HERITAGE LANDING

MAP 248, LOT 42 COW POND BROOK ROAD GROTON, MA

PRELIMINARY STORMWATER MANAGEMENT REPORT

THIS REPORT HAS BEEN PREPARED UNDER THE SUPERVISION OF A REGISTERED PROFESSIONAL ENGINEER LICENSED IN THE STATE OF MASSACHUSETTS



Date: January 30, 2024

PREPARED FOR:

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PROJECT NUMBER: 2944.00

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SECTION 1.0 INTRODUCTION

The following Preliminary Stormwater Management Report accompanies an application to the Groton Zoning Board of Appeals for a 28-unit "Chapter 40B" affordable housing project known as Heritage Landing. The intent of this Report is to demonstrate that compliance with the 10 Stormwater Management Standards is feasible. This Report is preliminary in nature and additional stormwater design and calculations will be required prior to construction.

The Heritage Landing project is located off Cow Pond Brook Road in Groton, Massachusetts. The subject parcel is identified as Map 248, Lot 42 on the Groton Tax Maps. The subject parcel was previously used as a quarry and has been excavated roughly 30 feet below the elevation of Cow Pond Brook Road. The on-site soils are highly infiltrative sands identified as Carver and Quonset on NRCS Soil Maps. The far rear of the site contains a small amount of Ridgebury sandy loam.

The proposed development consists of 28 single-family and duplex affordable housing units. The new units will be accessed by a new 980 ft long roadway known as Rosie Lane. The roadway, driveways, and units will drain to closed drainage system via catch basins, which will then discharge to an infiltration basin located at the rear of the development. The infiltration basin will store and infiltrate runoff up to, and including, the 100-year storm. A forebay is provided in the infiltration basin to allow for pre-treatment prior to infiltration.

HydroCAD model printouts are included within this Report from a simplified model. The sandy Carver and Quonset soils are modelled as Hydrologic Soil Group A. The small section of Ridgebury sandy loam is modelled as Hydrologic Soil Group D. In the post-development condition, it is assumed that the front of the units, driveways, and the proposed roadway will drain to the infiltration basin via the closed street system (subcatchment 150). It is assumed that the rear of the units and majority of the site will drain to the infiltration basin via overland flow & swales to be constructed around the perimeter of the development (subcatchment 100). The north property line is designated Point of Analysis A and the south property line is designated Point of Analysis B.

SECTION 2.0 THE STORMWATER MANAGEMENT STANDARDS

The 10 Stormwater Management Standards are reprinted below. Each is followed by a description of how this project will meet that standard:

The Stormwater Management Standards

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

There are no new outfalls proposed. The development drains to an infiltration basin which is sized to store and infiltrate all storms up to the 100-year event.

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

Peak runoff rates are summarized below and on the following page. See Section 4.0 for printouts of the hydrologic model used to generate the peak runoff rates.

Table 3.1 Heritage Landing – Preliminary Peak Flow Rate Comparison (Point of Analysis A – North Property Line)					
Storm EventPre-DevelopmentPost-DevelopmentPeak Flow Rate (cfs)Peak Flow Rate (cfs)					
2-year (3.0 in)	0.00	0.00			
10-year (4.4 in)	0.00	0.00			
25-year (5.2 in)	0.00	0.00			
100-year (6.3 in)	0.00	0.00			

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PRELIMINARY STORMWATER MANAGEMENT REPORT HERITAGE LANDING Cow Pond Brook Rd, Groton, Massachusetts

Table 3.2 Heritage Landing – Preliminary Peak Flow Rate Comparison (Point of Analysis B – South Property Line)					
Storm EventPre-DevelopmentPost-DevelopmentPeak Flow Rate (cfs)Peak Flow Rate (cfs)Peak Flow Rate (cfs)					
2-year (3.0 in)	0.00	0.00			
10-year (4.4 in)	0.00	0.00			
25-year (5.2 in)	0.01	0.01			
100-year (6.3 in)	0.03	0.03			

There is no expected increase in the peak rate of runoff to the Points of Analysis for the storm events analyzed. This is accomplished by the infiltration basin, and by limiting development to a small portion of the site.

