



ALLEN & MAJOR
ASSOCIATES, INC.

SITE LOCUS: N.T.S.



969 SHAWMUT AVENUE NEW BEDFORD, MASSACHUSETTS DRAINAGE REPORT

DATE PREPARED:

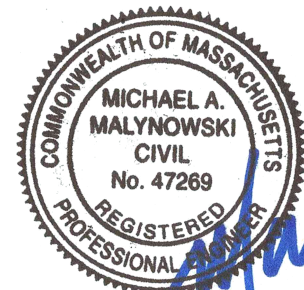
February 12, 2021

APPLICANT:

TRUE STORAGE NEW BEDFORD, LLC
670 N. COMMERCIAL STREET
MANCHESTER, NH 03101

PREPARED BY:

ALLEN & MAJOR ASSOCIATES, INC.
100 COMMERCE WAY
WOBURN, MA 01801



DRAINAGE REPORT

969 SHAWMUT AVENUE

NEW BEDFORD, MA

APPLICANT:

TRUE STORAGE NEW BEDFORD, LLC
670 N. COMMERCIAL STREET
MANCHESTER, NH 03101

PREPARED BY:

ALLEN & MAJOR ASSOCIATES, INC.
100 COMMERCE WAY, SUITE 5
WOBURN, MA 01801

ISSUED: FEBRUARY 12, 2021

A&M PROJECT #2038-03

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

Table of Contents

1	DRAINAGE REPORT	
2	OPERATION & MAINTENANCE PLAN	
3	HYDROCAD WORKSHEETS	EXISTING CONDITIONS
4	HYDROCAD WORKSHEETS	PROPOSED CONDITIONS
5	APPENDIX	
6	WATERSHED PLANS	

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

Section 1.0 Drainage Report

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

Section 1.0

Drainage Report

TABLE OF CONTENTS.....	1-1
INTRODUCTION	1-2
SITE CATEGORIZATION FOR STORMWATER REGULATIONS	1-2
SITE LOCATION AND ACCESS	1-2
EXISTING SITE CONDITIONS	1-3
EXISTING SOIL CONDITIONS	1-3
DRAINAGE ANALYSIS METHODOLOGY	1-3
PEAK RATE OF RUNOFF	1-3
PHOSPHORUS REMOVAL	1-3
MA DEP STORMWATER PERFORMANCE STANDARDS	1-3
STANDARD #1	1-5
STANDARD #2	1-5
STANDARD #3	1-5
STANDARD #4	1-6
STANDARD #5	1-7
STANDARD #6	1-7
STANDARD #7	1-7
STANDARD #8	1-7
STANDARD #9	1-7
STANDARD #10	1-7
MA DEP CHECKLIST FOR STORMWATER REPORT	1-8

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

• INTRODUCTION

The purpose of this drainage report is to provide a detailed review of the stormwater runoff, both quality and quantity, as it pertains to the existing and proposed developed conditions. The report will show by means of narrative, calculations and exhibits that appropriate best management practices have been used to mitigate the impacts from the proposed development. The report will demonstrate that there is a decrease in the total volume of runoff and the total peak rate of runoff from the site for all design storm events. The following table illustrates that an overall peak reduction of the site as a whole is achieved.

Total Offsite			
Design Storm	Pre-Development (cfs)	Post-Development (cfs)	Change (cfs)
1yr	7.22	6.11	-1.11
10yr	13.73	12.73	-1.00
25yr	17.56	16.63	-0.93
100yr	25.27	24.44	-0.83

The proposed project includes converting a former industrial building/loading dock to a climate-controlled self-storage facility. The site design includes the removal of existing pavement and concrete pads and replacing them with loam and seed, changing the traffic flow through the site, converting an industrial building to a self-storage facility, and tying into the existing stormwater management system. The stormwater management system will collect stormwater by means of existing catch basin inlets and sewer manholes, as well as infiltration trenches within parallel parking areas to aide groundwater recharge.

The stormwater management system (SMS) incorporates structural Best Management Practices to provide stormwater quality treatment, conveyance, and groundwater recharge. The SMS includes landscape area drains, and underground infiltration systems. All of the stormwater runoff from the proposed development is collected and treated (if necessary) on-site before discharged.

• SITE CATEGORIZATION FOR STORMWATER REGULATIONS

The proposed climate controlled self-storage facility development will produce a net decrease in impervious area from the previous industrial use. The stormwater analysis has been completed using ground coverage calculations when the site was occupied by an industrial building and pavement. Based upon the reduction of impervious area the site has been classified as a redevelopment project. 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 stormwater best management practice requirements of standards 4, 5, and 6. All MA DEP Stormwater Management Standards have been analyzed to improve existing conditions.

• SITE LOCATION AND ACCESS

The site is a 3.52 ± acre parcel located south of Massachusetts Route 140, northwest of the intersection of Hathaway Road and Shawmut Avenue. The building contains its frontage on Shawmut Avenue. The proposed development will be accessed via re-constructed existing curb cuts on Shawmut Avenue following the redevelopment.

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

• EXISTING SITE CONDITIONS

The project site consists of an industrial building/loading dock. The site slopes to the northeast, with elevations ranging from 148 at the southwest corner of the parcel to 104 along Shawmut Avenue. The existing parcel is primarily composed of a +/-75,076 S.F. building and approximately +/- 48,485 S.F. of pavement. This condition was utilized in the analysis of stormwater flows. The surface drainage flows were analyzed at one Analysis Point at the northwest corner of the parcel boundary. The flows to the Analysis Point include all on-site flow. Copies of the Existing and Proposed Watershed Maps are included in the appendices of this report.

• EXISTING SOIL CONDITIONS

The on-site soils were identified using the USDA Web Soil Survey. The survey classified the soil type on site to be Urban Land, with surrounding soils to the southwest of the parcel being Paxton fine sandy loam and Udorthents.

• DRAINAGE ANALYSIS METHODOLOGY

The stormwater runoff analysis of the existing and proposed conditions includes an estimate of the peak rate of runoff from various rainfall events. Peak runoff rates were developed using TR-55 Urban Hydrology for Small Watersheds, developed by the U.S. Department of Commerce, Engineering Division and the HydroCAD 10.00-18 computer program. Further, the analysis has been prepared in accordance with the Town of New Bedford requirements and standard engineering practices. The peak rate of runoff has been estimated for each watershed during the 1, 10, 25 and 100-year storm events. The rainfall intensities are based on the Northeast Regional Climate Center (NRCC) extreme precipitation tables. A copy of the extreme precipitation tables is included in the Appendix of this report.

• PEAK RATE OF RUNOFF

The stormwater runoff model shows that the proposed site development reduces the rate of runoff during all storm events at the identified point of analysis. The previous table provides a summary of the estimated peak rate and total runoff volume at the analysis point during each of the design storm events. The HydroCAD worksheets are included in Section 3 and 4 of this report.

• MA DEP STORMWATER PERFORMANCE STANDARDS

The MA DEP Stormwater Management Policy was developed to improve water quality by implementing performance standards for stormwater management. The intent is to implement the stormwater management standards through the review of Notice of Intent filings by the issuing authority (Conservation Commission or DEP). The following section outlines how the proposed Stormwater Management System meets the standards set forth by the Policy.

BMP's implemented in the design include:

- ✓ Deep Sump Catch Basin
- ✓ Subsurface Infiltration System
- ✓ Specific maintenance schedule

Stormwater Best Management Practices have been incorporated into the design of the project to mitigate the anticipated pollutant loading. An Operations and Maintenance Plan has been developed for the project, which addresses the long-term maintenance requirements of the proposed system.

Temporary erosion and sedimentation controls will be incorporated into the construction phase of the project. These temporary controls may include straw bale, straw waddle, silt fence barriers, inlet sediment traps, diversion channels, slope stabilization, and stabilized construction entrances.

The Massachusetts Department of Environmental Protection has established ten (10) Stormwater

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

Management Standards. A project that meets or exceeds the standards is presumed to satisfy the regulatory requirements regarding stormwater management. The Standards are as follows:

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

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

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.

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.

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.

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

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

The following calculations demonstrate that the proposed stormwater management system is in compliance with the performance standards as outlined in the MA DEP Stormwater Management Handbook.

- STANDARD #1: The proposed development will not introduce any new outfalls with direct discharge to a wetland area or waters of the Commonwealth of Massachusetts. All existing discharges will be treated for water quality to the maximum extent practical and the rate and volumes will not be increased over existing conditions.
- STANDARD #2: The proposed development has been designed so that the post-development peak discharge rates do not exceed the predevelopment peak discharge rates. A summary of the existing and proposed discharge rates are included within this report (See page 1-2).
- STANDARD #3: The existing annual recharge for the site has been approximated in the proposed condition. These systems are designed to meet the recharge requirement to the maximum extent practical. Percentages of stormwater runoff from the roof of the proposed structure and the proposed parking area is routed through the underground infiltration.

The proposed Recharge Volume is based on the Static Method per the MA DEP Stormwater Management Standards, Volume 3, Chapter 1.

The USDA Web Soil Survey determined the site to be classified as Urban Land. Based on the urban land designation, a conservative target depth factor of 0.25-inch was assumed for the site (*Table 2.3.2 Recharge Target depth factor by Hydrologic Soil Group - Massachusetts Stormwater Handbook*). The required recharge volume is calculated as follows:

Total impervious area (taken from HydroCAD model) = 103,199 ± square feet

Recharge Volume (R_v) = (F) x (Impervious Area)

Where:

R_v = Required Recharge Volume, expressed in cubic feet

F = Target Depth Factor associated with each Hydrologic Soil Group

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

Impervious Area = proposed pavement, sidewalk, rooftop in square feet

$$\begin{aligned}\text{Recharge Volume (Rv)} &= (F) \times (\text{Impervious Area}) \\ &= (0.25 \text{ inches}) \times (1/12 \text{ inches/ft}) \times (103,199 \text{ square feet}) \\ &= 2,150 \text{ ft}^3\end{aligned}$$

Total Designed Storage Volume = 1,267 ft³ (Total storage provided by infiltration trenches)

1,267 ft³ < 2,150 ft³ Required

Note: Recharge volume provided is 59%. Since the project is classified as a re-development, recharge is provided to the maximum extent practical for the existing impervious surfaces, which in this case is greater than half the required.

- **STANDARD #4:** The proposed stormwater management system has been designed so that the 80% TSS removal standard has been met. Standard #4 is met when structural stormwater best management practices are sized to capture and treat the required water quality volume and pretreatment is provided in accordance with the Massachusetts Stormwater Handbook. Standard #4 also requires that suitable source control measures are identified in the Long-Term Pollution Prevention Plan.

<u>Stormwater Management BMP</u>	<u>TSS Removal rate</u>
Parking Lot Sweeping	5 %
Underground Infiltration	80 %
Average Annual Load	= 1.0
Parking Lot Sweeping	= <u>5.0</u> % Removal Rate
	95.0 % TSS Load Remains
TSS Load Remaining	= 95.0 %
Underground Infiltration	= <u>80.0</u> % Removal Rate
	19.0 % TSS Load Remains

Percentage of TSS Remaining - Initial TSS Load = Final TSS Removal Rate

$$19.00 - 100.0 = 81.0 \%$$

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

- STANDARD #5: The Project is not classified as a land use with higher potential pollutant loads.
- STANDARD #6: This Project site is not within a Zone II or Interim Wellhead Protection Area of a Public water supply and stormwater does not discharge to any other critical area. Consequently, this standard does not apply.
- STANDARD #7: The proposed project is considered to be a re-development project under the Stormwater Management Handbook guidelines. All MA DEP Stormwater Management Standards have been analyzed to and have been met, where required in the proposed conditions.
- STANDARD #8: A plan to control construction-related impacts, including erosion, sedimentation and other pollutant sources during construction and land disturbance activities has been developed.
- STANDARD #9: A Long-Term Operation and Maintenance (O&M) Plan has been developed for the proposed stormwater management system and is included within this document. See Section 2.0 of this report.
- STANDARD #10: There are no expected illicit discharges to the stormwater management system.

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

WPA – STORMWATER MANAGEMENT FORM CHECKLIST

See following pages



Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.¹ This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8²
- Operation and Maintenance Plan required by Standard 9

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

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

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

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

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



Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature

Signature and Date

Checklist

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

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



Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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



Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

- ☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- ☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.
- ☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

- ☐ Soil Analysis provided.
- ☒ Required Recharge Volume calculation provided.
- ☐ Required Recharge volume reduced through use of the LID site Design Credits.
- ☒ Sizing the infiltration, BMPs is based on the following method: Check the method used.
 - ☒ Static
 - ☐ Simple Dynamic
 - ☐ Dynamic Field¹
- ☐ Runoff from all impervious areas at the site discharging to the infiltration BMP.
- ☒ Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- ☐ Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- ☒ Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
 - ☒ Site is comprised solely of C and D soils and/or bedrock at the land surface
 - ☐ M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
 - ☐ Solid Waste Landfill pursuant to 310 CMR 19.000
 - ☐ Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- ☒ Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- ☐ Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.

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



Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

- ☒ The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.
- ☐ Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

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

- Good housekeeping practices;
 - Provisions for storing materials and waste products inside or under cover;
 - Vehicle washing controls;
 - Requirements for routine inspections and maintenance of stormwater BMPs;
 - Spill prevention and response plans;
 - Provisions for maintenance of lawns, gardens, and other landscaped areas;
 - Requirements for storage and use of fertilizers, herbicides, and pesticides;
 - Pet waste management provisions;
 - Provisions for operation and management of septic systems;
 - Provisions for solid waste management;
 - Snow disposal and plowing plans relative to Wetland Resource Areas;
 - Winter Road Salt and/or Sand Use and Storage restrictions;
 - Street sweeping schedules;
 - Provisions for prevention of illicit discharges to the stormwater management system;
 - Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
 - Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
 - List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.
- ☐ A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.
 - ☐ Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:
 - ☐ is within the Zone II or Interim Wellhead Protection Area
 - ☐ is near or to other critical areas
 - ☐ is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
 - ☐ involves runoff from land uses with higher potential pollutant loads.
 - ☐ The Required Water Quality Volume is reduced through use of the LID site Design Credits.
 - ☒ Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.



Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

- ☒ The BMP is sized (and calculations provided) based on:
 - ☒ The ½" or 1" Water Quality Volume or
 - ☐ The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- ☐ The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- ☐ A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

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

- ☐ The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- ☐ The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted **prior to** the discharge of stormwater to the post-construction stormwater BMPs.
- ☐ The NPDES Multi-Sector General Permit does **not** cover the land use.
- ☐ LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- ☐ All exposure has been eliminated.
- ☐ All exposure has **not** been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- ☐ The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

- ☐ The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- ☐ Critical areas and BMPs are identified in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

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

- ☒ The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:
 - ☐ Limited Project
 - ☐ Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
 - ☐ Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
 - ☐ Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
 - ☐ Bike Path and/or Foot Path
- ☒ Redevelopment Project
- ☐ Redevelopment portion of mix of new and redevelopment.
- ☐ Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.
- ☐ The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

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

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

- Narrative;
 - Construction Period Operation and Maintenance Plan;
 - Names of Persons or Entity Responsible for Plan Compliance;
 - Construction Period Pollution Prevention Measures;
 - Erosion and Sedimentation Control Plan Drawings;
 - Detail drawings and specifications for erosion control BMPs, including sizing calculations;
 - Vegetation Planning;
 - Site Development Plan;
 - Construction Sequencing Plan;
 - Sequencing of Erosion and Sedimentation Controls;
 - Operation and Maintenance of Erosion and Sedimentation Controls;
 - Inspection Schedule;
 - Maintenance Schedule;
 - Inspection and Maintenance Log Form.
- ☒ A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.



Checklist for Stormwater Report

Checklist (continued)

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

- ☐ The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- ☐ The project is **not** covered by a NPDES Construction General Permit.
- ☐ The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- ☒ The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

- ☒ The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
 - ☒ Name of the stormwater management system owners;
 - ☒ Party responsible for operation and maintenance;
 - ☒ Schedule for implementation of routine and non-routine maintenance tasks;
 - ☒ Plan showing the location of all stormwater BMPs maintenance access areas;
 - ☒ Description and delineation of public safety features;
 - ☒ Estimated operation and maintenance budget; and
 - ☒ Operation and Maintenance Log Form.
- ☐ The responsible party is **not** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
 - ☐ A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
 - ☐ A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

- ☐ The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- ☐ An Illicit Discharge Compliance Statement is attached;
- ☒ NO Illicit Discharge Compliance Statement is attached but will be submitted **prior to** the discharge of any stormwater to post-construction BMPs.

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

Section 2.0 Operation & Maintenance Plan

Section 2.0 ***Operation & Maintenance Plan***

TABLE OF CONTENTS.....	2-1
INTRODUCTION	2-2
NOTIFICATION PROCEDURES FOR CHANGE OF RESPONSIBILITY FOR O&M	2-2
CONTACT INFORMATION	2-2
CONSTRUCTION PERIOD	2-3
LONG TERM POLLUTION PREVENTION PLAN	2-4
HOUSEKEEPING.....	2-4
STORING OF MATERIALS AND WASTE PRODUCTS	2-4
VEHICLE WASHING.....	2-4
SPILL PREVENTION AND RESPONSE	2-4
MAINTENANCE OF LAWNS, GARDENS AND OTHER LANDSCAPED AREAS	2-5
STORAGE AND USE OF HERBICIDES AND PESTICIDES	2-6
PET WASTE MANAGEMENT	2-7
OPERATIONS AND MANAGEMENT OF SEPTIC SYSTEMS	2-7
MANAGEMENT OF DEICING CHEMICALS AND SNOW	2-7
LONG TERM MAINTENANCE PLAN – FACILITIES DESCRIPTION.....	2-8
INFILTRATION SYSTEMS	2-8

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

INTRODUCTION

In accordance with the standards set forth by the Stormwater Management Policy issued by the Department of Environmental Protection (DEP), Allen & Major Associates, Inc. has prepared the following Operation and Maintenance Plan for the development of 969 Shawmut Avenue, New Bedford, MA.

The plan is broken down into three major sections. The first section describes construction-related erosion and sedimentation controls (Construction Period). The second section describes the long-term pollution prevention measures (Long Term Pollution Prevention Plan). The third section is a post-construction operation and maintenance plan designed to address the long-term maintenance needs of the stormwater management system (Long Term Maintenance Plan).

NOTIFICATION PROCEDURES FOR CHANGE OF RESPONSIBILITY FOR O&M

The Stormwater Management System (SMS) for this project is operated by the New Bedford Department of Public Infrastructure. The operator shall be responsible for the long-term operation and maintenance of this SMS as outlined in this Operation and Maintenance (O&M) Plan. Should ownership of the SMS change, the owner will continue to be responsible until the succeeding owner has assumed such responsibility.

CONTACT INFORMATION

Stormwater Management System Operator: Department of Public Infrastructure
1105 Shawmut Avenue
New Bedford, MA 02746
Phone: (508) 979-1150

Emergency Contact Information:

- | | |
|--|----------------------|
| ○ Department of Public Infrastructure (Operator) | Phone (617) 654-8900 |
| ○ Allen & Major Associates, Inc. (Site Civil Engineer) | Phone (781) 935-6889 |

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

CONSTRUCTION PERIOD

1. Contact the Town of New Bedford Public Infrastructure Department at least two (2) weeks prior to start of construction.
2. Install stabilized construction entrances. Site access shall be achieved only from the designated construction entrance.
3. Prepare temporary parking and storage area. Upon implementation and installation of the following areas: trailer, parking, lay down, wheel wash, concrete washout, masons area, fuel and material storage containers, solid waste containers, etc., denote them on the site maps immediately and note any changes in the locations as they occur throughout the construction process.
4. Install the coir logs and silt sacks as shown on the enclosed site preparation plan.
5. Remove pavement & structures as indicated on plan.
6. Construct the temporary sedimentation and sediment trap basins as necessary.
7. Construct stormwater measures. Site shall be stabilized prior to stormwater measures receiving runoff.
8. Halt all activities and contact the civil engineering consultant to perform inspection of BMPs. General Contractor shall schedule and conduct storm water pre-construction meeting with engineer and all ground disturbing contractors before proceeding with construction.
9. Start construction of building pad and structures. Temporarily seed denuded areas. All cut and fill slopes shall be seeded / loamed within 72 hours of achieving finish grade, except where rip rap is applied.
10. Install storm sewers, curbs and gutters.
11. Install inlet protection devices around all storm drain structures.
12. Finalize grading, and prepare site for paving. Note, all parking lots shall be stabilized within 72 hours of achieving finish grade.
13. Pave site. Complete finish grading and install permanent seeding and planting.
14. Once site is stabilized, remove all temporary erosion and sediment control devices (after approval by town engineer, owner, Town of New Bedford, and NHDES).
15. All erosion control measures shall be inspected weekly and after all rainfall events, and shall be maintained, repaired or replaced as required or at the direction of the owner's engineer, or the town engineer.
16. Sediment accumulation up-gradient of the coir logs and silt fence greater than 6" in depth shall be removed and disposed of in accordance with all applicable regulations.

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

17. If it appears that sediment is exiting the site, silt sacks shall be installed in all catch basins adjacent to the site. Sediment accumulation on all adjacent catch basin inlets shall be removed and the silt sack replaced if torn or damaged.
18. The contractor shall comply with the general and erosion notes as shown on the site development plans.

LONG TERM POLLUTION PREVENTION PLAN

Standard #4 from the MA DEP Stormwater Management Handbook requires that a Long-Term Pollution Prevention Plan (LTPPP) be prepared and incorporated as part of the Operation and Maintenance of the Stormwater Management System. The purpose of the LTPPP is to identify potential sources of pollution that may affect the quality of stormwater discharges, and to describe the implementation of practices to reduce the pollutants in stormwater discharges. The following items describe the source control and proper procedures for the LTPPP.

○ HOUSEKEEPING

The proposed site development has been designed to maintain a high level of water quality treatment for all stormwater discharge to the existing system. An Operation and Maintenance (O&M) plan has been prepared and is included in this section of the report. The owner (or its designee) is responsible for adherence to the O&M plan in a strict and complete manner.

