STORMWATER DRAINAGE ANALYSIS

FOR

PROPOSED

THE ENCLAVE AT NORFOLK

Village Green Street
Town of Norfolk, Massachusetts
Norfolk County

Prepared by:

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June 13, 2017
Revised January 25, 2019
BEPC #W131097

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I. INTRODUCTION

The purpose of this study is to analyze the stormwater drainage conditions that are expected to occur with the proposed development of an existing lot located on Village Green Street, Norfolk, Massachusetts. The site is further identified as Map 15, Parcels 54-87 and a portion of Parcel 11A on the Town of Norfolk's Tax Assessor's maps. The 34.4-acre project area is located in both the R-1 Residential District and Water Supply Protection District, and is currently wooded with bordering vegetated wetlands. The majority of the site is designated by NHESP as a Priority/Estimated Habitat mapped for the Eastern Box Turtle, a state listed species. The property is bordered by single family residences to the north, west, and east, and is bordered by wetlands to the south.

This report provides a comparative analysis of the calculated pre- and post-development site runoff conditions, with the primary focus being no increases in peak runoff rates exiting the site for the 2-, 10-, 25-, 50- and 100-year storm events. Additionally, this report provides calculations documenting the design of the proposed stormwater conveyance/management system. The project also proposes erosion and sedimentation controls during the demolition and construction periods, as well long term stabilization of the site.

II. DRAINAGE – EXISTING SITE CONDITIONS

The site is currently wooded. Under existing conditions, the site is broken into two watersheds that flow to the design points further described below.

Drainage Area E1 consists of ±519,834 sf of wooded area. Stormwater from Drainage Area E1 sheet flows to an existing depression before overflowing and sheet flowing to the wetlands that border the development program to the south (Design Point –DPE1).

Drainage Area E2 consists of ±70,348 sf of wooded area. Stormwater from Drainage Area E2 sheet flows to Village Green Street (Design Point –DPE2).

Drainage Areas E1 and E2 are shown on the "Existing Drainage Tributary Map" included within this report. The overall watershed for the area is shown on the Watershed Exhibit located in the appendices of this report.

Based on our review of the Natural Resources Conservation Service (NRCS) WSS online soil database, the underground soils at the subject site are classified as "Windsor Loamy Sand" and the soil testing performed on-site indicated sand & gravel that are excessively drained. Given this data, on-site soils have been assumed to be under the Hydrologic Group A classification. As such, the drainage design utilizes an exfiltration rate of 8.27in/hr which is appropriate for the excessively drained soils that were encountered.

III. DRAINAGE- PROPOSED SITE CONDITIONS

The post-development conditions include the clearing of wooded areas and installation of housing, roadways and utilities as depicted in the Site Development Plans prepared by Bohler Engineering. Under proposed conditions, the site is broken into two main watersheds which flow to the design points further described below.

Drainage Area P1 is further broken down to sub-watersheds P1A and P1B. Drainage Area P1A consists of ±137,866 sf of impervious area, ±4,540 sf of wooded area and ±280,644 sf of landscaped area totaling ±423,050 sf. Stormwater runoff generated as part of Drainage Area P1A sheet flows to deep sump hooded catch basins that convey stormwater through one of two sediment forebays and into an infiltration basin (Design Point –DPP1). The deep sump catch basins and sediment forebay are proposed to provide treatment of the stormwater prior to being infiltrated and recharged.

Drainage Area P1B consists of ±21,869 sf of impervious area and ±70,780 sf of landscaped area totaling ±92,649 sf. Stormwater from Drainage Area P1B sheet flows to a water quality swale that conveys stormwater into an infiltration basin (Design Point –DPP1). The deep sump catch basins and water quality swale are propsoed to provide treatment of the stormwater prior to being infiltrated and recharged.

Drainage Area P2 is further broken down to sub watersheds P2A & P2B.Drainage Area P2A consists of ±153 sf of impervious area, 29,567 sf of wooded area and ±5,753 sf of landscaped area totaling ±35,473 sf. Stormwater runoff generated as part of Drainage Area P2A sheet flows to Village Green Street (Design Point –DPP2).

Drainage Area P2B consists of ±16,937 sf of impervious area and ±17,991 sf of landscaped area, totaling ±34,928 sf. Stormwater runoff generated as part of Drainage Area P2 sheet flows to deep sump hooded catch basins at the bottom of the entrance drive which convey stormwater through a stormwater quality unit and into an underground infiltration system (Design Point –DPP2). The stormwater quality unit is proposed to provide treatment of the stormwater prior to being infiltrated and recharged.

Please refer to the "Proposed Drainage Tributary Map" included within this report for a graphical representation of the aforementioned drainage areas.

IV. DRAINAGE ANALYSIS METHODOLGY

The methodology utilized to design the subject stormwater management system is based on the SCS TR 55 Urban Hydrology for small watersheds method. In addition, times of concentration were generated from the SCS TR 55 Urban Hydrology for small watersheds method. Runoff coefficients for the existing and proposed development conditions were developed using widely accepted runoff coefficients.

V. DRAINAGE ANALYSIS RESULTS

The tables below demonstrate that the post-development stormwater runoff rates and volumes to Village Green Street, as well as the wetlands associated with all storm events including the 2-year, 10-year, 25-year and 100-year storms, will either be decreased or maintained as a result of the proposed stormwater management system.

Table 1 - Stormwater Runoff Rates Summary to Wetlands

Storm Frequency	Existing Flow (CFS)	Proposed Flow (CFS)	Change (CFS)
2 year	0.00	0.00	na
10 year	0.00	0.00	na
25 year	0.00	0.00	na
100 year	0.18	0.00	-0.18

Table 2 - Stormwater Runoff Volumes Summary to Wetlands

Storm Frequency	Existing Volume (ac-ft)	Proposed Volume (ac-ft)	Change (ac-ft)
2 year	0.000	0.000	na
10 year	0.000	0.000	na
25 year	0.000	0.000	na
100 year	0.071	0.000	-0.071

Table 3 - Stormwater Runoff Rates Summary to Village Green Street

Storm Frequency	Existing Flow (CFS)	Proposed Flow (CFS)	Change (CFS)
2 year	0.00	0.00	na
10 year	0.00	0.00	na
25 year	0.01	0.01	na
100 year	0.04	0.03	-0.01

Table 4 - Stormwater Runoff Volumes Summary to Village Green Street

Storm Frequency	Existing Volume (ac-ft)	Proposed Volume (ac-ft)	Change (ac-ft)
2 year	0.000	0.000	na
10 year	0.000	0.001	na
25 year	0.004	0.005	+0.001
100 year	0.022	0.017	-0.005

VI. CONCLUSIONS

In conclusion, the proposed stormwater management system illustrated on the enclosed drawings results in a decrease in post-development peak stormwater runoff rates and an increase in the amount of annual groundwater recharge associated with the proposed redevelopment condition. In addition, the stormwater quality measures proposed will be improved when compared to existing conditions due to the implementation of the proposed stormwater management system. As such, the project has been designed in accordance with Massachusetts Stormwater Management Handbook as well as the Town of Norfolk's Stormwater Drainage Requirements.

VII. SUMMARY OF STORMWATER MANAGEMENT STANDARDS

As outlined below, the proposed stormwater management system was designed in accordance with the Massachusetts Stormwater Management Policy to comply with all 10 standards.

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

There are no new outfalls that discharge untreated stormwater located on the site. The proposed development has been designed so that all proposed pavement areas from the development are collected through the stormwater management system for treatment prior to being discharged to their respective design points.

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

Runoff rates for the post-development conditions were calculated for the 2-year, 10-year, 25-year and 100-year 24-hour storm events. These calculations are provided in the drainage report. As summarized in the report, there is no increase in peak stormwater runoff rates for the any of the storm events analyzed for the development due to the implementation of a stormwater management system. This is largely due to the implementation of the proposed infiltration areas.

Standard #3: **Loss of annual recharge to ground water 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.**

Best management practices have been implemented into the proposed stormwater management system including infiltration basins, which will help exceed the required groundwater recharge volume. As a result, the project complies with this standard.

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

The proposed stormwater management system has been designed to provide at least 80% removal of TSS through the use of several BMPs, including deep sump hooded catch basins, stormwater quality unit, bio-retention areas and infiltration basins. All water quality BMPs for this project have been sized to meet DEP standards.

Standard #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.**

The proposed project is not considered a land use with higher pollutant loads, therefore this standard is not applicable.

Standard #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.**

The subject site is not located within a Zone II Aquifer Protection Area or within an Area of Critical Environmental Concern, therefore this standard is not applicable.

Standard #7: **A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable.**

The proposed project is not considered a redevelopment and therefore this standard is not applicable.

Standard #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.**

An Erosion and Sediment control plan has been prepared as part of the enclosed drawings prepared by Bohler Engineering. This includes implementation of a perimeter erosion control barrier along with a construction entrance, protection for catch basins inlets and protection around temporary material stock piles areas. Also, since the proposed area of disturbance is greater than one acre, the project will require filing a Notice of Intent with EPA and implement a Stormwater Pollution Prevention Plan (SWPPP) during construction. The contractor will be required to maintain erosion control measures during construction and prevent erosion or sediment discharges to downstream areas.

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

A Long Term Operation and Maintenance Plan for the proposed BMP's has been developed for this project. The O&M Plan outlines procedures and time tables for the long term operation and maintenance of the proposed stormwater management system, as well as includes a list of parties responsible and an estimated budget associated with inspections and maintenance.

Standard #10: **All illicit discharges to the stormwater management system are prohibited**

No illicit discharges will be created as part of the site construction in the area in question and an illicit discharge statement has been included within the Long Term Operation and Maintenance plan.

Appendix 1

Massachusetts Stormwater Management Checklist

Stormwater Report

A Stormwater Report must be submitted with the permit application to document compliance with the Stormwater Management Standards. The Stormwater Report must be organized into sections that correspond to the categories listed in the Checklist (e.g., Project Type, LID Practices, Standard 1 etc.). 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 by a Registered Professional Engineer (RPE) licensed in the Commonwealth.

The Stormwater Report must include:

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

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

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[1] 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.

[2] 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.

not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

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 to comprise 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 _____ 1/25/19

Signature, Date

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

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 _____

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.

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: Circle the method used.

(Static) Simple Dynamic Dynamic Field[3]

☒ 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.
☒ 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;

[3] 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

- 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.

☒ 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.

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.
☐ 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.
☐ 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 (to be completed by contractor)

☐ 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.

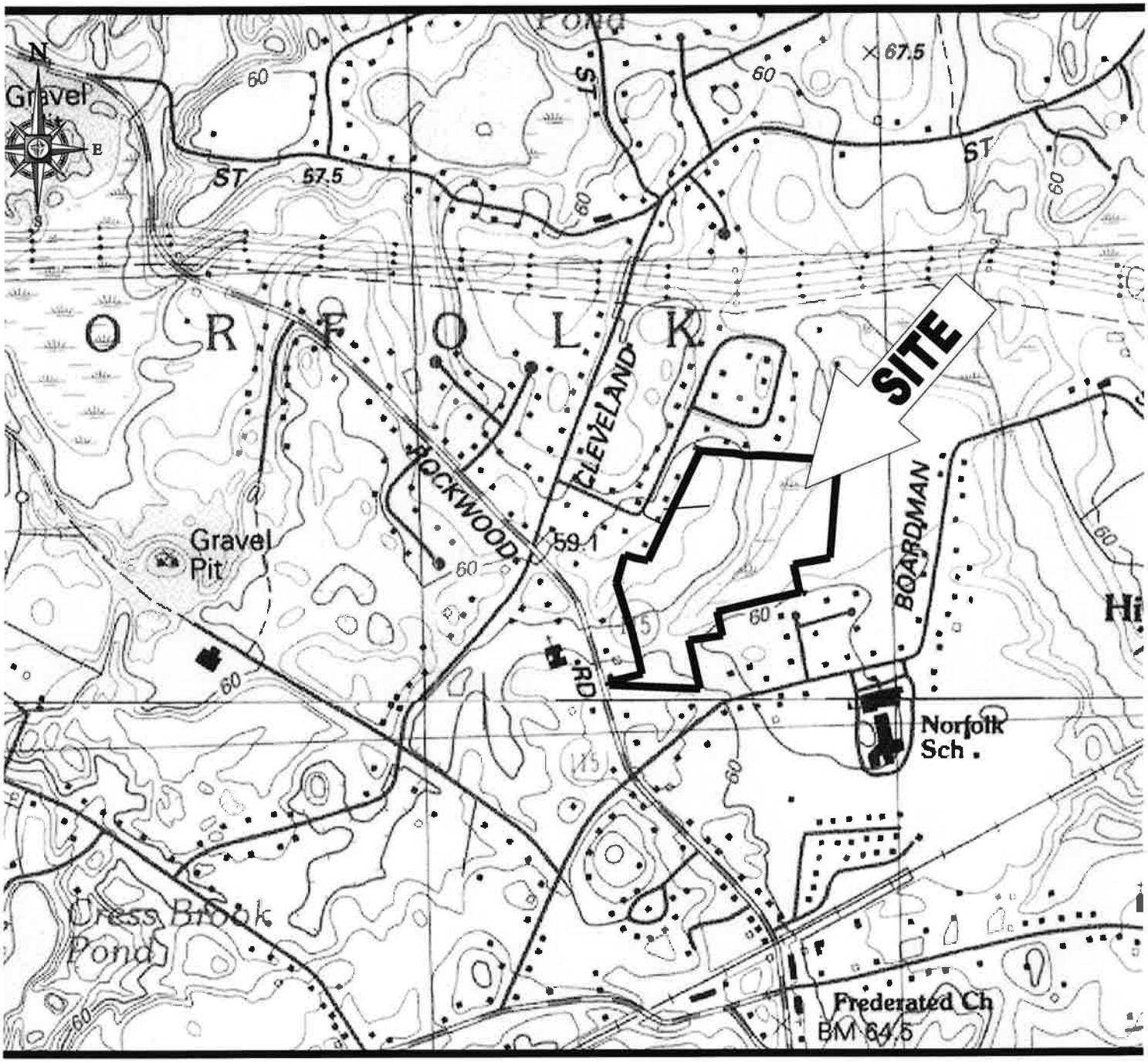
Standard 10: Prohibition of Illicit Discharges

☒ 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.

Appendix 2

Location Maps

Appendix 2A – USGS Map



LOCATION MAP

SCALE: 1"□1000□
PLAN REFERENCE: MASSGIS USGS

Appendix 2B – FEMA FIRMette

JOINS PANEL 0322

308000mE

MAP SCALE 1" = 500'

250 0 500 1000

FEET

METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0164E

FIRM

FLOOD INSURANCE RATE MAP

NORFOLK COUNTY, MASSACHUSETTS

(ALL JURISDICTIONS)

PANEL 164 OF 430

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MEDFIELD, TOWN OF	250243	0164	E
MILLIS, TOWN OF	250244	0164	E
NORFOLK, TOWN OF	255217	0164	E

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

MAP NUMBER
25021C0164E

EFFECTIVE DATE
JULY 17, 2012

Federal Emergency Management Agency

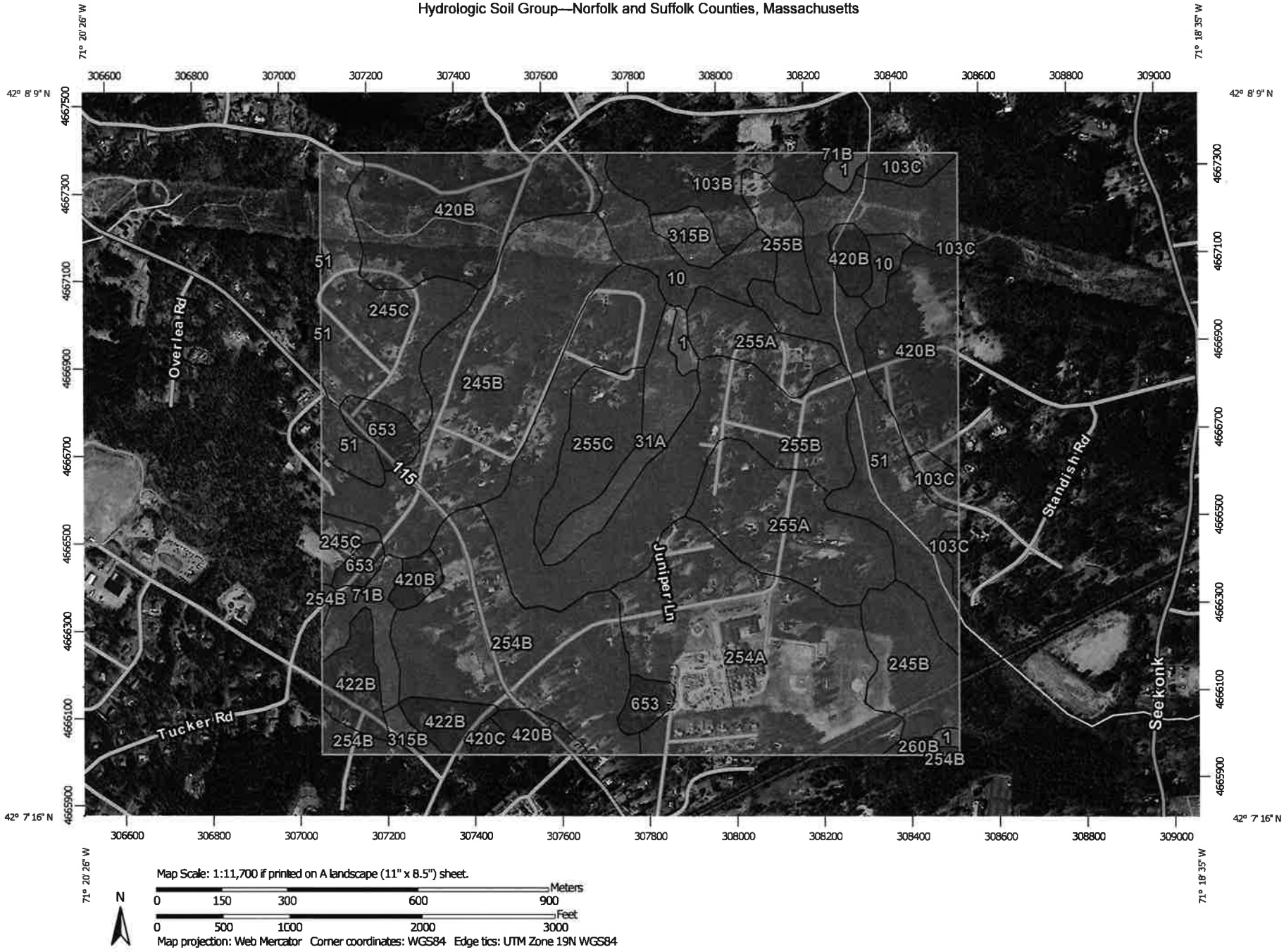
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Appendix 3

Soil Information

Appendix 3A – NRCS Custom Soil Resource Report

Hydrologic Soil Group—Norfolk and Suffolk Counties, Massachusetts



Map Scale: 1:11,700 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 150 300 600 900

Feet: 0 500 1000 2000 3000

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil 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 1:25,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
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: Norfolk and Suffolk Counties, Massachusetts
Survey Area Data: Version 8, Jul 23, 2010

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

Date(s) aerial images were photographed: Mar 30, 2011—May 1, 2011

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

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Norfolk and Suffolk Counties, Massachusetts (MA616)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
1	Water		3.5	0.7%
10	Scarboro and Birdsall soils, 0 to 3 percent slopes	D	14.7	3.0%
31A	Walpole sandy loam, 0 to 5 percent slopes	C	10.7	2.2%
51	Swansea muck, 0 to 1 percent slopes	D	41.8	8.4%
71B	Ridgebury fine sandy loam, 2 to 8 percent slopes, extremely stony	C	6.9	1.4%
103B	Charlton-Hollis-Rock outcrop complex, 3 to 8 percent slopes	B	15.0	3.0%
103C	Charlton-Hollis-Rock outcrop complex, 8 to 15 percent slopes	B	6.5	1.3%
245B	Hinckley sandy loam, 3 to 8 percent slopes	A	65.8	13.2%
245C	Hinckley sandy loam, 8 to 15 percent slopes	A	28.3	5.7%
254A	Merrimac fine sandy loam, 0 to 3 percent slopes	A	58.4	11.7%
254B	Merrimac fine sandy loam, 3 to 8 percent slopes	A	45.5	9.1%
255A	Windsor loamy sand, 0 to 3 percent slopes	A	35.1	7.0%
255B	Windsor loamy sand, 3 to 8 percent slopes	A	61.8	12.4%
255C	Windsor loamy sand, 8 to 15 percent slopes	A	13.1	2.6%
260B	Sudbury fine sandy loam, 2 to 8 percent slopes	B	0.7	0.1%
315B	Scituate fine sandy loam, 3 to 8 percent slopes	C	5.1	1.0%
420B	Canton fine sandy loam, 3 to 8 percent slopes	B	62.7	12.6%
420C	Canton fine sandy loam, 8 to 15 percent slopes	B	1.1	0.2%

Hydrologic Soil Group— Summary by Map Unit — Norfolk and Suffolk Counties, Massachusetts (MA616)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
422B	Canton fine sandy loam, 3 to 8 percent slopes, extremely stony	B	11.8	2.4%
653	Udorthents, sandy	B	9.4	1.9%
Totals for Area of Interest			**498.2**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Appendix 3B – Test Pit Logs

Site Location or lot #	Village Green St, Norfolk				DEEP HOLE # DT #1
Applicant/owner:	ER HOLDINGS				
DATE:	6/24/14	WEATHER:	Sunny	TEMP: 80 °	
LOCATION: (Refer to sketch attached)					
PERFORMED BY:	Randy Murin				
WITNESSED BY:	N/A				
Land Use:	Vacant		Landform:	Ground Moraine	
Vegetation:			Slope:	2-3	
Stone Walls:	☐ Y ☐ N		Surface Stones:	☐ Y ☐ N	

Distance From:			
Open Water Bodies:	ft.	Possible Wet Area:	ft.
Drinking Water Well:	ft.	Drainageway:	ft.
Property Line:	ft.	Other:	

