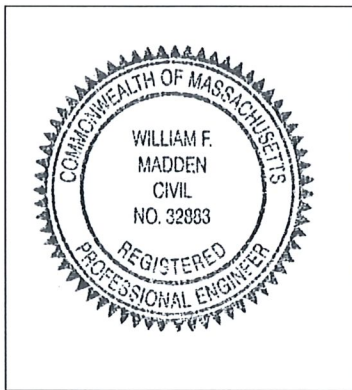
*Note:* Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that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



*William F. Madden* 11/22/21  
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

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## 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

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## 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<sup>1</sup>
- 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.

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<sup>1</sup> 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.





# Checklist for Stormwater Report

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## 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 proprietary 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

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## 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

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## 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 conveyances that discharge off the site.*
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.
  - *This project is located within land subject to coastal storm flowage. A waiver is requested from the requirement to analyze peak discharge rates.*
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 for the parking lot is provided based on HSG "B" soils requirement of 0.35 inches per impervious area.*
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 provides 80% TSS removal from the parking lot and walks.*

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. There are no existing or proposed stormwater discharges.*
  
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 redevelopment. Development of the project results in an improvement over existing conditions with respect to stormwater runoff.*
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 has been listed on the design plans and is included 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 22, 2021

To whom it may concern:

I hereby certify that no illicit discharge connections to the drainage system presently exist at 59 Main Street, Map 47 Lot 1124, 1125, and 1126 nor will any be permitted in the future.

  
Warren QOZB, LLC



## Long Term Operation and Maintenance Plan

**Responsible Party:** Warren QOZB, LLC  
18 Church Street  
Carver, MA 02330

The property owner is responsible for the inspection, operation, and maintenance of the Stormwater Management System. The property manager 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 a crushed stone trench with a twelve-inch diameter perforated pipe which collects runoff from the parking lot and conveys it to two infiltration beds consisting of concrete chambers which are placed on and surrounded by crushed stone.

**Parking Lot Sweeping:** Parking Lot 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 in the spring and once in the fall. 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)

**Pea Stone Trenches:** Pea Stone trenches consist of pea stone wrapped in filter fabric containing perforated pipe. They are used to collect surface water or groundwater for conveyance to other stormwater BMPs or simply offsite. Pea stone trenches should be inspected after significant rainfall events and when the parking lot is swept. Check for any stone settlement or displacement and restore the stone depth at the surface as needed. Remove any sand, leaves, or debris which could inhibit runoff from entering the trench. Sediment must be handled and disposed of properly in one of the ways approved by MassDEP. Refer to their policy on the management of catch basin cleanings. If there is evidence that they have been contaminated by a spill or other means, the cleanings must be evaluated in accordance with the MassDEP hazardous waste regulations, 310 CMR 30.00 and handled as hazardous waste.

**Concrete Chambers:** Underground concrete chambers shall be inspected through the use of a vertical inspection port after every major storm event for the first few months after installation to ensure proper stabilization and function. Thereafter inspection shall occur annually. Water depth should be observed after major storms to determine proper function. Exfiltration rates are determined by the drop in water level over the time it takes for the unit to empty. A comparison of exfiltration rate measurements taken over a period of years can provide helpful information in the event that clogging problems occur.

**Public Safety Features:** The top of the Pea Stone trench between the parking lot and sidewalk will be at the same grade and presents no hazard to pedestrians. The precast concrete galleys are underground and therefore inaccessible to foot traffic.

**Operation and Maintenance Budget:** The estimated annual cost for inspection 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 commercial marina administration building, restaurant/function center, outdoor pavilion, and associated paved parking lot, drainage, and utilities.

**Responsible Parties:** The site contractor and the owner.

### **Construction Period Operation / Maintenance Plan:**

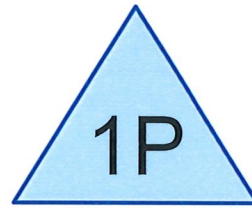
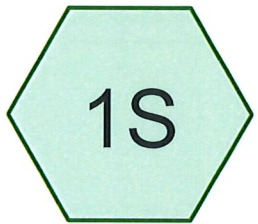
- Provide sufficient refuse containers and empty as needed.
- Inspect erosion controls daily. Repair or replace as needed.
- Police the area for safety hazards and trash on a daily basis.
- Store materials away from drainage and resource areas.
- Provide or receive only the materials which can be installed 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.
- Install silt sacks in existing catch basins.
- Install building foundations.
- Install drainage structures and utilities.
- Construct buildings.
- Install base course of pavement.
- Install top course pavement.
- Install landscaping. Loam & seed disturbed areas.
- Install permanent pavement markings.
- Remove erosion controls.