○ STORING OF MATERIALS AND WASTE PRODUCTS

There are no proposed exterior (un-covered) storage areas. The trash and waste program for the site includes an interior trash room.

○ VEHICLE WASHING

Outdoor vehicle washing has the potential to result in high loads of nutrients, metals, and hydrocarbons during dry weather conditions, as the detergent-rich water used to wash the grime off the vehicle enters the stormwater drainage system. The proposed project does not include any designated vehicle washing areas.

○ SPILL PREVENTION AND RESPONSE

Sources of potential spill hazards include vehicle fluids, liquid fuels, pesticides, paints, solvents, and liquid cleaning products. The majority of the spill hazards would likely occur within the building and would not enter the stormwater drainage system. However, there are spill hazards from vehicle fluids or liquid fuels located outside of the buildings. These exterior spill hazards have the potential to enter the stormwater drainage system and are to be addressed as follows:

1. Spill Hazards of pesticides, paints, and solvents shall be remediated using the Manufacturers' recommended spill cleanup protocol.
2. Vehicle fluids and liquid fuel spill shall be remediated according to the local and state regulations governing fuel spills.
3. The owner shall have the following equipment and materials on hand to address a spill clean-up: brooms, dust pans, mops, rags, gloves, absorptive material, sand, sawdust, plastic and metal trash containers.
4. All spills shall be cleaned up immediately after discovery
5. Spills of toxic or hazardous material shall be reported, regardless of size, to the Massachusetts Department of Environmental Protection at 888-304-1133.
6. Should a spill occur, the pollution prevention plan will be adjusted to include measures to prevent another spill of a similar nature. A description of the spill, along with the causes and cleanup measures will be included in the updated pollution prevention plan.

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

○ MAINTENANCE OF LAWNS, GARDENS AND OTHER LANDSCAPED AREAS

It should be recognized that this is a general guideline towards achieving high quality and well-groomed landscaped areas. The grounds staff / landscape contractor must recognize the shortcomings of a general maintenance plan such as this, and modify and/or augment it based on weekly, monthly, and yearly observations. In order to assure the highest quality conditions, the staff must also recognize and appreciate the need to be aware of the constantly changing conditions of the landscaping and be able to respond to them on a proactive basis.

▪ Fertilizer

Maintenance practices should be aimed at reducing environmental, mechanical and pest stresses to promote healthy and vigorous growth. When necessary, pest outbreaks should be treated with the most sensitive control measure available. Synthetic chemical controls should be used only as a last resort to organic and biological control methods. Fertilizer, synthetic chemical controls and pest management applications (when necessary) shall be performed only by licensed applicators in accordance with the manufacturer's label instructions when environmental conditions are conducive to controlled product application.

Only slow-release organic fertilizers should be used in the planting and mulch areas to limit the amount of nutrients that could enter downstream resource areas. Fertilization of the planting and mulch areas will be performed within manufacturers labeling instructions and shall not exceed an NPK ratio of 1:1:1 (i.e. Triple 10 fertilizer mix), considered a low nitrogen mixture. Fertilizers approved for the use under this O&M Plan are as follows:

Type:	LESCO® 28-0-12 (Lawn Fertilizer)
	MERIT® 0.2 Plus Turf Fertilizer
	MOMENTUM™ Force Weed & Feed

▪ Suggested Aeration Program

In-season aeration of lawn areas is good cultural practice, and is recommended whenever feasible. It should be accomplished with a solid thin tine aeration method to reduce disruption to the use of the area. The depth of solid tine aeration is similar to core type, but should be performed when the soil is somewhat drier for a greater overall effect.

Depending on the intensity of use, it can be expected that all landscaped lawn areas will need aeration to reduce compaction at least once per year. The first operation should occur in late May following the spring season. Methods of reducing compaction will vary based on the nature of the compaction. Compaction on newly established landscaped areas is generally limited to the top 2-3" and can be alleviated using hollow core or thin tine aeration methods.

The spring aeration should consist of two passes at opposite directions with 1/4" hollow core tines penetrating 3-5" into the soil profile. Aeration should occur when the soil is moist but not saturated. The soil cores should be shattered in place and dragged or swept back into the turf to control thatch. If desired the cores may also be removed and the area top-dressed with sand or sandy loam. If the area drains on average too slowly, the topdressing should contain a higher percentage of sand. If it is draining on average too quickly, the top dressing should contain a higher percentage of soil and organic matter.

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

▪ **Landscape Maintenance Program Practices:**

◆ **Lawn**

1. Mow a minimum of once a week in spring, to a height of 2" to 2 1/2" high. Mowing should be frequent enough so that no more than 1/3 of grass blade is removed at each mowing. The top growth supports the roots; the shorter the grass is cut, the less the roots will grow. Short cutting also dries out the soil and encourages weeds to germinate.
2. Mow approximately once every two weeks from July 1st to August 15th depending on lawn growth.
3. Mow on a ten-day cycle in fall, when growth is stimulated by cooler nights and increased moisture.
4. Do not remove grass clippings after mowing.
5. Keep mower blades sharp to prevent ragged cuts on grass leaves, which cause a brownish appearance and increase the chance for disease to enter a leaf.

◆ **Shrubs**

1. Mulch not more than 3" depth with shredded pine or fir bark.
2. Hand prune annually, immediately after blooming, to remove 1/3 of the above-ground biomass (older stems). Stem removals to occur within 6" of the ground to open up shrub and maintain two-year wood (the blooming wood).
3. Hand prune evergreen shrubs only as needed to remove dead and damaged wood and to maintain the naturalistic form of the shrub. Never mechanically shear evergreen shrubs.

◆ **Trees**

1. Provide aftercare for new tree plantings for the first three years.
2. Do not fertilize trees, it artificially stimulates them (unless tree health warrants).
3. Water once a week for the first year; twice a month the second, once a month the third year.
4. Prune trees on a four-year cycle.

◆ **Invasive Species**

1. Inform the Conservation Commission Agent prior to the removal of invasive species proposed either through hand work or through chemical removal.

○ **STORAGE AND USE OF HERBICIDES AND PESTICIDES**

Integrated Pest Management is the combination of all methods (of pest control) which may prevent, reduce, suppress, eliminate, or repel an insect population. The main requirements necessary to support any pest population are food, shelter and water, and any upset of the balance of these will assist in controlling a pest population. Scientific pest management is the knowledgeable use of all pest control methods (sanitation, mechanical, chemical) to benefit mankind's health, welfare, comfort, property and food. A Pest Management Professional (PMP) will be retained who is licensed with the Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs, Department of Agricultural Resources.

The site manager will be provided with approved bulletin before entering into or renewing an agreement to apply pesticides for the control of indoor or structural pests. 333 CMR 13.08.

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

Before beginning each application, the applicator must inform the conservation commission and post a state and local approved notice on all of the entrances to the treated room or area. The applicator must leave such notices posted after the application. The notice will be posted at conspicuous point(s) of access to the area treated. The location and number of signs will be determined by the configuration of the area to be treated based on the applicator's best judgment. It is intended to give sufficient notice that no one comes into an area being treated unaware that the applicator is working and pesticides are being applied. However, if the contracting entity does not want the signs posted, he/she may sign a Department approved waiver indicating this.

The applicator or employer will provide to any person upon their request the following information on previously conducted applications:

1. Name and phone number of pest control company
2. Date and time of the application;
3. Name and license number of the applicator
4. Target pests
5. Name and EPA Registration Number of pesticide products applied

The notification must be made in writing. The intent is so that individuals, who wish to avoid exposure or want to avoid encountering the applicator, can make necessary arrangements. Applicators are required by law to follow all directions on the pesticide label and must take all steps necessary to avoid applications with people present in a room or area to be treated. Individuals occupying a room or area to be treated at the time of application shall be informed of the procedure. Whenever possible, the applicator should not apply pesticides with anyone present. That may mean treating other areas and returning when occupants have left, asking people to leave the area while the work is being done, or treating before or after people occupy the room. If people do not leave, the applicator must make it clear that he is there to apply pesticides. The applicator will be prepared to provide whatever information possible about the pesticides and techniques used.

○ PET WASTE MANAGEMENT

The Town of New Bedford has regulations regarding the care of pets within public areas. The town has a pet waste law that requires pet owners to remove and dispose of pet waste from public areas. The owner's landscape crew (or designee) shall remove any obvious pet waste that has been left behind by pet owners within the project area. The pet waste shall be disposed of in accordance with local and state regulations.

○ OPERATIONS AND MANAGEMENT OF SEPTIC SYSTEMS

There are no proposed septic systems within the limits of the project.

○ MANAGEMENT OF DEICING CHEMICALS AND SNOW

The owner's maintenance staff (or its designee) will be responsible for the clearing of the sidewalks and building entrances. The owner may be required to use a de-icing agent such as potassium chloride to maintain a safe walking surface. The de-icing agent for the walkways and building entrances will be kept within the storage rooms located within the building. De-icing agents will not be stored outside. The owner's maintenance staff will limit the application of sand and salt.

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

LONG TERM MAINTENANCE PLAN – FACILITIES DESCRIPTION

The following is a description of the stormwater management system for the project site.

MAINTENANCE PLAN

Documentation

Maintenance documents shall include a completed maintenance checklist (attached) that will include any applicable notes or other documents as described in this section. These will be submitted to the New Bedford Public Infrastructure Department yearly.

Underground Infiltration

There are two proposed underground infiltration trench systems on-site. The proposed systems consist of 4' wide by 4' deep stone filled trenches running the length of the parallel parking spaces provided. Copies of the maintenance requirements are included in the following sections.

The owner or its designee shall maintain records of the maintenance activities completed. Maintenance documents shall include a completed maintenance checklist (attached) upon which personnel should note any abnormalities, degradations, or corrective actions (or on an extra sheet attached to it).

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

SUPPLEMENTAL INFORMATION (See following pages)

OPERATION & MAINTENANCE SCHEDULE & CHECKLIST

OPERATION AND MAINTENANCE PLAN SCHEDULE

Date: 02/09/2021



Project: 2038-03

Project Address: 969 Shawmut Avenue, New Bedford, MA

Responsible for O&M Plan: New Bedford Department of Public Infrastructure

Address: 1105 Shawmut Avenue

Phone: 508-979-1550

All information within table is derived from Massachusetts Stormwater Handbook: Volume 2, Chapter 2

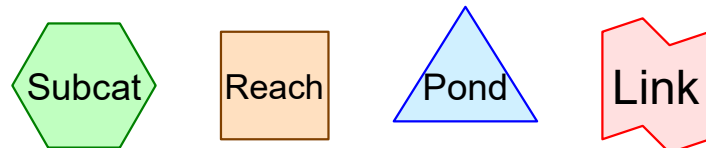
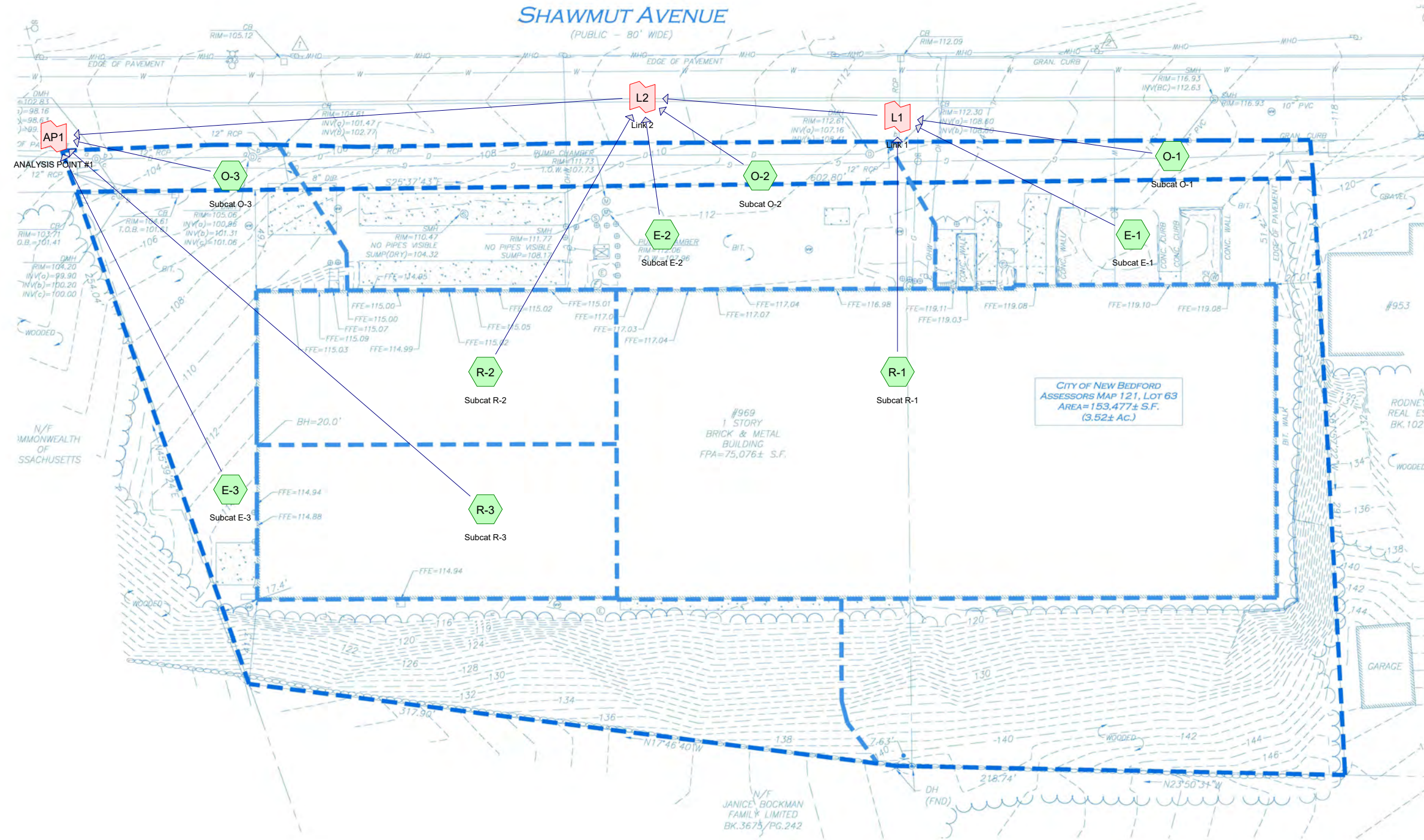
BMP CATEGORY	BMP OR MAINTENANCE ACTIVITY	SCHEDULE/FREQUENCY	NOTES	ESTIMATED ANNUAL MAINTENANCE COST	INSPECTION PERFORMED	
					DATE:	BY:
STRUCTURAL PRETREATMENT BMPs	DEEP SUMP CATCH BASIN	Four times per year (quarterly).	Inspect and clean catch basin units whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin.	\$1,000		
INFILTRATION BMPs	INFILTRATION BASIN	Inspect after every major storm during first 3 months of operation and twice a year thereafter. Clean pretreatment devices twice a year and after every major storm.	Inspect to ensure proper functioning. Mow the buffer area, side slopes, and basin bottom if grassed floor; rake if stone bottom; remove trash and debris; remove grass clippings and accumulated organic matter. Inspect and clean pretreatment devices.	\$1,500		
OTHER MAINTENANCE ACTIVITY	SNOW STORAGE	Clear and remove snow to approved storage locations as necessary to ensure systems are working properly and are protected from meltwater pollutants.	Carefully select snow disposal sites before winter. Avoid dumping removed snow over catch basins, or in detention ponds, sediment forebays, rivers, wetlands, and flood plains. It is also prohibited to dump snow in the bioretention basins or gravel swales.	\$500		
	STREET SWEEPING	Clear accumulations of winter sand in parking lots and along roadways at least once a year, preferably in the spring.	Sweep, power broom or vacuum paved areas. Submit information that confirms that all street sweepings have been completed in accordance with state and local requirements	\$2,000		

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

Section 3.0 HydroCAD Worksheets – Existing Conditions

EXISTING	1-YEAR STORM
EXISTING	10-YEAR STORM
EXISTING	25-YEAR STORM
EXISTING	100-YEAR STORM



Routing Diagram for 2038-03 - Existing HydroCAD
Prepared by Allen & Major Associates Inc., Printed 2/9/2021
HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

2038-03 - Existing HydroCAD

Prepared by Allen & Major Associates Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Printed 2/10/2021

Page 2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
2,502	86	<50% Grass cover, Poor, HSG C (E-1)
4,304	89	Gravel roads, HSG C (E-1, E-3)
36,182	98	Paved parking, HSG C (E-1, E-2, E-3)
12,302	98	Paved roads w/curbs & sewers, HSG C (O-1, O-2, O-3)
75,076	98	Roofs, HSG C (R-1, R-2, R-3)
35,469	70	Woods, Good, HSG C (E-1, E-3)
165,835	92	TOTAL AREA

2038-03 - Existing HydroCAD

Prepared by Allen & Major Associates Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Printed 2/10/2021

Page 3

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
165,835	HSG C	E-1, E-2, E-3, O-1, O-2, O-3, R-1, R-2, R-3
0	HSG D	
0	Other	
165,835		TOTAL AREA

2038-03 - Existing HydroCAD

Prepared by Allen & Major Associates Inc.

Printed 2/10/2021

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Page 4

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatchment Numbers
0	0	2,502	0	0	2,502	<50% Grass cover, Poor	E-1
0	0	4,304	0	0	4,304	Gravel roads	E-1, E-3
0	0	36,182	0	0	36,182	Paved parking	E-1, E-2, E-3
0	0	12,302	0	0	12,302	Paved roads w/curbs & sewers	O-1, O-2, O-3
0	0	75,076	0	0	75,076	Roofs	R-1, R-2, R-3
0	0	35,469	0	0	35,469	Woods, Good	E-1, E-3
0	0	165,835	0	0	165,835	TOTAL AREA	

2038-03 - Existing HydroCAD

Prepared by Allen & Major Associates Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 1-year Rainfall=2.79"

Printed 2/10/2021

Page 5

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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E-1: Subcat E-1	Runoff Area=33,536 sf 25.31% Impervious Runoff Depth=1.04" Flow Length=605' Tc=15.1 min CN=79 Runoff=0.68 cfs 2,899 cf
Subcatchment E-2: Subcat E-2	Runoff Area=14,697 sf 100.00% Impervious Runoff Depth=2.56" Tc=6.0 min CN=98 Runoff=0.89 cfs 3,134 cf
Subcatchment E-3: Subcat E-3	Runoff Area=30,224 sf 43.01% Impervious Runoff Depth=1.35" Flow Length=555' Tc=10.6 min CN=84 Runoff=0.93 cfs 3,388 cf
Subcatchment O-1: Subcat O-1	Runoff Area=3,881 sf 100.00% Impervious Runoff Depth=2.56" Tc=6.0 min CN=98 Runoff=0.23 cfs 828 cf
Subcatchment O-2: Subcat O-2	Runoff Area=6,088 sf 100.00% Impervious Runoff Depth=2.56" Tc=6.0 min CN=98 Runoff=0.37 cfs 1,298 cf
Subcatchment O-3: Subcat O-3	Runoff Area=2,333 sf 100.00% Impervious Runoff Depth=2.56" Tc=6.0 min CN=98 Runoff=0.14 cfs 498 cf
Subcatchment R-1: Subcat R-1	Runoff Area=48,720 sf 100.00% Impervious Runoff Depth=2.56" Tc=8.0 min CN=98 Runoff=2.79 cfs 10,390 cf
Subcatchment R-2: Subcat R-2	Runoff Area=13,170 sf 100.00% Impervious Runoff Depth=2.56" Tc=8.0 min CN=98 Runoff=0.75 cfs 2,809 cf
Subcatchment R-3: Subcat R-3	Runoff Area=13,186 sf 100.00% Impervious Runoff Depth=2.56" Tc=8.0 min CN=98 Runoff=0.75 cfs 2,812 cf
Link AP1: ANALYSIS POINT #1	Inflow=7.22 cfs 28,057 cf Primary=7.22 cfs 28,057 cf
Link L1: Link 1	Inflow=3.51 cfs 14,117 cf Primary=3.51 cfs 14,117 cf
Link L2: Link 2	Inflow=5.48 cfs 21,359 cf Primary=5.48 cfs 21,359 cf

Total Runoff Area = 165,835 sf Runoff Volume = 28,057 cf Average Runoff Depth = 2.03"
25.49% Pervious = 42,275 sf 74.51% Impervious = 123,560 sf

2038-03 - Existing HydroCAD

Prepared by Allen & Major Associates Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 1-year Rainfall=2.79"

Printed 2/10/2021

Page 6

Summary for Subcatchment E-1: Subcat E-1

Runoff = 0.68 cfs @ 12.22 hrs, Volume= 2,899 cf, Depth= 1.04"

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 1-year Rainfall=2.79"

Area (sf)	CN	Description
2,502	86	<50% Grass cover, Poor, HSG C
8,487	98	Paved parking, HSG C
1,701	89	Gravel roads, HSG C
20,846	70	Woods, Good, HSG C
33,536	79	Weighted Average
25,049		74.69% Pervious Area
8,487		25.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	50	0.1000	0.07		Sheet Flow, A-B
					Woods: Dense underbrush n= 0.800 P2= 3.28"
0.3	49	0.3470	2.95		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
1.7	137	0.0070	1.35		Shallow Concentrated Flow, C-D
					Unpaved Kv= 16.1 fps
2.0	369	0.0240	3.14		Shallow Concentrated Flow, D-E
					Paved Kv= 20.3 fps
15.1	605	Total			

Summary for Subcatchment E-2: Subcat E-2

Runoff = 0.89 cfs @ 12.09 hrs, Volume= 3,134 cf, Depth= 2.56"

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 1-year Rainfall=2.79"

Area (sf)	CN	Description
14,697	98	Paved parking, HSG C
14,697		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment E-3: Subcat E-3