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0-4"	- A	- Sandy Loam	10YR 3/2	
4-24"	- Bw	- Sandy Loam	10YR 5/6	M-F
24-30"	- C1	- Sand	10YR 5/4	Loose, single grain
30-120"	- C2	- Loamy Sand	2.5Y 5/3	Firm to Dense with depth, sandy till, many stc

Parent Material (geologic):	- Abkatun Till	Depth to Bedrock:	
Depth to Groundwater:	Standing Water in Hole:	None	
	Weeping From Pit Face:	None	
	Estimated Seasonal High Groundwater:		N/A

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:					
		Depth to weeping from side of obs. hole:					
		Depth to soil mottles, description:					
		Groundwater adjustment:					
Index Well #:		Reading Date:		Index Well Level:		Adj. Factor:	
Adj. ground water level:							

Notes: PT #1 Depth = 32-44"
Rate = 10mpi

Site Location or lot #	Village Green, Norfolk				DEEP HOLE # DT#2
Applicant/owner:	ER HOLDENS				
DATE:	6/24/14	WEATHER:	Sunny	TEMP: 80°	
LOCATION: (Refer to sketch attached)					
PERFORMED BY:	Randy Miran				
WITNESSED BY:	N/A				
Land Use:	Vacant		Landform:	Ground Moraine	
Vegetation:			Slope:		
Stone Walls:	☐ Y ☐ N		Surface Stones:	☐ Y ☐ N	

Distance From:			
Open Water Bodies:	ft.	Possible Wet Area:	ft.
Drinking Water Well:	ft.	Drainageway:	ft.
Property Line:	ft.	Other:	

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0-4"	- A	- Sandy Loam	10YR 3/2	
4-32"	- Bw	- Sandy Loam	10YR 5/6	M-F
32-120"	- C	- Loamy Sand	2.5Y 5/3	Firm to dense w/ depth; sandy till; many stc
	-	-		

Parent Material (geologic):	- Abbottstown Till	Depth to Bedrock:	
Depth to Groundwater:	Standing Water in Hole:	None	
	Weeping From Pit Face:	None	
	Estimated Seasonal High Groundwater:		N/A

DETERMINATION FOR SEASONAL HIGH WATER TABLE							
Method used:		Depth observed standing in obs. hole:					
		Depth to weeping from side of obs. hole:					
		Depth to soil mottles, description:					
		Groundwater adjustment:					
Index Well #:		Reading Date:		Index Well Level:		Adj. Factor:	
Adj. ground water level:							
Notes:							

Site Location or lot #	Village Green, Norfolk				DEEP HOLE # DT#3
Applicant/owner:	ER HOLDINGS				
DATE:	6/24/14	WEATHER:	Sunny	TEMP: 80°	
LOCATION: (Refer to sketch attached)					
PERFORMED BY:	Randy Marin				
WITNESSED BY:	N/A				
Land Use:			Landform:	Ground Morraine	
Vegetation:			Slope:		
Stone Walls:	☐ Y ☐ N		Surface Stones:	☐ Y ☐ N	

Distance From:			
Open Water Bodies:	ft.	Possible Wet Area:	ft.
Drinking Water Well:	ft.	Drainageway:	ft.
Property Line:	ft.	Other:	

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0-3"	- A	- Sandy Loam	10YR 3/2	
3-24"	- Bw	- Sandy Loam	10YR 5/6	MLF
24-108"	- C	- Sand	2.5Y 5/3	stratified sands + gravels, many stc, some silty pockets
	-	-		

Parent Material (geologic):	- Outwash	Depth to Bedrock:	
Depth to Groundwater:	Standing Water in Hole:	None	
	Weeping From Pit Face:	None	
	Estimated Seasonal High Groundwater:		N/A

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:					
		Depth to weeping from side of obs. hole:					
		Depth to soil mottles, description:					
		Groundwater adjustment:					
Index Well #:		Reading Date:		Index Well Level:		Adj. Factor:	
Adj. ground water level:							
Notes:							

Site Location or lot #	Village Green, Norfolk				DEEP HOLE # DT #4
Applicant/owner:	ER HOLDINGS				
DATE:	6/24/14	WEATHER:	Sunny	TEMP: 80°	
LOCATION: (Refer to sketch attached)					
PERFORMED BY:	Randy Miron				
WITNESSED BY:					
Land Use:	Vacant		Landform:	Ground Moraine	
Vegetation:			Slope:		
Stone Walls:	☐ Y ☐ N		Surface Stones:	☐ Y ☐ N	

Distance From:			
Open Water Bodies:	ft.	Possible Wet Area:	ft.
Drinking Water Well:	ft.	Drainageway:	ft.
Property Line:	ft.	Other:	

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0-3"	- A	- Sandy Loam	10YR 3/2	
3-24"	- Bw	- Sandy Loam	10YR 5/6	M-F
24-114"	- C	- Loamy Sand	2.5Y 5/3	Firm to dense w/ depth; sandy till, many stc
	-	-		

Parent Material (geologic):	- Ablation Till	Depth to Bedrock:	
Depth to Groundwater:	Standing Water in Hole:	None	
	Weeping From Pit Face:	None	
	Estimated Seasonal High Groundwater:		N/A

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:					
		Depth to weeping from side of obs. hole:					
		Depth to soil mottles, description:					
		Groundwater adjustment:					
Index Well #:		Reading Date:		Index Well Level:		Adj. Factor:	
Adj. ground water level:							
Notes:							

Site Location or lot #	Village Green, Norfolk				DEEP HOLE #DT #5
Applicant/owner:	ER HOLDINGS				
DATE:	6/24/14	WEATHER:	Sunny	TEMP:	°
LOCATION: (Refer to sketch attached)					
PERFORMED BY:	Randy Muir				
WITNESSED BY:					
Land Use:	Vacant		Landform:	Ground Moraine	
Vegetation:			Slope:		
Stone Walls:	☐ Y ☐ N		Surface Stones:	☐ Y ☐ N	

Distance From:			
Open Water Bodies:	ft.	Possible Wet Area:	ft.
Drinking Water Well:	ft.	Drainageway:	ft.
Property Line:	ft.	Other:	

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0-3"	- A	- Sandy Loam	10YR 3/2	
3-24"	- Bw	- Sandy Loam	10YR 5/6	M-F
24-48"	- C1	- Sand	10YR 5/4	Loose single grain
48-120"	- C2	- Loamy Sand	2.5Y 5/3	Firm to dense, many stc, sandy till

Parent Material (geologic):	-	Depth to Bedrock:	
Depth to Groundwater:	Standing Water in Hole:	None	
	Weeping From Pit Face:	None	
	Estimated Seasonal High Groundwater:		N/A

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:					
		Depth to weeping from side of obs. hole:					
		Depth to soil mottles, description:					
		Groundwater adjustment:					
Index Well #:		Reading Date:		Index Well Level:		Adj. Factor:	
Adj. ground water level:							
Notes:							

Site Location or lot #	Village Green, Norfolk			DEEP HOLE # DT#6
Applicant/owner:	EB HOLDINGS			
DATE:	6/24/14	WEATHER:	Sunny	TEMP: 80°
LOCATION: (Refer to sketch attached)				
PERFORMED BY:	Randy Minn			
WITNESSED BY:				
Land Use:	Vacant	Landform:	Ground Moraine	
Vegetation:		Slope:		
Stone Walls:	☐ Y ☐ N	Surface Stones:	☐ Y ☐ N	

Distance From:			
Open Water Bodies:	ft.	Possible Wet Area:	ft.
Drinking Water Well:	ft.	Drainageway:	ft.
Property Line:	ft.	Other:	

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0-3"	- A	- Sandy Loam	10YR 3/2	
3-30"	- Bw	- Sandy Loam	10YR 5/6	M-F
30-44"	- C	- Sand	10YR 5/4	Med sand, loose, single grain
	-	-		

Parent Material (geologic):	- Outwash	Depth to Bedrock:	
Depth to Groundwater:	Standing Water in Hole:	None	
	Weeping From Pit Face:	None	
	Estimated Seasonal High Groundwater:		N/A

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:					
		Depth to weeping from side of obs. hole:					
		Depth to soil mottles, description:					
		Groundwater adjustment:					
Index Well #:		Reading Date:		Index Well Level:		Adj. Factor:	
Adj. ground water level:							

Notes: Perc Depth = 32-44"
Rate = < 2mpi

Site Location or lot #	Village Green, Norfolk			DEEP HOLE # DT #7
Applicant/owner:	FR HOLDINGS			
DATE:	6/24/14	WEATHER:	Sunny	TEMP: 80°
LOCATION: (Refer to sketch attached)				
PERFORMED BY:	Randy Mion			
WITNESSED BY:				
Land Use:	Vacant	Landform:	Ground Moraine	
Vegetation:		Slope:		
Stone Walls:	☐ Y ☐ N	Surface Stones:	☐ Y ☐ N	

Distance From:			
Open Water Bodies:	ft.	Possible Wet Area:	ft.
Drinking Water Well:	ft.	Drainageway:	ft.
Property Line:	ft.	Other:	

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0-3"	- A	- Sandy Loam	10YR 3/2	
3-24"	- Bw	- Sandy Loam	10YR 5/6	M-F
24-66"	- C1	- Sand	10YR 5/4	Loose, single grains
66-132"	- C2	- Loamy Sand	2.5Y 5/3	Firm to dense ablation till

Parent Material (geologic):	- Outwash	Depth to Bedrock:	
Depth to Groundwater:	Standing Water in Hole:	None	
	Weeping From Pit Face:	None	
	Estimated Seasonal High Groundwater:		N/A

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:					
		Depth to weeping from side of obs. hole:					
		Depth to soil mottles, description:					
		Groundwater adjustment:					
Index Well #:		Reading Date:		Index Well Level:		Adj. Factor:	
Adj. ground water level:							
Notes:							

Site Location or lot #	Village Green, Norfolk				DEEP HOLE # DT#8
Applicant/owner:	ER HOLDINGS				
DATE:	6/24/14	WEATHER:	Sunny	TEMP: 80 °	
LOCATION: (Refer to sketch attached)					
PERFORMED BY:	Randy Miron				
WITNESSED BY:					
Land Use:	Vacant		Landform:	Ground Moraine	
Vegetation:			Slope:		
Stone Walls:	☐ Y ☐ N		Surface Stones:	☐ Y ☐ N	

Distance From:			
Open Water Bodies:	ft.	Possible Wet Area:	ft.
Drinking Water Well:	ft.	Drainageway:	ft.
Property Line:	ft.	Other:	

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0-4"	- A	- Sandy Loam	10YR 3/2	
4-28"	- Bw	- Sandy Loam	10YR 5/6	M-F
28-120"	- C	- Sand	10YR 5/2	Stratified sands + gravels, many stc, single grain
	-	-		

Parent Material (geologic):	- Outwash	Depth to Bedrock:	
Depth to Groundwater:	Standing Water in Hole:	None	
	Weeping From Pit Face:	None	
	Estimated Seasonal High Groundwater:		N/A

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:					
		Depth to weeping from side of obs. hole:					
		Depth to soil mottles, description:					
		Groundwater adjustment:					
Index Well #:		Reading Date:		Index Well Level:		Adj. Factor:	
Adj. ground water level:							

Notes: PT#8 Depth = 36-48"
Rate = < 2mpi

Site Location or lot #	Village Green, Norfolk				DEEP HOLE # PT #9
Applicant/owner:	ER HOLDINGS				
DATE:	6/24/14	WEATHER:	Sunny	TEMP: 80 °	
LOCATION: (Refer to sketch attached)					
PERFORMED BY:	Randy Mirin				
WITNESSED BY:					
Land Use:			Landform:		
Vegetation:			Slope:		
Stone Walls:	☐ Y ☐ N		Surface Stones:	☐ Y ☐ N	
Distance From:					
Open Water Bodies:	ft.	Possible Wet Area:	ft.		
Drinking Water Well:	ft.	Drainageway:	ft.		
Property Line:	ft.	Other:			

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0-4"	- A	- Sandy Loam	10YR 3/2	
4-28"	- Bw	- Sandy Loam	10YR 5/6	M-F
28-54"	- C1	- Sand	10YR 5/4	Coarse sand, loose, single grain
54-114"	- C2	- Sand	2.5Y 5/3	Fine med sand, loose

Parent Material (geologic):	- Outwash	Depth to Bedrock:	
Depth to Groundwater:	Standing Water in Hole:	None	
	Weeping From Pit Face:	None	
	Estimated Seasonal High Groundwater:		N/A

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:					
		Depth to weeping from side of obs. hole:					
		Depth to soil mottles, description:					
		Groundwater adjustment:					
Index Well #:		Reading Date:		Index Well Level:		Adj. Factor:	
Adj. ground water level:							

Notes: PT #9 Depth: 31-43"
Rate = < 2min

Site Location or lot #	Village Green, Norfolk				DEEP HOLE # DT #10
Applicant/owner:	ER HOLDINGS				
DATE:	6/24/14	WEATHER:	Sunny	TEMP: 80 °	
LOCATION: (Refer to sketch attached)					
PERFORMED BY:	Randy Muran				
WITNESSED BY:	N/A				
Land Use:	Vacant		Landform:	Ground Moraine	
Vegetation:			Slope:		
Stone Walls:	☐ Y ☐ N		Surface Stones:	☐ Y ☐ N	
Distance From:					
Open Water Bodies:	ft.	Possible Wet Area:	ft.		
Drinking Water Well:	ft.	Drainageway:	ft.		
Property Line:	ft.	Other:			

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0-3"	- A	- Sandy Loam	10YR 3/2	
3-24"	- Bw	- Sandy Loam	10YR 5/6	MFF
24-108"	- C	- Sand	10YR 5/4	Loose, single grain, coarse
	-	-		

Parent Material (geologic):	- Outwash	Depth to Bedrock:	
Depth to Groundwater:	Standing Water in Hole:	None	
	Weeping From Pit Face:	None	
	Estimated Seasonal High Groundwater:		N/A

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:					
		Depth to weeping from side of obs. hole:					
		Depth to soil mottles, description:					
		Groundwater adjustment:					
Index Well #:		Reading Date:		Index Well Level:		Adj. Factor:	
Adj. ground water level:							

Notes: Perc #10 Depth = 30-42"
Rate - < 2 mpi

Site Location or lot #	Village Green, Norfolk				DEEP HOLE # DH#11
Applicant/owner:	ER HOLDINGS				
DATE:	6/24/14	WEATHER:	Sunny	TEMP: 80 °	
LOCATION: (Refer to sketch attached)					
PERFORMED BY:	Randy Mim				
WITNESSED BY:					
Land Use:	Vacant		Landform:	Ground Moraine	
Vegetation:			Slope:		
Stone Walls:	☐ Y ☐ N		Surface Stones:	☐ Y ☐ N	

Distance From:			
Open Water Bodies:	ft.	Possible Wet Area:	ft.
Drinking Water Well:	ft.	Drainageway:	ft.
Property Line:	ft.	Other:	

DEEP OBSERVATION HOLE LOG

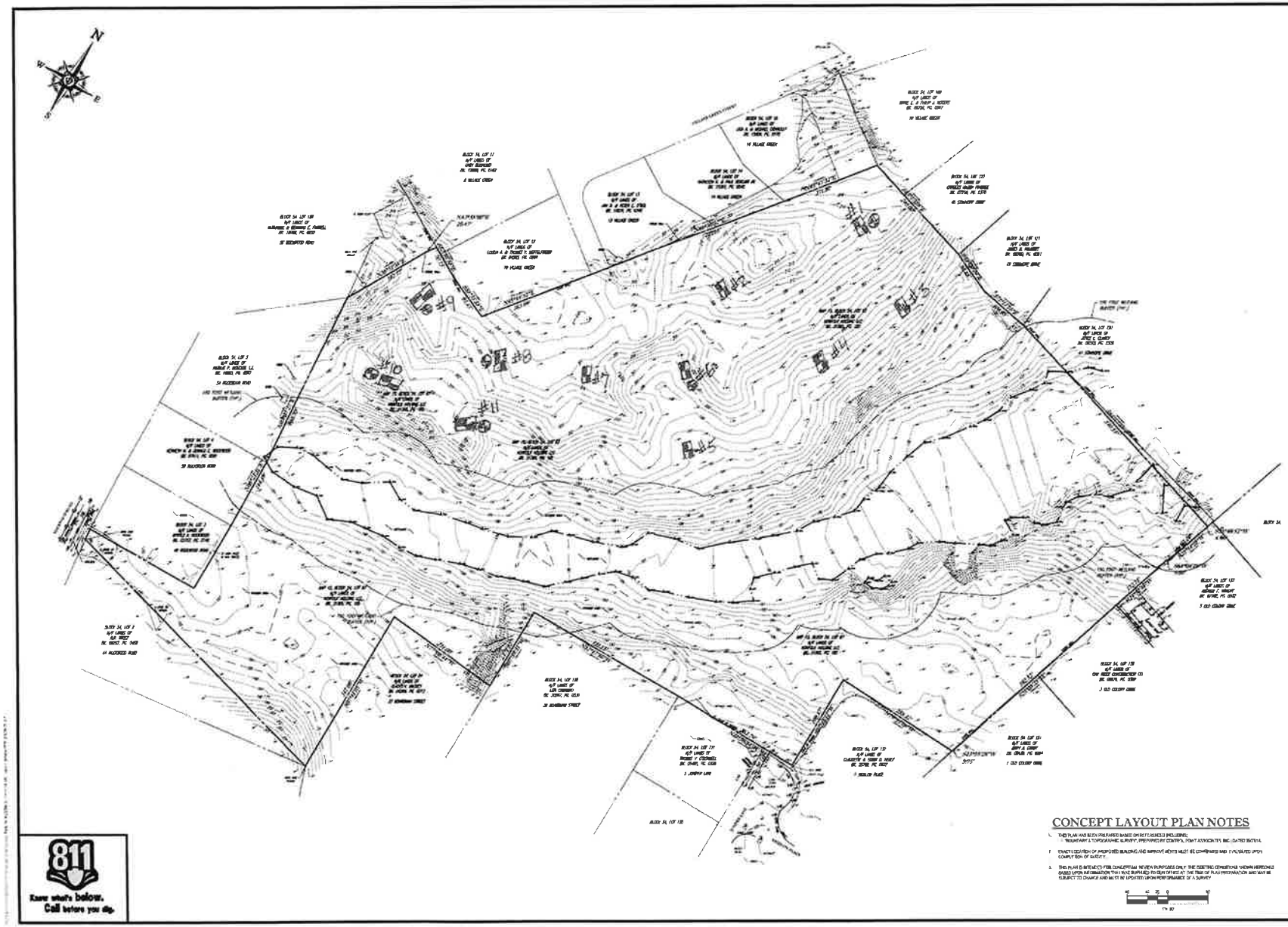
Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0-3"	- A	- Sandy Loam	10YR 3/2	
3-30"	- Bw	- Sandy Loam	10YR 5/6	M-F
30-114"	- C	- Sand	10YR 5/4	Loose, single grain, coarse Sand w/ S+C
	-	-		

Parent Material (geologic):	- outwash	Depth to Bedrock:	
Depth to Groundwater:	Standing Water in Hole:	None	
	Weeping From Pit Face:	None	
	Estimated Seasonal High Groundwater:		N/A

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:					
		Depth to weeping from side of obs. hole:					
		Depth to soil mottles, description:					
		Groundwater adjustment:					
Index Well #:		Reading Date:		Index Well Level:		Adj. Factor:	
Adj. ground water level:							

Notes: Perc #11 Depth = 36-48"
Rate = <2 MPI



CONCEPT LAYOUT PLAN NOTES

1. THIS PLAN HAS BEEN PREPARED BASED ON REFERENCE(S) INCLUDING:
   "BOUNDARY & TOPOGRAPHIC SURVEY", PREPARED BY CONTROL POINT ASSOCIATES, INC., DATED 05/07/14.
2. EXACT LOCATION OF PROPOSED BUILDING AND IMPROVEMENTS MUST BE COORDINATED AND EVALUATED UPON COMPLETION OF SURVEY.
3. THIS PLAN IS INTENDED FOR CONCEPTUAL REVIEW PURPOSES ONLY. THE EXISTING CONDITIONS SHOWN HEREON IS BASED UPON INFORMATION THAT WAS SUPPLIED TO BOHLER OFFICE AT THE TIME OF PLAN PREPARATION AND MAY BE SUBJECT TO CHANGE AND MUST BE UPDATED UPON PERFORMANCE OF A SURVEY.