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

According to the MassDEP Stormwater Handbook, the stormwater runoff volume to be recharged to groundwater is determined using the existing site (predevelopment) soil conditions. The total impervious area introduced through site development is multiplied by one of the following recharge factors:

TABLE 3.1RECHARGE RATES

Hydrologic Group	Volume to Recharge (x Total Impervious Area)
А	0.60 inches of runoff
В	0.35 inches of runoff
С	0.25 inches of runoff
D	0.10 inches of runoff

The Required Recharge is based on the following formula:

$Rv = F x A_{IMP}$

Where:

Rv	= Required Recharge Volume, expressed in Ft^3 , cubic yards, or acre-feet
F	= Target Depth Factor associated with each Hydrologic Soil Group
A _{IMP}	= Increase in Impervious Area (pavement and rooftop area) on site

For the subject property, the computation follows:

A_{IMP} (HSG A) =	86,471 SF
RV (HSG A) = ((86,471 SF) x 0.60 in) \div (12 in/ft) =	4,323 CF

Required Recharge (Rv) =

Recharge Provided:

Rv (Provided) =	28,073 CF > $Rv = 4,323$ CF	OK
Rv (Provided) Via HydroCAD model pond 1P:	<u>28,073 CF</u> (static	storage)
Recharge Provided via Infiltration Basin (SMF 1)		

4,323 CF

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

a. Suitable practices for source control and pollution prevention are identified in a longterm pollution prevention plan, and thereafter are implemented and maintained;

b. Structural stormwater best management practices are sized to capture the required water quality volume determined in accordance with the Massachusetts Stormwater Handbook; and

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

A Long-Term Pollution Prevention Plan will be included in the final Stormwater Management Report.

The formula for determining the Water Quality Volume is:

 $V_{WQ} = (DWQ/12 \text{ inches/foot}) * (A_{IMP})$

Where:

 V_{WQ} = Required Water Quality Volume (in cubic feet)

 D_{WQ} = Water Quality Depth: one-inch for discharges within a Zone II or Interim Wellhead Protection Area, to or near another critical area, runoff from a LUHPPL, or exfiltration to soils with infiltration rate greater than 2.4 inches/hour; $\frac{1}{2}$ -inch for discharges near or to other areas.

 A_{IMP} = Impervious Area (in square feet)

For the subject project, since it is an area with a highly infiltrative soils, a Water Quality Depth of 1 inch is used:

Use: $D_{WQ} = 1$ inch

For the subject property, the computation follows:

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A_{IMP} = \frac{86,471 \text{ SF}}{V_{WQ}} = (D_{WQ}/12 \text{ inches/foot}) * (A_{IMP} \text{ square feet})V_{WQ} = (1 \text{ inch/12 inches/foot}) * (86,471 \text{ ft}^2)
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 $V_{WQ} = \frac{7,205 \text{ ft}^3}{2}$

Recharge Provided via Infiltration Basin (SMF 1)

V_{WQ (Provided)} Via HydroCAD model pond 1P: <u>28,073 CF</u> (static storage)

Check Water Quality Volume

$Vwq^{Provided} = 28,073 \text{ ft}^3 > Vwq^{Required} = 7,205 \text{ ft}^3$	ft ³ 0)K
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TSS Removal is calculated via worksheets provided by MassDEP, as shown below:

INSTRUCTIONS:

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu

2. Select BMP from Drop Down Menu

3. After BMP is selected, TSS Removal and other Columns are automatically completed.

		Location:	SMF 1: Infiltration Basin			
		В	С	D	Е	F
			TSS Removal	Starting TSS	Amount	Remaining
		BMP ¹	Rate ¹	Load*	Removed (C*D)	Load (D-E)
	leet	Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
oval	orkst	Sediment Forebay	0.25	0.75	0.19	0.56
Remo	on W	Infiltration Basin	0.80	0.56	0.45	0.11
TSS	culati		0.00	0.11	0.00	0.11
	Cal		0.00	0.11	0.00	0.11
			Total T	SS Removal =	89%	Separate Form Needs to be Completed for Each Outlet or BMP Train
		Project: Prepared By: Date:	Heritage Landing, Groton, MA IJA 1/30/2024		*Equals remaining load fron which enters the BMP	n previous BMP (E)

Pretreatment TSS removal = 44% which is equal to the 44% required ------ OK

Total TSS removal = 89% which is greater than 80% required ------ OK

Version 1, Automated: Mar. 4, 2008

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

This project does not have a land use with higher pollutant loads. Standard 5 is not applicable.

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

This project does not propose any new discharges, and the project does not discharge to the areas described in Standard 6.