Runoff = 0.93 cfs @ 12.15 hrs, Volume= 3,388 cf, Depth= 1.35"

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 1-year Rainfall=2.79"

Area (sf)	CN	Description
14,623	70	Woods, Good, HSG C
12,998	98	Paved parking, HSG C
2,603	89	Gravel roads, HSG C
30,224	84	Weighted Average
17,226		56.99% Pervious Area
12,998		43.01% Impervious Area

2038-03 - Existing HydroCAD

Prepared by Allen & Major Associates Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 1-year Rainfall=2.79"

Printed 2/10/2021

Page 7

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.3200	0.12		Sheet Flow, A-B
					Woods: Dense underbrush n= 0.800 P2= 3.28"
0.1	17	0.4240	3.26		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
2.7	275	0.0110	1.69		Shallow Concentrated Flow, C-D
					Unpaved Kv= 16.1 fps
0.8	213	0.0516	4.61		Shallow Concentrated Flow, D-E
					Paved Kv= 20.3 fps
10.6	555	Total			

Summary for Subcatchment O-1: Subcat O-1

Runoff = 0.23 cfs @ 12.09 hrs, Volume= 828 cf, Depth= 2.56"

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 1-year Rainfall=2.79"

Area (sf)	CN	Description
3,881	98	Paved roads w/curbs & sewers, HSG C
3,881		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment O-2: Subcat O-2

Runoff = 0.37 cfs @ 12.09 hrs, Volume= 1,298 cf, Depth= 2.56"

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 1-year Rainfall=2.79"

Area (sf)	CN	Description
6,088	98	Paved roads w/curbs & sewers, HSG C
6,088		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment O-3: Subcat O-3

Runoff = 0.14 cfs @ 12.09 hrs, Volume= 498 cf, Depth= 2.56"

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 1-year Rainfall=2.79"

Area (sf)	CN	Description
2,333	98	Paved roads w/curbs & sewers, HSG C
2,333		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment R-1: Subcat R-1

Runoff = 2.79 cfs @ 12.11 hrs, Volume= 10,390 cf, Depth= 2.56"

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 1-year Rainfall=2.79"

2038-03 - Existing HydroCAD

Prepared by Allen & Major Associates Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 1-year Rainfall=2.79"

Printed 2/10/2021

Page 8

Area (sf)	CN	Description
48,720	98	Roofs, HSG C
48,720		100.00% Impervious Area

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

Summary for Subcatchment R-2: Subcat R-2

Runoff = 0.75 cfs @ 12.11 hrs, Volume= 2,809 cf, Depth= 2.56"

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 1-year Rainfall=2.79"

Area (sf)	CN	Description
13,170	98	Roofs, HSG C
13,170		100.00% Impervious Area

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

Summary for Subcatchment R-3: Subcat R-3

Runoff = 0.75 cfs @ 12.11 hrs, Volume= 2,812 cf, Depth= 2.56"

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 1-year Rainfall=2.79"

Area (sf)	CN	Description
13,186	98	Roofs, HSG C
13,186		100.00% Impervious Area

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

Summary for Link AP1: ANALYSIS POINT #1Inflow Area = 165,835 sf, 74.51% Impervious, Inflow Depth = 2.03" for 1-year event
Inflow = 7.22 cfs @ 12.11 hrs, Volume= 28,057 cf
Primary = 7.22 cfs @ 12.11 hrs, Volume= 28,057 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link L1: Link 1Inflow Area = 86,137 sf, 70.92% Impervious, Inflow Depth = 1.97" for 1-year event
Inflow = 3.51 cfs @ 12.12 hrs, Volume= 14,117 cf
Primary = 3.51 cfs @ 12.12 hrs, Volume= 14,117 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link L2: Link 2Inflow Area = 120,092 sf, 79.14% Impervious, Inflow Depth = 2.13" for 1-year event
Inflow = 5.48 cfs @ 12.11 hrs, Volume= 21,359 cf
Primary = 5.48 cfs @ 12.11 hrs, Volume= 21,359 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

2038-03 - Existing HydroCAD

Prepared by Allen & Major Associates Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.84"

Printed 2/10/2021

Page 9

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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E-1: Subcat E-1Runoff Area=33,536 sf 25.31% Impervious Runoff Depth=2.66"
Flow Length=605' Tc=15.1 min CN=79 Runoff=1.81 cfs 7,446 cf**Subcatchment E-2: Subcat E-2**Runoff Area=14,697 sf 100.00% Impervious Runoff Depth=4.60"
Tc=6.0 min CN=98 Runoff=1.56 cfs 5,638 cf**Subcatchment E-3: Subcat E-3**Runoff Area=30,224 sf 43.01% Impervious Runoff Depth=3.12"
Flow Length=555' Tc=10.6 min CN=84 Runoff=2.15 cfs 7,869 cf**Subcatchment O-1: Subcat O-1**Runoff Area=3,881 sf 100.00% Impervious Runoff Depth=4.60"
Tc=6.0 min CN=98 Runoff=0.41 cfs 1,489 cf**Subcatchment O-2: Subcat O-2**Runoff Area=6,088 sf 100.00% Impervious Runoff Depth=4.60"
Tc=6.0 min CN=98 Runoff=0.65 cfs 2,335 cf**Subcatchment O-3: Subcat O-3**Runoff Area=2,333 sf 100.00% Impervious Runoff Depth=4.60"
Tc=6.0 min CN=98 Runoff=0.25 cfs 895 cf**Subcatchment R-1: Subcat R-1**Runoff Area=48,720 sf 100.00% Impervious Runoff Depth=4.60"
Tc=8.0 min CN=98 Runoff=4.89 cfs 18,690 cf**Subcatchment R-2: Subcat R-2**Runoff Area=13,170 sf 100.00% Impervious Runoff Depth=4.60"
Tc=8.0 min CN=98 Runoff=1.32 cfs 5,052 cf**Subcatchment R-3: Subcat R-3**Runoff Area=13,186 sf 100.00% Impervious Runoff Depth=4.60"
Tc=8.0 min CN=98 Runoff=1.32 cfs 5,058 cf**Link AP1: ANALYSIS POINT #1**Inflow=13.73 cfs 54,473 cf
Primary=13.73 cfs 54,473 cf**Link L1: Link 1**Inflow=6.70 cfs 27,625 cf
Primary=6.70 cfs 27,625 cf**Link L2: Link 2**Inflow=10.14 cfs 40,651 cf
Primary=10.14 cfs 40,651 cf**Total Runoff Area = 165,835 sf Runoff Volume = 54,473 cf Average Runoff Depth = 3.94"**
25.49% Pervious = 42,275 sf 74.51% Impervious = 123,560 sf

2038-03 - Existing HydroCAD

Prepared by Allen & Major Associates Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.84"

Printed 2/10/2021

Page 10

Summary for Subcatchment E-1: Subcat E-1

Runoff = 1.81 cfs @ 12.21 hrs, Volume= 7,446 cf, Depth= 2.66"

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 Rainfall=4.84"

Area (sf)	CN	Description
2,502	86	<50% Grass cover, Poor, HSG C
8,487	98	Paved parking, HSG C
1,701	89	Gravel roads, HSG C
20,846	70	Woods, Good, HSG C
33,536	79	Weighted Average
25,049		74.69% Pervious Area
8,487		25.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	50	0.1000	0.07		Sheet Flow, A-B
					Woods: Dense underbrush n= 0.800 P2= 3.28"
0.3	49	0.3470	2.95		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
1.7	137	0.0070	1.35		Shallow Concentrated Flow, C-D
					Unpaved Kv= 16.1 fps
2.0	369	0.0240	3.14		Shallow Concentrated Flow, D-E
					Paved Kv= 20.3 fps
15.1	605	Total			

Summary for Subcatchment E-2: Subcat E-2

Runoff = 1.56 cfs @ 12.09 hrs, Volume= 5,638 cf, Depth= 4.60"

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 Rainfall=4.84"

Area (sf)	CN	Description
14,697	98	Paved parking, HSG C
14,697		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment E-3: Subcat E-3

Runoff = 2.15 cfs @ 12.15 hrs, Volume= 7,869 cf, Depth= 3.12"

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 Rainfall=4.84"

Area (sf)	CN	Description
14,623	70	Woods, Good, HSG C
12,998	98	Paved parking, HSG C
2,603	89	Gravel roads, HSG C
30,224	84	Weighted Average
17,226		56.99% Pervious Area
12,998		43.01% Impervious Area

2038-03 - Existing HydroCAD

Prepared by Allen & Major Associates Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.84"

Printed 2/10/2021

Page 11

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.3200	0.12		Sheet Flow, A-B
					Woods: Dense underbrush n= 0.800 P2= 3.28"
0.1	17	0.4240	3.26		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
2.7	275	0.0110	1.69		Shallow Concentrated Flow, C-D
					Unpaved Kv= 16.1 fps
0.8	213	0.0516	4.61		Shallow Concentrated Flow, D-E
					Paved Kv= 20.3 fps
10.6	555	Total			

Summary for Subcatchment O-1: Subcat O-1

Runoff = 0.41 cfs @ 12.09 hrs, Volume= 1,489 cf, Depth= 4.60"

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 Rainfall=4.84"

Area (sf)	CN	Description
3,881	98	Paved roads w/curbs & sewers, HSG C
3,881		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment O-2: Subcat O-2

Runoff = 0.65 cfs @ 12.09 hrs, Volume= 2,335 cf, Depth= 4.60"

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 Rainfall=4.84"

Area (sf)	CN	Description
6,088	98	Paved roads w/curbs & sewers, HSG C
6,088		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment O-3: Subcat O-3

Runoff = 0.25 cfs @ 12.09 hrs, Volume= 895 cf, Depth= 4.60"

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 Rainfall=4.84"

Area (sf)	CN	Description
2,333	98	Paved roads w/curbs & sewers, HSG C
2,333		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment R-1: Subcat R-1

Runoff = 4.89 cfs @ 12.11 hrs, Volume= 18,690 cf, Depth= 4.60"

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 Rainfall=4.84"

2038-03 - Existing HydroCAD

Prepared by Allen & Major Associates Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.84"

Printed 2/10/2021

Page 12

Area (sf)	CN	Description
48,720	98	Roofs, HSG C
48,720		100.00% Impervious Area

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

Summary for Subcatchment R-2: Subcat R-2

Runoff = 1.32 cfs @ 12.11 hrs, Volume= 5,052 cf, Depth= 4.60"

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 Rainfall=4.84"

Area (sf)	CN	Description
13,170	98	Roofs, HSG C
13,170		100.00% Impervious Area

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

Summary for Subcatchment R-3: Subcat R-3

Runoff = 1.32 cfs @ 12.11 hrs, Volume= 5,058 cf, Depth= 4.60"

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 Rainfall=4.84"

Area (sf)	CN	Description
13,186	98	Roofs, HSG C
13,186		100.00% Impervious Area

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

Summary for Link AP1: ANALYSIS POINT #1Inflow Area = 165,835 sf, 74.51% Impervious, Inflow Depth = 3.94" for 10-year event
Inflow = 13.73 cfs @ 12.11 hrs, Volume= 54,473 cf
Primary = 13.73 cfs @ 12.11 hrs, Volume= 54,473 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link L1: Link 1Inflow Area = 86,137 sf, 70.92% Impervious, Inflow Depth = 3.85" for 10-year event
Inflow = 6.70 cfs @ 12.12 hrs, Volume= 27,625 cf
Primary = 6.70 cfs @ 12.12 hrs, Volume= 27,625 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link L2: Link 2Inflow Area = 120,092 sf, 79.14% Impervious, Inflow Depth = 4.06" for 10-year event
Inflow = 10.14 cfs @ 12.11 hrs, Volume= 40,651 cf
Primary = 10.14 cfs @ 12.11 hrs, Volume= 40,651 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

2038-03 - Existing HydroCAD

Prepared by Allen & Major Associates Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.03"

Printed 2/10/2021

Page 13

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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E-1: Subcat E-1	Runoff Area=33,536 sf 25.31% Impervious Runoff Depth=3.71" Flow Length=605' Tc=15.1 min CN=79 Runoff=2.51 cfs 10,358 cf
Subcatchment E-2: Subcat E-2	Runoff Area=14,697 sf 100.00% Impervious Runoff Depth=5.79" Tc=6.0 min CN=98 Runoff=1.95 cfs 7,094 cf
Subcatchment E-3: Subcat E-3	Runoff Area=30,224 sf 43.01% Impervious Runoff Depth=4.22" Flow Length=555' Tc=10.6 min CN=84 Runoff=2.88 cfs 10,640 cf
Subcatchment O-1: Subcat O-1	Runoff Area=3,881 sf 100.00% Impervious Runoff Depth=5.79" Tc=6.0 min CN=98 Runoff=0.51 cfs 1,873 cf
Subcatchment O-2: Subcat O-2	Runoff Area=6,088 sf 100.00% Impervious Runoff Depth=5.79" Tc=6.0 min CN=98 Runoff=0.81 cfs 2,938 cf
Subcatchment O-3: Subcat O-3	Runoff Area=2,333 sf 100.00% Impervious Runoff Depth=5.79" Tc=6.0 min CN=98 Runoff=0.31 cfs 1,126 cf
Subcatchment R-1: Subcat R-1	Runoff Area=48,720 sf 100.00% Impervious Runoff Depth=5.79" Tc=8.0 min CN=98 Runoff=6.11 cfs 23,515 cf
Subcatchment R-2: Subcat R-2	Runoff Area=13,170 sf 100.00% Impervious Runoff Depth=5.79" Tc=8.0 min CN=98 Runoff=1.65 cfs 6,357 cf
Subcatchment R-3: Subcat R-3	Runoff Area=13,186 sf 100.00% Impervious Runoff Depth=5.79" Tc=8.0 min CN=98 Runoff=1.65 cfs 6,364 cf
Link AP1: ANALYSIS POINT #1	Inflow=17.56 cfs 70,265 cf Primary=17.56 cfs 70,265 cf
Link L1: Link 1	Inflow=8.60 cfs 35,746 cf Primary=8.60 cfs 35,746 cf
Link L2: Link 2	Inflow=12.88 cfs 52,135 cf Primary=12.88 cfs 52,135 cf

Total Runoff Area = 165,835 sf Runoff Volume = 70,265 cf Average Runoff Depth = 5.08"
25.49% Pervious = 42,275 sf 74.51% Impervious = 123,560 sf

2038-03 - Existing HydroCAD

Prepared by Allen & Major Associates Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.03"

Printed 2/10/2021

Page 14

Summary for Subcatchment E-1: Subcat E-1

Runoff = 2.51 cfs @ 12.21 hrs, Volume= 10,358 cf, Depth= 3.71"

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 Rainfall=6.03"

Area (sf)	CN	Description
2,502	86	<50% Grass cover, Poor, HSG C
8,487	98	Paved parking, HSG C
1,701	89	Gravel roads, HSG C
20,846	70	Woods, Good, HSG C
33,536	79	Weighted Average
25,049		74.69% Pervious Area
8,487		25.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	50	0.1000	0.07		Sheet Flow, A-B
					Woods: Dense underbrush n= 0.800 P2= 3.28"
0.3	49	0.3470	2.95		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
1.7	137	0.0070	1.35		Shallow Concentrated Flow, C-D
					Unpaved Kv= 16.1 fps
2.0	369	0.0240	3.14		Shallow Concentrated Flow, D-E
					Paved Kv= 20.3 fps
15.1	605	Total			

Summary for Subcatchment E-2: Subcat E-2

Runoff = 1.95 cfs @ 12.09 hrs, Volume= 7,094 cf, Depth= 5.79"

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 Rainfall=6.03"

Area (sf)	CN	Description
14,697	98	Paved parking, HSG C
14,697		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment E-3: Subcat E-3

Runoff = 2.88 cfs @ 12.15 hrs, Volume= 10,640 cf, Depth= 4.22"

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 Rainfall=6.03"

Area (sf)	CN	Description
14,623	70	Woods, Good, HSG C
12,998	98	Paved parking, HSG C
2,603	89	Gravel roads, HSG C
30,224	84	Weighted Average
17,226		56.99% Pervious Area
12,998		43.01% Impervious Area

2038-03 - Existing HydroCAD

Prepared by Allen & Major Associates Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.03"

Printed 2/10/2021

Page 15

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.3200	0.12		Sheet Flow, A-B
					Woods: Dense underbrush n= 0.800 P2= 3.28"
0.1	17	0.4240	3.26		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
2.7	275	0.0110	1.69		Shallow Concentrated Flow, C-D
					Unpaved Kv= 16.1 fps
0.8	213	0.0516	4.61		Shallow Concentrated Flow, D-E
					Paved Kv= 20.3 fps
10.6	555	Total			

Summary for Subcatchment O-1: Subcat O-1

Runoff = 0.51 cfs @ 12.09 hrs, Volume= 1,873 cf, Depth= 5.79"

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 Rainfall=6.03"

Area (sf)	CN	Description
3,881	98	Paved roads w/curbs & sewers, HSG C
3,881		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment O-2: Subcat O-2

Runoff = 0.81 cfs @ 12.09 hrs, Volume= 2,938 cf, Depth= 5.79"

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 Rainfall=6.03"

Area (sf)	CN	Description
6,088	98	Paved roads w/curbs & sewers, HSG C
6,088		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment O-3: Subcat O-3

Runoff = 0.31 cfs @ 12.09 hrs, Volume= 1,126 cf, Depth= 5.79"

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 Rainfall=6.03"

Area (sf)	CN	Description
2,333	98	Paved roads w/curbs & sewers, HSG C
2,333		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment R-1: Subcat R-1

Runoff = 6.11 cfs @ 12.11 hrs, Volume= 23,515 cf, Depth= 5.79"

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 Rainfall=6.03"

2038-03 - Existing HydroCAD

Prepared by Allen & Major Associates Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.03"

Printed 2/10/2021

Page 16

Area (sf)	CN	Description
48,720	98	Roofs, HSG C
48,720		100.00% Impervious Area

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

Summary for Subcatchment R-2: Subcat R-2

Runoff = 1.65 cfs @ 12.11 hrs, Volume= 6,357 cf, Depth= 5.79"

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 Rainfall=6.03"

Area (sf)	CN	Description
13,170	98	Roofs, HSG C
13,170		100.00% Impervious Area

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

Summary for Subcatchment R-3: Subcat R-3

Runoff = 1.65 cfs @ 12.11 hrs, Volume= 6,364 cf, Depth= 5.79"

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 Rainfall=6.03"

Area (sf)	CN	Description
13,186	98	Roofs, HSG C
13,186		100.00% Impervious Area

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

Summary for Link AP1: ANALYSIS POINT #1Inflow Area = 165,835 sf, 74.51% Impervious, Inflow Depth = 5.08" for 25-year event
Inflow = 17.56 cfs @ 12.11 hrs, Volume= 70,265 cf
Primary = 17.56 cfs @ 12.11 hrs, Volume= 70,265 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link L1: Link 1Inflow Area = 86,137 sf, 70.92% Impervious, Inflow Depth = 4.98" for 25-year event
Inflow = 8.60 cfs @ 12.12 hrs, Volume= 35,746 cf
Primary = 8.60 cfs @ 12.12 hrs, Volume= 35,746 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link L2: Link 2Inflow Area = 120,092 sf, 79.14% Impervious, Inflow Depth = 5.21" for 25-year event
Inflow = 12.88 cfs @ 12.11 hrs, Volume= 52,135 cf
Primary = 12.88 cfs @ 12.11 hrs, Volume= 52,135 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

2038-03 - Existing HydroCAD

Prepared by Allen & Major Associates Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.41"

Printed 2/10/2021

Page 17

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 Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment E-1: Subcat E-1Runoff Area=33,536 sf 25.31% Impervious Runoff Depth=5.89"
Flow Length=605' Tc=15.1 min CN=79 Runoff=3.95 cfs 16,463 cf**Subcatchment E-2: Subcat E-2**Runoff Area=14,697 sf 100.00% Impervious Runoff Depth=8.17"
Tc=6.0 min CN=98 Runoff=2.72 cfs 10,006 cf**Subcatchment E-3: Subcat E-3**Runoff Area=30,224 sf 43.01% Impervious Runoff Depth=6.49"
Flow Length=555' Tc=10.6 min CN=84 Runoff=4.34 cfs 16,345 cf**Subcatchment O-1: Subcat O-1**Runoff Area=3,881 sf 100.00% Impervious Runoff Depth=8.17"
Tc=6.0 min CN=98 Runoff=0.72 cfs 2,642 cf**Subcatchment O-2: Subcat O-2**Runoff Area=6,088 sf 100.00% Impervious Runoff Depth=8.17"
Tc=6.0 min CN=98 Runoff=1.13 cfs 4,145 cf**Subcatchment O-3: Subcat O-3**Runoff Area=2,333 sf 100.00% Impervious Runoff Depth=8.17"
Tc=6.0 min CN=98 Runoff=0.43 cfs 1,588 cf**Subcatchment R-1: Subcat R-1**Runoff Area=48,720 sf 100.00% Impervious Runoff Depth=8.17"
Tc=8.0 min CN=98 Runoff=8.54 cfs 33,170 cf**Subcatchment R-2: Subcat R-2**Runoff Area=13,170 sf 100.00% Impervious Runoff Depth=8.17"
Tc=8.0 min CN=98 Runoff=2.31 cfs 8,967 cf**Subcatchment R-3: Subcat R-3**Runoff Area=13,186 sf 100.00% Impervious Runoff Depth=8.17"
Tc=8.0 min CN=98 Runoff=2.31 cfs 8,977 cf**Link AP1: ANALYSIS POINT #1**Inflow=25.27 cfs 102,303 cf
Primary=25.27 cfs 102,303 cf**Link L1: Link 1**Inflow=12.42 cfs 52,275 cf
Primary=12.42 cfs 52,275 cf**Link L2: Link 2**Inflow=18.40 cfs 75,393 cf
Primary=18.40 cfs 75,393 cf**Total Runoff Area = 165,835 sf Runoff Volume = 102,303 cf Average Runoff Depth = 7.40"**
25.49% Pervious = 42,275 sf 74.51% Impervious = 123,560 sf