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REV.	DATE	COMMENT	BY
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PRELIMINARY

PROJECT NO.: [illegible]
DRAWN BY: [illegible]
CHECKED BY: [illegible]
DATE: [illegible]
SCALE: [illegible]
CAD I.D.: [illegible]

PROJECT: SITE DEVELOPMENT PLANS
-FOR-
ER HOLDINGS, LLC

LOCATION OF SITE
VILLAGE GREEN
NORFOLK, MA

BOHLER ENGINEERING
352 TURNPIKE ROAD
SOUTHBOROUGH, MA 01772
Phone: (508) 480-9900
Fax: (508) 480-9095
www.BohlerEngineering.com

W.D. GOEBEL
PROFESSIONAL ENGINEER

SHEET TITLE:
PROPOSED TESTPIT LOCATION PLAN

SHEET NUMBER:
1
OF 1

REV 0 - 05/09/2014

Site Location or lot #	Village Green St, Norfolk				DEEP HOLE # DT #12
Applicant/owner:	Norfolk Holding LLC				
DATE:	4/16/18	WEATHER:	RAIN	TEMP: 50 °	
LOCATION: (Refer to sketch attached)					
PERFORMED BY:	Randy Miron, Licensed Soil Evaluator				
WITNESSED BY:	N/A				
Land Use:	Wooded		Landform:		
Vegetation:			Slope:	2-3%	
Stone Walls:	☒ Y ☐ N		Surface Stones:	☒ Y ☐ N	
Distance From:					
Open Water Bodies:	>100 ft.	Possible Wet Area:		>100 ft.	
Drinking Water Well:	>100 ft.	Drainageway:		>100 ft.	
Property Line:	ft.	Other:			

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0-7"	A	Sandy Loam	10YR 3/2	M-F
7-30"	Bw	Sandy Loam	10YR 5/6	M-F
30-130"	C	Sand	10YR 5/4	Loose, single grain

Parent Material (geologic):	Glacial Outwash	Depth to Bedrock:	> 130'
Depth to Groundwater:	Standing Water in Hole:	N/A	
	Weeping From Pit Face:	N/A	
	Estimated Seasonal High Groundwater:		> 130"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:					
		Depth to weeping from side of obs. hole:					
		Depth to soil mottles, description:					
		Groundwater adjustment:					
Index Well #:		Reading Date:		Index Well Level:		Adj. Factor:	
Adj. ground water level:							

Notes:	No soil mottling observed Perc Depth: 36-48", Rate = < 2 mpi

Site Location or lot #	Village Green St, Norfolk				DEEP HOLE # DT #13
Applicant/owner:	Norfolk Holdings LLC				
DATE:	10/10/18	WEATHER:	Sunny	TEMP: 80°	
LOCATION: (Refer to sketch attached)					
PERFORMED BY:	Randy Muran, Licensed Soil Evaluator				
WITNESSED BY:	N/A				
Land Use:	Vacant / Wooded		Landform:		
Vegetation:			Slope:		
Stone Walls:	☒ Y ☐ N		Surface Stones:	☒ Y ☐ N	
Distance From:					
Open Water Bodies:	ft.	Possible Wet Area:		ft.	
Drinking Water Well:	ft.	Drainageway:		ft.	
Property Line:	ft.	Other:			

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0-6"	A	Sandy Loam	10YR 3/2	M-F
6-28"	Bw	Sandy Loam	10YR 5/6	M-F
28-56"	C1	Sand	10YR 5/4	Loose, single grain
56-174"	C2	Loamy Sand	10YR 5/3	Sandy till w/ many stones + cobbles, gravelly; Firm

Parent Material (geologic):	Ablation Till	Depth to Bedrock:	>174"
Depth to Groundwater:	Standing Water in Hole:	168"	
	Weeping From Pit Face:	168"	
	Estimated Seasonal High Groundwater:		@ 168"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:					
		Depth to weeping from side of obs. hole:					
		Depth to soil mottles, description:					
		Groundwater adjustment:					
Index Well #:		Reading Date:		Index Well Level:		Adj. Factor:	
Adj. ground water level:							

Notes: No soil mottling observed

Site Location or lot #	Village Green St, Norfolk				DEEP HOLE # DT #14
Applicant/owner:	Norfolk Holding LLC				
DATE:	10/10/18	WEATHER:	Sunny	TEMP: 80°	
LOCATION: (Refer to sketch attached)					
PERFORMED BY:	Randy Miron, Licensed Soil Evaluator				
WITNESSED BY:	N/A				
Land Use:	Wooded / vacant		Landform:		
Vegetation:			Slope:		
Stone Walls:	☒ Y ☐ N		Surface Stones:	☒ Y ☐ N	
Distance From:					
Open Water Bodies:	ft.	Possible Wet Area:		ft.	
Drinking Water Well:	ft.	Drainageway:		ft.	
Property Line:	ft.	Other:			

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0-6"	A	Sandy Loam	10YR 3/2	M-F
6-32"	Bu	Sandy Loam	10YR 5/6	M-F
32-48"	C1	Sand	10YR 5/4	Loose, single grain
48-168"	C2	Loamy Sand	10YR 5/3	Sandy Till w/ many stones + cobbles, gravelly

Parent Material (geologic):	Ablation Till	Depth to Bedrock:	> 168"
Depth to Groundwater:	Standing Water in Hole:	162"	
	Weeping From Pit Face:	162"	
	Estimated Seasonal High Groundwater:		@ 162"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:					
		Depth to weeping from side of obs. hole:					
		Depth to soil mottles, description:					
		Groundwater adjustment:					
Index Well #:		Reading Date:		Index Well Level:		Adj. Factor:	
Adj. ground water level:							

Notes: No soil mottling observed

Site Location or lot #	Village Green St.				DEEP HOLE # DT#15
Applicant/owner:	Norfolk Holdings LLC				
DATE:	10/10/18	WEATHER:	Sunny	TEMP: 80 °	
LOCATION: (Refer to sketch attached)					
PERFORMED BY:	Randy Niven, Licensed Soil Evaluator				
WITNESSED BY:	N/A				
Land Use:		Landform:			
Vegetation:		Slope:			
Stone Walls:	☐ Y ☐ N	Surface Stones:	☐ Y ☐ N		

Distance From:			
Open Water Bodies:	ft.	Possible Wet Area:	ft.
Drinking Water Well:	ft.	Drainageway:	ft.
Property Line:	ft.	Other:	

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0-6"	A	Sandy Loam	10YR 3/2	M-F
6-24"	Bw	Sandy Loam	10YR 5/6	M-F
24-48"	C1	Sand	10YR 5/4	Loose, single grain
48-132"	C2	Sand	10YR 5/4	Stratified sands and gravels, very gravelly w/ stones + cobbles

Parent Material (geologic):	Glacial Outwash	Depth to Bedrock:	>132"
Depth to Groundwater:	Standing Water in Hole:	126"	
	Weeping From Pit Face:	126"	
	Estimated Seasonal High Groundwater:		@ 126"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:					
		Depth to weeping from side of obs. hole:					
		Depth to soil mottles, description:					
		Groundwater adjustment:					
Index Well #:		Reading Date:		Index Well Level:		Adj. Factor:	
Adj. ground water level:							

Notes: No soil mottling observed
Perc: Depth = 50-62", Rate = < 2 mpi

Site Location or lot #	Village Green St				DEEP HOLE # DT #16
Applicant/owner:	Norfolk Holdings LLC				
DATE:	10/10/18	WEATHER:	Sunny	TEMP: 80 °	
LOCATION: (Refer to sketch attached)					
PERFORMED BY:	Randy Miron, Licensed Soil Evaluator				
WITNESSED BY:	N/A				
Land Use:		Landform:			
Vegetation:		Slope:			
Stone Walls:	☐ Y ☐ N	Surface Stones:	☐ Y ☐ N		
Distance From:					
Open Water Bodies:	ft.	Possible Wet Area:	ft.		
Drinking Water Well:	ft.	Drainageway:	ft.		
Property Line:	ft.	Other:			

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0-6"	- A	- Sandy Loam	10YR 3/2	M-F
6-28"	- Bw	- Loamy Sand	10YR 5/6	M-F
28-144"	- C	- Sand	10YR 5/4	Loose, single grain, med sand
	-	-		

Parent Material (geologic):	- Glacial Outwash	Depth to Bedrock:	
Depth to Groundwater:	Standing Water in Hole:	N/A	
	Weeping From Pit Face:	N/A	
	Estimated Seasonal High Groundwater:		N/A

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:					
		Depth to weeping from side of obs. hole:					
		Depth to soil mottles, description:					
		Groundwater adjustment:					
Index Well #:		Reading Date:		Index Well Level:		Adj. Factor:	
Adj. ground water level:							

Notes:	No soil mottling observed Perc Depth: 36-48", Rock = <2mpi

Site Location or lot #	Village Green St.				DEEP HOLE # DT #17
Applicant/owner:	Norfolk Holding LLC				
DATE:	10/10/18	WEATHER:	Sunny	TEMP: 80 °	
LOCATION: (Refer to sketch attached)					
PERFORMED BY:	Randy Miron, Licensed Soil Evaluator				
WITNESSED BY:	N/A				
Land Use:			Landform:		
Vegetation:			Slope:		
Stone Walls:	☐ Y ☐ N		Surface Stones:	☐ Y ☐ N	

Distance From:			
Open Water Bodies:	ft.	Possible Wet Area:	ft.
Drinking Water Well:	ft.	Drainageway:	ft.
Property Line:	ft.	Other:	

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0-6"	- A	- Sandy Loam	10YR 3/2	M-F
6-26"	- Bw	- Loamy Sand	10YR 5/6	M-F
26-132"	- C	- Sand	10YR 5/4	Stratified sands + gravels, very gravelly w/ stones + cobbles
	-	-		

Parent Material (geologic):	- Glacial Outwash	Depth to Bedrock:	
Depth to Groundwater:	Standing Water in Hole:	N/A	
	Weeping From Pit Face:	N/A	
	Estimated Seasonal High Groundwater:		>132"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:					
		Depth to weeping from side of obs. hole:					
		Depth to soil mottles, description:					
		Groundwater adjustment:					
Index Well #:		Reading Date:		Index Well Level:		Adj. Factor:	
Adj. ground water level:							

Notes: No soil mottles observed
Perc Depth: 30-42", Rate = < 2 mpi

Site Location or lot #	Village Green St.				DEEP HOLE # DT#18
Applicant/owner:	Norfolk Holdings LLC				
DATE:	10/10/18	WEATHER:	Sunny	TEMP: 80°	
LOCATION: (Refer to sketch attached)					
PERFORMED BY:	Randy Miron, Licensed Soil Evaluator				
WITNESSED BY:	N/A				
Land Use:		Landform:			
Vegetation:		Slope:			
Stone Walls:	☐ Y ☐ N	Surface Stones:	☐ Y ☐ N		
Distance From:					
Open Water Bodies:	ft.	Possible Wet Area:	ft.		
Drinking Water Well:	ft.	Drainageway:	ft.		
Property Line:	ft.	Other:			

DEEP OBSERVATION HOLE LOG

Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0-6"	A	Sandy Loam	10YR 3/2	M-F
6-32"	Bw	Sandy Loam	10YR 5/6	M-F
32-48"	C1	Sand	10YR 5/4	Loose, single grain
48-168"	C2	Sandy Loam	10YR 5/3	Sandy Till w/ stones + cobbles, gravelly

Parent Material (geologic):	Abatum Till	Depth to Bedrock:	>168"
Depth to Groundwater:	Standing Water in Hole:	N/A	
	Weeping From Pit Face:	N/A	
	Estimated Seasonal High Groundwater:		>168"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:					
		Depth to weeping from side of obs. hole:					
		Depth to soil mottles, description:					
		Groundwater adjustment:					
Index Well #:		Reading Date:		Index Well Level:		Adj. Factor:	
Adj. ground water level:							

Notes: No soil mottles observed

Site Location or lot #	Village Green St				DEEP HOLE # DT #19
Applicant/owner:	Norfolk Holdings LLC				
DATE:	10/10/18	WEATHER:	Sunny	TEMP: 80 °	
LOCATION: (Refer to sketch attached)					
PERFORMED BY:	Randy Miron, Licensed Soil Evaluator				
WITNESSED BY:	N/A				
Land Use:		Landform:			
Vegetation:		Slope:			
Stone Walls:	☐ Y ☐ N	Surface Stones:	☐ Y ☐ N		
Distance From:					
Open Water Bodies:	ft.	Possible Wet Area:	ft.		
Drinking Water Well:	ft.	Drainageway:	ft.		
Property Line:	ft.	Other:			

DEEP OBSERVATION HOLE LOG

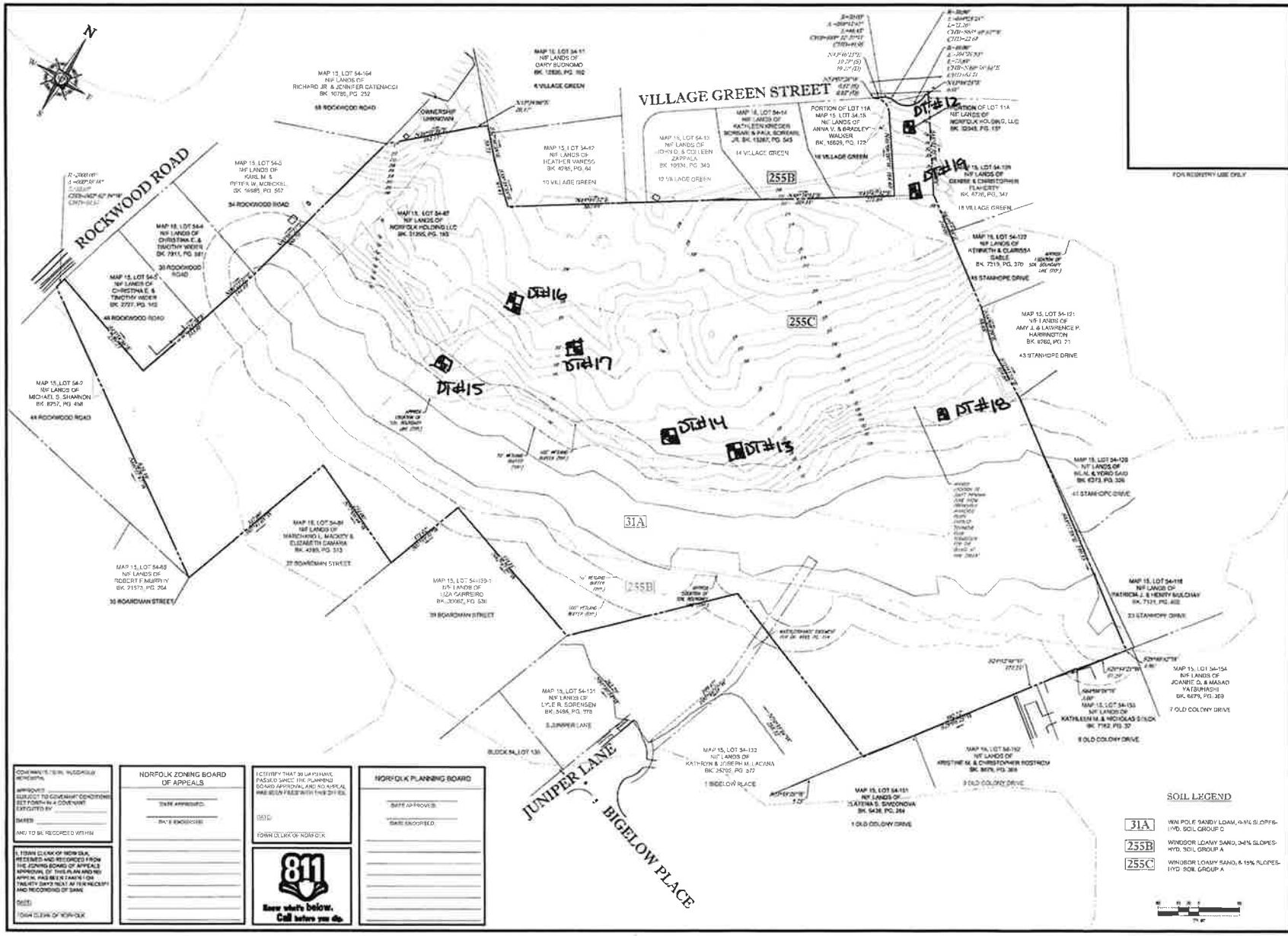
Depth	Soil Horizon	Soil Texture	Soil Color	Other: Structures; Stones; Boulders; Consistency; % gravel
0-4"	- A	- Sandy Loam	10YR 3/2	M-F
4-20"	- Bw	- Sandy Loam	10YR 5/6	M-F
20-132"	- C	- Sand	10YR 5/4	Med sand, loose, single grain
	-	-		

Parent Material (geologic):	- Glacial Outwash	Depth to Bedrock:	>132"
Depth to Groundwater:	Standing Water in Hole:	N/A	
	Weeping From Pit Face:	N/A	
	Estimated Seasonal High Groundwater:		>132"

DETERMINATION FOR SEASONAL HIGH WATER TABLE

Method used:		Depth observed standing in obs. hole:					
		Depth to weeping from side of obs. hole:					
		Depth to soil mottles, description:					
		Groundwater adjustment:					
Index Well #:		Reading Date:		Index Well Level:		Adj. Factor:	
Adj. ground water level:							

Notes: No mottling observed



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REVISIONS

PRELIMINARY PLAN FOR COMPREHENSIVE PERMIT "THE ENCLAVE AT NORFOLK"
A SUBDIVISION IN NORFOLK, MASS.
OWNER: NORFOLK HOLDINGS, LLC
VILLAGE GREEN
TOWN OF NORFOLK
NORFOLK COUNTY, MASS
MAP 15, LOT 54-67

BOHLER ENGINEERING
352 TURNPIKE ROAD
SOUTHBOROUGH, MA 01772
www.BohlerEngineering.com

J.G. SWERLING

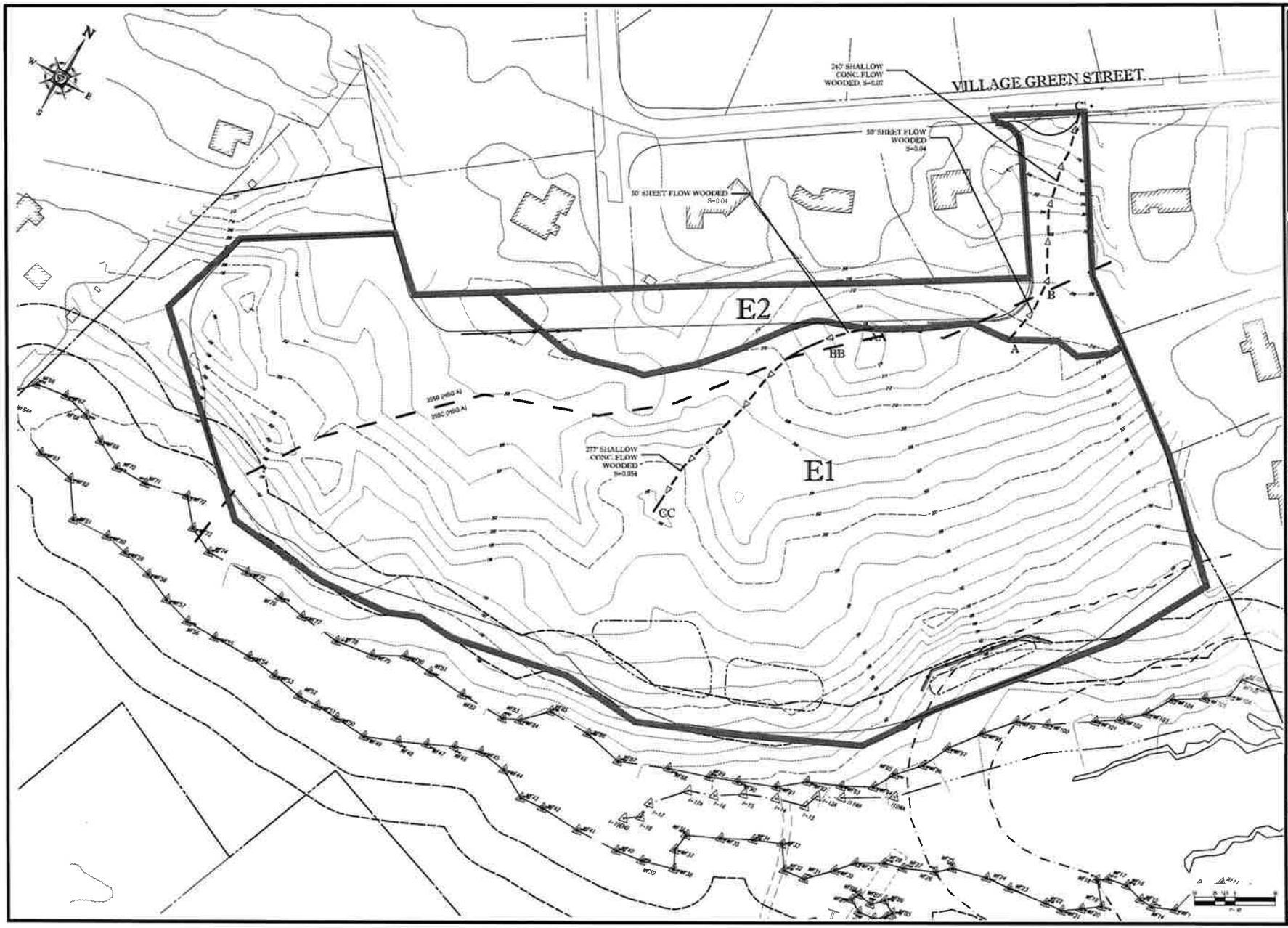
EXISTING CONDITIONS PLAN

SHEET NUMBER: C-3

Appendix 4

Existing Conditions Hydrologic Analysis

Appendix 4A – Existing Conditions Drainage Map



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PROJECT NO.: [illegible]
DRAWN BY: KSS
CHECKED BY: RNM
DATE: 06/13/2017
SCALE: AS NOTED
CAD I.D.: [illegible]

PROJECT:
PRELIMINARY PLAN
FOR
COMPREHENSIVE PERMIT
"THE ENCLAVE AT NORFOLK"
A SUBDIVISION IN NORFOLK, MASS.