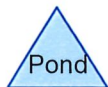
**Maintenance Schedule:**

- 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 Chambers

Chambers



**9438 Post**

Prepared by G.A.F. Engineering, Inc.  
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**Project Notes**

Rainfall events imported from "9600 POST.hcp"

**9438 Post**

**Area Listing (all nodes)**

Area (acres)	CN	Description (subcatchment-numbers)
0.115	61	>75% Grass cover, Good, HSG B (1S)
0.501	98	Paved parking, HSG B (1S)
<b>0.615</b>	<b>91</b>	<b>TOTAL AREA</b>

**9438 Post**

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**Soil Listing (all nodes)**

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.615	HSG B	1S
0.000	HSG C	
0.000	HSG D	
0.000	Other	
<b>0.615</b>		<b>TOTAL AREA</b>



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**Ground Covers (all nodes)**

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.115	0.000	0.000	0.000	0.115	>75% Grass cover, Good	1S
0.000	0.501	0.000	0.000	0.000	0.501	Paved parking	1S
<b>0.000</b>	<b>0.615</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>0.615</b>	<b>TOTAL AREA</b>	

**9438 Post**

Type III 24-hr One Inch First Flush Rainfall=1.00"

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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 Chambers**

Runoff Area=26,810 sf 81.35% Impervious Runoff Depth=0.36"  
Tc=6.0 min CN=91 Runoff=0.25 cfs 0.018 af

**Pond 1P: Chambers**

Peak Elev=3.25' Storage=211 cf Inflow=0.25 cfs 0.018 af  
Outflow=0.05 cfs 0.018 af

**Total Runoff Area = 0.615 ac Runoff Volume = 0.018 af Average Runoff Depth = 0.36"**  
**18.65% Pervious = 0.115 ac 81.35% Impervious = 0.501 ac**

**9438 Post**

Type III 24-hr One Inch First Flush Rainfall=1.00"

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**Summary for Subcatchment 1S: To Chambers**

Runoff = 0.25 cfs @ 12.10 hrs, Volume= 0.018 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 One Inch First Flush Rainfall=1.00"

Area (sf)	CN	Description
21,810	98	Paved parking, HSG B
5,000	61	>75% Grass cover, Good, HSG B
26,810	91	Weighted Average
5,000		18.65% Pervious Area
21,810		81.35% Impervious Area

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

**Summary for Pond 1P: Chambers**

Inflow Area = 0.615 ac, 81.35% Impervious, Inflow Depth = 0.36" for One Inch First Flush event  
 Inflow = 0.25 cfs @ 12.10 hrs, Volume= 0.018 af  
 Outflow = 0.05 cfs @ 12.57 hrs, Volume= 0.018 af, Atten= 79%, Lag= 28.3 min  
 Discarded = 0.05 cfs @ 12.57 hrs, Volume= 0.018 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs / 2  
 Peak Elev= 3.25' @ 12.57 hrs Surf.Area= 2,100 sf Storage= 211 cf

Plug-Flow detention time= 29.5 min calculated for 0.018 af (100% of inflow)  
 Center-of-Mass det. time= 29.3 min ( 885.0 - 855.7 )

Volume	Invert	Avail.Storage	Storage Description
#1	3.00'	2,001 cf	<b>30.00'W x 35.00'L x 2.50'H Prismatic</b> x 2 5,250 cf Overall - 248 cf Embedded = 5,002 cf x 40.0% Voids
#2	4.00'	149 cf	<b>Concrete Galley 4x8x1</b> x 8 Inside #1 Inside= 42.0"W x 9.0"H => 2.49 sf x 7.50'L = 18.7 cf Outside= 48.0"W x 12.0"H => 3.88 sf x 8.00'L = 31.0 cf 8 Chambers in 7 Rows
		2,150 cf	Total Available Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	3.00'	<b>1.020 in/hr Exfiltration over Wetted area</b>

Discarded OutFlow Max=0.05 cfs @ 12.57 hrs HW=3.25' (Free Discharge)  
 ↑1=Exfiltration (Exfiltration Controls 0.05 cfs)