2038-03 - Existing HydroCAD

Prepared by Allen & Major Associates Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.41"

Printed 2/10/2021

Page 18

Summary for Subcatchment E-1: Subcat E-1

Runoff = 3.95 cfs @ 12.21 hrs, Volume= 16,463 cf, Depth= 5.89"

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 Rainfall=8.41"

Area (sf)	CN	Description
2,502	86	<50% Grass cover, Poor, HSG C
8,487	98	Paved parking, HSG C
1,701	89	Gravel roads, HSG C
20,846	70	Woods, Good, HSG C
33,536	79	Weighted Average
25,049		74.69% Pervious Area
8,487		25.31% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	50	0.1000	0.07		Sheet Flow, A-B
					Woods: Dense underbrush n= 0.800 P2= 3.28"
0.3	49	0.3470	2.95		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
1.7	137	0.0070	1.35		Shallow Concentrated Flow, C-D
					Unpaved Kv= 16.1 fps
2.0	369	0.0240	3.14		Shallow Concentrated Flow, D-E
					Paved Kv= 20.3 fps
15.1	605	Total			

Summary for Subcatchment E-2: Subcat E-2

Runoff = 2.72 cfs @ 12.09 hrs, Volume= 10,006 cf, Depth= 8.17"

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 Rainfall=8.41"

Area (sf)	CN	Description
14,697	98	Paved parking, HSG C
14,697		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment E-3: Subcat E-3

Runoff = 4.34 cfs @ 12.15 hrs, Volume= 16,345 cf, Depth= 6.49"

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 Rainfall=8.41"

Area (sf)	CN	Description
14,623	70	Woods, Good, HSG C
12,998	98	Paved parking, HSG C
2,603	89	Gravel roads, HSG C
30,224	84	Weighted Average
17,226		56.99% Pervious Area
12,998		43.01% Impervious Area

2038-03 - Existing HydroCAD

Prepared by Allen & Major Associates Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.41"

Printed 2/10/2021

Page 19

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.3200	0.12		Sheet Flow, A-B
					Woods: Dense underbrush n= 0.800 P2= 3.28"
0.1	17	0.4240	3.26		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
2.7	275	0.0110	1.69		Shallow Concentrated Flow, C-D
					Unpaved Kv= 16.1 fps
0.8	213	0.0516	4.61		Shallow Concentrated Flow, D-E
					Paved Kv= 20.3 fps
10.6	555	Total			

Summary for Subcatchment O-1: Subcat O-1

Runoff = 0.72 cfs @ 12.09 hrs, Volume= 2,642 cf, Depth= 8.17"

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 Rainfall=8.41"

Area (sf)	CN	Description
3,881	98	Paved roads w/curbs & sewers, HSG C
3,881		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment O-2: Subcat O-2

Runoff = 1.13 cfs @ 12.09 hrs, Volume= 4,145 cf, Depth= 8.17"

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 Rainfall=8.41"

Area (sf)	CN	Description
6,088	98	Paved roads w/curbs & sewers, HSG C
6,088		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment O-3: Subcat O-3

Runoff = 0.43 cfs @ 12.09 hrs, Volume= 1,588 cf, Depth= 8.17"

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 Rainfall=8.41"

Area (sf)	CN	Description
2,333	98	Paved roads w/curbs & sewers, HSG C
2,333		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment R-1: Subcat R-1

Runoff = 8.54 cfs @ 12.11 hrs, Volume= 33,170 cf, Depth= 8.17"

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 Rainfall=8.41"

2038-03 - Existing HydroCAD

Prepared by Allen & Major Associates Inc.

HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.41"

Printed 2/10/2021

Page 20

Area (sf)	CN	Description
48,720	98	Roofs, HSG C
48,720		100.00% Impervious Area

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

Summary for Subcatchment R-2: Subcat R-2

Runoff = 2.31 cfs @ 12.11 hrs, Volume= 8,967 cf, Depth= 8.17"

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 Rainfall=8.41"

Area (sf)	CN	Description
13,170	98	Roofs, HSG C
13,170		100.00% Impervious Area

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

Summary for Subcatchment R-3: Subcat R-3

Runoff = 2.31 cfs @ 12.11 hrs, Volume= 8,977 cf, Depth= 8.17"

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 Rainfall=8.41"

Area (sf)	CN	Description
13,186	98	Roofs, HSG C
13,186		100.00% Impervious Area

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

Summary for Link AP1: ANALYSIS POINT #1Inflow Area = 165,835 sf, 74.51% Impervious, Inflow Depth = 7.40" for 100-year event
Inflow = 25.27 cfs @ 12.11 hrs, Volume= 102,303 cf
Primary = 25.27 cfs @ 12.11 hrs, Volume= 102,303 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link L1: Link 1Inflow Area = 86,137 sf, 70.92% Impervious, Inflow Depth = 7.28" for 100-year event
Inflow = 12.42 cfs @ 12.12 hrs, Volume= 52,275 cf
Primary = 12.42 cfs @ 12.12 hrs, Volume= 52,275 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link L2: Link 2Inflow Area = 120,092 sf, 79.14% Impervious, Inflow Depth = 7.53" for 100-year event
Inflow = 18.40 cfs @ 12.11 hrs, Volume= 75,393 cf
Primary = 18.40 cfs @ 12.11 hrs, Volume= 75,393 cf, Atten= 0%, Lag= 0.0 min

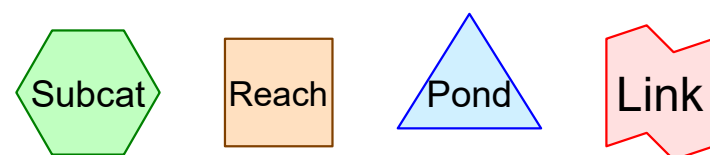
Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

Section 4.0 HydroCAD Worksheets – Proposed Conditions

PROPOSED	1-YEAR STORM
PROPOSED	10-YEAR STORM
PROPOSED	25-YEAR STORM
PROPOSED	100-YEAR STORM



Prepared by Allen & Major Associates Inc., Printed 2/9/2021
HydroCAD® 10.00-26 s/n 02947 © 2020 HydroCAD Software Solutions LLC

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Printed 2/10/2021

Page 2

Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
23,823	74	>75% Grass cover, Good, HSG C (O-1, O-2, O-3, O-4, P-1, P-2, P-3, P-3A, P-4)
3,460	89	Gravel roads, HSG C (P-1, P-3)
23,945	98	Paved parking, HSG C (P-1, P-2A, P-3, P-3A, P-4)
696	98	Paved roads w/curbs & sewers, HSG C (O-1, O-2, O-3, O-4)
75,835	98	Roofs, HSG C (P-1, P-3, P-3A, R-1, R-2, R-3)
594	79	Stone riprap, Good, HSG C (P-2A, P-3A)
2,013	98	Unconnected pavement, HSG C (O-3, O-4, P-1, P-2A, P-3A, P-4)
35,469	70	Woods, Good, HSG C (P-1, P-3)
165,835	88	TOTAL AREA

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Printed 2/10/2021

Page 3

Soil Listing (all nodes)

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
0	HSG B	
165,835	HSG C	O-1, O-2, O-3, O-4, P-1, P-2, P-2A, P-3, P-3A, P-4, R-1, R-2, R-3
0	HSG D	
0	Other	
165,835		TOTAL AREA

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Printed 2/10/2021

Page 4

Ground Covers (all nodes)

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Subcatchment Numbers
0	0	23,823	0	0	23,823	>75% Grass cover, Good	O-1, O-2, O-3, O-4, P-1, P-2, P-3, P-3A, P-4
0	0	3,460	0	0	3,460	Gravel roads	P-1, P-3
0	0	23,945	0	0	23,945	Paved parking	P-1, P-2A, P-3, P-3A, P-4
0	0	696	0	0	696	Paved roads w/curbs & sewers	O-1, O-2, O-3, O-4
0	0	75,835	0	0	75,835	Roofs	P-1, P-3, P-3A, R-1, R-2, R-3
0	0	594	0	0	594	Stone riprap, Good	P-2A, P-3A
0	0	2,013	0	0	2,013	Unconnected pavement	O-3, O-4, P-1, P-2A, P-3A, P-4
0	0	35,469	0	0	35,469	Woods, Good	P-1, P-3
0	0	165,835	0	0	165,835	TOTAL AREA	

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 1-year Rainfall=2.79"

Printed 2/10/2021

Page 5

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

SubcatchmentO-1: Subcat O-1	Runoff Area=2,582 sf 4.61% Impervious Runoff Depth=0.83" Tc=6.0 min CN=75 Runoff=0.05 cfs 178 cf
SubcatchmentO-2: Subcat O-2	Runoff Area=2,582 sf 4.61% Impervious Runoff Depth=0.83" Tc=6.0 min CN=75 Runoff=0.05 cfs 178 cf
SubcatchmentO-3: Subcat O-3	Runoff Area=4,583 sf 18.52% Impervious Runoff Depth=0.93" Tc=6.0 min UI Adjusted CN=77 Runoff=0.11 cfs 354 cf
SubcatchmentO-4: Subcat O-4	Runoff Area=2,612 sf 34.30% Impervious Runoff Depth=1.22" Tc=6.0 min CN=82 Runoff=0.08 cfs 265 cf
SubcatchmentP-1: Subcat P-1	Runoff Area=30,736 sf 18.69% Impervious Runoff Depth=0.93" Flow Length=618' Tc=15.4 min CN=77 Runoff=0.54 cfs 2,377 cf
SubcatchmentP-2: Subcat P-2	Runoff Area=2,030 sf 0.00% Impervious Runoff Depth=0.78" Tc=6.0 min CN=74 Runoff=0.04 cfs 132 cf
SubcatchmentP-2A: Subcat P-2A	Runoff Area=4,643 sf 94.31% Impervious Runoff Depth=2.45" Tc=6.0 min CN=97 Runoff=0.28 cfs 948 cf
SubcatchmentP-3: Subcat P-3	Runoff Area=29,216 sf 28.59% Impervious Runoff Depth=1.09" Flow Length=560' Tc=10.7 min CN=80 Runoff=0.71 cfs 2,665 cf
SubcatchmentP-3A: Subcat P-3A	Runoff Area=5,400 sf 77.83% Impervious Runoff Depth=2.05" Tc=6.0 min CN=93 Runoff=0.28 cfs 924 cf
SubcatchmentP-4: Subcat P-4	Runoff Area=6,375 sf 43.14% Impervious Runoff Depth=1.35" Tc=6.0 min CN=84 Runoff=0.23 cfs 715 cf
SubcatchmentR-1: Subcat R-1	Runoff Area=48,720 sf 100.00% Impervious Runoff Depth=2.56" Tc=8.0 min CN=98 Runoff=2.79 cfs 10,390 cf
SubcatchmentR-2: Subcat R-2	Runoff Area=13,170 sf 100.00% Impervious Runoff Depth=2.56" Tc=8.0 min CN=98 Runoff=0.75 cfs 2,809 cf
SubcatchmentR-3: Subcat R-3	Runoff Area=13,186 sf 100.00% Impervious Runoff Depth=2.56" Tc=8.0 min CN=98 Runoff=0.75 cfs 2,812 cf
Pond IT-1: Infiltration Trench #1	Peak Elev=113.92' Storage=691 cf Inflow=1.03 cfs 3,733 cf Discarded=0.01 cfs 815 cf Primary=1.07 cfs 2,534 cf Outflow=1.07 cfs 3,349 cf
Pond IT-2: Infiltration Trench #2	Peak Elev=117.90' Storage=549 cf Inflow=0.28 cfs 948 cf Discarded=0.01 cfs 610 cf Primary=0.03 cfs 91 cf Outflow=0.04 cfs 701 cf
Link AP1: ANALYSISPOINT #1	Inflow=6.18 cfs 22,692 cf Primary=6.18 cfs 22,692 cf
Link L1: Link 1	Inflow=3.26 cfs 13,169 cf Primary=3.26 cfs 13,169 cf
Link L2: Link 2	Inflow=3.72 cfs 14,680 cf Primary=3.72 cfs 14,680 cf

Total Runoff Area = 165,835 sf Runoff Volume = 24,747 cf Average Runoff Depth = 1.79"
38.20% Pervious = 63,346 sf 61.80% Impervious = 102,489 sf

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 1-year Rainfall=2.79"

Printed 2/10/2021

Page 6

Summary for Subcatchment O-1: Subcat O-1

Runoff = 0.05 cfs @ 12.10 hrs, Volume= 178 cf, Depth= 0.83"

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 1-year Rainfall=2.79"

Area (sf)	CN	Description
119	98	Paved roads w/curbs & sewers, HSG C
2,463	74	>75% Grass cover, Good, HSG C
2,582	75	Weighted Average
2,463		95.39% Pervious Area
119		4.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment O-2: Subcat O-2

Runoff = 0.05 cfs @ 12.10 hrs, Volume= 178 cf, Depth= 0.83"

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 1-year Rainfall=2.79"

Area (sf)	CN	Description
119	98	Paved roads w/curbs & sewers, HSG C
2,463	74	>75% Grass cover, Good, HSG C
2,582	75	Weighted Average
2,463		95.39% Pervious Area
119		4.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment O-3: Subcat O-3

Runoff = 0.11 cfs @ 12.10 hrs, Volume= 354 cf, Depth= 0.93"

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 1-year Rainfall=2.79"

Area (sf)	CN	Adj	Description
283	98		Paved roads w/curbs & sewers, HSG C
566	98		Unconnected pavement, HSG C
3,734	74		>75% Grass cover, Good, HSG C
4,583	78	77	Weighted Average, UI Adjusted
3,734			81.48% Pervious Area
849			18.52% Impervious Area
566			66.67% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment O-4: Subcat O-4

Runoff = 0.08 cfs @ 12.10 hrs, Volume= 265 cf, Depth= 1.22"

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 1-year Rainfall=2.79"

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 1-year Rainfall=2.79"

Printed 2/10/2021

Page 7

Area (sf)	CN	Description
175	98	Paved roads w/curbs & sewers, HSG C
1,716	74	>75% Grass cover, Good, HSG C
721	98	Unconnected pavement, HSG C
2,612	82	Weighted Average
1,716		65.70% Pervious Area
896		34.30% Impervious Area
721		80.47% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment P-1: Subcat P-1

Runoff = 0.54 cfs @ 12.23 hrs, Volume= 2,377 cf, Depth= 0.93"

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 1-year Rainfall=2.79"

Area (sf)	CN	Description
2,444	74	>75% Grass cover, Good, HSG C
5,393	98	Paved parking, HSG C
1,702	89	Gravel roads, HSG C
20,846	70	Woods, Good, HSG C
39	98	Unconnected pavement, HSG C
312	98	Roofs, HSG C
30,736	77	Weighted Average
24,992		81.31% Pervious Area
5,744		18.69% Impervious Area
39		0.68% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	50	0.1000	0.07		Sheet Flow, A-B
					Woods: Dense underbrush n= 0.800 P2= 3.28"
0.3	49	0.3470	2.95		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
1.7	137	0.0070	1.35		Shallow Concentrated Flow, C-D
					Unpaved Kv= 16.1 fps
2.3	382	0.0180	2.72		Shallow Concentrated Flow, D-E
					Paved Kv= 20.3 fps
15.4	618	Total			

Summary for Subcatchment P-2: Subcat P-2

Runoff = 0.04 cfs @ 12.10 hrs, Volume= 132 cf, Depth= 0.78"

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 1-year Rainfall=2.79"

Area (sf)	CN	Description
2,030	74	>75% Grass cover, Good, HSG C
2,030		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 1-year Rainfall=2.79"

Printed 2/10/2021

Page 8

Summary for Subcatchment P-2A: Subcat P-2A

Runoff = 0.28 cfs @ 12.09 hrs, Volume= 948 cf, Depth= 2.45"

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 1-year Rainfall=2.79"

Area (sf)	CN	Description
4,016	98	Paved parking, HSG C
363	98	Unconnected pavement, HSG C
264	79	Stone riprap, Good, HSG C
4,643	97	Weighted Average
264		5.69% Pervious Area
4,379		94.31% Impervious Area
363		8.29% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment P-3: Subcat P-3

Runoff = 0.71 cfs @ 12.16 hrs, Volume= 2,665 cf, Depth= 1.09"

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 1-year Rainfall=2.79"

Area (sf)	CN	Description
14,623	70	Woods, Good, HSG C
8,157	98	Paved parking, HSG C
1,758	89	Gravel roads, HSG C
4,481	74	>75% Grass cover, Good, HSG C
197	98	Roofs, HSG C
29,216	80	Weighted Average
20,862		71.41% Pervious Area
8,354		28.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.3200	0.12		Sheet Flow, A-B Woods: Dense underbrush n= 0.800 P2= 3.28"
0.1	17	0.3530	2.97		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
2.9	285	0.0105	1.65		Shallow Concentrated Flow, C-D Unpaved Kv= 16.1 fps
0.7	208	0.0529	4.67		Shallow Concentrated Flow, D-E Paved Kv= 20.3 fps
10.7	560	Total			

Summary for Subcatchment P-3A: Subcat P-3A

Runoff = 0.28 cfs @ 12.09 hrs, Volume= 924 cf, Depth= 2.05"

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 1-year Rainfall=2.79"

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 1-year Rainfall=2.79"

Printed 2/10/2021

Page 9

Area (sf)	CN	Description
3,778	98	Paved parking, HSG C
867	74	>75% Grass cover, Good, HSG C
250	98	Roofs, HSG C
175	98	Unconnected pavement, HSG C
330	79	Stone riprap, Good, HSG C
5,400	93	Weighted Average
1,197		22.17% Pervious Area
4,203		77.83% Impervious Area
175		4.16% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment P-4: Subcat P-4

Runoff = 0.23 cfs @ 12.09 hrs, Volume= 715 cf, Depth= 1.35"

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 1-year Rainfall=2.79"

Area (sf)	CN	Description
2,601	98	Paved parking, HSG C
149	98	Unconnected pavement, HSG C
3,625	74	>75% Grass cover, Good, HSG C
6,375	84	Weighted Average
3,625		56.86% Pervious Area
2,750		43.14% Impervious Area
149		5.42% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment R-1: Subcat R-1

Runoff = 2.79 cfs @ 12.11 hrs, Volume= 10,390 cf, Depth= 2.56"

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 1-year Rainfall=2.79"

Area (sf)	CN	Description
48,720	98	Roofs, HSG C
48,720		100.00% Impervious Area

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

Summary for Subcatchment R-2: Subcat R-2

Runoff = 0.75 cfs @ 12.11 hrs, Volume= 2,809 cf, Depth= 2.56"

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 1-year Rainfall=2.79"

Area (sf)	CN	Description
13,170	98	Roofs, HSG C
13,170		100.00% Impervious Area

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.
 HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 1-year Rainfall=2.79"

Printed 2/10/2021

Page 10

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

Summary for Subcatchment R-3: Subcat R-3

Runoff = 0.75 cfs @ 12.11 hrs, Volume= 2,812 cf, Depth= 2.56"

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 1-year Rainfall=2.79"

Area (sf)	CN	Description
13,186	98	Roofs, HSG C
13,186		100.00% Impervious Area

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

Summary for Pond IT-1: Infiltration Trench #1

Infiltration Rate = 0.459 IN/HR

[88] Warning: Qout>Qin may require smaller dt or Finer Routing

[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=8)

Inflow Area = 18,570 sf, 93.55% Impervious, Inflow Depth = 2.41" for 1-year event
 Inflow = 1.03 cfs @ 12.10 hrs, Volume= 3,733 cf
 Outflow = 1.07 cfs @ 12.10 hrs, Volume= 3,349 cf, Atten= 0%, Lag= 0.0 min
 Discarded = 0.01 cfs @ 12.10 hrs, Volume= 815 cf
 Primary = 1.07 cfs @ 12.10 hrs, Volume= 2,534 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 113.92' @ 12.10 hrs Surf.Area= 440 sf Storage= 691 cf
 Flood Elev= 114.00' Surf.Area= 440 sf Storage= 704 cf

Plug-Flow detention time= 178.1 min calculated for 3,344 cf (90% of inflow)
 Center-of-Mass det. time= 129.1 min (899.3 - 770.2)

Volume	Invert	Avail.Storage	Storage Description
#1	110.00'	704 cf	Custom Stage Data (Conic) Listed below (Recalc) 1,760 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
110.00	440	0	0	440
114.00	440	1,760	1,760	737

Device	Routing	Invert	Outlet Devices
#1	Primary	113.90'	110.0' long x 3.0' 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 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

#2 Discarded 110.00' **0.459 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.01 cfs @ 12.10 hrs HW=113.92' (Free Discharge)
 ↑ **2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.98 cfs @ 12.10 hrs HW=113.92' (Free Discharge)
 ↑ **1=Broad-Crested Rectangular Weir**(Weir Controls 0.98 cfs @ 0.38 fps)

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 1-year Rainfall=2.79"

Printed 2/10/2021

Page 11

Summary for Pond IT-2: Infiltration Trench #2

Infiltration Rate = 0.459 IN/HR

[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=17)

Inflow Area = 4,643 sf, 94.31% Impervious, Inflow Depth = 2.45" for 1-year event
 Inflow = 0.28 cfs @ 12.09 hrs, Volume= 948 cf
 Outflow = 0.04 cfs @ 12.90 hrs, Volume= 701 cf, Atten= 86%, Lag= 49.1 min
 Discarded = 0.01 cfs @ 12.90 hrs, Volume= 610 cf
 Primary = 0.03 cfs @ 12.90 hrs, Volume= 91 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 117.90' @ 12.90 hrs Surf.Area= 352 sf Storage= 549 cf
 Flood Elev= 118.00' Surf.Area= 352 sf Storage= 563 cf

Plug-Flow detention time= 533.2 min calculated for 701 cf (74% of inflow)
 Center-of-Mass det. time= 446.7 min (1,216.3 - 769.6)