OWNER: NORFOLK HOLDINGS, LLC
VILLAGE GREEN
TOWN OF NORFOLK
NORFOLK COUNTY, MASS.
MAP #15, LOT 54-57

BOHLER ENGINEERING
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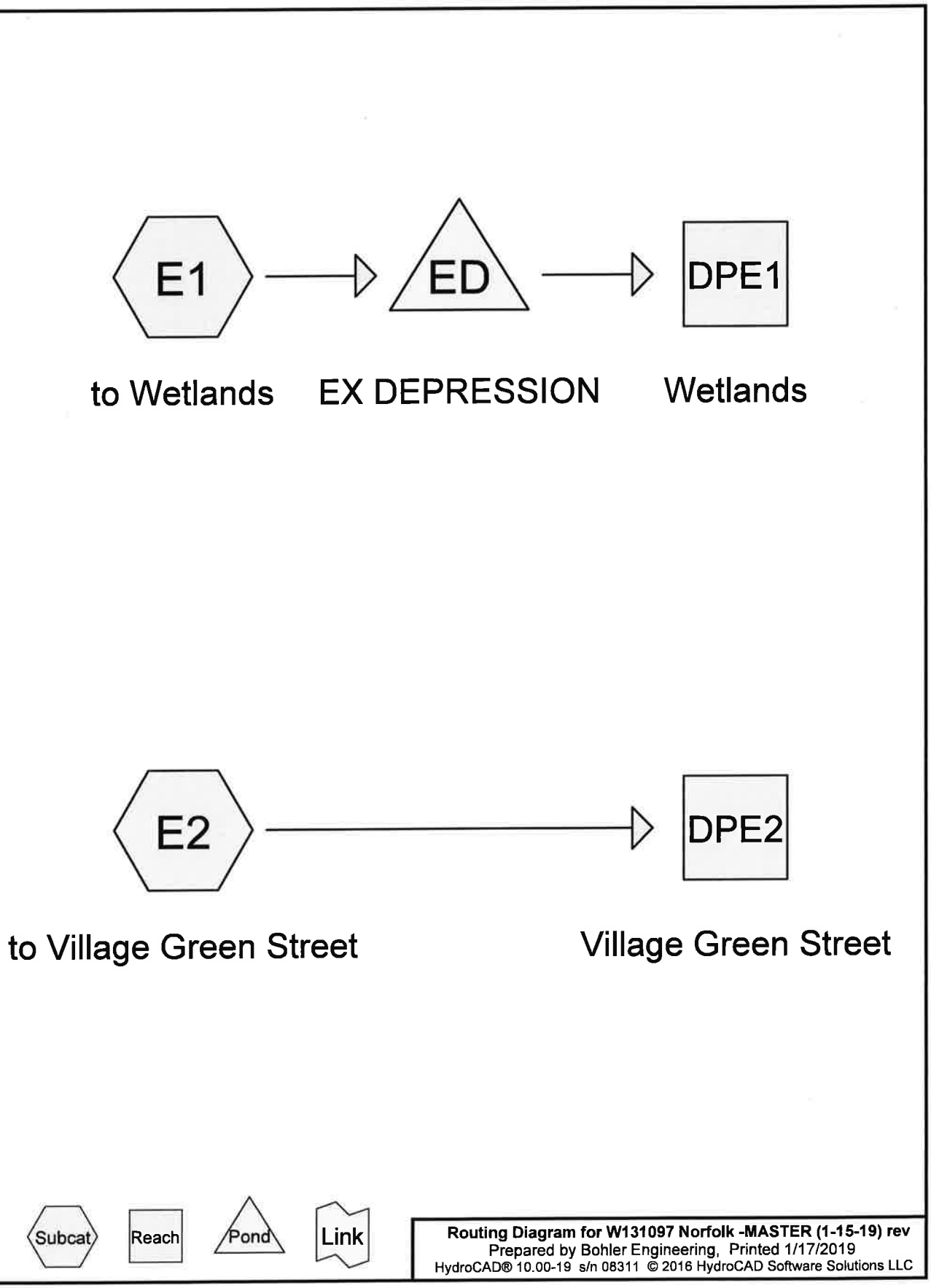
SHEET TITLE:
EXISTING DRAINAGE TRIBUTARY MAP

SHEET NUMBER:
ED-1

Appendix 4B – HydroCAD computations



Routing Diagram for W131097 Norfolk -MASTER (1-15-19) rev
Prepared by Bohler Engineering, Printed 1/17/2019
HydroCAD® 10.00-19 s/n 08311 © 2016 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
13.454	30	Woods, Good, HSG A (E1, E2)
13.454	**30**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
13.454	HSG A	E1, E2
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
13.454		**TOTAL AREA**

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentE1: to Wetlands Runoff Area=513,215 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=327' Tc=13.3 min CN=30 Runoff=0.00 cfs 0.000 af

SubcatchmentE2: to Village Green Street Runoff Area=72,856 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=290' Tc=12.3 min CN=30 Runoff=0.00 cfs 0.000 af

Reach DPE1: Wetlands Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach DPE2: Village Green Street Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Pond ED: EX DEPRESSION Peak Elev=197.80' Storage=0 cf Inflow=0.00 cfs 0.000 af
Discarded=0.00 cfs 0.000 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

Total Runoff Area = 13.454 ac Runoff Volume = 0.000 af Average Runoff Depth = 0.00"
100.00% Pervious = 13.454 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment E1: to Wetlands

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 yr Rainfall=3.20"

Area (sf)	CN	Description
513,215	30	Woods, Good, HSG A
513,215		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		**Sheet Flow, AA-BB** Woods: Light underbrush n= 0.400 P2= 3.20"
4.0	277	0.0540	1.16		**Shallow Concentrated Flow, BB-CC** Woodland Kv= 5.0 fps
13.3	327	Total			

Summary for Subcatchment E2: to Village Green Street

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 yr Rainfall=3.20"

Area (sf)	CN	Description
72,856	30	Woods, Good, HSG A
72,856		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
3.0	240	0.0700	1.32		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
12.3	290	Total			

Summary for Reach DPE1: Wetlands

Inflow Area = 11.782 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2 yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DPE2: Village Green Street

Inflow Area = 1.673 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2 yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Pond ED: EX DEPRESSION

Inflow Area = 11.782 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2 yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 197.80' @ 0.00 hrs Surf.Area= 50 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	197.80'	55 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
197.80	50	0	0
198.00	500	55	55

Device	Routing	Invert	Outlet Devices
#1	Discarded	197.80'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	198.00'	**20.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=197.80' (Free Discharge)
└**1=Exfiltration** (Passes 0.00 cfs of 0.01 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=197.80' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentE1: to Wetlands Runoff Area=513,215 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=327' Tc=13.3 min CN=30 Runoff=0.00 cfs 0.000 af

SubcatchmentE2: to Village Green Street Runoff Area=72,856 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=290' Tc=12.3 min CN=30 Runoff=0.00 cfs 0.000 af

Reach DPE1: Wetlands Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach DPE2: Village Green Street Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Pond ED: EX DEPRESSION Peak Elev=197.80' Storage=0 cf Inflow=0.00 cfs 0.000 af
Discarded=0.00 cfs 0.000 af Primary=0.00 cfs 0.000 af Outflow=0.00 cfs 0.000 af

Total Runoff Area = 13.454 ac Runoff Volume = 0.000 af Average Runoff Depth = 0.00"
100.00% Pervious = 13.454 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment E1: to Wetlands

Runoff = 0.00 cfs @ 24.07 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=4.70"

Area (sf)	CN	Description
513,215	30	Woods, Good, HSG A
513,215		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		**Sheet Flow, AA-BB** Woods: Light underbrush n= 0.400 P2= 3.20"
4.0	277	0.0540	1.16		**Shallow Concentrated Flow, BB-CC** Woodland Kv= 5.0 fps
13.3	327	Total			

Summary for Subcatchment E2: to Village Green Street

Runoff = 0.00 cfs @ 24.06 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=4.70"

Area (sf)	CN	Description
72,856	30	Woods, Good, HSG A
72,856		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
3.0	240	0.0700	1.32		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
12.3	290	Total			

Summary for Reach DPE1: Wetlands

Inflow Area = 11.782 ac, 0.00% Impervious, Inflow Depth = 0.00" for 10 yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DPE2: Village Green Street

Inflow Area = 1.673 ac, 0.00% Impervious, Inflow Depth = 0.00" for 10 yr event
Inflow = 0.00 cfs @ 24.06 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 24.06 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Pond ED: EX DEPRESSION

Inflow Area = 11.782 ac, 0.00% Impervious, Inflow Depth = 0.00" for 10 yr event
Inflow = 0.00 cfs @ 24.07 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 24.07 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.1 min
Discarded = 0.00 cfs @ 24.07 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 197.80' @ 24.07 hrs Surf.Area= 50 sf Storage= 0 cf

Plug-Flow detention time= 0.2 min calculated for 0.000 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (1,436.2 - 1,436.1)

Volume	Invert	Avail.Storage	Storage Description
#1	197.80'	55 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
197.80	50	0	0
198.00	500	55	55

Device	Routing	Invert	Outlet Devices
#1	Discarded	197.80'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	198.00'	**20.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.01 cfs @ 24.07 hrs HW=197.80' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=197.80' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentE1: to Wetlands Runoff Area=513,215 sf 0.00% Impervious Runoff Depth=0.03"
Flow Length=327' Tc=13.3 min CN=30 Runoff=0.04 cfs 0.028 af

SubcatchmentE2: to Village Green Street Runoff Area=72,856 sf 0.00% Impervious Runoff Depth=0.03"
Flow Length=290' Tc=12.3 min CN=30 Runoff=0.01 cfs 0.004 af

Reach DPE1: Wetlands Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach DPE2: Village Green Street Inflow=0.01 cfs 0.004 af
Outflow=0.01 cfs 0.004 af

Pond ED: EX DEPRESSION Peak Elev=197.88' Storage=10 cf Inflow=0.04 cfs 0.028 af
Discarded=0.04 cfs 0.028 af Primary=0.00 cfs 0.000 af Outflow=0.04 cfs 0.028 af

Total Runoff Area = 13.454 ac Runoff Volume = 0.032 af Average Runoff Depth = 0.03"
100.00% Pervious = 13.454 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment E1: to Wetlands

Runoff = 0.04 cfs @ 21.15 hrs, Volume= 0.028 af, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr Rainfall=5.50"

Area (sf)	CN	Description
513,215	30	Woods, Good, HSG A
513,215		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		**Sheet Flow, AA-BB** Woods: Light underbrush n= 0.400 P2= 3.20"
4.0	277	0.0540	1.16		**Shallow Concentrated Flow, BB-CC** Woodland Kv= 5.0 fps
13.3	327	Total			

Summary for Subcatchment E2: to Village Green Street

Runoff = 0.01 cfs @ 21.17 hrs, Volume= 0.004 af, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr Rainfall=5.50"

Area (sf)	CN	Description
72,856	30	Woods, Good, HSG A
72,856		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
3.0	240	0.0700	1.32		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
12.3	290	Total			

Summary for Reach DPE1: Wetlands

Inflow Area = 11.782 ac, 0.00% Impervious, Inflow Depth = 0.00" for 25 yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DPE2: Village Green Street

Inflow Area = 1.673 ac, 0.00% Impervious, Inflow Depth = 0.03" for 25 yr event
Inflow = 0.01 cfs @ 21.17 hrs, Volume= 0.004 af
Outflow = 0.01 cfs @ 21.17 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Pond ED: EX DEPRESSION

Inflow Area = 11.782 ac, 0.00% Impervious, Inflow Depth = 0.03" for 25 yr event
Inflow = 0.04 cfs @ 21.15 hrs, Volume= 0.028 af
Outflow = 0.04 cfs @ 21.33 hrs, Volume= 0.028 af, Atten= 0%, Lag= 11.0 min
Discarded = 0.04 cfs @ 21.33 hrs, Volume= 0.028 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 197.88' @ 21.33 hrs Surf.Area= 222 sf Storage= 10 cf

Plug-Flow detention time= 3.7 min calculated for 0.028 af (100% of inflow)
Center-of-Mass det. time= 3.7 min (1,203.5 - 1,199.8)

Volume	Invert	Avail.Storage	Storage Description
#1	197.80'	55 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
197.80	50	0	0
198.00	500	55	55

Device	Routing	Invert	Outlet Devices
#1	Discarded	197.80'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	198.00'	**20.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.04 cfs @ 21.33 hrs HW=197.88' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.04 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=197.80' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=0.00-36.00 hrs, dt=0.01 hrs, 3601 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

SubcatchmentE1: to Wetlands Runoff Area=513,215 sf 0.00% Impervious Runoff Depth=0.16"
Flow Length=327' Tc=13.3 min CN=30 Runoff=0.26 cfs 0.160 af

SubcatchmentE2: to Village Green Street Runoff Area=72,856 sf 0.00% Impervious Runoff Depth=0.16"
Flow Length=290' Tc=12.3 min CN=30 Runoff=0.04 cfs 0.023 af

Reach DPE1: Wetlands Inflow=0.20 cfs 0.069 af
Outflow=0.20 cfs 0.069 af

Reach DPE2: Village Green Street Inflow=0.04 cfs 0.023 af
Outflow=0.04 cfs 0.023 af

Pond ED: EX DEPRESSION Peak Elev=198.03' Storage=55 cf Inflow=0.26 cfs 0.160 af
Discarded=0.10 cfs 0.092 af Primary=0.20 cfs 0.069 af Outflow=0.30 cfs 0.160 af

Total Runoff Area = 13.454 ac Runoff Volume = 0.183 af Average Runoff Depth = 0.16"
100.00% Pervious = 13.454 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment E1: to Wetlands

Runoff = 0.26 cfs @ 14.85 hrs, Volume= 0.160 af, Depth= 0.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr Rainfall=6.70"

Area (sf)	CN	Description
513,215	30	Woods, Good, HSG A
513,215		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		**Sheet Flow, AA-BB** Woods: Light underbrush n= 0.400 P2= 3.20"
4.0	277	0.0540	1.16		**Shallow Concentrated Flow, BB-CC** Woodland Kv= 5.0 fps
13.3	327	Total			

Summary for Subcatchment E2: to Village Green Street

Runoff = 0.04 cfs @ 14.83 hrs, Volume= 0.023 af, Depth= 0.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr Rainfall=6.70"

Area (sf)	CN	Description
72,856	30	Woods, Good, HSG A
72,856		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.3	50	0.0400	0.09		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
3.0	240	0.0700	1.32		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
12.3	290	Total			

Summary for Reach DPE1: Wetlands

Inflow Area = 11.782 ac, 0.00% Impervious, Inflow Depth = 0.07" for 100 yr event
Inflow = 0.20 cfs @ 14.85 hrs, Volume= 0.069 af
Outflow = 0.20 cfs @ 14.85 hrs, Volume= 0.069 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DPE2: Village Green Street

Inflow Area =	1.673 ac,	0.00% Impervious,	Inflow Depth =	0.16"	for 100 yr event
Inflow =	0.04 cfs @	14.83 hrs, Volume=	0.023 af		
Outflow =	0.04 cfs @	14.83 hrs, Volume=	0.023 af,	Atten= 0%,	Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Pond ED: EX DEPRESSION

Inflow Area =	11.782 ac,	0.00% Impervious,	Inflow Depth =	0.16"	for 100 yr event
Inflow =	0.26 cfs @	14.85 hrs, Volume=	0.160 af		
Outflow =	0.30 cfs @	14.85 hrs, Volume=	0.160 af,	Atten= 0%,	Lag= 0.0 min
Discarded =	0.10 cfs @	13.04 hrs, Volume=	0.092 af		
Primary =	0.20 cfs @	14.85 hrs, Volume=	0.069 af		

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 198.03' @ 14.85 hrs Surf.Area= 500 sf Storage= 55 cf

Plug-Flow detention time= 5.4 min calculated for 0.160 af (100% of inflow)
Center-of-Mass det. time= 5.4 min (1,066.9 - 1,061.5)

Volume	Invert	Avail.Storage	Storage Description
#1	197.80'	55 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
197.80	50	0	0
198.00	500	55	55

Device	Routing	Invert	Outlet Devices
#1	Discarded	197.80'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	198.00'	**20.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.10 cfs @ 13.04 hrs HW=198.00' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.10 cfs)

Primary OutFlow Max=0.20 cfs @ 14.85 hrs HW=198.03' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 0.20 cfs @ 0.39 fps)

Appendix 5

Proposed Conditions Hydrologic Analysis

Appendix 5A – Proposed Conditions Drainage Map

BOHLER ENGINEERING

REVISIONS

PROJECT NO.
DRAWN BY
CHECKED BY
DATE
SCALE: AS NOTED
CAD I.D.

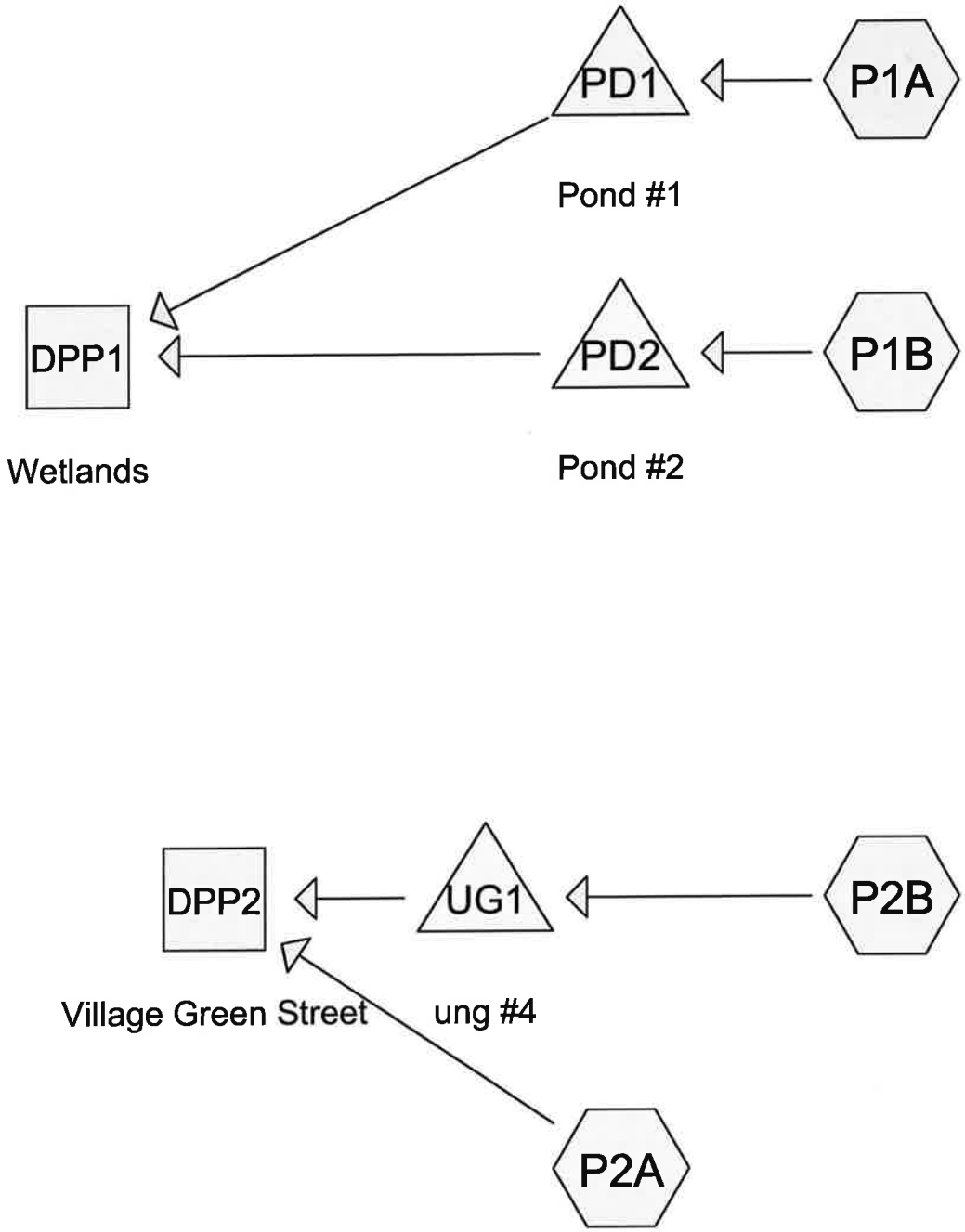
PROJECT:
PRELIMINARY PLAN
FOR
COMPREHENSIVE PERMIT
"THE ENCLAVE AT NORFOLK"
A SUBDIVISION IN NORFOLK, MASS.
OWNER: NORFOLK HOLDINGS, LLC
VILLAGE GREEN
TOWN OF NORFOLK
NORFOLK COUNTY MASS.
MAP 415, LOT 56-57

BOHLER ENGINEERING
352 TURNPIKE ROAD
SOUTHBOROUGH, MA 01772
Phone (508) 480-9595
Fax (508) 480-9580
www.BohlerEngineering.com

SHEET TITLE:
PROPOSED DRAINAGE TRIBUTARY MAP

SHEET NUMBER
PD-1

Appendix 5B – HydroCAD Computations



Subcat Reach Pond Link

Routing Diagram for W131097 Norfolk -MASTER (1-15-19) rev
Prepared by Bohler Engineering, Printed 1/23/2019
HydroCAD® 10.00-19 s/n 08311 © 2016 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
7.769	39	>75% Grass cover, Good, HSG A (P1A, P1B, P2A, P2B)
2.355	98	Paved parking, HSG A (P1A, P1B, P2A, P2B)
2.151	98	Roofs, HSG A (P1A, P1B)
1.179	30	Woods, Good, HSG A (P1A, P1B, P2A)
13.454	**58**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
13.454	HSG A	P1A, P1B, P2A, P2B
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
0.000	Other	
13.454		**TOTAL AREA**

Summary for Subcatchment P1A:

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 1 inch Rainfall=1.00"

Area (sf)	CN	Description
249,139	39	>75% Grass cover, Good, HSG A
17,420	30	Woods, Good, HSG A
72,945	98	Paved parking, HSG A
79,500	98	Roofs, HSG A
419,004	60	Weighted Average
266,559		63.62% Pervious Area
152,445		36.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0350	0.19		**Sheet Flow, AA-BB** Grass: Short n= 0.150 P2= 3.20"
10.2	680	0.0250	1.11		**Shallow Concentrated Flow, BB-CC** Short Grass Pasture Kv= 7.0 fps
14.7	730	Total			

Summary for Subcatchment P1B:

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 1 inch Rainfall=1.00"

Area (sf)	CN	Description
67,055	39	>75% Grass cover, Good, HSG A
12,475	98	Paved parking, HSG A
14,200	98	Roofs, HSG A
4,375	30	Woods, Good, HSG A
98,105	55	Weighted Average
71,430		72.81% Pervious Area
26,675		27.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.0600	0.23		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
4.1	407	0.0570	1.67		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
7.7	457	Total			

Summary for Subcatchment P2A:

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 1 inch Rainfall=1.00"

Area (sf)	CN	Description
5,753	39	>75% Grass cover, Good, HSG A
153	98	Paved parking, HSG A
29,567	30	Woods, Good, HSG A
35,473	32	Weighted Average
35,320		99.57% Pervious Area
153		0.43% Impervious Area

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

Summary for Subcatchment P2B:

Runoff = 0.00 cfs @ 22.66 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 1 inch Rainfall=1.00"

Area (sf)	CN	Description
16,491	39	>75% Grass cover, Good, HSG A
16,999	98	Paved parking, HSG A
33,490	69	Weighted Average
16,491		49.24% Pervious Area
16,999		50.76% Impervious Area