**INSTRUCTIONS:**

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: 59 Main Street, Wareham, MA

B BMP <sup>1</sup>	C TSS Removal Rate <sup>1</sup>	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Infiltration Trench	0.80	1.00	0.80	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20
	0.00	0.20	0.00	0.20

**Total TSS Removal =** 80%

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

Project: Warren QOZB, LLC  
 Prepared By: GAF Engineering, Inc.  
 Date: 22-Nov-21

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

**TSS Removal Calculation Worksheet**

## Water Quality Volume Calculation

### Area to Chambers

Design Water Quality Depth = 1.00 inch volume from pavement and walks

Total Pavement Area = 21,810 sf

Water Quality Volume =  $21,810 \text{ sf} \times 1.00''/12 = 1,817.5 \text{ cf}$

Total Storage in Chambers = 2,150 cf (HydroCAD )

2,150 cf > 1,817.5 cf - OK

## Recharge Volume Calculation

Required Recharge Depth = 0.35-inch volume from impervious surfaces (HSG B Soil)

The total impervious area is 64% of the site.  $61,414 \text{ sf} \times 0.64 = 39,309 \text{ sf}$

Required Recharge Volume =  $39,309 \text{ sf} \times 0.35/12 = 1,146.5 \text{ cubic feet}$

Total volume in underground chambers = 2,150 cubic feet (HydroCAD)

$2,150 \text{ cf} > 1,146.5 \text{ cf}$  OK

Recharge System Drawdown time (72 hrs. max.)

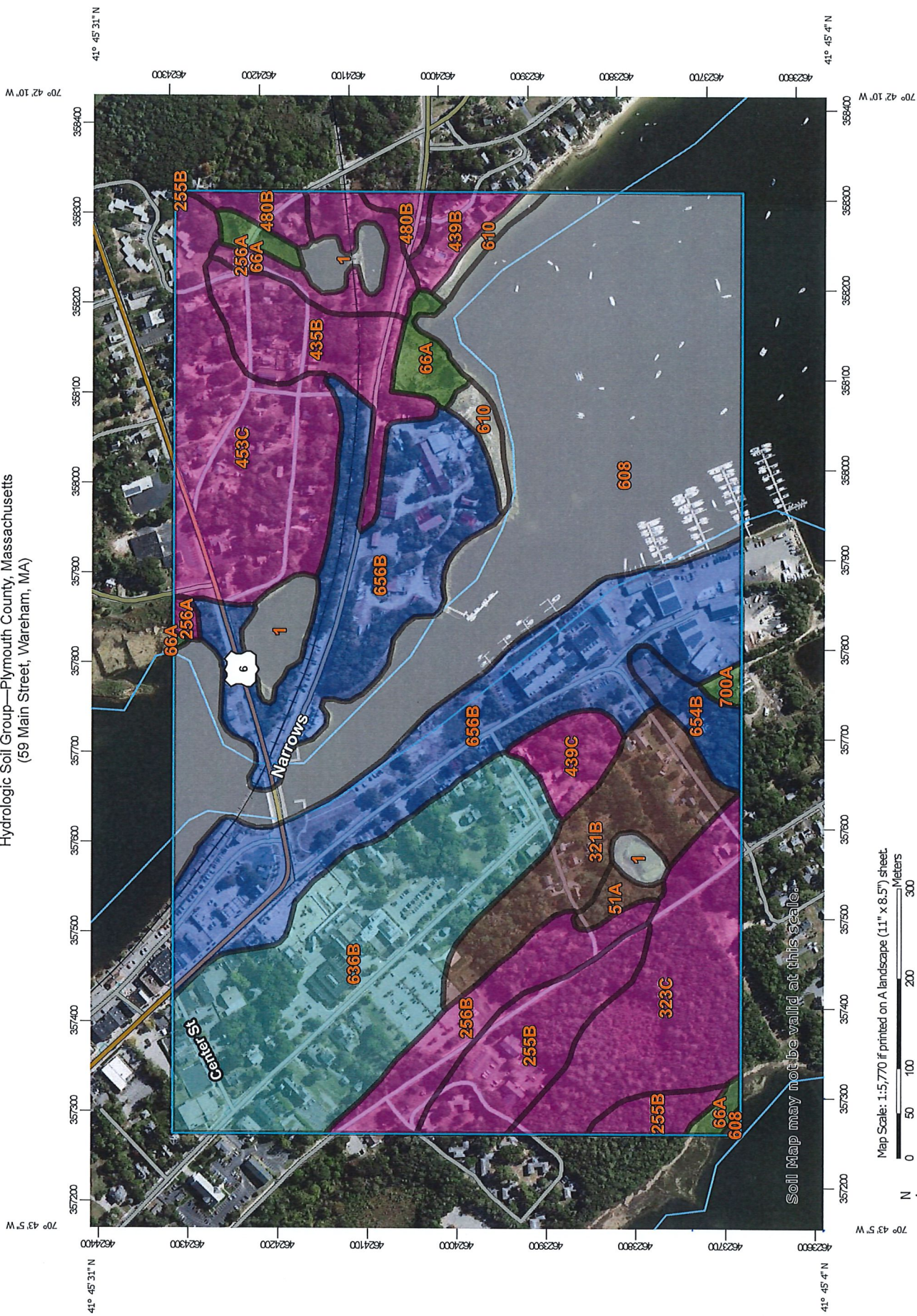
Time =  $\frac{\text{Storage Volume}}{(\text{Rawls Rate}) (\text{Bottom Area})}$