Volume	Invert	Avail.Storage	Storage Description												
#1	114.00'	563 cf	Custom Stage Data (Conic) Listed below (Recalc) 1,408 cf Overall x 40.0% Voids												
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)											
114.00	352	0	0	352											
118.00	352	1,408	1,408	618											
Device	Routing	Invert	Outlet Devices												
#1	Primary	117.90'	88.0' long x 3.0' 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 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32												
#2	Discarded	114.00'	0.459 in/hr Exfiltration over Wetted area												

Discarded OutFlow Max=0.01 cfs @ 12.90 hrs HW=117.90' (Free Discharge)
 ↑ **2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.01 cfs @ 12.90 hrs HW=117.90' (Free Discharge)
 ↑ **1=Broad-Crested Rectangular Weir** (Weir Controls 0.01 cfs @ 0.08 fps)

Summary for Link AP1: ANALYSIS POINT #1

Inflow Area = 165,835 sf, 61.80% Impervious, Inflow Depth = 1.64" for 1-year event
 Inflow = 6.18 cfs @ 12.11 hrs, Volume= 22,692 cf
 Primary = 6.18 cfs @ 12.11 hrs, Volume= 22,692 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link L1: Link 1

Inflow Area = 88,711 sf, 66.47% Impervious, Inflow Depth = 1.78" for 1-year event
 Inflow = 3.26 cfs @ 12.12 hrs, Volume= 13,169 cf
 Primary = 3.26 cfs @ 12.12 hrs, Volume= 13,169 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link L2: Link 2

Inflow Area = 104,863 sf, 60.63% Impervious, Inflow Depth = 1.68" for 1-year event
 Inflow = 3.72 cfs @ 12.11 hrs, Volume= 14,680 cf
 Primary = 3.72 cfs @ 12.11 hrs, Volume= 14,680 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.84"

Printed 2/10/2021

Page 12

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

SubcatchmentO-1: Subcat O-1	Runoff Area=2,582 sf 4.61% Impervious Runoff Depth=2.32" Tc=6.0 min CN=75 Runoff=0.16 cfs 499 cf
SubcatchmentO-2: Subcat O-2	Runoff Area=2,582 sf 4.61% Impervious Runoff Depth=2.32" Tc=6.0 min CN=75 Runoff=0.16 cfs 499 cf
SubcatchmentO-3: Subcat O-3	Runoff Area=4,583 sf 18.52% Impervious Runoff Depth=2.49" Tc=6.0 min UI Adjusted CN=77 Runoff=0.30 cfs 951 cf
SubcatchmentO-4: Subcat O-4	Runoff Area=2,612 sf 34.30% Impervious Runoff Depth=2.94" Tc=6.0 min CN=82 Runoff=0.20 cfs 639 cf
SubcatchmentP-1: Subcat P-1	Runoff Area=30,736 sf 18.69% Impervious Runoff Depth=2.49" Flow Length=618' Tc=15.4 min CN=77 Runoff=1.53 cfs 6,377 cf
SubcatchmentP-2: Subcat P-2	Runoff Area=2,030 sf 0.00% Impervious Runoff Depth=2.24" Tc=6.0 min CN=74 Runoff=0.12 cfs 378 cf
SubcatchmentP-2A: Subcat P-2A	Runoff Area=4,643 sf 94.31% Impervious Runoff Depth=4.49" Tc=6.0 min CN=97 Runoff=0.49 cfs 1,736 cf
SubcatchmentP-3: Subcat P-3	Runoff Area=29,216 sf 28.59% Impervious Runoff Depth=2.75" Flow Length=560' Tc=10.7 min CN=80 Runoff=1.84 cfs 6,704 cf
SubcatchmentP-3A: Subcat P-3A	Runoff Area=5,400 sf 77.83% Impervious Runoff Depth=4.04" Tc=6.0 min CN=93 Runoff=0.54 cfs 1,818 cf
SubcatchmentP-4: Subcat P-4	Runoff Area=6,375 sf 43.14% Impervious Runoff Depth=3.12" Tc=6.0 min CN=84 Runoff=0.52 cfs 1,660 cf
SubcatchmentR-1: Subcat R-1	Runoff Area=48,720 sf 100.00% Impervious Runoff Depth=4.60" Tc=8.0 min CN=98 Runoff=4.89 cfs 18,690 cf
SubcatchmentR-2: Subcat R-2	Runoff Area=13,170 sf 100.00% Impervious Runoff Depth=4.60" Tc=8.0 min CN=98 Runoff=1.32 cfs 5,052 cf
SubcatchmentR-3: Subcat R-3	Runoff Area=13,186 sf 100.00% Impervious Runoff Depth=4.60" Tc=8.0 min CN=98 Runoff=1.32 cfs 5,058 cf
Pond IT-1: Infiltration Trench #1	Peak Elev=113.93' Storage=692 cf Inflow=1.85 cfs 6,871 cf Discarded=0.01 cfs 863 cf Primary=1.84 cfs 5,622 cf Outflow=1.85 cfs 6,486 cf
Pond IT-2: Infiltration Trench #2	Peak Elev=117.92' Storage=552 cf Inflow=0.49 cfs 1,736 cf Discarded=0.01 cfs 664 cf Primary=0.60 cfs 785 cf Outflow=0.61 cfs 1,449 cf
Link AP1: ANALYSISPOINT #1	Inflow=12.72 cfs 47,864 cf Primary=12.72 cfs 47,864 cf
Link L1: Link 1	Inflow=6.70 cfs 26,730 cf Primary=6.70 cfs 26,730 cf
Link L2: Link 2	Inflow=7.84 cfs 30,479 cf Primary=7.84 cfs 30,479 cf

Total Runoff Area = 165,835 sf Runoff Volume = 50,064 cf Average Runoff Depth = 3.62"
38.20% Pervious = 63,346 sf 61.80% Impervious = 102,489 sf

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.84"

Printed 2/10/2021

Page 13

Summary for Subcatchment O-1: Subcat O-1

Runoff = 0.16 cfs @ 12.09 hrs, Volume= 499 cf, Depth= 2.32"

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 Rainfall=4.84"

Area (sf)	CN	Description
119	98	Paved roads w/curbs & sewers, HSG C
2,463	74	>75% Grass cover, Good, HSG C
2,582	75	Weighted Average
2,463		95.39% Pervious Area
119		4.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment O-2: Subcat O-2

Runoff = 0.16 cfs @ 12.09 hrs, Volume= 499 cf, Depth= 2.32"

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 Rainfall=4.84"

Area (sf)	CN	Description
119	98	Paved roads w/curbs & sewers, HSG C
2,463	74	>75% Grass cover, Good, HSG C
2,582	75	Weighted Average
2,463		95.39% Pervious Area
119		4.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment O-3: Subcat O-3

Runoff = 0.30 cfs @ 12.09 hrs, Volume= 951 cf, Depth= 2.49"

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 Rainfall=4.84"

Area (sf)	CN	Adj	Description
283	98		Paved roads w/curbs & sewers, HSG C
566	98		Unconnected pavement, HSG C
3,734	74		>75% Grass cover, Good, HSG C
4,583	78	77	Weighted Average, UI Adjusted
3,734			81.48% Pervious Area
849			18.52% Impervious Area
566			66.67% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment O-4: Subcat O-4

Runoff = 0.20 cfs @ 12.09 hrs, Volume= 639 cf, Depth= 2.94"

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 Rainfall=4.84"

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.84"

Printed 2/10/2021

Page 14

Area (sf)	CN	Description
175	98	Paved roads w/curbs & sewers, HSG C
1,716	74	>75% Grass cover, Good, HSG C
721	98	Unconnected pavement, HSG C
2,612	82	Weighted Average
1,716		65.70% Pervious Area
896		34.30% Impervious Area
721		80.47% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment P-1: Subcat P-1

Runoff = 1.53 cfs @ 12.22 hrs, Volume= 6,377 cf, Depth= 2.49"

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 Rainfall=4.84"

Area (sf)	CN	Description
2,444	74	>75% Grass cover, Good, HSG C
5,393	98	Paved parking, HSG C
1,702	89	Gravel roads, HSG C
20,846	70	Woods, Good, HSG C
39	98	Unconnected pavement, HSG C
312	98	Roofs, HSG C
30,736	77	Weighted Average
24,992		81.31% Pervious Area
5,744		18.69% Impervious Area
39		0.68% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	50	0.1000	0.07		Sheet Flow, A-B
					Woods: Dense underbrush n= 0.800 P2= 3.28"
0.3	49	0.3470	2.95		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
1.7	137	0.0070	1.35		Shallow Concentrated Flow, C-D
					Unpaved Kv= 16.1 fps
2.3	382	0.0180	2.72		Shallow Concentrated Flow, D-E
					Paved Kv= 20.3 fps
15.4	618	Total			

Summary for Subcatchment P-2: Subcat P-2

Runoff = 0.12 cfs @ 12.10 hrs, Volume= 378 cf, Depth= 2.24"

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 Rainfall=4.84"

Area (sf)	CN	Description
2,030	74	>75% Grass cover, Good, HSG C
2,030		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.84"

Printed 2/10/2021

Page 15

Summary for Subcatchment P-2A: Subcat P-2A

Runoff = 0.49 cfs @ 12.09 hrs, Volume= 1,736 cf, Depth= 4.49"

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 Rainfall=4.84"

Area (sf)	CN	Description
4,016	98	Paved parking, HSG C
363	98	Unconnected pavement, HSG C
264	79	Stone riprap, Good, HSG C
4,643	97	Weighted Average
264		5.69% Pervious Area
4,379		94.31% Impervious Area
363		8.29% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment P-3: Subcat P-3

Runoff = 1.84 cfs @ 12.15 hrs, Volume= 6,704 cf, Depth= 2.75"

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 Rainfall=4.84"

Area (sf)	CN	Description
14,623	70	Woods, Good, HSG C
8,157	98	Paved parking, HSG C
1,758	89	Gravel roads, HSG C
4,481	74	>75% Grass cover, Good, HSG C
197	98	Roofs, HSG C
29,216	80	Weighted Average
20,862		71.41% Pervious Area
8,354		28.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.3200	0.12		Sheet Flow, A-B Woods: Dense underbrush n= 0.800 P2= 3.28"
0.1	17	0.3530	2.97		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
2.9	285	0.0105	1.65		Shallow Concentrated Flow, C-D Unpaved Kv= 16.1 fps
0.7	208	0.0529	4.67		Shallow Concentrated Flow, D-E Paved Kv= 20.3 fps
10.7	560	Total			

Summary for Subcatchment P-3A: Subcat P-3A

Runoff = 0.54 cfs @ 12.09 hrs, Volume= 1,818 cf, Depth= 4.04"

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 10-year Rainfall=4.84"

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.
 HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.84"

Printed 2/10/2021

Page 16

Area (sf)	CN	Description
3,778	98	Paved parking, HSG C
867	74	>75% Grass cover, Good, HSG C
250	98	Roofs, HSG C
175	98	Unconnected pavement, HSG C
330	79	Stone riprap, Good, HSG C
5,400	93	Weighted Average
1,197		22.17% Pervious Area
4,203		77.83% Impervious Area
175		4.16% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment P-4: Subcat P-4

Runoff = 0.52 cfs @ 12.09 hrs, Volume= 1,660 cf, Depth= 3.12"

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 Rainfall=4.84"

Area (sf)	CN	Description
2,601	98	Paved parking, HSG C
149	98	Unconnected pavement, HSG C
3,625	74	>75% Grass cover, Good, HSG C
6,375	84	Weighted Average
3,625		56.86% Pervious Area
2,750		43.14% Impervious Area
149		5.42% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment R-1: Subcat R-1

Runoff = 4.89 cfs @ 12.11 hrs, Volume= 18,690 cf, Depth= 4.60"

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 Rainfall=4.84"

Area (sf)	CN	Description
48,720	98	Roofs, HSG C
48,720		100.00% Impervious Area

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

Summary for Subcatchment R-2: Subcat R-2

Runoff = 1.32 cfs @ 12.11 hrs, Volume= 5,052 cf, Depth= 4.60"

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 Rainfall=4.84"

Area (sf)	CN	Description
13,170	98	Roofs, HSG C
13,170		100.00% Impervious Area

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.
 HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 10-year Rainfall=4.84"

Printed 2/10/2021

Page 17

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

Summary for Subcatchment R-3: Subcat R-3

Runoff = 1.32 cfs @ 12.11 hrs, Volume= 5,058 cf, Depth= 4.60"

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 Rainfall=4.84"

Area (sf)	CN	Description
13,186	98	Roofs, HSG C
13,186		100.00% Impervious Area

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

Summary for Pond IT-1: Infiltration Trench #1

Infiltration Rate = 0.459 IN/HR

[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=7)

Inflow Area = 18,570 sf, 93.55% Impervious, Inflow Depth = 4.44" for 10-year event
 Inflow = 1.85 cfs @ 12.10 hrs, Volume= 6,871 cf
 Outflow = 1.85 cfs @ 12.10 hrs, Volume= 6,486 cf, Atten= 0%, Lag= 0.0 min
 Discarded = 0.01 cfs @ 12.10 hrs, Volume= 863 cf
 Primary = 1.84 cfs @ 12.10 hrs, Volume= 5,622 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 113.93' @ 12.10 hrs Surf.Area= 440 sf Storage= 692 cf
 Flood Elev= 114.00' Surf.Area= 440 sf Storage= 704 cf

Plug-Flow detention time= 112.2 min calculated for 6,486 cf (94% of inflow)
 Center-of-Mass det. time= 80.3 min (838.3 - 758.1)

Volume	Invert	Avail.Storage	Storage Description
#1	110.00'	704 cf	Custom Stage Data (Conic) Listed below (Recalc) 1,760 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
110.00	440	0	0	440
114.00	440	1,760	1,760	737

Device	Routing	Invert	Outlet Devices
#1	Primary	113.90'	110.0' long x 3.0' 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 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

#2 Discarded 110.00' **0.459 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.01 cfs @ 12.10 hrs HW=113.93' (Free Discharge)
 ↳ **2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=1.64 cfs @ 12.10 hrs HW=113.93' (Free Discharge)
 ↳ **1=Broad-Crested Rectangular Weir**(Weir Controls 1.64 cfs @ 0.45 fps)

Summary for Pond IT-2: Infiltration Trench #2

Infiltration Rate = 0.459 IN/HR

[88] Warning: Qout>Qin may require smaller dt or Finer Routing

[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=19)

Inflow Area = 4,643 sf, 94.31% Impervious, Inflow Depth = 4.49" for 10-year event
 Inflow = 0.49 cfs @ 12.09 hrs, Volume= 1,736 cf
 Outflow = 0.61 cfs @ 12.06 hrs, Volume= 1,449 cf, Atten= 0%, Lag= 0.0 min
 Discarded = 0.01 cfs @ 12.05 hrs, Volume= 664 cf
 Primary = 0.60 cfs @ 12.06 hrs, Volume= 785 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 117.92' @ 12.05 hrs Surf.Area= 352 sf Storage= 552 cf
 Flood Elev= 118.00' Surf.Area= 352 sf Storage= 563 cf

Plug-Flow detention time= 294.6 min calculated for 1,447 cf (83% of inflow)
 Center-of-Mass det. time= 227.4 min (983.8 - 756.4)

Volume	Invert	Avail.Storage	Storage Description												
#1	114.00'	563 cf	Custom Stage Data (Conic) Listed below (Recalc) 1,408 cf Overall x 40.0% Voids												
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)											
114.00	352	0	0	352											
118.00	352	1,408	1,408	618											
Device	Routing	Invert	Outlet Devices												
#1	Primary	117.90'	88.0' long x 3.0' 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 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32												
#2	Discarded	114.00'	0.459 in/hr Exfiltration over Wetted area												

Discarded OutFlow Max=0.01 cfs @ 12.05 hrs HW=117.92' (Free Discharge)↑**2=Exfiltration** (Exfiltration Controls 0.01 cfs)**Primary OutFlow** Max=0.49 cfs @ 12.06 hrs HW=117.92' (Free Discharge)↑**1=Broad-Crested Rectangular Weir**(Weir Controls 0.49 cfs @ 0.32 fps)**Summary for Link AP1: ANALYSIS POINT #1**

Inflow Area = 165,835 sf, 61.80% Impervious, Inflow Depth = 3.46" for 10-year event
 Inflow = 12.72 cfs @ 12.12 hrs, Volume= 47,864 cf
 Primary = 12.72 cfs @ 12.12 hrs, Volume= 47,864 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link L1: Link 1

Inflow Area = 88,711 sf, 66.47% Impervious, Inflow Depth = 3.62" for 10-year event
 Inflow = 6.70 cfs @ 12.12 hrs, Volume= 26,730 cf
 Primary = 6.70 cfs @ 12.12 hrs, Volume= 26,730 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link L2: Link 2

Inflow Area = 104,863 sf, 60.63% Impervious, Inflow Depth = 3.49" for 10-year event
 Inflow = 7.84 cfs @ 12.12 hrs, Volume= 30,479 cf
 Primary = 7.84 cfs @ 12.12 hrs, Volume= 30,479 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.03"

Printed 2/10/2021

Page 19

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

SubcatchmentO-1: Subcat O-1	Runoff Area=2,582 sf 4.61% Impervious Runoff Depth=3.31" Tc=6.0 min CN=75 Runoff=0.23 cfs 712 cf
SubcatchmentO-2: Subcat O-2	Runoff Area=2,582 sf 4.61% Impervious Runoff Depth=3.31" Tc=6.0 min CN=75 Runoff=0.23 cfs 712 cf
SubcatchmentO-3: Subcat O-3	Runoff Area=4,583 sf 18.52% Impervious Runoff Depth=3.51" Tc=6.0 min UI Adjusted CN=77 Runoff=0.42 cfs 1,339 cf
SubcatchmentO-4: Subcat O-4	Runoff Area=2,612 sf 34.30% Impervious Runoff Depth=4.01" Tc=6.0 min CN=82 Runoff=0.27 cfs 874 cf
SubcatchmentP-1: Subcat P-1	Runoff Area=30,736 sf 18.69% Impervious Runoff Depth=3.51" Flow Length=618' Tc=15.4 min CN=77 Runoff=2.16 cfs 8,978 cf
SubcatchmentP-2: Subcat P-2	Runoff Area=2,030 sf 0.00% Impervious Runoff Depth=3.21" Tc=6.0 min CN=74 Runoff=0.17 cfs 543 cf
SubcatchmentP-2A: Subcat P-2A	Runoff Area=4,643 sf 94.31% Impervious Runoff Depth=5.67" Tc=6.0 min CN=97 Runoff=0.61 cfs 2,195 cf
SubcatchmentP-3: Subcat P-3	Runoff Area=29,216 sf 28.59% Impervious Runoff Depth=3.81" Flow Length=560' Tc=10.7 min CN=80 Runoff=2.53 cfs 9,272 cf
SubcatchmentP-3A: Subcat P-3A	Runoff Area=5,400 sf 77.83% Impervious Runoff Depth=5.21" Tc=6.0 min CN=93 Runoff=0.69 cfs 2,345 cf
SubcatchmentP-4: Subcat P-4	Runoff Area=6,375 sf 43.14% Impervious Runoff Depth=4.22" Tc=6.0 min CN=84 Runoff=0.70 cfs 2,244 cf
SubcatchmentR-1: Subcat R-1	Runoff Area=48,720 sf 100.00% Impervious Runoff Depth=5.79" Tc=8.0 min CN=98 Runoff=6.11 cfs 23,515 cf
SubcatchmentR-2: Subcat R-2	Runoff Area=13,170 sf 100.00% Impervious Runoff Depth=5.79" Tc=8.0 min CN=98 Runoff=1.65 cfs 6,357 cf
SubcatchmentR-3: Subcat R-3	Runoff Area=13,186 sf 100.00% Impervious Runoff Depth=5.79" Tc=8.0 min CN=98 Runoff=1.65 cfs 6,364 cf
Pond IT-1: Infiltration Trench #1	Peak Elev=113.94' Storage=693 cf Inflow=2.33 cfs 8,702 cf Discarded=0.01 cfs 880 cf Primary=2.32 cfs 7,437 cf Outflow=2.33 cfs 8,317 cf
Pond IT-2: Infiltration Trench #2	Peak Elev=117.92' Storage=552 cf Inflow=0.61 cfs 2,195 cf Discarded=0.01 cfs 681 cf Primary=0.64 cfs 1,218 cf Outflow=0.64 cfs 1,899 cf
Link AP1: ANALYSISPOINT #1	Inflow=16.70 cfs 63,207 cf Primary=16.70 cfs 63,207 cf
Link L1: Link 1	Inflow=8.78 cfs 34,966 cf Primary=8.78 cfs 34,966 cf
Link L2: Link 2	Inflow=10.35 cfs 40,134 cf Primary=10.35 cfs 40,134 cf

Total Runoff Area = 165,835 sf Runoff Volume = 65,450 cf Average Runoff Depth = 4.74"
38.20% Pervious = 63,346 sf 61.80% Impervious = 102,489 sf

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.03"

Printed 2/10/2021

Page 20

Summary for Subcatchment O-1: Subcat O-1

Runoff = 0.23 cfs @ 12.09 hrs, Volume= 712 cf, Depth= 3.31"

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 Rainfall=6.03"

Area (sf)	CN	Description
119	98	Paved roads w/curbs & sewers, HSG C
2,463	74	>75% Grass cover, Good, HSG C
2,582	75	Weighted Average
2,463		95.39% Pervious Area
119		4.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment O-2: Subcat O-2

Runoff = 0.23 cfs @ 12.09 hrs, Volume= 712 cf, Depth= 3.31"

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 Rainfall=6.03"

Area (sf)	CN	Description
119	98	Paved roads w/curbs & sewers, HSG C
2,463	74	>75% Grass cover, Good, HSG C
2,582	75	Weighted Average
2,463		95.39% Pervious Area
119		4.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment O-3: Subcat O-3