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

Summary for Reach DPP1: Wetlands

Inflow Area = 11.871 ac, 34.64% Impervious, Inflow Depth = 0.00" for 1 inch event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DPP2: Village Green Street

Inflow Area = 1.583 ac, 24.87% Impervious, Inflow Depth = 0.00" for 1 inch event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Pond PD1: Pond #1

Inflow Area = 9.619 ac, 36.38% Impervious, Inflow Depth = 0.00" for 1 inch event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 185.00' @ 0.00 hrs Surf.Area= 12,190 sf Storage= 0 cf
Flood Elev= 188.00' Surf.Area= 21,786 sf Storage= 49,144 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	185.00'	49,144 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
185.00	12,190	0	0
186.00	14,175	13,183	13,183
188.00	21,786	35,961	49,144

Device	Routing	Invert	Outlet Devices
#1	Discarded	185.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	187.00'	**30.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=185.00' (Free Discharge)
└**1=Exfiltration** (Passes 0.00 cfs of 2.33 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=185.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond PD2: Pond #2

Inflow Area =	2.252 ac, 27.19% Impervious, Inflow Depth = 0.00" for 1 inch event				
Inflow =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	
Outflow =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af,	Atten= 0%, Lag= 0.0 min
Discarded =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 174.00' @ 0.00 hrs Surf.Area= 654 sf Storage= 0 cf
Flood Elev= 178.00' Surf.Area= 4,373 sf Storage= 9,917 cf

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= (not calculated: no inflow)

Volume	Invert	Avail.Storage	Storage Description
#1	174.00'	9,917 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
174.00	654	0	0
176.00	2,445	3,099	3,099
178.00	4,373	6,818	9,917

Device	Routing	Invert	Outlet Devices
#1	Discarded	174.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	177.00'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=174.00' (Free Discharge)
└**1=Exfiltration** (Passes 0.00 cfs of 0.13 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=174.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond UG1: ung #4

Inflow Area =	0.769 ac, 50.76% Impervious, Inflow Depth = 0.00" for 1 inch event				
Inflow =	0.00 cfs @	22.66 hrs,	Volume=	0.000 af	
Outflow =	0.00 cfs @	22.71 hrs,	Volume=	0.000 af,	Atten= 0%, Lag= 2.9 min
Discarded =	0.00 cfs @	22.71 hrs,	Volume=	0.000 af	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 187.00' @ 22.71 hrs Surf.Area= 998 sf Storage= 0 cf
Flood Elev= 193.75' Surf.Area= 998 sf Storage= 4,186 cf

Plug-Flow detention time= 2.4 min calculated for 0.000 af (100% of inflow)
Center-of-Mass det. time= 2.4 min (1,262.2 - 1,259.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	187.00'	1,700 cf	**19.42'W x 51.39'L x 6.75'H Field A** 6,736 cf Overall - 2,486 cf Embedded = 4,250 cf x 40.0% Voids
#2A	187.75'	2,486 cf	**ADS_StormTech MC-4500 +Cap** x 22 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 2 Rows of 11 Chambers Cap Storage= +35.7 cf x 2 x 2 rows = 142.8 cf
		4,186 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	187.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	194.03'	**24.0" x 24.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.19 cfs @ 22.71 hrs HW=187.00' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=187.00' (Free Discharge)
└**2=Grate** (Controls 0.00 cfs)

Summary for Subcatchment P1A:

Runoff = 2.08 cfs @ 12.31 hrs, Volume= 0.327 af, Depth= 0.41"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 yr Rainfall=3.20"

Area (sf)	CN	Description
249,139	39	>75% Grass cover, Good, HSG A
17,420	30	Woods, Good, HSG A
72,945	98	Paved parking, HSG A
79,500	98	Roofs, HSG A
419,004	60	Weighted Average
266,559		63.62% Pervious Area
152,445		36.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0350	0.19		**Sheet Flow, AA-BB** Grass: Short n= 0.150 P2= 3.20"
10.2	680	0.0250	1.11		**Shallow Concentrated Flow, BB-CC** Short Grass Pasture Kv= 7.0 fps
14.7	730	Total			

Summary for Subcatchment P1B:

Runoff = 0.23 cfs @ 12.36 hrs, Volume= 0.047 af, Depth= 0.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 yr Rainfall=3.20"

Area (sf)	CN	Description
67,055	39	>75% Grass cover, Good, HSG A
12,475	98	Paved parking, HSG A
14,200	98	Roofs, HSG A
4,375	30	Woods, Good, HSG A
98,105	55	Weighted Average
71,430		72.81% Pervious Area
26,675		27.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.0600	0.23		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
4.1	407	0.0570	1.67		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
7.7	457	Total			

Summary for Subcatchment P2A:

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 yr Rainfall=3.20"

Area (sf)	CN	Description
5,753	39	>75% Grass cover, Good, HSG A
153	98	Paved parking, HSG A
29,567	30	Woods, Good, HSG A
35,473	32	Weighted Average
35,320		99.57% Pervious Area
153		0.43% Impervious Area

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

Summary for Subcatchment P2B:

Runoff = 0.62 cfs @ 12.10 hrs, Volume= 0.050 af, Depth= 0.78"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 2 yr Rainfall=3.20"

Area (sf)	CN	Description
16,491	39	>75% Grass cover, Good, HSG A
16,999	98	Paved parking, HSG A
33,490	69	Weighted Average
16,491		49.24% Pervious Area
16,999		50.76% Impervious Area

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

Summary for Reach DPP1: Wetlands

Inflow Area = 11.871 ac, 34.64% Impervious, Inflow Depth = 0.00" for 2 yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DPP2: Village Green Street

Inflow Area = 1.583 ac, 24.87% Impervious, Inflow Depth = 0.00" for 2 yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Pond PD1: Pond #1

Inflow Area = 9.619 ac, 36.38% Impervious, Inflow Depth = 0.41" for 2 yr event
Inflow = 2.08 cfs @ 12.31 hrs, Volume= 0.327 af
Outflow = 2.04 cfs @ 12.38 hrs, Volume= 0.327 af, Atten= 2%, Lag= 4.0 min
Discarded = 2.04 cfs @ 12.38 hrs, Volume= 0.327 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 185.03' @ 12.38 hrs Surf.Area= 12,242 sf Storage= 319 cf
Flood Elev= 188.00' Surf.Area= 21,786 sf Storage= 49,144 cf

Plug-Flow detention time= 2.6 min calculated for 0.327 af (100% of inflow)
Center-of-Mass det. time= 2.6 min (931.0 - 928.4)

Volume	Invert	Avail.Storage	Storage Description
#1	185.00'	49,144 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
185.00	12,190	0	0
186.00	14,175	13,183	13,183
188.00	21,786	35,961	49,144

Device	Routing	Invert	Outlet Devices
#1	Discarded	185.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	187.00'	**30.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=2.34 cfs @ 12.38 hrs HW=185.03' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 2.34 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=185.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond PD2: Pond #2

Inflow Area =	2.252 ac, 27.19% Impervious, Inflow Depth = 0.25" for 2 yr event				
Inflow =	0.23 cfs @	12.36 hrs,	Volume=	0.047 af	
Outflow =	0.15 cfs @	12.57 hrs,	Volume=	0.047 af,	Atten= 35%, Lag= 12.7 min
Discarded =	0.15 cfs @	12.57 hrs,	Volume=	0.047 af	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 174.15' @ 12.57 hrs Surf.Area= 788 sf Storage= 108 cf
Flood Elev= 178.00' Surf.Area= 4,373 sf Storage= 9,917 cf

Plug-Flow detention time= 4.6 min calculated for 0.047 af (100% of inflow)
Center-of-Mass det. time= 4.6 min (961.6 - 957.0)

Volume	Invert	Avail.Storage	Storage Description
#1	174.00'	9,917 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
174.00	654	0	0
176.00	2,445	3,099	3,099
178.00	4,373	6,818	9,917

Device	Routing	Invert	Outlet Devices
#1	Discarded	174.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	177.00'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.15 cfs @ 12.57 hrs HW=174.15' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.15 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=174.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond UG1: ung #4

Inflow Area =	0.769 ac, 50.76% Impervious, Inflow Depth = 0.78" for 2 yr event				
Inflow =	0.62 cfs @	12.10 hrs,	Volume=	0.050 af	
Outflow =	0.19 cfs @	12.00 hrs,	Volume=	0.050 af,	Atten= 69%, Lag= 0.0 min
Discarded =	0.19 cfs @	12.00 hrs,	Volume=	0.050 af	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 187.84' @ 12.51 hrs Surf.Area= 998 sf Storage= 377 cf
Flood Elev= 193.75' Surf.Area= 998 sf Storage= 4,186 cf

Plug-Flow detention time= 11.2 min calculated for 0.050 af (100% of inflow)
Center-of-Mass det. time= 11.2 min (890.6 - 879.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	187.00'	1,700 cf	**19.42'W x 51.39'L x 6.75'H Field A** 6,736 cf Overall - 2,486 cf Embedded = 4,250 cf x 40.0% Voids
#2A	187.75'	2,486 cf	**ADS_StormTech MC-4500 +Cap** x 22 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 2 Rows of 11 Chambers Cap Storage= +35.7 cf x 2 x 2 rows = 142.8 cf
		4,186 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	187.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	194.03'	**24.0" x 24.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.19 cfs @ 12.00 hrs HW=187.07' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=187.00' (Free Discharge)
└**2=Grate** (Controls 0.00 cfs)

Summary for Subcatchment P1A:

Runoff = 8.38 cfs @ 12.23 hrs, Volume= 0.906 af, Depth= 1.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=4.70"

Area (sf)	CN	Description
249,139	39	>75% Grass cover, Good, HSG A
17,420	30	Woods, Good, HSG A
72,945	98	Paved parking, HSG A
79,500	98	Roofs, HSG A
419,004	60	Weighted Average
266,559		63.62% Pervious Area
152,445		36.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0350	0.19		**Sheet Flow, AA-BB** Grass: Short n= 0.150 P2= 3.20"
10.2	680	0.0250	1.11		**Shallow Concentrated Flow, BB-CC** Short Grass Pasture Kv= 7.0 fps
14.7	730	Total			

Summary for Subcatchment P1B:

Runoff = 1.56 cfs @ 12.14 hrs, Volume= 0.157 af, Depth= 0.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=4.70"

Area (sf)	CN	Description
67,055	39	>75% Grass cover, Good, HSG A
12,475	98	Paved parking, HSG A
14,200	98	Roofs, HSG A
4,375	30	Woods, Good, HSG A
98,105	55	Weighted Average
71,430		72.81% Pervious Area
26,675		27.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.0600	0.23		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
4.1	407	0.0570	1.67		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
7.7	457	Total			

Summary for Subcatchment P2A:

Runoff = 0.00 cfs @ 22.86 hrs, Volume= 0.001 af, Depth= 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=4.70"

Area (sf)	CN	Description
5,753	39	>75% Grass cover, Good, HSG A
153	98	Paved parking, HSG A
29,567	30	Woods, Good, HSG A
35,473	32	Weighted Average
35,320		99.57% Pervious Area
153		0.43% Impervious Area

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

Summary for Subcatchment P2B:

Runoff = 1.52 cfs @ 12.09 hrs, Volume= 0.112 af, Depth= 1.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 10 yr Rainfall=4.70"

Area (sf)	CN	Description
16,491	39	>75% Grass cover, Good, HSG A
16,999	98	Paved parking, HSG A
33,490	69	Weighted Average
16,491		49.24% Pervious Area
16,999		50.76% Impervious Area

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

Summary for Reach DPP1: Wetlands

Inflow Area = 11.871 ac, 34.64% Impervious, Inflow Depth = 0.00" for 10 yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DPP2: Village Green Street

Inflow Area = 1.583 ac, 24.87% Impervious, Inflow Depth = 0.00" for 10 yr event
Inflow = 0.00 cfs @ 22.86 hrs, Volume= 0.001 af
Outflow = 0.00 cfs @ 22.86 hrs, Volume= 0.001 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Pond PD1: Pond #1

Inflow Area = 9.619 ac, 36.38% Impervious, Inflow Depth = 1.13" for 10 yr event
Inflow = 8.38 cfs @ 12.23 hrs, Volume= 0.906 af
Outflow = 2.58 cfs @ 12.75 hrs, Volume= 0.906 af, Atten= 69%, Lag= 31.3 min
Discarded = 2.58 cfs @ 12.75 hrs, Volume= 0.906 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 185.65' @ 12.75 hrs Surf.Area= 13,483 sf Storage= 8,360 cf
Flood Elev= 188.00' Surf.Area= 21,786 sf Storage= 49,144 cf

Plug-Flow detention time= 21.3 min calculated for 0.905 af (100% of inflow)
Center-of-Mass det. time= 21.3 min (909.6 - 888.3)

Volume	Invert	Avail.Storage	Storage Description
#1	185.00'	49,144 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
185.00	12,190	0	0
186.00	14,175	13,183	13,183
188.00	21,786	35,961	49,144

Device	Routing	Invert	Outlet Devices
#1	Discarded	185.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	187.00'	**30.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=2.58 cfs @ 12.75 hrs HW=185.65' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 2.58 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=185.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond PD2: Pond #2

Inflow Area =	2.252 ac, 27.19% Impervious, Inflow Depth = 0.83" for 10 yr event				
Inflow =	1.56 cfs @	12.14 hrs,	Volume=	0.157 af	
Outflow =	0.35 cfs @	12.80 hrs,	Volume=	0.157 af,	Atten= 77%, Lag= 40.2 min
Discarded =	0.35 cfs @	12.80 hrs,	Volume=	0.157 af	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 175.32' @ 12.80 hrs Surf.Area= 1,837 sf Storage= 1,646 cf
Flood Elev= 178.00' Surf.Area= 4,373 sf Storage= 9,917 cf

Plug-Flow detention time= 44.3 min calculated for 0.157 af (100% of inflow)
Center-of-Mass det. time= 44.3 min (944.7 - 900.4)

Volume	Invert	Avail.Storage	Storage Description
#1	174.00'	9,917 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
174.00	654	0	0
176.00	2,445	3,099	3,099
178.00	4,373	6,818	9,917

Device	Routing	Invert	Outlet Devices
#1	Discarded	174.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	177.00'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.35 cfs @ 12.80 hrs HW=175.32' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.35 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=174.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond UG1: ung #4

Inflow Area =	0.769 ac, 50.76% Impervious, Inflow Depth = 1.74" for 10 yr event				
Inflow =	1.52 cfs @	12.09 hrs,	Volume=	0.112 af	
Outflow =	0.19 cfs @	11.76 hrs,	Volume=	0.112 af,	Atten= 87%, Lag= 0.0 min
Discarded =	0.19 cfs @	11.76 hrs,	Volume=	0.112 af	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 189.35' @ 12.93 hrs Surf.Area= 998 sf Storage= 1,589 cf
Flood Elev= 193.75' Surf.Area= 998 sf Storage= 4,186 cf

Plug-Flow detention time= 68.4 min calculated for 0.112 af (100% of inflow)
Center-of-Mass det. time= 68.3 min (922.1 - 853.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	187.00'	1,700 cf	**19.42'W x 51.39'L x 6.75'H Field A** 6,736 cf Overall - 2,486 cf Embedded = 4,250 cf x 40.0% Voids
#2A	187.75'	2,486 cf	**ADS_StormTech MC-4500 +Cap** x 22 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 2 Rows of 11 Chambers Cap Storage= +35.7 cf x 2 x 2 rows = 142.8 cf
		4,186 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	187.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	194.03'	**24.0" x 24.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.19 cfs @ 11.76 hrs HW=187.07' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=187.00' (Free Discharge)
└**2=Grate** (Controls 0.00 cfs)

Summary for Subcatchment P1A:

Runoff = 12.61 cfs @ 12.22 hrs, Volume= 1.285 af, Depth= 1.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr Rainfall=5.50"

Area (sf)	CN	Description
249,139	39	>75% Grass cover, Good, HSG A
17,420	30	Woods, Good, HSG A
72,945	98	Paved parking, HSG A
79,500	98	Roofs, HSG A
419,004	60	Weighted Average
266,559		63.62% Pervious Area
152,445		36.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0350	0.19		**Sheet Flow, AA-BB** Grass: Short n= 0.150 P2= 3.20"
10.2	680	0.0250	1.11		**Shallow Concentrated Flow, BB-CC** Short Grass Pasture Kv= 7.0 fps
14.7	730	Total			

Summary for Subcatchment P1B:

Runoff = 2.61 cfs @ 12.13 hrs, Volume= 0.233 af, Depth= 1.24"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr Rainfall=5.50"

Area (sf)	CN	Description
67,055	39	>75% Grass cover, Good, HSG A
12,475	98	Paved parking, HSG A
14,200	98	Roofs, HSG A
4,375	30	Woods, Good, HSG A
98,105	55	Weighted Average
71,430		72.81% Pervious Area
26,675		27.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.0600	0.23		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
4.1	407	0.0570	1.67		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
7.7	457	Total			

Summary for Subcatchment P2A:

Runoff = 0.01 cfs @ 15.46 hrs, Volume= 0.005 af, Depth= 0.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr Rainfall=5.50"

Area (sf)	CN	Description
5,753	39	>75% Grass cover, Good, HSG A
153	98	Paved parking, HSG A
29,567	30	Woods, Good, HSG A
35,473	32	Weighted Average
35,320		99.57% Pervious Area
153		0.43% Impervious Area

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

Summary for Subcatchment P2B:

Runoff = 2.07 cfs @ 12.09 hrs, Volume= 0.149 af, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 25 yr Rainfall=5.50"

Area (sf)	CN	Description
16,491	39	>75% Grass cover, Good, HSG A
16,999	98	Paved parking, HSG A
33,490	69	Weighted Average
16,491		49.24% Pervious Area
16,999		50.76% Impervious Area

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

Summary for Reach DPP1: Wetlands

Inflow Area = 11.871 ac, 34.64% Impervious, Inflow Depth = 0.00" for 25 yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DPP2: Village Green Street

Inflow Area = 1.583 ac, 24.87% Impervious, Inflow Depth = 0.04" for 25 yr event
Inflow = 0.01 cfs @ 15.46 hrs, Volume= 0.005 af
Outflow = 0.01 cfs @ 15.46 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Pond PD1: Pond #1

Inflow Area = 9.619 ac, 36.38% Impervious, Inflow Depth = 1.60" for 25 yr event
Inflow = 12.61 cfs @ 12.22 hrs, Volume= 1.285 af
Outflow = 2.83 cfs @ 12.89 hrs, Volume= 1.285 af, Atten= 78%, Lag= 40.1 min
Discarded = 2.83 cfs @ 12.89 hrs, Volume= 1.285 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 186.16' @ 12.89 hrs Surf.Area= 14,780 sf Storage= 15,485 cf
Flood Elev= 188.00' Surf.Area= 21,786 sf Storage= 49,144 cf

Plug-Flow detention time= 43.8 min calculated for 1.284 af (100% of inflow)
Center-of-Mass det. time= 43.8 min (920.5 - 876.6)

Volume	Invert	Avail.Storage	Storage Description
#1	185.00'	49,144 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
185.00	12,190	0	0
186.00	14,175	13,183	13,183
188.00	21,786	35,961	49,144

Device	Routing	Invert	Outlet Devices
#1	Discarded	185.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	187.00'	**30.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=2.83 cfs @ 12.89 hrs HW=186.16' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 2.83 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=185.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond PD2: Pond #2

Inflow Area =	2.252 ac, 27.19% Impervious, Inflow Depth = 1.24" for 25 yr event				
Inflow =	2.61 cfs @	12.13 hrs,	Volume=	0.233 af	
Outflow =	0.46 cfs @	12.91 hrs,	Volume=	0.233 af,	Atten= 82%, Lag= 47.2 min
Discarded =	0.46 cfs @	12.91 hrs,	Volume=	0.233 af	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 175.96' @ 12.91 hrs Surf.Area= 2,408 sf Storage= 2,998 cf
Flood Elev= 178.00' Surf.Area= 4,373 sf Storage= 9,917 cf

Plug-Flow detention time= 68.1 min calculated for 0.233 af (100% of inflow)
Center-of-Mass det. time= 68.1 min (953.8 - 885.7)

Volume	Invert	Avail.Storage	Storage Description
#1	174.00'	9,917 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
174.00	654	0	0
176.00	2,445	3,099	3,099
178.00	4,373	6,818	9,917

Device	Routing	Invert	Outlet Devices
#1	Discarded	174.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	177.00'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.46 cfs @ 12.91 hrs HW=175.96' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.46 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=174.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond UG1: ung #4

Inflow Area =	0.769 ac, 50.76% Impervious, Inflow Depth = 2.33" for 25 yr event				
Inflow =	2.07 cfs @	12.09 hrs,	Volume=	0.149 af	
Outflow =	0.19 cfs @	11.68 hrs,	Volume=	0.149 af,	Atten= 91%, Lag= 0.0 min
Discarded =	0.19 cfs @	11.68 hrs,	Volume=	0.149 af	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 190.52' @ 13.35 hrs Surf.Area= 998 sf Storage= 2,474 cf
Flood Elev= 193.75' Surf.Area= 998 sf Storage= 4,186 cf

Plug-Flow detention time= 117.7 min calculated for 0.149 af (100% of inflow)
Center-of-Mass det. time= 117.7 min (962.8 - 845.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	187.00'	1,700 cf	**19.42'W x 51.39'L x 6.75'H Field A** 6,736 cf Overall - 2,486 cf Embedded = 4,250 cf x 40.0% Voids
#2A	187.75'	2,486 cf	**ADS_StormTech MC-4500 +Cap** x 22 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 2 Rows of 11 Chambers Cap Storage= +35.7 cf x 2 x 2 rows = 142.8 cf
		4,186 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	187.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	194.03'	**24.0" x 24.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.19 cfs @ 11.68 hrs HW=187.07' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=187.00' (Free Discharge)
└**2=Grate** (Controls 0.00 cfs)

Summary for Subcatchment P1A:

Runoff = 19.70 cfs @ 12.21 hrs, Volume= 1.919 af, Depth= 2.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr Rainfall=6.70"