Chambers:

Time =  $\frac{2,150 \text{ cf}}{(1.02 \text{ inches/hour})(1 \text{ ft}/12 \text{ inches})(2,100 \text{ sf})}$

12.1 hours < 72 hours OK

Hydrologic Soil Group—Plymouth County, Massachusetts  
 (59 Main Street, Wareham, MA)



Soil Map may not be valid at this scale.









































Map Scale: 1:5,770 if printed on A landscape (11" x 8.5") sheet



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



## MAP LEGEND

	Area of Interest (AOI)		C
	Area of Interest (AOI)		C/D
	Soils		D
	Soil Rating Polygons		Not rated or not available
	A		Water Features
	A/D		Streams and Canals
	B		Transportation
	B/D		Rails
	C		Interstate Highways
	C/D		US Routes
	D		Major Roads
	Not rated or not available		Local Roads
	Soil Rating Lines		Background
	A		Aerial Photography
	A/D		
	B		
	B/D		
	C		
	C/D		
	D		
	Not rated or not available		
	Soil Rating Points		
	A		
	A/D		
	B		
	B/D		

## 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 14, Sep 2, 2021

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

Date(s) aerial images were photographed: Sep 25, 2020—Oct 9, 2020

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

## Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
1	Water		3.7	2.2%
51A	Swansea muck, 0 to 1 percent slopes	B/D	0.8	0.5%
66A	Ipswich - Pawcatuck - Matunuck complex, 0 to 2 percent slopes, very frequently flooded	A/D	2.6	1.6%
255B	Windsor loamy sand, 3 to 8 percent slopes	A	6.8	4.1%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	A	3.2	1.9%
256B	Deerfield loamy fine sand, 3 to 8 percent slopes	A	5.0	3.0%
321B	Birchwood sand, 3 to 8 percent slopes, very stony	B/D	7.6	4.6%
323C	Poquonock sand, 8 to 15 percent slopes, very stony	A	10.4	6.3%
435B	Plymouth loamy coarse sand, 3 to 8 percent slopes	A	5.8	3.5%
439B	Gloucester - Canton complex, 3 to 8 percent slopes	A	1.6	1.0%
439C	Gloucester - Canton complex, 8 to 15 percent slopes	A	2.2	1.3%
453C	Gloucester - Canton complex, 8 to 15 percent slopes, extremely bouldery	A	12.9	7.8%
480B	Plymouth - Carver complex, 3 to 8 percent slopes	A	1.8	1.1%
608	Water, ocean		42.2	25.6%
610	Beaches, sand		1.6	0.9%
636B	Montauk-Urban land complex, 0 to 8 percent slopes	C	22.2	13.5%
654B	Udorthents, loamy, 0 to 8 percent slopes	B	2.0	1.2%

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
656B	Udorthents - Urban land complex, 0 to 8 percent slopes	B	32.2	19.5%
700A	Udipsamments, wet substratum, 0 to 3 percent slopes	A/D	0.4	0.2%
<b>Totals for Area of Interest</b>			<b>165.0</b>	<b>100.0%</b>

## 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