Runoff = 0.42 cfs @ 12.09 hrs, Volume= 1,339 cf, Depth= 3.51"

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 Rainfall=6.03"

Area (sf)	CN	Adj	Description
283	98		Paved roads w/curbs & sewers, HSG C
566	98		Unconnected pavement, HSG C
3,734	74		>75% Grass cover, Good, HSG C
4,583	78	77	Weighted Average, UI Adjusted
3,734			81.48% Pervious Area
849			18.52% Impervious Area
566			66.67% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment O-4: Subcat O-4

Runoff = 0.27 cfs @ 12.09 hrs, Volume= 874 cf, Depth= 4.01"

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 Rainfall=6.03"

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.03"

Printed 2/10/2021

Page 21

Area (sf)	CN	Description
175	98	Paved roads w/curbs & sewers, HSG C
1,716	74	>75% Grass cover, Good, HSG C
721	98	Unconnected pavement, HSG C
2,612	82	Weighted Average
1,716		65.70% Pervious Area
896		34.30% Impervious Area
721		80.47% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment P-1: Subcat P-1

Runoff = 2.16 cfs @ 12.21 hrs, Volume= 8,978 cf, Depth= 3.51"

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 Rainfall=6.03"

Area (sf)	CN	Description
2,444	74	>75% Grass cover, Good, HSG C
5,393	98	Paved parking, HSG C
1,702	89	Gravel roads, HSG C
20,846	70	Woods, Good, HSG C
39	98	Unconnected pavement, HSG C
312	98	Roofs, HSG C
30,736	77	Weighted Average
24,992		81.31% Pervious Area
5,744		18.69% Impervious Area
39		0.68% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	50	0.1000	0.07		Sheet Flow, A-B
					Woods: Dense underbrush n= 0.800 P2= 3.28"
0.3	49	0.3470	2.95		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
1.7	137	0.0070	1.35		Shallow Concentrated Flow, C-D
					Unpaved Kv= 16.1 fps
2.3	382	0.0180	2.72		Shallow Concentrated Flow, D-E
					Paved Kv= 20.3 fps
15.4	618	Total			

Summary for Subcatchment P-2: Subcat P-2

Runoff = 0.17 cfs @ 12.09 hrs, Volume= 543 cf, Depth= 3.21"

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 Rainfall=6.03"

Area (sf)	CN	Description
2,030	74	>75% Grass cover, Good, HSG C
2,030		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.03"

Printed 2/10/2021

Page 22

Summary for Subcatchment P-2A: Subcat P-2A

Runoff = 0.61 cfs @ 12.09 hrs, Volume= 2,195 cf, Depth= 5.67"

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 Rainfall=6.03"

Area (sf)	CN	Description			
4,016	98	Paved parking, HSG C			
363	98	Unconnected pavement, HSG C			
264	79	Stone riprap, Good, HSG C			
4,643	97	Weighted Average			
264		5.69% Pervious Area			
4,379		94.31% Impervious Area			
363		8.29% Unconnected			
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment P-3: Subcat P-3

Runoff = 2.53 cfs @ 12.15 hrs, Volume= 9,272 cf, Depth= 3.81"

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 Rainfall=6.03"

Area (sf)	CN	Description			
14,623	70	Woods, Good, HSG C			
8,157	98	Paved parking, HSG C			
1,758	89	Gravel roads, HSG C			
4,481	74	>75% Grass cover, Good, HSG C			
197	98	Roofs, HSG C			
29,216	80	Weighted Average			
20,862		71.41% Pervious Area			
8,354		28.59% Impervious Area			
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.3200	0.12		Sheet Flow, A-B Woods: Dense underbrush n= 0.800 P2= 3.28"
0.1	17	0.3530	2.97		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
2.9	285	0.0105	1.65		Shallow Concentrated Flow, C-D Unpaved Kv= 16.1 fps
0.7	208	0.0529	4.67		Shallow Concentrated Flow, D-E Paved Kv= 20.3 fps
10.7	560	Total			

Summary for Subcatchment P-3A: Subcat P-3A

Runoff = 0.69 cfs @ 12.09 hrs, Volume= 2,345 cf, Depth= 5.21"

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 Rainfall=6.03"

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.
 HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.03"

Printed 2/10/2021

Page 23

Area (sf)	CN	Description
3,778	98	Paved parking, HSG C
867	74	>75% Grass cover, Good, HSG C
250	98	Roofs, HSG C
175	98	Unconnected pavement, HSG C
330	79	Stone riprap, Good, HSG C

5,400	93	Weighted Average
1,197		22.17% Pervious Area
4,203		77.83% Impervious Area
175		4.16% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment P-4: Subcat P-4

Runoff = 0.70 cfs @ 12.09 hrs, Volume= 2,244 cf, Depth= 4.22"

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 Rainfall=6.03"

Area (sf)	CN	Description
2,601	98	Paved parking, HSG C
149	98	Unconnected pavement, HSG C
3,625	74	>75% Grass cover, Good, HSG C
6,375	84	Weighted Average
3,625		56.86% Pervious Area
2,750		43.14% Impervious Area
149		5.42% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment R-1: Subcat R-1

Runoff = 6.11 cfs @ 12.11 hrs, Volume= 23,515 cf, Depth= 5.79"

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 Rainfall=6.03"

Area (sf)	CN	Description
48,720	98	Roofs, HSG C
48,720		100.00% Impervious Area

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

Summary for Subcatchment R-2: Subcat R-2

Runoff = 1.65 cfs @ 12.11 hrs, Volume= 6,357 cf, Depth= 5.79"

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 Rainfall=6.03"

Area (sf)	CN	Description
13,170	98	Roofs, HSG C
13,170		100.00% Impervious Area

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.
 HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 25-year Rainfall=6.03"

Printed 2/10/2021

Page 24

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

Summary for Subcatchment R-3: Subcat R-3

Runoff = 1.65 cfs @ 12.11 hrs, Volume= 6,364 cf, Depth= 5.79"

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 Rainfall=6.03"

Area (sf)	CN	Description
13,186	98	Roofs, HSG C
13,186		100.00% Impervious Area

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

Summary for Pond IT-1: Infiltration Trench #1

Infiltration Rate = 0.459 IN/HR

[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=6)

Inflow Area = 18,570 sf, 93.55% Impervious, Inflow Depth = 5.62" for 25-year event
 Inflow = 2.33 cfs @ 12.10 hrs, Volume= 8,702 cf
 Outflow = 2.33 cfs @ 12.10 hrs, Volume= 8,317 cf, Atten= 0%, Lag= 0.0 min
 Discarded = 0.01 cfs @ 12.10 hrs, Volume= 880 cf
 Primary = 2.32 cfs @ 12.10 hrs, Volume= 7,437 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 113.94' @ 12.10 hrs Surf.Area= 440 sf Storage= 693 cf
 Flood Elev= 114.00' Surf.Area= 440 sf Storage= 704 cf

Plug-Flow detention time= 93.5 min calculated for 8,317 cf (96% of inflow)
 Center-of-Mass det. time= 67.2 min (821.1 - 753.9)

Volume	Invert	Avail.Storage	Storage Description
#1	110.00'	704 cf	Custom Stage Data (Conic) Listed below (Recalc) 1,760 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
110.00	440	0	0	440
114.00	440	1,760	1,760	737

Device	Routing	Invert	Outlet Devices
#1	Primary	113.90'	110.0' long x 3.0' 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 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32
#2	Discarded	110.00'	0.459 in/hr Exfiltration over Wetted area

Discarded OutFlow Max=0.01 cfs @ 12.10 hrs HW=113.94' (Free Discharge)
 ↳ **2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=2.10 cfs @ 12.10 hrs HW=113.94' (Free Discharge)
 ↳ **1=Broad-Crested Rectangular Weir**(Weir Controls 2.10 cfs @ 0.48 fps)

Summary for Pond IT-2: Infiltration Trench #2

Infiltration Rate = 0.459 IN/HR

[88] Warning: Qout>Qin may require smaller dt or Finer Routing

[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=10)

Inflow Area = 4,643 sf, 94.31% Impervious, Inflow Depth = 5.67" for 25-year event
 Inflow = 0.61 cfs @ 12.09 hrs, Volume= 2,195 cf
 Outflow = 0.64 cfs @ 12.09 hrs, Volume= 1,899 cf, Atten= 0%, Lag= 0.4 min
 Discarded = 0.01 cfs @ 12.09 hrs, Volume= 681 cf
 Primary = 0.64 cfs @ 12.09 hrs, Volume= 1,218 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 117.92' @ 12.09 hrs Surf.Area= 352 sf Storage= 552 cf
 Flood Elev= 118.00' Surf.Area= 352 sf Storage= 563 cf

Plug-Flow detention time= 242.4 min calculated for 1,899 cf (87% of inflow)
 Center-of-Mass det. time= 181.7 min (933.7 - 752.1)

Volume	Invert	Avail.Storage	Storage Description												
#1	114.00'	563 cf	Custom Stage Data (Conic) Listed below (Recalc) 1,408 cf Overall x 40.0% Voids												
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)											
114.00	352	0	0	352											
118.00	352	1,408	1,408	618											
Device	Routing	Invert	Outlet Devices												
#1	Primary	117.90'	88.0' long x 3.0' 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 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32												
#2	Discarded	114.00'	0.459 in/hr Exfiltration over Wetted area												

Discarded OutFlow Max=0.01 cfs @ 12.09 hrs HW=117.92' (Free Discharge)↑**2=Exfiltration** (Exfiltration Controls 0.01 cfs)**Primary OutFlow** Max=0.61 cfs @ 12.09 hrs HW=117.92' (Free Discharge)↑**1=Broad-Crested Rectangular Weir**(Weir Controls 0.61 cfs @ 0.34 fps)**Summary for Link AP1: ANALYSIS POINT #1**

Inflow Area = 165,835 sf, 61.80% Impervious, Inflow Depth = 4.57" for 25-year event
 Inflow = 16.70 cfs @ 12.11 hrs, Volume= 63,207 cf
 Primary = 16.70 cfs @ 12.11 hrs, Volume= 63,207 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link L1: Link 1

Inflow Area = 88,711 sf, 66.47% Impervious, Inflow Depth = 4.73" for 25-year event
 Inflow = 8.78 cfs @ 12.12 hrs, Volume= 34,966 cf
 Primary = 8.78 cfs @ 12.12 hrs, Volume= 34,966 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link L2: Link 2

Inflow Area = 104,863 sf, 60.63% Impervious, Inflow Depth = 4.59" for 25-year event
 Inflow = 10.35 cfs @ 12.11 hrs, Volume= 40,134 cf
 Primary = 10.35 cfs @ 12.11 hrs, Volume= 40,134 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.41"

Printed 2/10/2021

Page 26

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

SubcatchmentO-1: Subcat O-1	Runoff Area=2,582 sf 4.61% Impervious Runoff Depth=5.41" Tc=6.0 min CN=75 Runoff=0.37 cfs 1,165 cf
SubcatchmentO-2: Subcat O-2	Runoff Area=2,582 sf 4.61% Impervious Runoff Depth=5.41" Tc=6.0 min CN=75 Runoff=0.37 cfs 1,165 cf
SubcatchmentO-3: Subcat O-3	Runoff Area=4,583 sf 18.52% Impervious Runoff Depth=5.65" Tc=6.0 min UI Adjusted CN=77 Runoff=0.68 cfs 2,158 cf
SubcatchmentO-4: Subcat O-4	Runoff Area=2,612 sf 34.30% Impervious Runoff Depth=6.25" Tc=6.0 min CN=82 Runoff=0.42 cfs 1,360 cf
SubcatchmentP-1: Subcat P-1	Runoff Area=30,736 sf 18.69% Impervious Runoff Depth=5.65" Flow Length=618' Tc=15.4 min CN=77 Runoff=3.46 cfs 14,476 cf
SubcatchmentP-2: Subcat P-2	Runoff Area=2,030 sf 0.00% Impervious Runoff Depth=5.29" Tc=6.0 min CN=74 Runoff=0.28 cfs 896 cf
SubcatchmentP-2A: Subcat P-2A	Runoff Area=4,643 sf 94.31% Impervious Runoff Depth=8.05" Tc=6.0 min CN=97 Runoff=0.86 cfs 3,115 cf
SubcatchmentP-3: Subcat P-3	Runoff Area=29,216 sf 28.59% Impervious Runoff Depth=6.01" Flow Length=560' Tc=10.7 min CN=80 Runoff=3.94 cfs 14,633 cf
SubcatchmentP-3A: Subcat P-3A	Runoff Area=5,400 sf 77.83% Impervious Runoff Depth=7.57" Tc=6.0 min CN=93 Runoff=0.98 cfs 3,406 cf
SubcatchmentP-4: Subcat P-4	Runoff Area=6,375 sf 43.14% Impervious Runoff Depth=6.49" Tc=6.0 min CN=84 Runoff=1.05 cfs 3,448 cf
SubcatchmentR-1: Subcat R-1	Runoff Area=48,720 sf 100.00% Impervious Runoff Depth=8.17" Tc=8.0 min CN=98 Runoff=8.54 cfs 33,170 cf
SubcatchmentR-2: Subcat R-2	Runoff Area=13,170 sf 100.00% Impervious Runoff Depth=8.17" Tc=8.0 min CN=98 Runoff=2.31 cfs 8,967 cf
SubcatchmentR-3: Subcat R-3	Runoff Area=13,186 sf 100.00% Impervious Runoff Depth=8.17" Tc=8.0 min CN=98 Runoff=2.31 cfs 8,977 cf
Pond IT-1: Infiltration Trench #1	Peak Elev=113.95' Storage=695 cf Inflow=3.27 cfs 12,373 cf Discarded=0.01 cfs 902 cf Primary=3.26 cfs 11,085 cf Outflow=3.27 cfs 11,987 cf
Pond IT-2: Infiltration Trench #2	Peak Elev=117.92' Storage=552 cf Inflow=0.86 cfs 3,115 cf Discarded=0.01 cfs 705 cf Primary=0.86 cfs 2,111 cf Outflow=0.86 cfs 2,816 cf
Link AP1: ANALYSISPOINT #1	Inflow=24.44 cfs 94,644 cf Primary=24.44 cfs 94,644 cf
Link L1: Link 1	Inflow=12.73 cfs 51,817 cf Primary=12.73 cfs 51,817 cf
Link L2: Link 2	Inflow=15.15 cfs 59,949 cf Primary=15.15 cfs 59,949 cf

Total Runoff Area = 165,835 sf Runoff Volume = 96,936 cf Average Runoff Depth = 7.01"
38.20% Pervious = 63,346 sf 61.80% Impervious = 102,489 sf

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.41"

Printed 2/10/2021

Page 27

Summary for Subcatchment O-1: Subcat O-1

Runoff = 0.37 cfs @ 12.09 hrs, Volume= 1,165 cf, Depth= 5.41"

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 Rainfall=8.41"

Area (sf)	CN	Description
119	98	Paved roads w/curbs & sewers, HSG C
2,463	74	>75% Grass cover, Good, HSG C
2,582	75	Weighted Average
2,463		95.39% Pervious Area
119		4.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment O-2: Subcat O-2

Runoff = 0.37 cfs @ 12.09 hrs, Volume= 1,165 cf, Depth= 5.41"

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 Rainfall=8.41"

Area (sf)	CN	Description
119	98	Paved roads w/curbs & sewers, HSG C
2,463	74	>75% Grass cover, Good, HSG C
2,582	75	Weighted Average
2,463		95.39% Pervious Area
119		4.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment O-3: Subcat O-3

Runoff = 0.68 cfs @ 12.09 hrs, Volume= 2,158 cf, Depth= 5.65"

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 Rainfall=8.41"

Area (sf)	CN	Adj	Description
283	98		Paved roads w/curbs & sewers, HSG C
566	98		Unconnected pavement, HSG C
3,734	74		>75% Grass cover, Good, HSG C
4,583	78	77	Weighted Average, UI Adjusted
3,734			81.48% Pervious Area
849			18.52% Impervious Area
566			66.67% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment O-4: Subcat O-4

Runoff = 0.42 cfs @ 12.09 hrs, Volume= 1,360 cf, Depth= 6.25"

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 Rainfall=8.41"

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.41"

Printed 2/10/2021

Page 28

Area (sf)	CN	Description
175	98	Paved roads w/curbs & sewers, HSG C
1,716	74	>75% Grass cover, Good, HSG C
721	98	Unconnected pavement, HSG C
2,612	82	Weighted Average
1,716		65.70% Pervious Area
896		34.30% Impervious Area
721		80.47% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment P-1: Subcat P-1

Runoff = 3.46 cfs @ 12.21 hrs, Volume= 14,476 cf, Depth= 5.65"

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 Rainfall=8.41"

Area (sf)	CN	Description
2,444	74	>75% Grass cover, Good, HSG C
5,393	98	Paved parking, HSG C
1,702	89	Gravel roads, HSG C
20,846	70	Woods, Good, HSG C
39	98	Unconnected pavement, HSG C
312	98	Roofs, HSG C
30,736	77	Weighted Average
24,992		81.31% Pervious Area
5,744		18.69% Impervious Area
39		0.68% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.1	50	0.1000	0.07		Sheet Flow, A-B
					Woods: Dense underbrush n= 0.800 P2= 3.28"
0.3	49	0.3470	2.95		Shallow Concentrated Flow, B-C
					Woodland Kv= 5.0 fps
1.7	137	0.0070	1.35		Shallow Concentrated Flow, C-D
					Unpaved Kv= 16.1 fps
2.3	382	0.0180	2.72		Shallow Concentrated Flow, D-E
					Paved Kv= 20.3 fps
15.4	618	Total			

Summary for Subcatchment P-2: Subcat P-2

Runoff = 0.28 cfs @ 12.09 hrs, Volume= 896 cf, Depth= 5.29"

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 Rainfall=8.41"

Area (sf)	CN	Description
2,030	74	>75% Grass cover, Good, HSG C
2,030		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.41"

Printed 2/10/2021

Page 29

Summary for Subcatchment P-2A: Subcat P-2A

Runoff = 0.86 cfs @ 12.09 hrs, Volume= 3,115 cf, Depth= 8.05"

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 Rainfall=8.41"

Area (sf)	CN	Description
4,016	98	Paved parking, HSG C
363	98	Unconnected pavement, HSG C
264	79	Stone riprap, Good, HSG C
4,643	97	Weighted Average
264		5.69% Pervious Area
4,379		94.31% Impervious Area
363		8.29% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment P-3: Subcat P-3

Runoff = 3.94 cfs @ 12.15 hrs, Volume= 14,633 cf, Depth= 6.01"

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 Rainfall=8.41"

Area (sf)	CN	Description
14,623	70	Woods, Good, HSG C
8,157	98	Paved parking, HSG C
1,758	89	Gravel roads, HSG C
4,481	74	>75% Grass cover, Good, HSG C
197	98	Roofs, HSG C
29,216	80	Weighted Average
20,862		71.41% Pervious Area
8,354		28.59% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.0	50	0.3200	0.12		Sheet Flow, A-B Woods: Dense underbrush n= 0.800 P2= 3.28"
0.1	17	0.3530	2.97		Shallow Concentrated Flow, B-C Woodland Kv= 5.0 fps
2.9	285	0.0105	1.65		Shallow Concentrated Flow, C-D Unpaved Kv= 16.1 fps
0.7	208	0.0529	4.67		Shallow Concentrated Flow, D-E Paved Kv= 20.3 fps
10.7	560	Total			

Summary for Subcatchment P-3A: Subcat P-3A

Runoff = 0.98 cfs @ 12.09 hrs, Volume= 3,406 cf, Depth= 7.57"

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 Rainfall=8.41"

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.
 HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.41"

Printed 2/10/2021

Page 30

Area (sf)	CN	Description
3,778	98	Paved parking, HSG C
867	74	>75% Grass cover, Good, HSG C
250	98	Roofs, HSG C
175	98	Unconnected pavement, HSG C
330	79	Stone riprap, Good, HSG C

5,400	93	Weighted Average
1,197		22.17% Pervious Area
4,203		77.83% Impervious Area
175		4.16% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment P-4: Subcat P-4

Runoff = 1.05 cfs @ 12.09 hrs, Volume= 3,448 cf, Depth= 6.49"

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 Rainfall=8.41"

Area (sf)	CN	Description
2,601	98	Paved parking, HSG C
149	98	Unconnected pavement, HSG C
3,625	74	>75% Grass cover, Good, HSG C
6,375	84	Weighted Average
3,625		56.86% Pervious Area
2,750		43.14% Impervious Area
149		5.42% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					Direct Entry, TR-55 min.