Area (sf)	CN	Description
249,139	39	>75% Grass cover, Good, HSG A
17,420	30	Woods, Good, HSG A
72,945	98	Paved parking, HSG A
79,500	98	Roofs, HSG A
419,004	60	Weighted Average
266,559		63.62% Pervious Area
152,445		36.38% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.5	50	0.0350	0.19		**Sheet Flow, AA-BB** Grass: Short n= 0.150 P2= 3.20"
10.2	680	0.0250	1.11		**Shallow Concentrated Flow, BB-CC** Short Grass Pasture Kv= 7.0 fps
14.7	730	Total			

Summary for Subcatchment P1B:

Runoff = 4.44 cfs @ 12.12 hrs, Volume= 0.363 af, Depth= 1.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr Rainfall=6.70"

Area (sf)	CN	Description
67,055	39	>75% Grass cover, Good, HSG A
12,475	98	Paved parking, HSG A
14,200	98	Roofs, HSG A
4,375	30	Woods, Good, HSG A
98,105	55	Weighted Average
71,430		72.81% Pervious Area
26,675		27.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.6	50	0.0600	0.23		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
4.1	407	0.0570	1.67		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
7.7	457	Total			

Summary for Subcatchment P2A:

Runoff = 0.03 cfs @ 12.49 hrs, Volume= 0.017 af, Depth= 0.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr Rainfall=6.70"

Area (sf)	CN	Description
5,753	39	>75% Grass cover, Good, HSG A
153	98	Paved parking, HSG A
29,567	30	Woods, Good, HSG A
35,473	32	Weighted Average
35,320		99.57% Pervious Area
153		0.43% Impervious Area

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

Summary for Subcatchment P2B:

Runoff = 2.94 cfs @ 12.09 hrs, Volume= 0.209 af, Depth= 3.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Type III 24-hr 100 yr Rainfall=6.70"

Area (sf)	CN	Description
16,491	39	>75% Grass cover, Good, HSG A
16,999	98	Paved parking, HSG A
33,490	69	Weighted Average
16,491		49.24% Pervious Area
16,999		50.76% Impervious Area

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

Summary for Reach DPP1: Wetlands

Inflow Area = 11.871 ac, 34.64% Impervious, Inflow Depth = 0.00" for 100 yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Reach DPP2: Village Green Street

Inflow Area = 1.583 ac, 24.87% Impervious, Inflow Depth = 0.13" for 100 yr event
Inflow = 0.03 cfs @ 12.49 hrs, Volume= 0.017 af
Outflow = 0.03 cfs @ 12.49 hrs, Volume= 0.017 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs

Summary for Pond PD1: Pond #1

Inflow Area = 9.619 ac, 36.38% Impervious, Inflow Depth = 2.39" for 100 yr event
Inflow = 19.70 cfs @ 12.21 hrs, Volume= 1.919 af
Outflow = 3.40 cfs @ 13.05 hrs, Volume= 1.919 af, Atten= 83%, Lag= 50.0 min
Discarded = 3.40 cfs @ 13.05 hrs, Volume= 1.919 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 186.94' @ 13.05 hrs Surf.Area= 17,750 sf Storage= 28,180 cf
Flood Elev= 188.00' Surf.Area= 21,786 sf Storage= 49,144 cf

Plug-Flow detention time= 78.2 min calculated for 1.918 af (100% of inflow)
Center-of-Mass det. time= 78.1 min (942.3 - 864.1)

Volume	Invert	Avail.Storage	Storage Description
#1	185.00'	49,144 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
185.00	12,190	0	0
186.00	14,175	13,183	13,183
188.00	21,786	35,961	49,144

Device	Routing	Invert	Outlet Devices
#1	Discarded	185.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	187.00'	**30.0' long x 6.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50 Coef. (English) 2.37 2.51 2.70 2.68 2.68 2.67 2.65 2.65 2.65 2.65 2.66 2.66 2.67 2.69 2.72 2.76 2.83

Discarded OutFlow Max=3.40 cfs @ 13.05 hrs HW=186.94' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 3.40 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=185.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond PD2: Pond #2

Inflow Area =	2.252 ac, 27.19% Impervious, Inflow Depth = 1.94" for 100 yr event				
Inflow =	4.44 cfs @	12.12 hrs,	Volume=	0.363 af	
Outflow =	0.63 cfs @	13.01 hrs,	Volume=	0.363 af,	Atten= 86%, Lag= 53.3 min
Discarded =	0.63 cfs @	13.01 hrs,	Volume=	0.363 af	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 176.86' @ 13.01 hrs Surf.Area= 3,270 sf Storage= 5,546 cf
Flood Elev= 178.00' Surf.Area= 4,373 sf Storage= 9,917 cf

Plug-Flow detention time= 100.9 min calculated for 0.363 af (100% of inflow)
Center-of-Mass det. time= 100.9 min (971.5 - 870.7)

Volume	Invert	Avail.Storage	Storage Description
#1	174.00'	9,917 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
174.00	654	0	0
176.00	2,445	3,099	3,099
178.00	4,373	6,818	9,917

Device	Routing	Invert	Outlet Devices
#1	Discarded	174.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	177.00'	**20.0' long x 10.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.49 2.56 2.70 2.69 2.68 2.69 2.67 2.64

Discarded OutFlow Max=0.63 cfs @ 13.01 hrs HW=176.86' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.63 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=174.00' (Free Discharge)
└**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond UG1: ung #4

Inflow Area =	0.769 ac, 50.76% Impervious, Inflow Depth = 3.27" for 100 yr event				
Inflow =	2.94 cfs @	12.09 hrs,	Volume=	0.209 af	
Outflow =	0.19 cfs @	11.53 hrs,	Volume=	0.209 af,	Atten= 94%, Lag= 0.0 min
Discarded =	0.19 cfs @	11.53 hrs,	Volume=	0.209 af	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-36.00 hrs, dt= 0.01 hrs
Peak Elev= 193.46' @ 14.12 hrs Surf.Area= 998 sf Storage= 4,068 cf
Flood Elev= 193.75' Surf.Area= 998 sf Storage= 4,186 cf

Plug-Flow detention time= 207.6 min calculated for 0.209 af (100% of inflow)
Center-of-Mass det. time= 207.6 min (1,042.7 - 835.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	187.00'	1,700 cf	**19.42'W x 51.39'L x 6.75'H Field A** 6,736 cf Overall - 2,486 cf Embedded = 4,250 cf x 40.0% Voids
#2A	187.75'	2,486 cf	**ADS_StormTech MC-4500 +Cap** x 22 Inside #1 Effective Size= 90.4"W x 60.0"H => 26.46 sf x 4.03'L = 106.5 cf Overall Size= 100.0"W x 60.0"H x 4.33'L with 0.31' Overlap 2 Rows of 11 Chambers Cap Storage= +35.7 cf x 2 x 2 rows = 142.8 cf
		4,186 cf	Total Available Storage

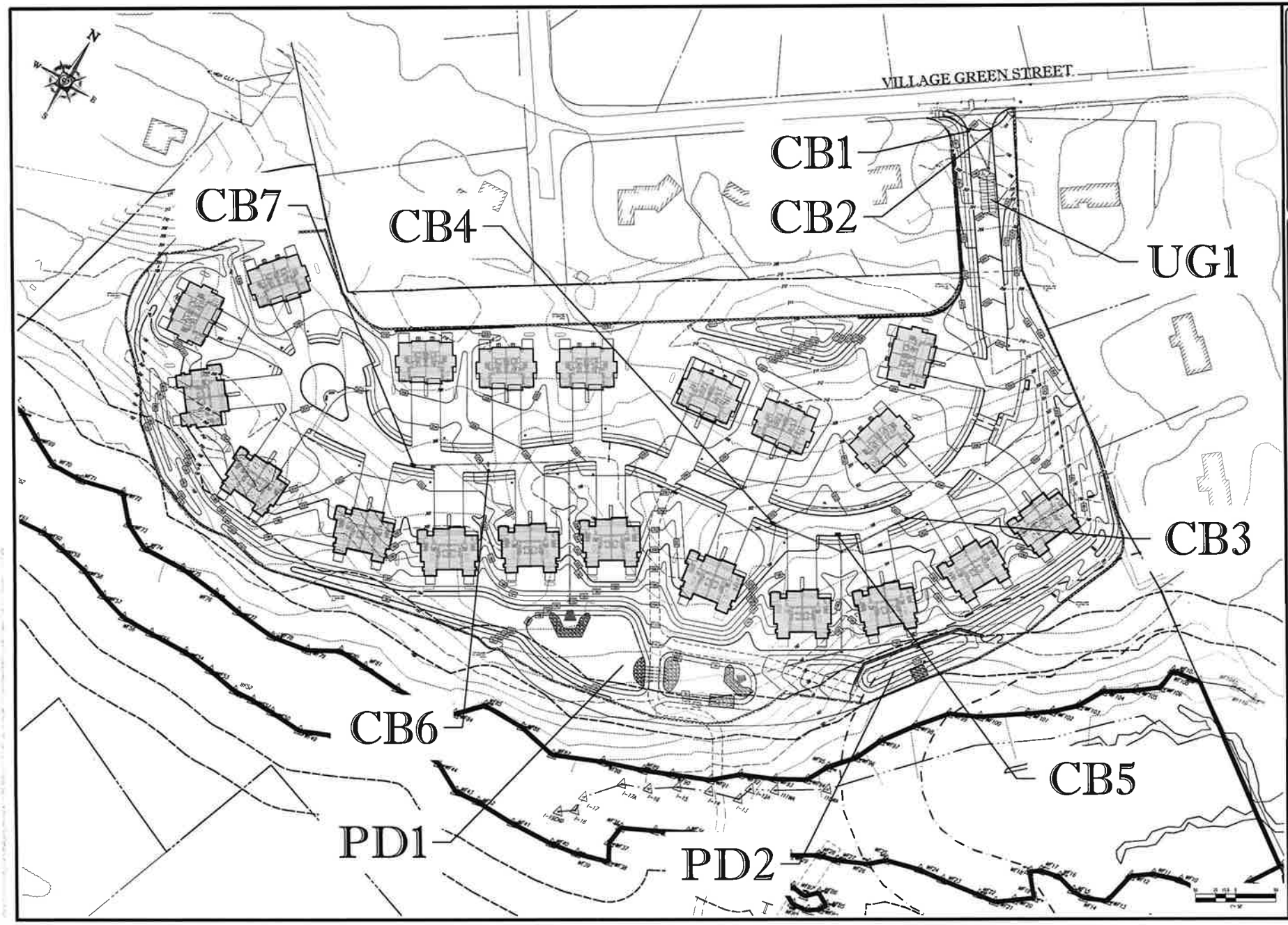
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	187.00'	**8.270 in/hr Exfiltration over Surface area**
#2	Primary	194.03'	**24.0" x 24.0" Horiz. Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.19 cfs @ 11.53 hrs HW=187.07' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.19 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=187.00' (Free Discharge)
└**2=Grate** (Controls 0.00 cfs)

Appendix 5C - Proposed Conditions Catch Basin Map



BOHLER ENGINEERING

REVISIONS

REV.	DATE	COMMENT	BY
1			
2			
3			
4			
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6			
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14			
15			

PROJECT No.: W11189
DRAWN BY: JGS
CHECKED BY: RMM
DATE: 08/13/2019
SCALE: AS INDICATED
CAD I.D.: W11189_SB11_DRAIN

PROJECT:
PRELIMINARY PLAN
-FOR-
COMPREHENSIVE PERMIT
"THE ENCLAVE AT NORFOLK"
A SUBDIVISION IN NORFOLK, MASS
OWNER: NORFOLK HOLDINGS, LLC
VILLAGE GREEN
TOWN OF NORFOLK
NORFOLK COUNTY, MASS.
MAP #15, LOT 54-67

BOHLER ENGINEERING
352 TURNPIKE ROAD
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www.BohlerEngineering.com

SHEET TITLE:
CATCH BASIN MAP

SHEET NUMBER:
PCB-1

REV 16 - 04/17/2019

Appendix 6

Stormwater Attenuation and Drainage Calculations

Appendix 6A – MA Standard #3 – Recharge and Drawdown Time

Drawdown Analysis

JOB: ENCLAVE AT NORFOLK
LOCATION: NORFOLK
BY:DTB

AREA IN QUESTION: **Surface Infiltration Pond (PD1)**

RV	**29,260**	**cubic feet**
K	**8.27**	**see table**
Bottom Area	**10370**	**square feet**
$Time_{drawdown} = \frac{Rv}{(K)(Bottom\ \ Area)}$	**4**	**Hours**

RV=Storage Volume

K = Saturated Hydraulic Conductivity For "Static" and "Simple Dynamic" Methods, use Rawls Rate (see Table 2.3.3)

Bottom Area= Bottom area of the Recharge Structure

Table 2.3.3 Rawls Rate

Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate Inches/Hour
Sand	A	8.27
Loamy Sand	A	2.41
Sandy Loam	B	1.02
Loam	B	0.52
Sandy Clay Loam	C	0.17
Clay Loam	D	0.09
Silty Clay Loam	D	0.06
Sandy Clay	D	0.05
Silty Clay	D	0.04
Clay	D	0.02

Drawdown Analysis

JOB: ENCLAVE AT NORFOLK
LOCATION: NORFOLK
BY:DTB

AREA IN QUESTION: **Surface Infiltration Pond (PD1)**

RV	**6,026**	**cubic feet**
K	**8.27**	**see table**
Bottom Area	**654**	**square feet**
$Time_{drawdown} = \frac{Rv}{(K)(Bottom\ \ Area)}$	**13**	**Hours**

RV=Storage Volume

K = Saturated Hydraulic Conductivity For "Static" and "Simple Dynamic" Methods, use Rawls Rate (see Table 2.3.3)

Bottom Area= Bottom area of the Recharge Structure

Table 2.3.3 Rawls Rate

Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate Inches/Hour
Sand	A	8.27
Loamy Sand	A	2.41
Sandy Loam	B	1.02
Loam	B	0.52
Sandy Clay Loam	C	0.17
Clay Loam	D	0.09
Silty Clay Loam	D	0.06
Sandy Clay	D	0.05
Silty Clay	D	0.04
Clay	D	0.02

Drawdown Analysis

JOB: ENCLAVE AT NORFOLK
LOCATION: NORFOLK
BY:DTB

AREA IN QUESTION: **Subsurface Infiltration Pond (UG1)**

RV	**4,184**	**cubic feet**
K	**8.27**	**see table**
Bottom Area	**998**	**square feet**
$Time_{drawdown} = \frac{Rv}{(K)(Bottom\ \ Area)}$	**6**	**Hours**

RV=Storage Volume

K = Saturated Hydraulic Conductivity For "Static" and "Simple Dynamic" Methods, use Rawls Rate (see Table 2.3.3)

Bottom Area= Bottom area of the Recharge Structure

Table 2.3.3 Rawls Rate

Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate Inches/Hour
Sand	A	8.27
Loamy Sand	A	2.41
Sandy Loam	B	1.02
Loam	B	0.52
Sandy Clay Loam	C	0.17
Clay Loam	D	0.09
Silty Clay Loam	D	0.06
Sandy Clay	D	0.05
Silty Clay	D	0.04
Clay	D	0.02

Recharge Volume Calculator

JOB:ENCLAVE AT NORFOLK
LOCATION: NORFOLK
BY:DTB

AREA IN QUESTION: Subsurface Infiltration Pond (UG1)

IMPERVIOUS COVERAGE (AC)	**0.39**	**ACRES**
RECHARGE FACTOR**	**0.6**	**INCHES**
WQV=1"/ IMPERVIOUS ACRE	**849**	**CF REQUIRED**
******		

Hydrologic Group Volume to Recharge (x Total Impervious Area)

Hydrologic Group	Volume to Recharge x Total Impervious Area
A	0.60 inches of runoff
B	0.35 inches of runoff
C	0.25 inches of runoff
D	0.10 inches of runoff

Summary

Total Volume Provided	**4,184 cf @ elev.=193.75**
Recharge Total Volume Required	**849 cf**

Recharge Volume Calculator

JOB:ENCLAVE AT NORFOLK
LOCATION: NORFOLK
BY:DTB

AREA IN QUESTION: Surface Infiltration Pond (PD1)

IMPERVIOUS COVERAGE (AC)	**3.499**	**ACRES**
RECHARGE FACTOR**	**0.6**	**INCHES**
WQV=1"/ IMPERVIOUS ACRE	**7,621**	**CF REQUIRED**
**		

Hydrologic Group Volume to Recharge (x Total Impervious Area)

Hydrologic Group	Volume to Recharge x Total Impervious Area
A	0.60 inches of runoff
B	0.35 inches of runoff
C	0.25 inches of runoff
D	0.10 inches of runoff

Summary

Total Volume Provided	**29,260 cf @ elev.=187.00**
Recharge Total Volume Required	**7,621 cf**

Recharge Volume Calculator

JOB:ENCLAVE AT NORFOLK
LOCATION: NORFOLK
BY:DTB

AREA IN QUESTION: Surface Infiltration Pond (PD2)

IMPERVIOUS COVERAGE (AC)	0.612	ACRES
RECHARGE FACTOR**	0.6	INCHES
WQV=1"/ IMPERVIOUS ACRE	1,333	CF REQUIRED
**		

Hydrologic Group Volume to Recharge (x Total Impervious Area)

Hydrologic Group	Volume to Recharge x Total Impervious Area
A	0.60 inches of runoff
B	0.35 inches of runoff
C	0.25 inches of runoff
D	0.10 inches of runoff

Summary

Total Volume Provided	6,026 cf @ elev.=177.00
Recharge Total Volume Required	1,333 cf

Appendix 6B – MA Standard #4 – Water Quality and TSS Removal

Water Quality Volume & Peak Flow Calculations

Project Name	The Enclave At Norfolk
Physical Address	Village Green Street
City/County	Norflk
Governing Municipality	Norflk
Developer	Norfolk Holdings, LLC
Engineer	Bohler
Designed by	DTB
Date	W131097

Input Requirements

Impervious Area (acres)	0.39	impervious area
Total Area (acres)	0.7688	total drainage area
P, Rainfall (inches)	1	85th percentile annual rainfall event

Water Quality Volume Calculation

I (%)	51	percent of impervious cover
Rv	0.507	Volumetric runoff coefficient
WQv (acre-feet)	0.032	Water quality volume in acre feet
Qwv (in)	0.507	Water quality volume in inches

Water Quality Volume Peak Flow Calculation

CN	98	SCS Runoff Curve Number
Tc (hours)	0.08	Time of concentration
S (in)	0.20	Potential maximum soil retention
Ia (in)	0.041	Initial abstraction from total rainfall
Ia/P	0.041	
qu (cfs/mi^2/in)	710	unit peak discharge
Qwq (cfs)	0.4	Water quality peak flow

Min. # of StormTech Chambers Needed for Isolator Row (for 80% min. TSS capture rate)

SC-740 chamber	2.9	0.15 cfs/chamber treatment rate
SC-310 chamber	4.3	0.10 cfs/chamber treatment rate
MC-4500 chamber	2.6	0.167 cfs/chamber treatment rate
MC-3500 chamber	1.8	0.24 cfs/chamber treatment rate

Project:

StormTech
Detention · Retention · Water Quality
A division of ADS

Chamber Model -	MC-4500	
Units -	Imperial	Click Here for Metric
Number of Chambers -	1	
Number of End Caps -	10	
Voids in the stone (porosity) -	40	%
Base of STONE Elevation -	187.00	ft
Amount of Stone Above Chambers -	12	in
Amount of Stone Below Chambers -	9	in