Summary for Subcatchment R-1: Subcat R-1

Runoff = 8.54 cfs @ 12.11 hrs, Volume= 33,170 cf, Depth= 8.17"

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 Rainfall=8.41"

Area (sf)	CN	Description
48,720	98	Roofs, HSG C
48,720		100.00% Impervious Area

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

Summary for Subcatchment R-2: Subcat R-2

Runoff = 2.31 cfs @ 12.11 hrs, Volume= 8,967 cf, Depth= 8.17"

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 Rainfall=8.41"

Area (sf)	CN	Description
13,170	98	Roofs, HSG C
13,170		100.00% Impervious Area

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.
 HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.41"

Printed 2/10/2021

Page 31

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

Summary for Subcatchment R-3: Subcat R-3

Runoff = 2.31 cfs @ 12.11 hrs, Volume= 8,977 cf, Depth= 8.17"

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 Rainfall=8.41"

Area (sf)	CN	Description
13,186	98	Roofs, HSG C
13,186		100.00% Impervious Area

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

Summary for Pond IT-1: Infiltration Trench #1

Infiltration Rate = 0.459 IN/HR

[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=5)

Inflow Area = 18,570 sf, 93.55% Impervious, Inflow Depth = 8.00" for 100-year event
 Inflow = 3.27 cfs @ 12.10 hrs, Volume= 12,373 cf
 Outflow = 3.27 cfs @ 12.10 hrs, Volume= 11,987 cf, Atten= 0%, Lag= 0.0 min
 Discarded = 0.01 cfs @ 12.10 hrs, Volume= 902 cf
 Primary = 3.26 cfs @ 12.10 hrs, Volume= 11,085 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 113.95' @ 12.10 hrs Surf.Area= 440 sf Storage= 695 cf
 Flood Elev= 114.00' Surf.Area= 440 sf Storage= 704 cf

Plug-Flow detention time= 69.7 min calculated for 11,971 cf (97% of inflow)
 Center-of-Mass det. time= 51.3 min (799.7 - 748.4)

Volume	Invert	Avail.Storage	Storage Description
#1	110.00'	704 cf	Custom Stage Data (Conic) Listed below (Recalc) 1,760 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
110.00	440	0	0	440
114.00	440	1,760	1,760	737

Device	Routing	Invert	Outlet Devices
#1	Primary	113.90'	110.0' long x 3.0' 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 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32
#2	Discarded	110.00'	0.459 in/hr Exfiltration over Wetted area

Discarded OutFlow Max=0.01 cfs @ 12.10 hrs HW=113.95' (Free Discharge)
 ↳ **2=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=3.10 cfs @ 12.10 hrs HW=113.95' (Free Discharge)
 ↳ **1=Broad-Crested Rectangular Weir**(Weir Controls 3.10 cfs @ 0.55 fps)

2038-03 - Proposed HydroCAD

Prepared by Allen & Major Associates, Inc.

HydroCAD® 10.00-26 s/n 02881 © 2020 HydroCAD Software Solutions LLC

Type III 24-hr 100-year Rainfall=8.41"

Printed 2/10/2021

Page 32

Summary for Pond IT-2: Infiltration Trench #2

Infiltration Rate = 0.459 IN/HR

[88] Warning: Qout>Qin may require smaller dt or Finer Routing

[85] Warning: Oscillations may require smaller dt or Finer Routing (severity=3)

Inflow Area = 4,643 sf, 94.31% Impervious, Inflow Depth = 8.05" for 100-year event
 Inflow = 0.86 cfs @ 12.09 hrs, Volume= 3,115 cf
 Outflow = 0.86 cfs @ 12.09 hrs, Volume= 2,816 cf, Atten= 0%, Lag= 0.1 min
 Discarded = 0.01 cfs @ 12.09 hrs, Volume= 705 cf
 Primary = 0.86 cfs @ 12.09 hrs, Volume= 2,111 cf

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs
 Peak Elev= 117.92' @ 12.09 hrs Surf.Area= 352 sf Storage= 552 cf
 Flood Elev= 118.00' Surf.Area= 352 sf Storage= 563 cf

Plug-Flow detention time= 185.0 min calculated for 2,816 cf (90% of inflow)
 Center-of-Mass det. time= 136.4 min (882.7 - 746.3)

Volume	Invert	Avail.Storage	Storage Description
#1	114.00'	563 cf	Custom Stage Data (Conic) Listed below (Recalc) 1,408 cf Overall x 40.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
114.00	352	0	0	352
118.00	352	1,408	1,408	618

Device	Routing	Invert	Outlet Devices
#1	Primary	117.90'	88.0' long x 3.0' 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 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32
#2	Discarded	114.00'	0.459 in/hr Exfiltration over Wetted area

Discarded OutFlow Max=0.01 cfs @ 12.09 hrs HW=117.92' (Free Discharge)↑**2=Exfiltration** (Exfiltration Controls 0.01 cfs)**Primary OutFlow** Max=0.78 cfs @ 12.09 hrs HW=117.92' (Free Discharge)↑**1=Broad-Crested Rectangular Weir**(Weir Controls 0.78 cfs @ 0.37 fps)**Summary for Link AP1: ANALYSIS POINT #1**

Inflow Area = 165,835 sf, 61.80% Impervious, Inflow Depth = 6.85" for 100-year event
 Inflow = 24.44 cfs @ 12.11 hrs, Volume= 94,644 cf
 Primary = 24.44 cfs @ 12.11 hrs, Volume= 94,644 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link L1: Link 1

Inflow Area = 88,711 sf, 66.47% Impervious, Inflow Depth = 7.01" for 100-year event
 Inflow = 12.73 cfs @ 12.12 hrs, Volume= 51,817 cf
 Primary = 12.73 cfs @ 12.12 hrs, Volume= 51,817 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

Summary for Link L2: Link 2

Inflow Area = 104,863 sf, 60.63% Impervious, Inflow Depth = 6.86" for 100-year event
 Inflow = 15.15 cfs @ 12.11 hrs, Volume= 59,949 cf
 Primary = 15.15 cfs @ 12.11 hrs, Volume= 59,949 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-36.00 hrs, dt= 0.05 hrs

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

Section 5.0

Appendix

A.) RAINFALL DATA

B.) SOIL INFORMATION

C.) TSS REMOVAL CALCULATION

D.) GROUNDWATER RECHARGE CALCULATION

E.) INFILTRATION TRENCH DRAIN CALCULATION

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

A.) RAINFALL DATA

Extreme Precipitation Tables

Northeast Regional Climate Center

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

Smoothing	Yes
State	Massachusetts
Location	
Longitude	70.948 degrees West
Latitude	41.660 degrees North
Elevation	0 feet
Date/Time	Wed, 10 Feb 2021 08:33:34 -0500

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.43	0.54	0.71	0.88	1.12	1yr	0.76	1.09	1.30	1.67	2.15	2.79	3.13	1yr	2.47	3.01	3.45	4.17	4.83	1yr
2yr	0.36	0.56	0.69	0.91	1.15	1.44	2yr	0.99	1.36	1.67	2.10	2.63	3.30	3.64	2yr	2.92	3.50	4.00	4.73	5.38	2yr
5yr	0.43	0.67	0.85	1.13	1.45	1.84	5yr	1.25	1.73	2.13	2.66	3.31	4.11	4.59	5yr	3.63	4.41	5.01	5.85	6.58	5yr
10yr	0.50	0.78	0.98	1.34	1.74	2.22	10yr	1.50	2.08	2.57	3.20	3.95	4.84	5.46	10yr	4.29	5.25	5.93	6.89	7.67	10yr
25yr	0.59	0.94	1.20	1.66	2.21	2.83	25yr	1.90	2.64	3.29	4.08	4.99	6.03	6.89	25yr	5.34	6.62	7.43	8.54	9.39	25yr
50yr	0.68	1.09	1.40	1.96	2.64	3.41	50yr	2.28	3.17	3.96	4.89	5.93	7.12	8.21	50yr	6.30	7.89	8.81	10.05	10.95	50yr
100yr	0.79	1.27	1.64	2.33	3.17	4.10	100yr	2.74	3.82	4.77	5.86	7.07	8.41	9.79	100yr	7.44	9.41	10.45	11.84	12.77	100yr
200yr	0.91	1.48	1.92	2.75	3.80	4.94	200yr	3.28	4.59	5.73	7.02	8.42	9.93	11.67	200yr	8.79	11.22	12.40	13.95	14.90	200yr
500yr	1.11	1.83	2.39	3.46	4.84	6.30	500yr	4.18	5.86	7.31	8.91	10.60	12.39	14.74	500yr	10.97	14.18	15.56	17.33	18.28	500yr

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.24	0.37	0.45	0.60	0.74	0.88	1yr	0.64	0.86	1.00	1.38	1.90	2.59	2.46	1yr	2.29	2.37	3.22	3.94	4.57	1yr
2yr	0.35	0.54	0.66	0.89	1.10	1.34	2yr	0.95	1.31	1.58	2.08	2.64	3.24	3.56	2yr	2.87	3.42	3.93	4.63	5.29	2yr
5yr	0.40	0.61	0.76	1.04	1.32	1.59	5yr	1.14	1.55	1.86	2.45	3.13	3.89	4.34	5yr	3.44	4.17	4.75	5.55	6.24	5yr
10yr	0.43	0.67	0.83	1.16	1.50	1.81	10yr	1.29	1.77	2.08	2.77	3.52	4.45	5.01	10yr	3.94	4.82	5.47	6.34	7.03	10yr
25yr	0.49	0.75	0.93	1.33	1.76	2.16	25yr	1.52	2.11	2.43	3.24	4.11	5.33	6.09	25yr	4.72	5.86	6.56	7.59	8.23	25yr
50yr	0.54	0.83	1.03	1.48	1.99	2.45	50yr	1.72	2.39	2.73	3.65	4.58	6.10	7.07	50yr	5.40	6.80	7.47	8.69	9.27	50yr
100yr	0.60	0.91	1.14	1.65	2.27	2.77	100yr	1.96	2.71	3.07	4.10	5.13	6.96	8.20	100yr	6.16	7.88	8.60	9.94	10.45	100yr
200yr	0.67	1.00	1.27	1.84	2.56	3.14	200yr	2.21	3.07	3.45	4.59	5.72	7.98	9.52	200yr	7.06	9.15	9.89	11.40	11.76	200yr
500yr	0.76	1.13	1.46	2.12	3.02	3.69	500yr	2.60	3.61	4.04	5.36	6.60	9.56	11.62	500yr	8.46	11.17	11.90	13.67	13.75	500yr

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.31	0.48	0.58	0.78	0.96	1.21	1yr	0.83	1.18	1.42	1.91	2.41	2.96	3.33	1yr	2.62	3.20	3.68	4.42	5.08	1yr
2yr	0.38	0.59	0.72	0.98	1.20	1.46	2yr	1.04	1.43	1.71	2.25	2.86	3.41	3.74	2yr	3.02	3.60	4.13	4.84	5.55	2yr
5yr	0.48	0.74	0.92	1.27	1.61	1.97	5yr	1.39	1.93	2.28	2.92	3.62	4.33	4.85	5yr	3.84	4.66	5.23	6.18	6.90	5yr
10yr	0.59	0.90	1.12	1.56	2.02	2.49	10yr	1.74	2.44	2.84	3.58	4.38	5.24	5.91	10yr	4.64	5.68	6.31	7.43	8.17	10yr
25yr	0.77	1.17	1.46	2.09	2.74	3.39	25yr	2.37	3.32	3.78	4.71	5.66	6.73	7.68	25yr	5.96	7.38	8.08	9.51	10.25	25yr
50yr	0.94	1.44	1.79	2.57	3.46	4.30	50yr	2.99	4.20	4.70	5.79	6.88	8.16	9.38	50yr	7.23	9.02	9.66	11.45	12.18	50yr
100yr	1.17	1.76	2.21	3.19	4.37	5.44	100yr	3.77	5.32	5.86	7.10	8.40	9.89	11.44	100yr	8.75	11.00	11.62	13.81	14.45	100yr
200yr	1.43	2.16	2.73	3.96	5.52	6.88	200yr	4.76	6.73	7.30	8.76	10.26	11.98	13.96	200yr	10.60	13.43	14.01	16.67	17.20	200yr
500yr	1.90	2.83	3.64	5.29	7.52	9.43	500yr	6.49	9.22	9.80	11.59	13.38	15.43	18.12	500yr	13.66	17.43	17.92	21.37	21.65	500yr

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

B.) SOIL INFORMATION



United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for **Bristol County, Massachusetts, Southern Part**



February 3, 2021

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Preface	2
How Soil Surveys Are Made	5
Soil Map	8
Soil Map.....	9
Legend.....	10
Map Unit Legend.....	11
Map Unit Descriptions.....	11
Bristol County, Massachusetts, Southern Part.....	13
72A—Whitman fine sandy loam, 0 to 3 percent slopes.....	13
73A—Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony...	14
276A—Ninigret fine sandy loam, 0 to 3 percent slopes.....	16
305B—Paxton fine sandy loam, 3 to 8 percent slopes.....	18
602—Urban land.....	19
651—Udorthents, smoothed.....	20
656—Udorthents - Urban land complex.....	20
Soil Information for All Uses	22
Soil Properties and Qualities.....	22
Soil Physical Properties.....	22
Saturated Hydraulic Conductivity (Ksat).....	22
Soil Qualities and Features.....	25
Hydrologic Soil Group.....	26
References	31

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

Custom Soil Resource Report

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map may not be valid at this scale.

Map Scale: 1:6,020 if printed on A landscape (11" x 8.5") sheet.

0 50 100 200 300 Meters


0 250 500 1000 1500 Feet

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


Custom Soil Resource Report


MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)


Soils


 Soil Map Unit Polygons


 Soil Map Unit Lines


 Soil Map Unit Points

Special Point Features

 Blowout


 Borrow Pit


 Clay Spot

 Closed Depression

 Gravel Pit


 Gravelly Spot

 Landfill

 Lava Flow

 Marsh or swamp

 Mine or Quarry

 Miscellaneous Water

 Perennial Water

 Rock Outcrop

 Saline Spot

 Sandy Spot

 Severely Eroded Spot


 Sinkhole


 Slide or Slip

 Sodic Spot


 Spoil Area

 Stony Spot


 Very Stony Spot

 Wet Spot

 Other

 Special Line Features

Water Features

 Streams and Canals


Transportation

 Rails


 Interstate Highways

 US Routes

 Major Roads

 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Bristol County, Massachusetts, Southern Part
Survey Area Data: Version 14, 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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
72A	Whitman fine sandy loam, 0 to 3 percent slopes	1.1	1.4%
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	0.2	0.2%
276A	Ninigret fine sandy loam, 0 to 3 percent slopes	1.4	1.7%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	11.3	13.8%
602	Urban land	55.5	67.8%
651	Udorthents, smoothed	3.7	4.5%
656	Udorthents - Urban land complex	8.7	10.6%
Totals for Area of Interest		81.8	100.0%

Map Unit Descriptions

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

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

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor

components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

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

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

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

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

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

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

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

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

Bristol County, Massachusetts, Southern Part

72A—Whitman fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2zggp

Elevation: 0 to 1,080 feet

Mean annual precipitation: 36 to 71 inches

Mean annual air temperature: 39 to 55 degrees F

Frost-free period: 140 to 240 days

Farmland classification: Not prime farmland

Map Unit Composition

Whitman and similar soils: 80 percent

Minor components: 20 percent

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

Description of Whitman

Setting

Landform: Hills, ground moraines, drumlins, depressions, drainageways

Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Base slope

Down-slope shape: Concave

Across-slope shape: Concave

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

Typical profile

Oi - 0 to 1 inches: peat

A - 1 to 10 inches: fine sandy loam

Bg - 10 to 17 inches: gravelly fine sandy loam

Cdg - 17 to 61 inches: fine sandy loam

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: 7 to 38 inches to densic material

Drainage class: Very poorly drained

Runoff class: Negligible

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)

Depth to water table: About 0 to 6 inches

Frequency of flooding: None

Frequency of ponding: Frequent

Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)

Available water capacity: Low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 5w

Hydrologic Soil Group: D

Ecological site: F144AY041MA - Very Wet Till Depressions

Hydric soil rating: Yes

Minor Components

Ridgebury

Percent of map unit: 10 percent
Landform: Hills, ground moraines, depressions, drumlins, drainageways
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Base slope, head slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 6 percent
Landform: Drainageways, outwash deltas, outwash terraces, depressions
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

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

Woodbridge

Percent of map unit: 1 percent
Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Backslope, footslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

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

Map Unit Setting

National map unit symbol: 2w695
Elevation: 0 to 1,580 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Whitman, extremely stony, and similar soils: 81 percent
Minor components: 19 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Whitman, Extremely Stony

Setting

Landform: Depressions, drainageways, hills, ground moraines, drumlins
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Coarse-loamy lodgment till derived from gneiss, granite, and/or schist

Typical profile

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

Properties and qualities

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

Interpretive groups

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

Minor Components

Ridgebury, extremely stony

Percent of map unit: 10 percent
Landform: Ground moraines, depressions, drumlins, drainageways, hills
Landform position (two-dimensional): Toeslope, footslope
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

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

Swansea

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

Woodbridge, extremely stony

Percent of map unit: 1 percent
Landform: Drumlins, hills, ground moraines
Landform position (two-dimensional): Backslope, footslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

276A—Ninigret fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2tyr6
Elevation: 0 to 1,250 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: All areas are prime farmland

Map Unit Composition

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

Description of Ninigret

Setting

Landform: Kames, moraines, outwash plains, kame terraces, depressions, drainageways, outwash terraces
Landform position (two-dimensional): Backslope, shoulder, footslope, summit
Landform position (three-dimensional): Side slope, crest, tread, rise, dip
Down-slope shape: Convex, concave, linear
Across-slope shape: Convex, concave
Parent material: Coarse-loamy eolian deposits over sandy and gravelly glaciofluvial deposits derived from gneiss, granite, schist, and/or phyllite

Typical profile

Ap - 0 to 8 inches: fine sandy loam
Bw1 - 8 to 16 inches: fine sandy loam
Bw2 - 16 to 26 inches: fine sandy loam
2C - 26 to 65 inches: stratified loamy sand to loamy fine sand

Custom Soil Resource Report

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: 18 to 38 inches to strongly contrasting textural stratification

Drainage class: Moderately well drained

Runoff class: Very low

Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)

Depth to water table: About 17 to 39 inches

Frequency of flooding: None

Frequency of ponding: None

Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)

Available water capacity: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 2w

Hydrologic Soil Group: C

Ecological site: F144AY026CT - Moist Silty Outwash

Hydric soil rating: No

Minor Components

Agawam

Percent of map unit: 5 percent

Landform: Kames, outwash terraces, outwash plains, moraines, kame terraces

Landform position (two-dimensional): Backslope, shoulder, footslope, summit

Landform position (three-dimensional): Side slope, crest, tread, riser, rise

Down-slope shape: Convex

Across-slope shape: Convex

Hydric soil rating: No

Deerfield

Percent of map unit: 5 percent

Landform: Outwash plains, terraces, deltas

Landform position (two-dimensional): Footslope

Landform position (three-dimensional): Tread, talf

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

Windsor

Percent of map unit: 5 percent

Landform: Outwash terraces, deltas, outwash plains, dunes

Landform position (three-dimensional): Tread, riser

Down-slope shape: Linear, convex

Across-slope shape: Linear, convex

Hydric soil rating: No

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

Map Unit Setting

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

Map Unit Composition

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

Description of Paxton

Setting

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

Typical profile

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

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 18 to 39 inches to densic material
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: C
Ecological site: F144AY007CT - Well Drained Dense Till Uplands

Custom Soil Resource Report

Hydric soil rating: No

Minor Components

Woodbridge

Percent of map unit: 9 percent

Landform: Hills, drumlins, ground moraines

Landform position (two-dimensional): Backslope, footslope, summit

Landform position (three-dimensional): Side slope

Down-slope shape: Concave

Across-slope shape: Linear

Hydric soil rating: No

Ridgebury

Percent of map unit: 6 percent

Landform: Drainageways, hills, ground moraines, depressions

Landform position (two-dimensional): Backslope, footslope, toeslope

Landform position (three-dimensional): Head slope, base slope, dip

Down-slope shape: Concave

Across-slope shape: Concave

Hydric soil rating: Yes

Charlton

Percent of map unit: 5 percent

Landform: Hills

Down-slope shape: Linear

Across-slope shape: Linear

Hydric soil rating: No

602—Urban land

Map Unit Setting

National map unit symbol: v5ry

Frost-free period: 120 to 200 days

Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 85 percent

Minor components: 15 percent

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

Description of Urban Land

Setting

Parent material: Excavated and filled land

Minor Components

Udorthents

Percent of map unit: 15 percent

Hydric soil rating: Unranked

651—Udorthents, smoothed

Map Unit Setting

National map unit symbol: v5rw
Elevation: 0 to 3,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents, smoothed, and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents, Smoothed

Setting

Parent material: Made land over loose sandy and gravelly glaciofluvial deposits and/or firm coarse-loamy basal till derived from granite and gneiss

Typical profile

H1 - 0 to 6 inches: variable
H2 - 6 to 60 inches: variable

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: More than 80 inches
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.06 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: Unranked

656—Udorthents - Urban land complex

Map Unit Setting

National map unit symbol: v5y8
Elevation: 0 to 250 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F

Custom Soil Resource Report

Frost-free period: 120 to 240 days

Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 55 percent

Urban land: 45 percent

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

Description of Udorthents

Properties and qualities

Slope: 0 to 8 percent

Depth to restrictive feature: More than 80 inches

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Soil Information for All Uses

Soil Properties and Qualities

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

Soil Physical Properties

Soil Physical Properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Saturated Hydraulic Conductivity (Ksat)

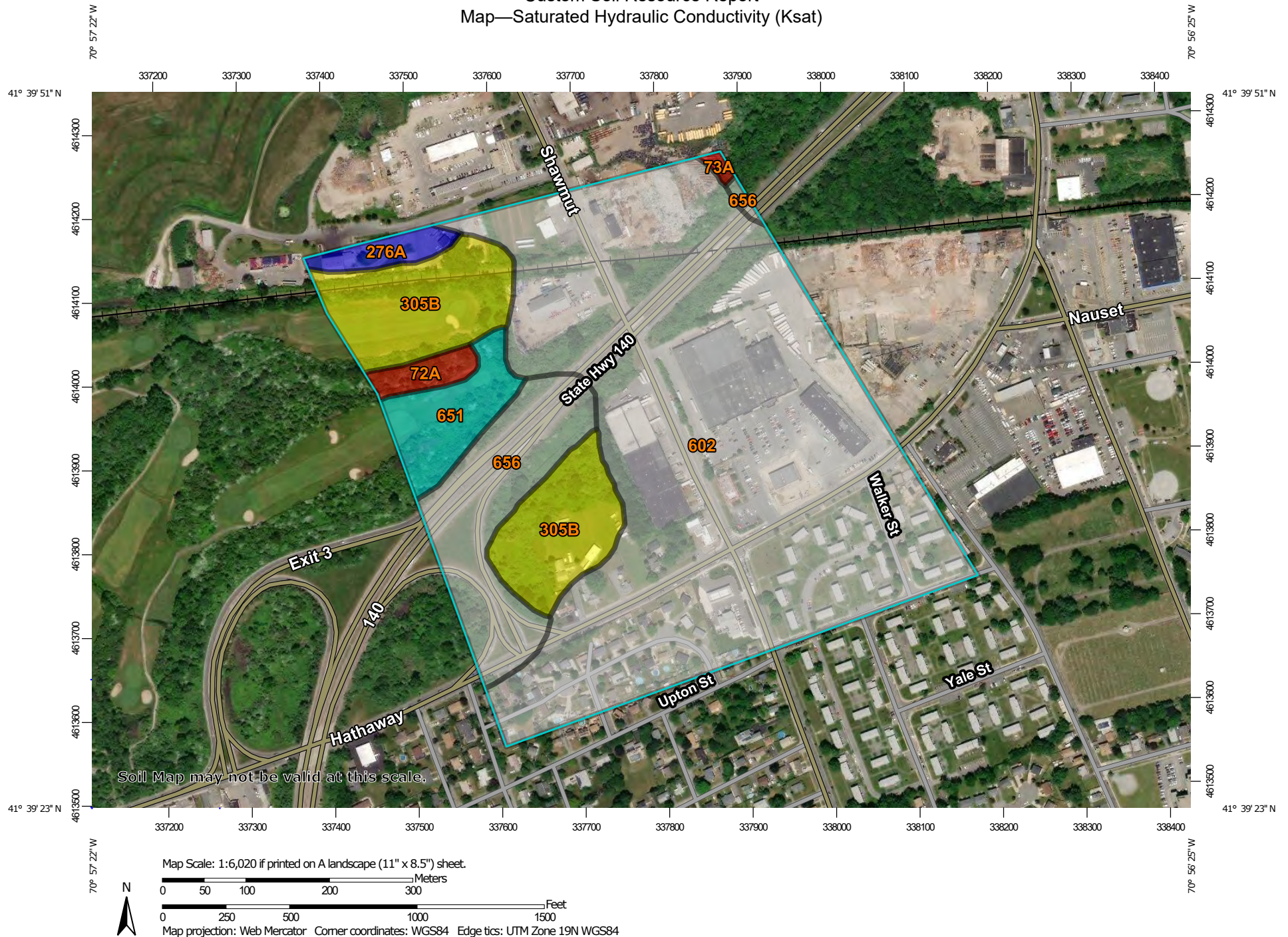
Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity is considered in the design of soil drainage systems and septic tank absorption fields.

For each soil layer, this attribute is actually recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For this soil property, only the representative value is used.

The numeric Ksat values have been grouped according to standard Ksat class limits.


Custom Soil Resource Report

Map—Saturated Hydraulic Conductivity (Ksat)








MAP LEGEND

Area of Interest (AOI)






 Area of Interest (AOI)

Soils






Soil Rating Polygons

 ≤ 1.7493
 > 1.7493 and ≤ 3.2407
 > 3.2407 and ≤ 70.7800
 > 70.7800 and ≤ 71.4483
 Not rated or not available

Soil Rating Lines

 ≤ 1.7493
 > 1.7493 and ≤ 3.2407
 > 3.2407 and ≤ 70.7800
 > 70.7800 and ≤ 71.4483
 Not rated or not available

Soil Rating Points




 ≤ 1.7493
 > 1.7493 and ≤ 3.2407
 > 3.2407 and ≤ 70.7800
 > 70.7800 and ≤ 71.4483
 Not rated or not available

Water Features


 Streams and Canals

Transportation

 Rails
 Interstate Highways

 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Bristol County, Massachusetts, Southern Part
 Survey Area Data: Version 14, 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.

Table—Saturated Hydraulic Conductivity (Ksat)

Map unit symbol	Map unit name	Rating (micrometers per second)	Acres in AOI	Percent of AOI
72A	Whitman fine sandy loam, 0 to 3 percent slopes	1.7493	1.1	1.4%
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	1.7493	0.2	0.2%
276A	Ninigret fine sandy loam, 0 to 3 percent slopes	71.4483	1.4	1.7%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	3.2407	11.3	13.8%
602	Urban land		55.5	67.8%
651	Udorthents, smoothed	70.7800	3.7	4.5%
656	Udorthents - Urban land complex		8.7	10.6%
Totals for Area of Interest			81.8	100.0%

Rating Options—Saturated Hydraulic Conductivity (Ksat)

Units of Measure: micrometers per second

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Fastest

Interpret Nulls as Zero: No

Layer Options (Horizon Aggregation Method): Depth Range (Weighted Average)

Top Depth: 8

Bottom Depth: 96

Units of Measure: Inches

Soil Qualities and Features

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

Hydrologic Soil Group

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

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

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

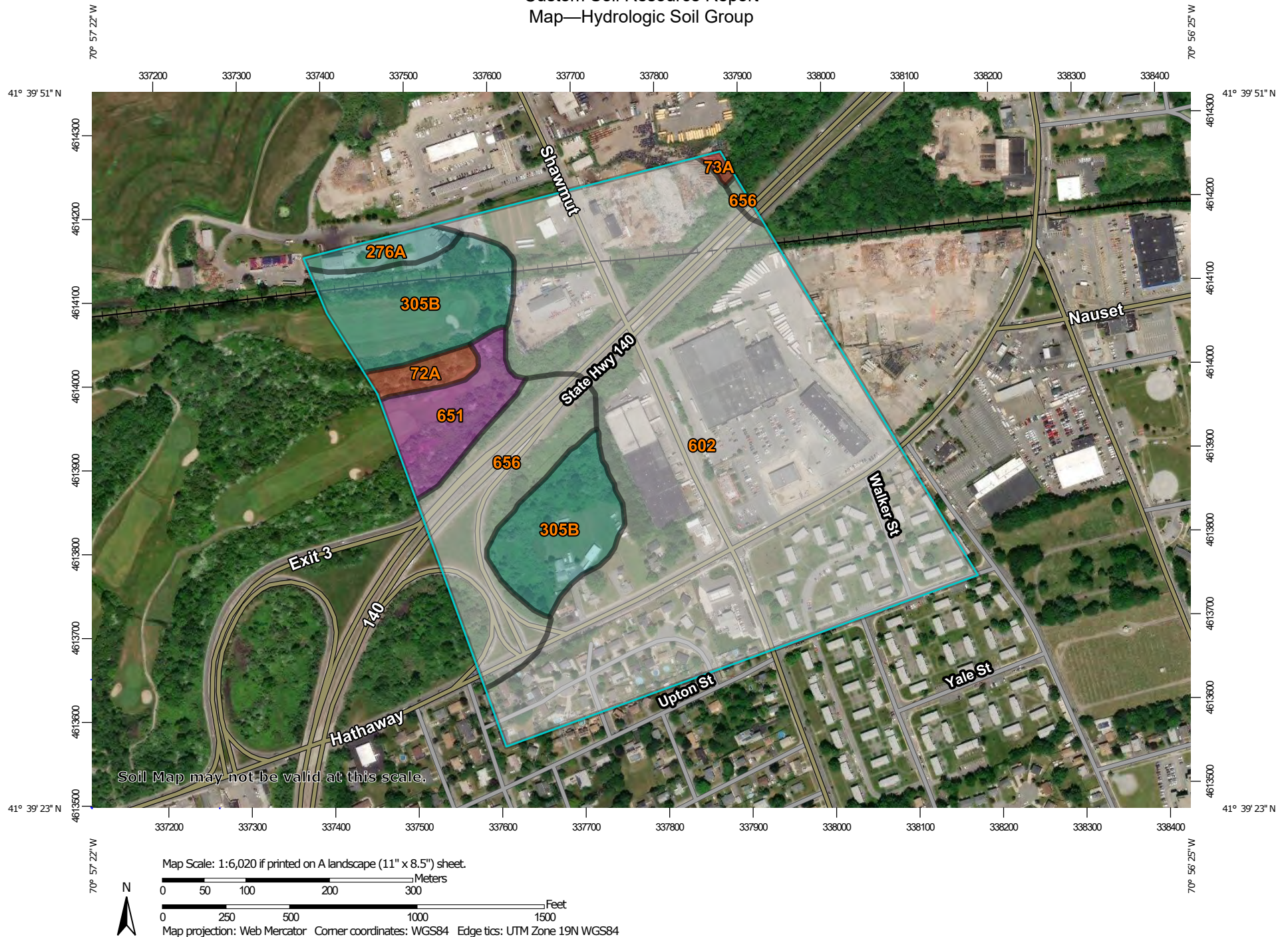
Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

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

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

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


Custom Soil Resource Report Map—Hydrologic Soil Group



Custom Soil Resource Report








MAP LEGEND

Area of Interest (AOI)









 Area of Interest (AOI)

Soils

Soil Rating Polygons





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

Soil Rating Lines


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

Soil Rating Points






 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Bristol County, Massachusetts, Southern Part
Survey Area Data: Version 14, 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.

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
72A	Whitman fine sandy loam, 0 to 3 percent slopes	D	1.1	1.4%
73A	Whitman fine sandy loam, 0 to 3 percent slopes, extremely stony	D	0.2	0.2%
276A	Ninigret fine sandy loam, 0 to 3 percent slopes	C	1.4	1.7%
305B	Paxton fine sandy loam, 3 to 8 percent slopes	C	11.3	13.8%
602	Urban land		55.5	67.8%
651	Udorthents, smoothed	A	3.7	4.5%
656	Udorthents - Urban land complex		8.7	10.6%
Totals for Area of Interest			81.8	100.0%

Rating Options—Hydrologic Soil Group*Aggregation Method: Dominant Condition*

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value

Custom Soil Resource Report

should be returned in the case of a percent composition tie. The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

References

- American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.
- American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.
- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.
- Federal Register. July 13, 1994. Changes in hydric soils of the United States.
- Federal Register. September 18, 2002. Hydric soils of the United States.
- Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.
- National Research Council. 1995. Wetlands: Characteristics and boundaries.
- Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262
- Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577
- Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580
- Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.
- United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.
- United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374
- United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelpdb1043084>

Custom Soil Resource Report

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

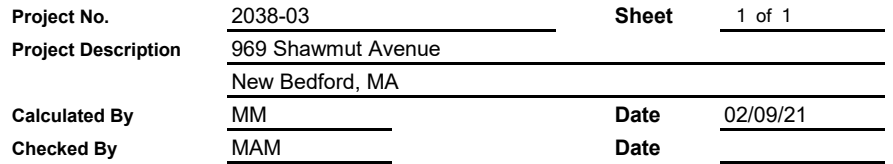
United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

C.) TSS REMOVAL CALCULATION



1

Percentage of TSS Remaining	-	Initial TSS Load	=	Final TSS Removal Rate
19.00	-	100.0	=	81.0 %

81.0 % of the annual TSS load and therefore will meet the TSS removal standard.

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

D.) GROUNDWATER RECHARGE CALCULATION



Project No.	2038-03	Sheet	1 of 1
Project Description	969 Shawmut Avenue New Bedford, MA		
Calculated By	JG	Date	02/09/21
Checked By	MAM	Date	

Standard # 3: Groundwater Recharge

Proposed recharge system: Subsurface Infiltration System

In accordance with *MADEP – Volume 2, Technical Guide for Compliance with Massachusetts Stormwater Management Standards, dated January 2008*

A soils require a Volume to recharge of	0.60	inches
B soils require a Volume to recharge of	0.35	inches
C soils require a Volume to recharge of	0.25	inches
D soils require a Volume to recharge of	0.10	inches

Impervious area within: A-soils =	0	sf	Weighted Groundwater Recharge Depth =	0.25	in
Impervious area within: B-soils =	0	sf			
Impervious area within: C-soils =	103,199	sf			
Impervious area within: D-soils =	0	sf			

Total Site Volume required to be recharged =

$$103,199 \text{ sf} \times 1" / 12 \times 0.25 \text{ in} = 2,150 \text{ cf}$$

Site Volume recharge provided by both infiltration trenches :

Trench #1 Volume = 704 cf

Trench #2 Volume = 563 cf

$$= 1,267 \text{ c.f. Total Volume Recharged} < 2,150 \text{ cf (NG)}$$

Recharge volume is 59% of that required due to it being the maximum extent practicable

DRAINAGE REPORT

969 Shawmut Avenue – New Bedford, MA

E.) INFILTRATION TRENCH DRAIN CALCULATION



Project No.	2038-03	Sheet	1 of 2
Project Description	969 Shawmut Avenue		
	New Bedford, MA		
Calculated By	JG	Date	02/09/21
Checked By	MAM	Date	

Drawdown within 72 hours Analysis for Static Method

Infiltration Chambers

Infiltration Rate: 1.02 inches/hour (*From table 2.3.3: Rawls, Brakensiek, Saxton, 1982*)

Design Infiltration Rate: 0.46 inches/hour (*Assume 50% reduction for safety*)

Volume Provide for Infiltration: 704 cf

Basin bottom area: 440 sf

Time_{drawdown} = (Required Recharge Volume in cubic feet as determined by the Static Method)(1/Design Infiltration Rate in inches per hour)(conversion for inches to feet)(1/bottom area in feet)

$$\begin{aligned}\text{Time}_{\text{drawdown}} &= (704 \text{ cf}) (1 / 0.46 \text{ in/hr}) (1\text{ft}/12 \text{ in.}) (1 / 440 \text{ sf}) \\ &= 41.83 \text{ hours}\end{aligned}$$



Project No.	2038-03	Sheet	2 of 2
Project Description	969 Shawmut Avenue		
	New Bedford, MA		
Calculated By	JG	Date	02/09/21
Checked By	MAM	Date	

Drawdown within 72 hours Analysis for Static Method

Infiltration Chambers

Infiltration Rate: 1.02 inches/hour (From table 2.3.3: Rawls, Brakensiek, Saxton, 1982)

Design Infiltration Rate: 0.46 inches/hour (Assume 50% reduction for safety)

Volume Provide for Infiltration: 563 cf

Basin bottom area: 352 sf

Time_{drawdown} = (Required Recharge Volume in cubic feet as determined by the Static Method)(1/Design Infiltration Rate in inches per hour)(conversion for inches to feet)(1/bottom area in feet)

$$\begin{aligned}\text{Time}_{\text{drawdown}} &= (563 \text{ cf}) (1 / 0.46 \text{ in/hr}) (1\text{ft}/12 \text{ in.}) (1 / 352 \text{ sf}) \\ &= 41.82 \text{ hours}\end{aligned}$$

DRAINAGE REPORT

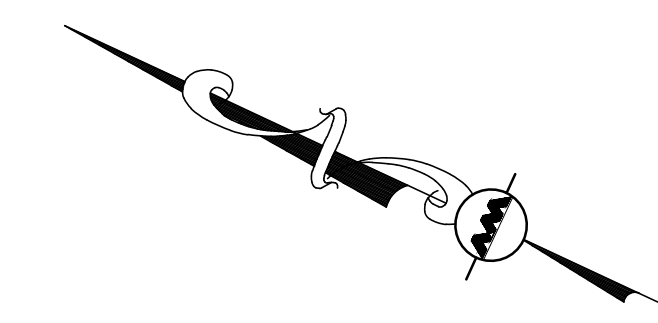
969 Shawmut Avenue – New Bedford, MA

Section 6.0

Watershed Plans

PRE-DEVELOPMENT WATERSHED PLAN

POST-DEVELOPMENT WATERSHED PLAN



FLOW DIRECTION

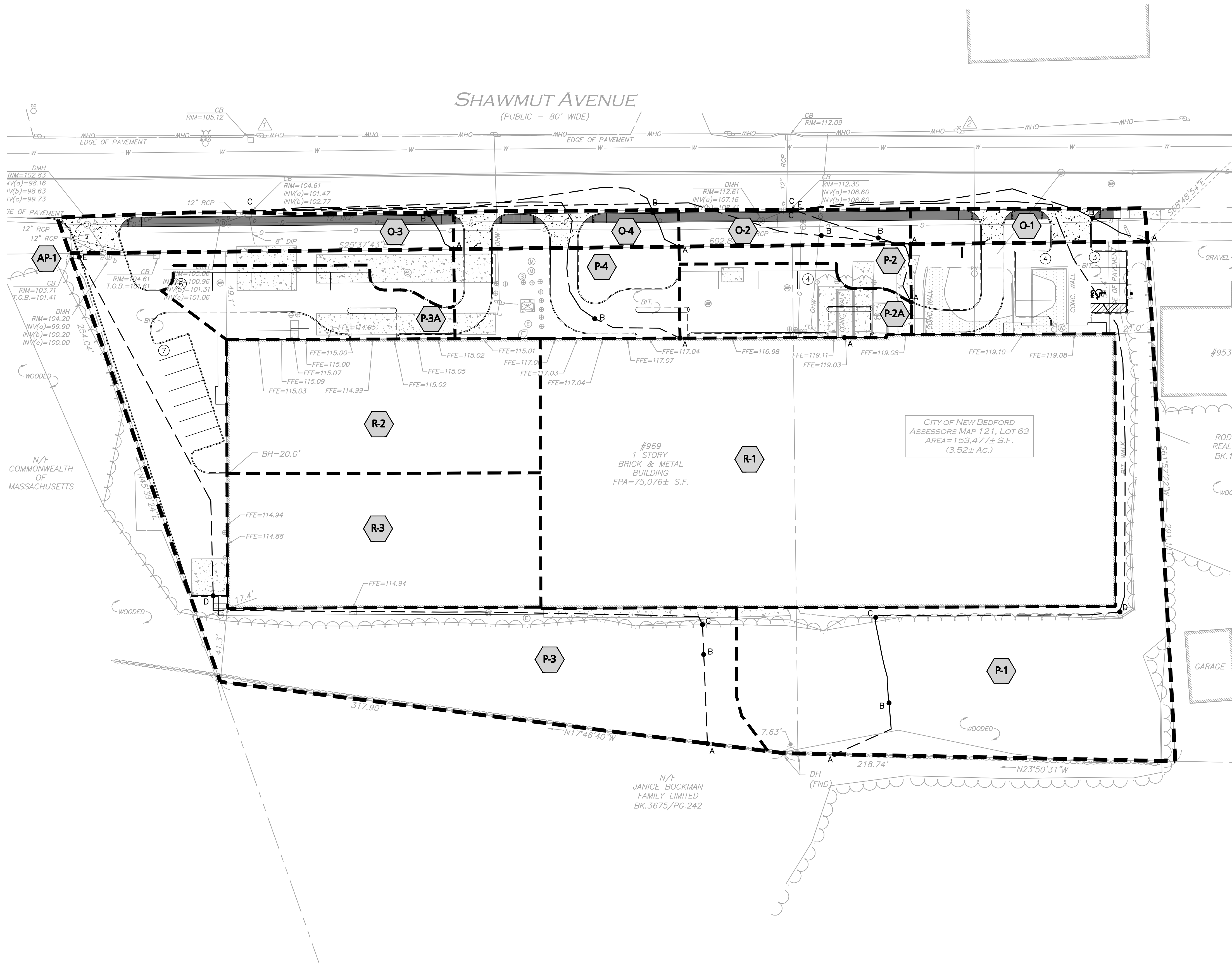


EWS-1

Copyright © 2021 Allen & Major Associates, Inc.
All Rights Reserved

R:\PROJECTS\2038-03\CIVIL\DRAWINGS\CURRENT\C-2038-03_WATERSHED-EXISTING.DWG

R:\PROJECTS\2038-03 CIVIL DRAWINGS\CURRENT\C-2038-03_WATERSHED-PROPOSED.DWG



LEGEND

EXISTING WATERSHED

PROPOSED WATERSHED

SCS SOILS BOUNDARY

Tc FLOW PATH

SUBCATCHMENT LABEL

SUBCATCHMENT BOUNDARY

FLOW DIRECTION

PROFESSIONAL ENGINEER FOR
ALLEN & MAJOR ASSOCIATES, INC.

REV	DATE	DESCRIPTION
-----	------	-------------

APPLICANT/OWNER:
TRUE STORAGE NEW BEDFORD, LLC
670 N. COMMERCIAL STREET, SUITE 303
MANCHESTER, NH 03101

PROJECT:
**COMMERCIAL BUILDING
CONVERSION**
969 SHAWMUT AVENUE
NEW BEDFORD, MA

PROJECT NO.	2038-03	DATE:	FEBRUARY 9, 2021
-------------	---------	-------	------------------

SCALE:	1" = 30'	DWG. :	C2038-03_WATERSHED-PROPOSED
--------	----------	--------	-----------------------------

DRAFTED BY:	MM	CHECKED BY:	MAM
-------------	----	-------------	-----

ALLEN & MAJOR
ASSOCIATES, INC.

civil engineering • land surveying
environmental consulting • landscape architecture
www.allenmajor.com
100 COMMERCE WAY, SUITE 5
WOBBURN MA 01801
TEL: (781) 935-6889
FAX: (781) 935-2896

WOBBURN, MA • LAKEVILLE, MA • MANCHESTER, NH

THIS DRAWING HAS BEEN PREPARED IN ELECTRONIC FORMAT. CLIENTS/CLIENTS REPRESENTATIVE OR CONSULTANT MAY BE PROVIDED COPIES OF DRAWINGS AND SPECIFICATIONS ON MAGNETIC MEDIA. FOR HIS/HER INFORMATION AND USE FOR SPECIFIC APPLICATION TO THIS PROJECT. DUE TO THE POTENTIAL THAT THE MAGNETIC INFORMATION MAY BE MODIFIED UNINTENTIONALLY OR OTHERWISE, ALLEN & MAJOR ASSOCIATES, INC. MAY REMOVE ALL INDICATION OF THE DOCUMENTS AUTHORITYSHIP ON THE MAGNETIC MEDIA. PRINTED REPRESENTATIONS OF THE DRAWINGS AND SPECIFICATIONS ISSUED SHALL BE THE ONLY RECORD COPIES OF ALLEN & MAJOR ASSOCIATES, INC.'S WORK PRODUCT.

DRAWING TITLE:	SHEET No.
PROPOSED WATERSHED PLAN	PWS-1

Copyright © 2021 Allen & Major Associates, Inc.
All Rights Reserved