☐ Include Perimeter Stone in Calculations

Height of System (inches)	Incremental Single Chamber (cubic feet)	Incremental Single End Cap (cubic feet)	Incremental Chambers (cubic feet)	Incremental End Cap (cubic feet)	Incremental Stone (cubic feet)	Incremental Ch, EC and Stone (cubic feet)	Cumulative System (cubic feet)	Elevation (feet)
81	0.00	0.00	0.00	0.00	11.99	11.99	1249.51	193.75
80	0.00	0.00	0.00	0.00	11.99	11.99	1237.52	193.67
79	0.00	0.00	0.00	0.00	11.99	11.99	1225.53	193.58
78	0.00	0.00	0.00	0.00	11.99	11.99	1213.53	193.50
77	0.00	0.00	0.00	0.00	11.99	11.99	1201.54	193.42
76	0.00	0.00	0.00	0.00	11.99	11.99	1189.55	193.33
75	0.00	0.00	0.00	0.00	11.99	11.99	1177.56	193.25
74	0.00	0.00	0.00	0.00	11.99	11.99	1165.57	193.17
73	0.00	0.00	0.00	0.00	11.99	11.99	1153.57	193.08
72	0.00	0.00	0.00	0.00	11.99	11.99	1141.58	193.00
71	0.00	0.00	0.00	0.00	11.99	11.99	1129.59	192.92
70	0.00	0.00	0.00	0.00	11.99	11.99	1117.60	192.83
69	0.04	0.00	0.04	0.00	11.98	12.02	1105.61	192.75
68	0.12	0.01	0.12	0.10	11.91	12.12	1093.59	192.67
67	0.16	0.03	0.16	0.26	11.82	12.25	1081.47	192.58
66	0.21	0.05	0.21	0.48	11.72	12.40	1069.22	192.50
65	0.27	0.07	0.27	0.68	11.61	12.56	1056.81	192.42
64	0.45	0.09	0.45	0.88	11.46	12.79	1044.26	192.33
63	0.67	0.11	0.67	1.13	11.27	13.07	1031.47	192.25
62	0.80	0.14	0.80	1.41	11.11	13.32	1018.40	192.17
61	0.91	0.17	0.91	1.68	10.96	13.54	1005.08	192.08
60	1.00	0.19	1.00	1.92	10.82	13.74	991.53	192.00
59	1.09	0.22	1.09	2.15	10.70	13.94	977.79	191.92
58	1.16	0.24	1.16	2.41	10.56	14.14	963.86	191.83
57	1.23	0.27	1.23	2.70	10.42	14.35	949.72	191.75
56	1.30	0.30	1.30	2.98	10.28	14.56	935.36	191.67
55	1.36	0.32	1.36	3.23	10.15	14.75	920.81	191.58
54	1.42	0.35	1.42	3.48	10.03	14.93	906.06	191.50
53	1.47	0.37	1.47	3.71	9.92	15.10	891.13	191.42
52	1.53	0.39	1.53	3.94	9.81	15.27	876.02	191.33
51	1.57	0.42	1.57	4.17	9.69	15.44	860.75	191.25
50	1.62	0.44	1.62	4.40	9.58	15.61	845.31	191.17
49	1.67	0.46	1.67	4.63	9.48	15.77	829.70	191.08
48	1.71	0.48	1.71	4.84	9.37	15.92	813.94	191.00
47	1.75	0.50	1.75	5.05	9.27	16.07	798.02	190.92
46	1.79	0.53	1.79	5.25	9.18	16.22	781.94	190.83
45	1.83	0.55	1.83	5.45	9.08	16.36	765.73	190.75
44	1.86	0.56	1.86	5.64	8.99	16.50	749.37	190.67
43	1.90	0.58	1.90	5.83	8.90	16.63	732.87	190.58
42	1.93	0.60	1.93	6.02	8.81	16.76	716.24	190.50
41	1.96	0.62	1.96	6.20	8.73	16.89	699.48	190.42
40	2.00	0.64	2.00	6.38	8.64	17.02	682.59	190.33
39	2.03	0.66	2.03	6.56	8.56	17.14	665.57	190.25
38	2.05	0.67	2.05	6.73	8.48	17.26	648.43	190.17
37	2.08	0.69	2.08	6.90	8.40	17.38	631.17	190.08
36	**2.11**	**0.71**	**2.11**	**7.07**	**8.32**	**17.50**	**613.78**	**190.00**
35	2.13	0.72	2.13	7.24	8.24	17.62	596.28	189.92
34	2.16	0.74	2.16	7.40	8.17	17.73	578.67	189.83
33	2.18	0.76	2.18	7.56	8.10	17.84	560.94	189.75
32	2.21	0.77	2.21	7.72	8.02	17.94	543.10	189.67
31	2.23	0.79	2.23	7.87	7.95	18.05	525.16	189.58
30	2.25	0.80	2.25	8.02	7.89	18.15	507.11	189.50
29	2.27	0.82	2.27	8.21	7.80	18.28	488.96	189.42
28	2.29	0.84	2.29	8.41	7.71	18.41	470.68	189.33
27	2.31	0.85	2.31	8.46	7.69	18.45	452.27	189.25
26	2.33	0.86	2.33	8.59	7.63	18.54	433.82	189.17
25	2.34	0.87	2.34	8.72	7.57	18.63	415.28	189.08
24	2.36	0.89	2.36	8.85	7.51	18.72	396.65	189.00
23	2.38	0.90	2.38	8.98	7.45	18.81	377.93	188.92
22	2.39	0.91	2.39	9.10	7.39	18.89	359.12	188.83
21	2.41	0.92	2.41	9.22	7.34	18.97	340.23	188.75
20	2.42	0.93	2.42	9.34	7.29	19.05	321.26	188.67
19	2.43	0.95	2.43	9.46	7.24	19.13	302.21	188.58
18	2.44	0.96	2.44	9.57	7.19	19.20	283.09	188.50
17	2.46	0.97	2.46	9.67	7.14	19.27	263.89	188.42
16	2.47	0.98	2.47	9.78	7.09	19.34	244.62	188.33

Water Quality Volume Calculator

JOB: ENCLAVE AT NORFOLK
LOCATION: NORFOLK **AREA IN QUESTION: Surface Infiltration Pond (PD2)**
BY:DTB

IMPERVIOUS COVERAGE (AC)	**0.612**	**ACRES**
WQV FACTOR (.5 OR 1) (INCHES)*	**1**	**INCHES**
WATER QUALITY VOLUME	**2221.56**	**CF REQUIRED**

*** SEE THE STORMWATER MANAGEMENT REGULATIONS TO DETERMINE WHICH FACTOR TO USE.**

Summary

Total Volume Provided	**6,026**	**cf**
WQV Total Volume Required	**2,222**	**cf**

Water Quality Volume Calculator

JOB: ENCLAVE AT NORFOLK
LOCATION: NORFOLK
BY:DTB

AREA IN QUESTION: Site to Infiltration Pond

IMPERVIOUS COVERAGE (AC)	**3.499**	**ACRES**
WQV FACTOR (.5 OR 1) (INCHES)*	**1**	**INCHES**
WATER QUALITY VOLUME	**12701.37**	**CF REQUIRED**

*** SEE THE STORMWATER MANAGEMENT REGULATIONS TO DETERMINE WHICH FACTOR TO USE.**

Summary

Total Volume Provided	**29,260**	**cf**
WQV Total Volume Required	**12,701**	**cf**

Location: Infiltration Pond & Underground w/ Pretreatment

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[2]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Infiltration Basin	0.80	0.75	0.60	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15

Total TSS Removal = 85%

Project: ENCLAVE AT NORFOLK

Prepared By: Danell Baptiste

Date: 1/17/2019

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

1. BMP From Table on Page 1-7 of MassDEP Stormwater Mgt. Policy Handbook, Volume 1
2. TSS Removal Rate from Table on page 1-7 of the MassDEP Stormwater Mgt. Policy, Volume 1

Automated 4-19-06

Location: Infiltration Pond & Underground w/ Pretreatment

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[2]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Sediment Trap (Forebay)	0.25	0.75	0.19	0.56
	0.00	0.56	0.00	0.56
	0.00	0.56	0.00	0.56
	0.00	0.56	0.00	0.56

Total TSS Removal = 44%

Project: ENCLAVE AT NORFOLK

Prepared By: Danell Baptiste

Date: 1/17/2019

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

1. BMP From Table on Page 1-7 of MassDEP Stormwater Mgt. Policy Handbook, Volume 1
2. TSS Removal Rate from Table on page 1-7 of the MassDEP Stormwater Mgt. Policy, Volume 1

Automated 4-19-06

Appendix 6C—Forebay Sizing Calculations

Forebay Sizing Calculator

JOB:ENCLAVE AT NORFOLK
LOCATION: NORFOLK
BY:DTB

AREA IN QUESTION: Forebay-1

IMPERVIOUS COVERAGE (AC)	**1**	**ACRES**
FOREBAY DESIGN FACTOR	**0.1**	**INCHES**
WQV=1"/ IMPERVIOUS ACRE	**3,630**	**CF REQUIRED**
Tributary areas include CB-3, CB-4, and CB-5		

Summary

Total Volume Provided	**953 cf @ elev.=187.00**
Recharge Total Volume Required	**363 cf**

P

Forebay Sizing Calculator

JOB:ENCLAVE AT NORFOLK
LOCATION: NORFOLK
BY:DTB

AREA IN QUESTION: Forebay-2

IMPERVIOUS COVERAGE (AC)	**1.327**	**ACRES**
FOREBAY DESIGN FACTOR	**0.1**	**INCHES**
WQV=1"/ IMPERVIOUS ACRE	**4,817**	**CF REQUIRED**
Tributary areas include CB-6 and CB-7		

Summary

Total Volume Provided	**972 cf @ elev.=187.00**
Recharge Total Volume Required	**482 cf**

Appendix 6D – Pipe Sizing

DRAINAGE COMPUTATIONS FOR 25-YEAR STORM EVENT

LOCATION		IMPERVIOUS AREA			OTHER			SUM			Q				Q	V
FROM	TO	A	C	CA	A	C	CA	CA	Tc	I	IxCA	D	S	n	full	full
		(Ac)			(Ac)				(Min)	in/hr	(cfs)	(in)	(ft/ft)		(cfs)	(fps)
CB1	DMH-A	0.240	0.9	0.22	0.198	0.3	0.06	0.28	5	6.0	1.65	12	0.024	0.011	6.55	8.34
CB2	DMH-A	0.240	0.9	0.22	0.198	0.3	0.06	0.28	5	6.0	1.65	12	0.027	0.011	6.88	8.76
DMH-A	UNG	0.480	0.9	0.43	0.396	0.3	0.12	0.55	5	6.0	3.30	12	0.035	0.011	7.88	10.03
CB3	DMH B	0.254	0.9	0.23	0.011	0.3	0.00	0.23	5	6.0	1.39	12	0.023	0.011	6.39	8.13
CB4	DMH B	0.575	0.9	0.52	0.705	0.3	0.21	0.73	5	6.0	4.37	12	0.048	0.011	9.18	11.68
CB5	DMH B	0.174	0.9	0.16	0.695	0.3	0.21	0.37	5	6.0	2.19	12	0.011	0.011	4.46	5.67
DMH B	DMH C/ FOREBAY	1.003	0.9	0.90	1.411	0.3	0.42	1.33	5	6.0	7.96	15	0.027	0.011	12.54	10.22
CB6	DMH D	0.332	0.9	0.30	0.122	0.3	0.04	0.34	5	6.0	2.01	12	0.025	0.011	6.68	8.51
CB7	DMH D	0.996	0.9	0.90	0.853	0.3	0.26	1.15	5	6.0	6.91	12	0.030	0.011	7.29	9.29
DMH D	DMH E/FOREBAY	1.328	0.9	1.20	0.975	0.3	0.29	1.49	5	6.0	8.93	15	0.035	0.011	14.28	11.64

Rip Rap and Apron Sizing Worksheet

Address: Enclave At Norfolk
Norfolk, MA

Project No.: W131097
Date: 1/17/2019
Prepared By: DTB

Apron Sizing:

$$La = \frac{1.7Q}{Do^{3/2}} + 8Do$$

$$W\ end = 3Do + 0.4La\ for\ Tailwater \geq 0.5Do$$
$$W\ end = 3Do + La\ for\ Tailwater < 0.5Do$$

INPUT	Quantity	Units	Notes
Do	1.25	ft	Inside diameter of culvert
Q	8.93	cfs	Pipe discharge for conduit design storm or 25 year storm, whichever is greater

OUTPUT	Quantity	Units	Notes
La	20.86264	ft	Length of apron (minimum)
For tailwater elevation greater than or equal to the elevation of the center of the pipe:			
W start	3.75	ft	Width of apron at the culvert (minimum)
W end	12.09506	ft	Width of apron end (minimum)
For tailwater elevation less than the elevation of the center of the pipe:			
W start	3.75	ft	Width of apron at the culvert (minimum)
W end	24.61264	ft	Width of apron end (minimum)

Rip Rap Sizing:

$$d-50 = \frac{0.02}{TW} * (\frac{Q}{Do})^{4/3}$$

INPUT	Quantity	Units	Notes
TW	0.5	ft	Tailwater depth above the invert of the culvert
Do	1.25	ft	Inside diameter of culvert (defined in apron sizing)
Q	8.93	cfs	Pipe discharge for conduit design storm or 25 year storm, whichever is greater (defined in apron sizing)

OUTPUT	Quantity	Units	Notes
d-50	0.550362	ft	Median stone diameter in feet
	6.604346	in	Median stone diameter in inches

NOTE: calculations based on largest discharge flow rate.

Appendix 7

Operation and Maintenance

Appendix 7A – Long Term Stormwater System Operation and Maintenance Plan

STORMWATER CONTROLS MAINTENANCE
&
LONG-TERM POLLUTION PREVENTION PLAN

The Enclave at Norfolk
Village Green Street
Norfolk, Massachusetts
11/22/17
Revised 1/17/19

The Stormwater Management Standards

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

The Long-term Operation and Maintenance Plan shall at a minimum identify:

1. Stormwater management system(s) owners;
2. The party or parties responsible for operation and maintenance, including how future property owners will be notified of the presence of the stormwater management system and the requirement for proper operation and maintenance;
3. The routine and non-routine maintenance tasks to be undertaken after construction is complete and a schedule for implementing those tasks;
4. Plan that is drawn to scale and shows the location of all stormwater BMPs in each treatment train along with the discharge point;
5. Description and delineation of public safety features; and
6. Estimated operations and maintenance budget.

The Operation and Maintenance Plan shall identify best management practices for implementing maintenance activities in a manner that minimizes impacts to wetland resource areas.

The Proposal is for a private development.

Stormwater Management Systems – "The Enclave at Norfolk", Village Green St, Norfolk, MA

Owner: Norfolk Holdings, LLC

General Contractor: DiPlacido Development Corp.

The General Contractor shall have all logs and reports as stated within the Stormwater Pollution Prevention Plan readily available at all times for inspection by the Town of Norfolk.

Method of recording for future Owners

☐ Deed
☒ Order of Conditions
☐ Other: _____

LONG-TERM POLLUTION PREVENTION PLAN

The Long Term Pollution Prevention Plan (LTPPP) that follows is a guideline for source control and pollution prevention to help maintain stormwater quality. In general, this facility is not expected to generate significant amounts of hazardous waste, if any, nor will there be outdoor storage of any petroleum products, chemicals, etc. The following LTPPP provides for these conditions in the event that they occur.

1. ROUTINE INSPECTION AND MAINTENANCE OF STORMWATER BMPs

   System Inspector: The Owner shall be the Party Responsible for Inspection and Maintenance, and shall ensure that the inspection duties outlined in this section are performed. The system inspector shall be knowledgeable of the functionality of individual stormwater infrastructure components and be capable of recognizing system deficiencies due to needed maintenance or repair. The system inspector will be responsible for advising the Owner of observed conditions of the system which require attention, and shall be capable of providing maintenance instructions to infrastructure maintenance personnel for the various stormwater management components.

   The system inspector will prepare inspection reports and details for the Owner's use.

   Required maintenance tasks are detailed in the Operation and Maintenance Section.

2. SPILL PREVENTION AND RESPONSE PLAN

   The following good housekeeping and material management practices shall be followed to reduce the risk of spills or other accidental exposure of hazardous materials to storm water runoff:

   - Store quantities of materials required for the facility and not more,
   - Store materials onsite in a neat, orderly manner in appropriate labeled containers,
   - Store materials indoors or under cover, and
   - Follow manufacturers' recommendations for proper use and disposal of materials.

   If an emergency spill or release occurs, site personnel will report the spill or release to site management and evacuate the area. All employees shall receive Awareness Level training as part of their hazard communication training and shall have a general understanding of the onsite drainage system components. A map of all best management practices (BMPs) relevant to the drainage system shall be posted and made visible to all employees. Only employees trained at the First Responder Operations Level of 29 CFR

1910.120(q) will be authorized to respond in a defensive manner to emergency spills or releases of fuel and other materials.

If a spill occurs, site management shall be contacted and site management with assistance from appropriately trained personnel will contain the spill. If necessary, site management will contact an emergency response contractor and will also notify all other authorities and agencies in accordance with state and local regulations. Absorptive materials and other supplies will be used as needed to clean up and prevent the spill from spreading. The source of the spill shall be eliminated immediately. Water shall not be used to wash the spill down. Recycled oil and oily wastes shall be disposed in accordance with all applicable federal, state, tribal, and local requirements.

A spill control and containment kit (containing, for example, absorbent materials, acid neutralizing powder, brooms, dust pans, mops, rags, gloves, goggles, plastic and metal trash containers, etc.) will be provided on site to control spills of 30-50 gallons.

For spills of less than five (5) gallons of material, proceed with source control and containment, clean-up with absorbent materials or other applicable means unless an imminent hazard or other circumstances dictate that the spill should be treated by a professional emergency response contractor.

For spills greater than five (5) gallons of material immediately contact the MADEP at the toll-free 24-hour statewide emergency number: **1-888-304-1133**, the local fire department (**9-1-1**) and an approved emergency response contractor. Provide information on the type of material spilled, the location of the spill, the quantity spilled, and the time of the spill to the emergency response contractor or coordinator, and proceed with prevention, containment and/or clean-up if so desired. (Use the form provided or similar).

In the event that an accident or some other incident, such as an explosion, a release to groundwater or the environment, or an exposure to toxic chemical levels as described in 310 CMR 40.1600, Revised Massachusetts Contingency Plan, occurs, the Massachusetts Department of Environmental Protection, (Central Region) in Worcester (508-792-7650), MassDEP Emergency Response (888-304-1133) the Local Emergency Planning Committee (LEPC), Department of Public Works, and all other appropriate federal, state, and local authorities and agencies will be notified by site management in accordance with 310 CMR 40.0333. The local Fire Department should be notified of any releases or incidents at 911 for emergencies.

The National Response Center (NRC) must be notified at 800-424-8802 where a leak, spill, or other release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity established under either 40 CFR Part 110, 40 CFR Part 117, or 40 CFR Part 302 occurs during a 24-hour period. A description of the release, the circumstances leading to the release, and the date of the release must be provided within 7 calendar days of the knowledge of the release.

3. MAINTENANCE OF LAWNS, GARDENS, AND OTHER LANDSCAPED AREAS

Maintenance of lawns, gardens, and landscaped areas will be completed by the Owner in accordance with their standard policies and schedules.

Management of fertilizers, herbicides, and pesticides will follow the guidelines set forth below in Section 4.

4. STORAGE AND USE OF FERTILIZERS, HERBICIDES, AND PESTICIDES

Fertilizers, herbicides, and pesticides should be stored indoors or under cover. Partially used bags of fertilizers should be stored in sealable plastic bins. Application and disposal of such materials will be completed in accordance with manufacturer's instructions.

Discharges of fertilizers containing nitrogen or phosphorus to watercourses, wetlands, or other offsite areas shall be minimized as follows:

- Apply at a rate and in amounts consistent with manufacturers' specifications,
- Apply at the appropriate time of year for the site's location and to coincide as closely as possible to the period of maximum vegetation uptake and growth,
- Avoid applying before heavy rains that could wash away the fertilizer,
- Never apply to frozen ground,
- Never apply to stormwater conveyance channels that contain flowing water, and
- Follow all federal, state, tribal, and local requirements regarding fertilizer application.

The use of pesticides will be kept at a level consistent with typical residential use. Where possible mechanical methods (i.e. pest traps) or biological methods (i.e. beneficial insects) of pest control shall be implemented. If pesticides (insecticide, herbicide, and fungicide) are required to be used, a pesticide which poses the lowest risk to public health and the environment shall be used. Follow all federal, state, tribal and local requirements regarding the use of pesticides.

5. PROPER MANAGEMENT OF DEICING CHEMICALS AND SNOW

Snow removal service will adhere to the MassDEP Snow Removal Guidance document (attached). Snow shall not be stored in bio-retention cells. It is not anticipated that sand piles will be maintained on the property. However, should sand piles be maintained on the property, they will be contained and stabilized to prevent the discharge of sand to

wetlands or waterbodies, and covered, where feasible. Deicing chemicals should be stored indoors or under cover. The amount of road salt or deicing chemicals applied should be limited to that required to maintain safety by the use of spreaders equipped with calibration devices.

6. REQUIREMENTS FOR THE USE OF SALT, SAND, AND HEAVY EQUIPMENT FOR SNOW PLOWING OPERATIONS

Snow removal shall be the responsibility of the property owner. Salting and/or sanding of pavement / walkway areas during winter conditions shall only be done in accordance with all state/local requirements and approvals.

Snow piles shall be located adjacent to or on pervious surfaces in upland areas. In no case shall snow be disposed of or stored in the infiltration basins or bio-retention areas. In no case shall snow be disposed of or stored in resource areas (wetlands, floodplain, streams or other water bodies).

If necessary, stockpiled snow will be removed from the site and disposed of at an off-site location in accordance with all local, state and federal regulations. Storage of salt and sand stockpiles must be covered at all times. Heavy equipment can only be stored at designated locations.

7. PROVISIONS FOR PREVENTION OF ILLICIT DISCHARGES TO THE STORMWATER MANAGEMENT SYSTEM

No chemicals, litter, trash or other materials shall be dumped into or otherwise allowed to enter the stormwater drainage system. Only stormwater and the following non-stormwater discharges may enter the storm drainage system:

a. Water line flushing
b. Landscape irrigation
c. Diverted stream flows
d. Rising ground water
e. Uncontaminated ground water infiltration (as defined at 40 CFR 35.2005(20))
f. Uncontaminated pumped ground water
g. Discharge from potable water sources
h. Air conditioning condensation
i. Irrigation water, springs
j. Water from crawl space pumps
k. Footing drains
l. Lawn watering
m. Individual resident car washing

n. Flow from riparian habitats and wetlands
o. De-chlorinated swimming pool discharges
p. Street wash waters and
q. Residential building wash waters without detergents

Illicit Discharge Statement

Certain types of non-stormwater discharges are allowed under the U.S. Environmental Protection Agency Construction General Permit. These types of discharges will be allowed under the conditions that no pollutants will be allowed to come in contact with the water prior to or after its discharge. The control measures which have been outlined previously in this LTPPP will be strictly followed to ensure that no contamination of these non-storm water discharges takes place. Any existing illicit discharges, if discovered during the course of the work, will be reported to MassDEP, as applicable, to be addressed in accordance with their respective policies. No illicit discharges will be allowed in conjunction with the proposed improvements.

8. PROVISIONS FOR SOLID WASTE MANAGEMENT

All solid waste management systems shall be inspected and maintained in accordance with all local, state and federal requirements.

9. CONTACT INFORMATION

In case of emergency, please contact:

- Norfolk Police Department
  117 Main Street
  Norfolk, MA 02056
  (508) 528-3206
  Emergency Number: 911

- Norfolk Fire Department
  117 Main Street
  Norfolk, MA 02056
  (508) 528-3207
  Emergency Number: 911

SURFACE MAINTENANCE

The stormwater controls are to be operated and maintained in compliance with the following permanent procedures by the land owner. See attached sketch entitled "BMP Map" for corresponding component location onsite.

COMPONENT: Stormwater Quality Units (Stormceptor Units)
RESPONSIBILITY: Norfolk Holdings, LLC
ACTION: Inspection / cleaning
FREQUENCY: Per Manufacturer's Maintenance Guidelines (attached). Inspections & cleanings should be performed at a minimum of once per year, however more frequent inspections & cleanings may be required depending on the rate of sediment accumulation due to equipment wash down, winter sanding operations, or in areas where excessive amounts of trash are expected.
DESCRIPTION: See attached Manufacturer's Maintenance Guidelines. All accumulated materials shall be disposed of in accordance with DEP regulations. A vacuum truck will be required to remove sediment and debris from the sump of the structure.
BUDGET: Inspection/cleaning- $500/yr based on inspections and cleanings of once per year.

COMPONENT: Drive Aisles / Parking Areas
RESPONSIBILITY: Norfolk Holdings, LLC
ACTION: Street Sweeping
FREQUENCY:

- Type: High Efficiency Vacuum Sweeper
  Frequency: Quarterly Average, with sweeping scheduled primarily in spring and fall.
- Type: Regenerative Air Sweeper– Frequency of Sweeping
  Frequency: Quarterly Average, with sweeping scheduled primarily in spring and fall.
- Type: Mechanical Sweeper (Rotary Broom)
  Frequency: Monthly Average, with sweeping scheduled primarily in spring and fall

DESCRIPTION: Drive aisles and parking areas shall be swept per the above table. Sweeping shall be performed to remove sediments prior to introduction into the stormwater collection system. Washing and water jetting shall be discouraged.
BUDGET: $1,000 /year based on quarterly sweepings post construction.

COMPONENT: Outlet Structures / Deep sump catch basins
RESPONSIBILITY: Norfolk Holdings, LLC
ACTION: Cleaning (Sediment removal / sump cleaning) and Inspection
FREQUENCY:

1. Cleaning – Four times a year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom invert of the lowest pipe in the basin.
2. Inspection – Four times per year

DESCRIPTION: Catch basins are to be cleaned four times per year. The Owner will monitor sumps post construction on an as needed basis. Precautions shall take place to maintain the integrity of the oil trapping hoods during cleaning. The hoods shall be inspected and repaired as necessary. Accumulated Hydrocarbon shall be collected separately from accumulated sediment. All material shall be disposed of in accordance with DEP regulations.
Inspections:

- Frame and Grate

- Inlet and Outlet condition
- Cracks and settlement & joint failure & leaking
- Sediment Accumulation
- Oil/Gas Sheen in water
- Condition of hood
- General Inspection of structure

BUDGET: $500/ per basin per year based on inspections and cleanings of four times a year.

COMPONENT: Subsurface Infiltration Systems & Infiltration Trench
RESPONSIBILITY: Norfolk Holdings, LLC
ACTION: Various inspection, maintenance, and cleaning activities
FREQUENCY:

1. Preventative Maintenance - Two times per year.
2. Inspection to ensure proper function – After every major storm during the first 3 months of operation and twice a year thereafter, and after a storm event of 1-inch or greater.
3. Inspect and clean pretreatment devices

DESCRIPTION: Inspection ports / access covers are to be examined to determine if the underdrain system is working. There should not be any water in the system within 72 hours after the end of rainfall. If there is routinely water within the system within that time, contact a civil engineer for further observation and potential repairs.

COMPONENT: Infiltration Ponds/Basins (Above Ground)
RESPONSIBILITY: Norfolk Holdings, LLC
ACTION: Preventative Maintenance, Inspection & Mowing
FREQUENCY:

1. Preventative Maintenance - Two times per year.
2. Inspection to ensure proper function – After every major storm during the first 3 months of operation and twice a year thereafter.
3. Mow the buffer area and side slopes. Remove all grass clippings and accumulated organic matter- Twice yearly during the growing season.
4. Inspect and clean pretreatment devices

DESCRIPTION: Infiltration ponds shall be inspected a minimum of two times per year to ensure that they are operating as intended and that all components are stable and in working order. Inspections shall be by qualified personnel. During the growing season, the ponds shall be mowed at least twice, with additional cuttings performed as needed. All tree saplings of any species will be removed from embankments and the pond bottom. The inlet to the pond shall be inspected for erosion and sedimentation, and rip-rap shall be promptly repaired as needed. Sediment collecting in the pond bottom shall be inspected four times annually, and removal shall commence any time the sediment reaches a depth of six inches anywhere in the pond. Any pond sediments removed shall be disposed of in accordance with the latest DEP guidelines for stormwater sediment disposal.

OTHER SURFACE MAINTENANCE PROCEDURES:

Snow plowing operations shall store snow at the locations shown on the approved site plans. In the event snow storage hinders the parking or accessibility operations of the development, the owner shall have the snow stockpiles removed from the site in accordance to all state, local and federal regulations. Stockpiling snow within the wetland areas is strictly forbidden. Each spring the snow stockpile locations shall be swept (remove sediment per applicable codes) and replace vegetation as necessary.

POST CONSTRUCTION ACTIVITY FORM

NOTE: The contractor is responsible for maintaining an accurate and complete log of construction activities, including, but not limited to, commencement of stabilization, major grading activities, timeframes when construction ceases on a portion of site (temporary or permanent) until the Notice of Termination (NOT) is filed.

MAJOR STABILIZATION AND GRADING ACTIVITIES

Construction Activity	Contractor Name	Start Date	End Date	Location

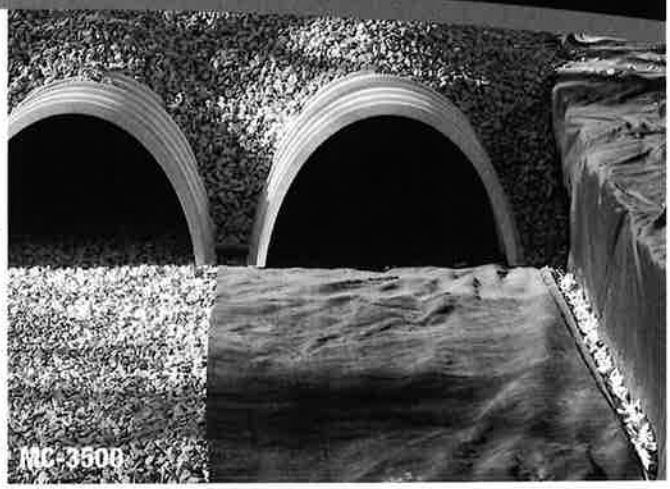
Appendix 7B – Isolator Row Operation and Maintenance

StormTech®

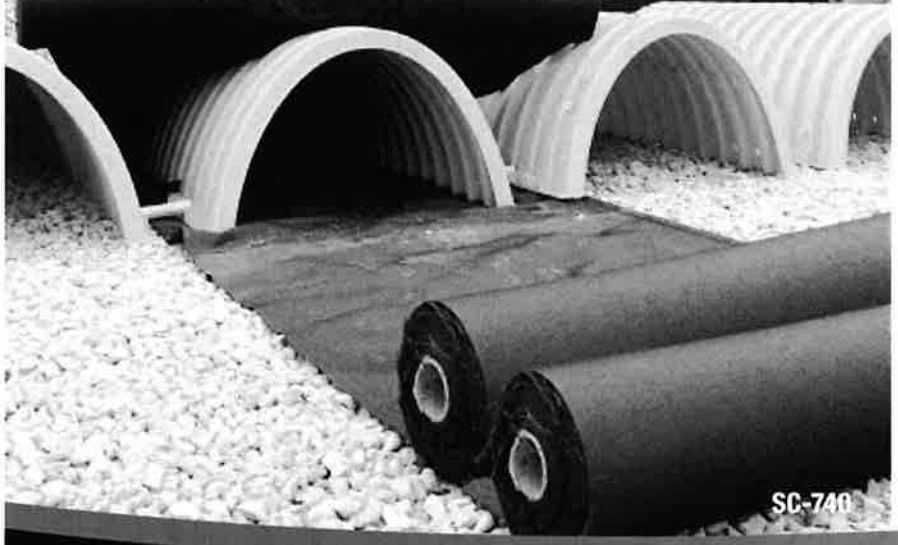
Detention • Retention • Water Quality

An ADS company

Isolator® Row O&M Manual



MC-3500



SC-740

MC-4500

THE MOST ADVANCED NAME IN WATER MANAGEMENT SOLUTIONS™

ADS®

THE ISOLATOR® ROW

INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a technique to inexpensively enhance Total Suspended Solids (TSS) and Total Phosphorus (TP) removal with easy access for inspection and maintenance.

THE ISOLATOR ROW

The Isolator Row is a row of StormTech chambers, either SC-160, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The woven geotextile provides a media for stormwater filtration, a durable surface for maintenance, prevents scour of the underlying stone and remains intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the SC-160, DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

The Isolator Row is typically designed to capture the "first flush" and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole provides access to the Isolator Row and typically includes a high flow weir. When flow rates or volumes exceed the Isolator Row weir capacity the water will flow over the weir and discharge through a manifold to the other chambers.

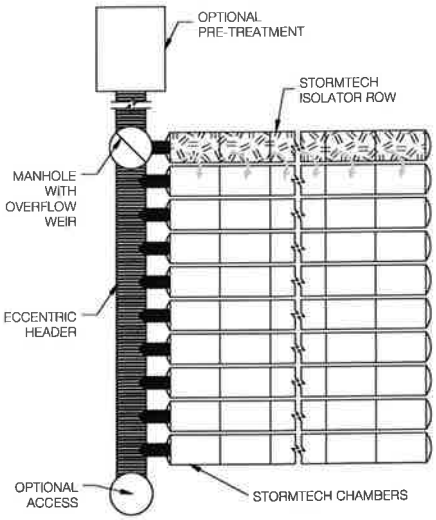
Another acceptable design uses one open grate inlet structure. Using a "high/low" design (low invert elevation on the Isolator Row and a higher invert elevation on the manifold) an open grate structure can provide the advantages of the Isolator Row by creating a differential between the Isolator Row and manifold thus allowing for settlement in the Isolator Row.

The Isolator Row may be part of a treatment train system. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.

StormTech Isolator Row with Overflow Spillway (not to scale)



ISOLATOR ROW INSPECTION/MAINTENANCE

INSPECTION

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

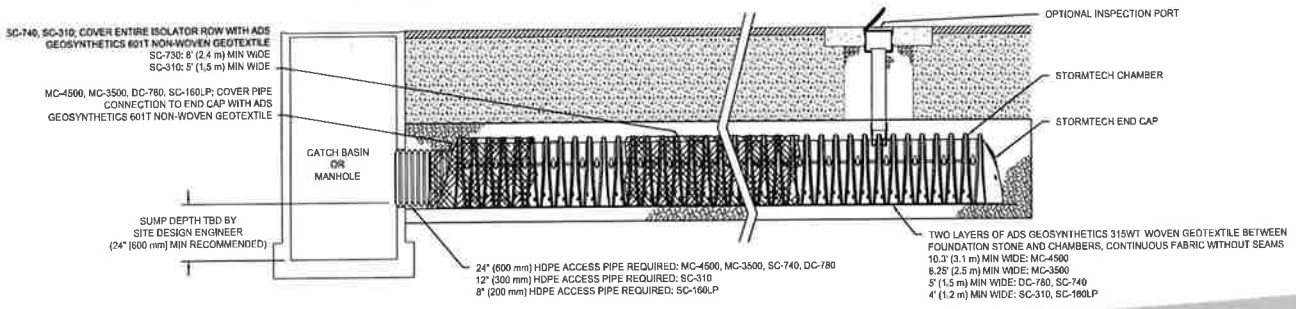
MAINTENANCE

The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)

Note: Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-4500 chamber models and is not required over the entire Isolator Row.



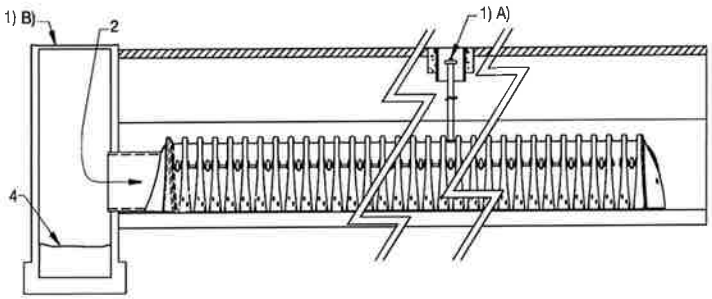
ISOLATOR ROW STEP BY STEP MAINTENANCE PROCEDURES

STEP 1
Inspect Isolator Row for sediment.
- A) Inspection ports (if present)
  - i. Remove lid from floor box frame
  - ii. Remove cap from inspection riser
  - iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
  - iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.
- B) All Isolator Rows
  - i. Remove cover from manhole at upstream end of Isolator Row
  - ii. Using a flashlight, inspect down Isolator Row through outlet pipe
    1. Mirrors on poles or cameras may be used to avoid a confined space entry
    2. Follow OSHA regulations for confined space entry if entering manhole
  - iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2. If not, proceed to Step 3.

STEP 2
Clean out Isolator Row using the JetVac process.
- A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
- B) Apply multiple passes of JetVac until backflush water is clean
- C) Vacuum manhole sump as required

STEP 3
Replace all caps, lids and covers, record observations and actions.

STEP 4
Inspect & clean catch basins and manholes upstream of the StormTech system.



SAMPLE MAINTENANCE LOG

Date	Stadia Rod Readings		Sediment Depth (1)–(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

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StormTech

Advanced Drainage Systems, Inc.
4640 Trueman Blvd., Hilliard, OH 43026
1-800-821-6710 www.ads-pipe.com

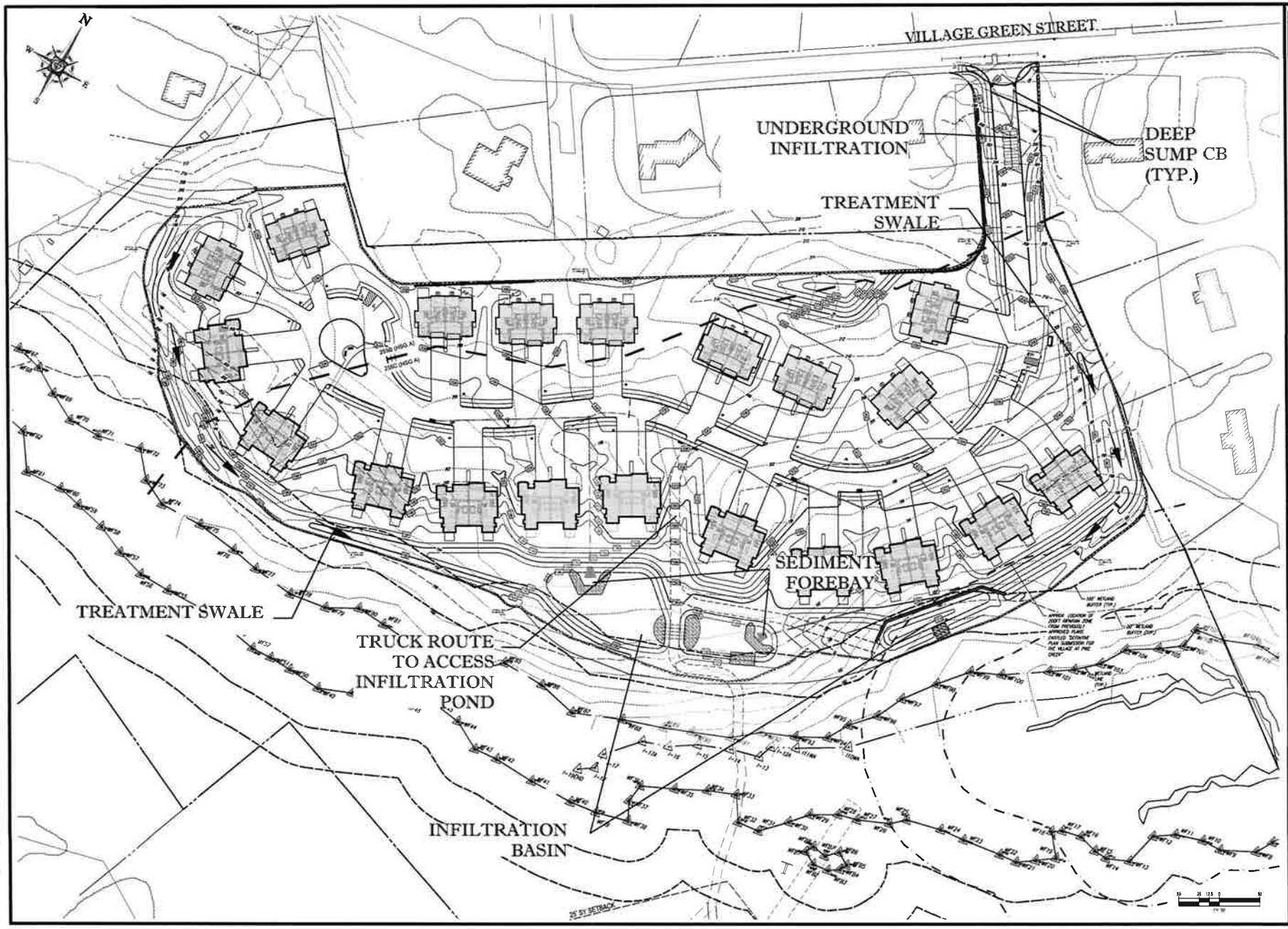
Appendix 7C – Inspection and Maintenance Log Form

STORMWATER INSPECTION AND MAINTENANCE LOG FORM

Enclave At Norfolk

Stormwater Management Practice	Responsible Party	Date	Maintenance Activity Performed

Appendix 7D – Proposed Best Management Practices (BMP) Map



BOHLER ENGINEERING

REVISIONS

REV.	DATE	COMMENT	BY
1			
2			
3			
4			
5			
6			
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10			
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12			
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PROJECT No.: W12-0[illegible]
DRAWN BY: KGS
CHECKED BY: RMM
DATE: [illegible]
SCALE: AS[illegible]
CAD FILE: W12-0[illegible]-BMP-1.DWG

PROJECT
PRELIMINARY PLAN
FOR
COMPREHENSIVE PERMIT
"THE ENCLAVE AT NORFOLK"
A SUBDIVISION IN NORFOLK, MASS.
OWNER: NORFOLK HOLDINGS, LLC
VILLAGE GREEN
TOWN OF NORFOLK
NORFOLK COUNTY, MASS
MAP #15 LOT 54-57

BOHLER ENGINEERING
352 TURNPIKE ROAD
SOUTHBOROUGH, MA 01772
Phone (508) 480-9000
Fax (508) 480-9080
www.BohlerEngineering.com

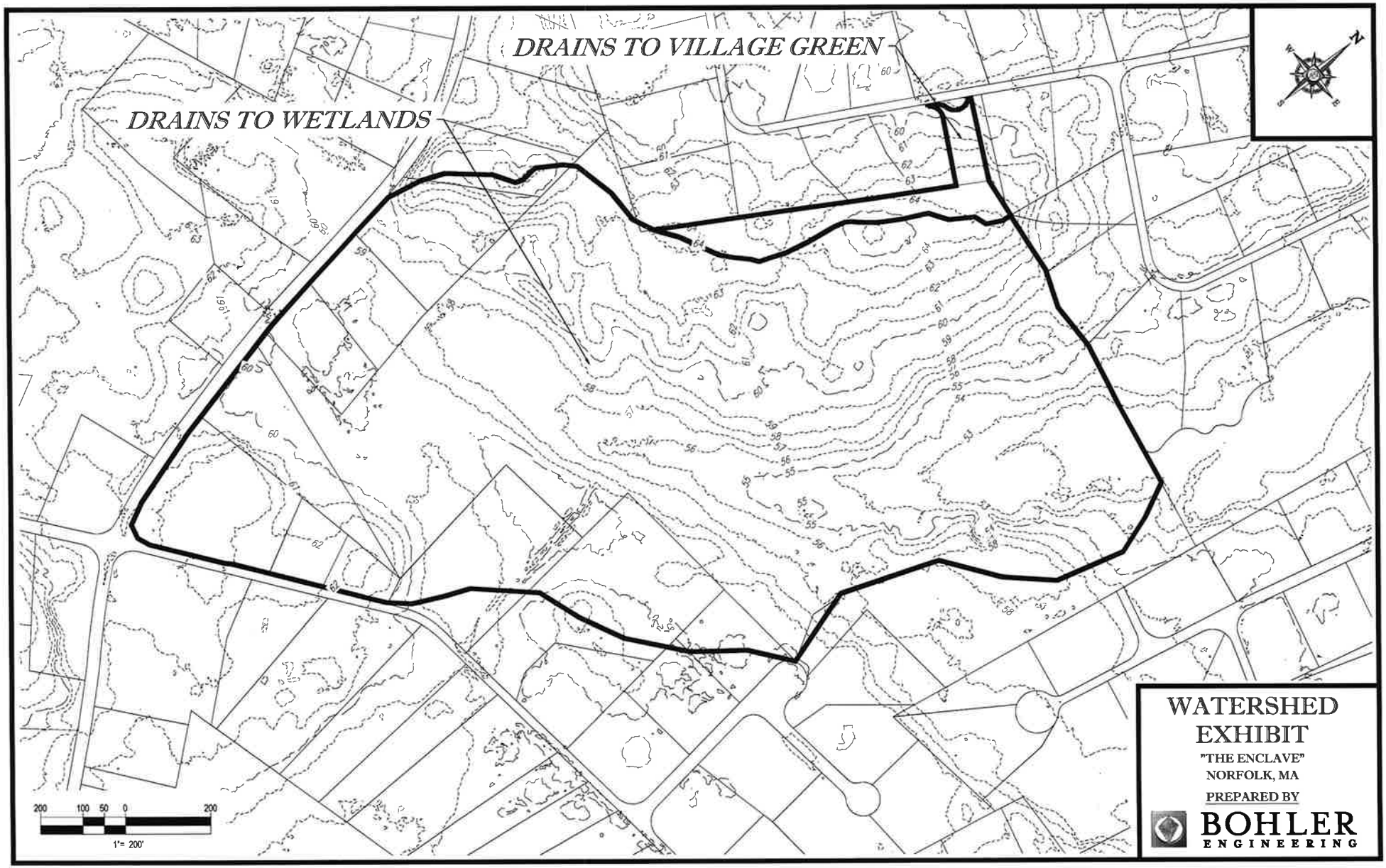
SHEET TITLE
BMP MAP

SHEET NUMBER
BMP-1

REV 10 - 01/17/2018

Appendix 8

Watershed Exhibit



WATERSHED EXHIBIT

"THE ENCLAVE"
NORFOLK, MA

PREPARED BY

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