7. A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5, and 6. Existing stormwater discharges shall comply with Standard 1 only to the maximum extent practicable. A redevelopment project shall also comply with all other requirements of the Stormwater Management Standards and improve existing conditions.

This project is not redevelopment. Standard 7 is not applicable.

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.

A SWPPP plan will be prepared with input from the selected contractor prior to construction. Erosion control details are included on the project plans. Additional detail will provided on the plans at the time of final design.

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

An Operation and Maintenance Plan will be included in the final Stormwater Management Report.

10. All illicit discharges to the stormwater management system are prohibited.¹

An Illicit Discharge Statement will be included in the final Stormwater Management Report.

<The Remainder of this Page is Blank>

¹ Massachusetts Stormwater Handbook, Volume 1: <u>http://www.mass.gov/eea/agencies/massdep/water/regulations/massachusetts-stormwater-handbook.html</u>

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PRELIMINARY STORMWATER MANAGEMENT REPORT HERITAGE LANDING Cow Pond Brook Rd, Groton, Massachusetts

SECTION 3.0

MASSDEP STORMWATER CHECKLIST



Massachusetts Department of Environmental Protection Bureau of Resource Protection - Wetlands Program Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

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

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

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

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

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

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



B. Stormwater Checklist and Certification

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

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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



Signature and Date

Checklist

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

New development



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:

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

Standard 1: No New Untreated Discharges

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



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 predevelopment 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 24hour storm.

Standard 3: Recharge

Soil Analysis provided.

- Required Recharge Volume calculation provided.
- Required Recharge volume reduced through use of the LID site Design Credits.
- Sizing the infiltration, BMPs is based on the following method: Check the method used.

\bowtie	Static
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Dynamic Field¹

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

Simple Dynamic

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.

\boxtimes	Recharge B	BMPs have be	en sized to	infiltrate the	e Required	Recharge	Volume.
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Recharge BMPs have been sized to infiltrate the Required Recharge Volume only to the maximum
extent practicable for the following reason:

- Site is comprised solely of C and D soils and/or bedrock at the land surface
- M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
- Solid Waste Landfill pursuant to 310 CMR 19.000
- Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- Calculations showing that the infiltration BMPs will drain in 72 hours are provided.

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

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



Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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



Standard 4: Water Quality (continued)

- The BMP is sized (and calculations provided) based on:
 - The 1/2" 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	ct
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- Small Residential Projects: 5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
- Small Residential Projects: 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
- Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
- Bike Path and/or Foot Path
- Redevelopment Project
- Redevelopment portion of mix of new and redevelopment.
- Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.

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

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

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

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

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



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

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

The project is <i>not</i> covered by a NPDES Construction General Perm	nit.
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- The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

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

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

Standard 10: Prohibition of Illicit Discharges

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

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PRELIMINARY STORMWATER MANAGEMENT REPORT HERITAGE LANDING Cow Pond Brook Rd, Groton, Massachusetts

SECTION 4.0

HYDROCAD WORKSHEETS





2944 Drainage PRE-DEV Prepared by Meisner-Brem Corp HydroCAD® 10.20-4a s/n 00650 © 2023 HydroCAD Software Solutions LLC

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.00	2
2	10-Year	Type III 24-hr		Default	24.00	1	4.40	2
3	25-Year	Type III 24-hr		Default	24.00	1	5.20	2
4	100-Year	Type III 24-hr		Default	24.00	1	6.30	2

Rainfall Events Listing

Area Listing (all nodes)

Area	CN	Description
(sq-ft)		(subcatchment-numbers)
509,652	39	>75% Grass cover, Good, HSG A (100, 200)
128,066	30	Woods, Good, HSG A (100, 200)
11,326	77	Woods, Good, HSG D (100, 200)
649,044	38	TOTAL AREA

Soil Listing (all nodes)

Area	Soil	Subcatchment
(sq-ft)	Group	Numbers
637,718	HSG A	100, 200
0	HSG B	
0	HSG C	
11,326	HSG D	100, 200
0	Other	
649,044		TOTAL AREA

2944 Drainage PRE-DEV

Prepared by Meisne	er-Brem C	orp			
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HSG-A	HSG-B	HSG-C	HSG-D	Other	Total	Ground	Sı
 (sq-ft)	(sq-ft)	(sq-ft)	(sq-ft)	(sq-ft)	(sq-ft)	Cover	Ni
 509,652	0	0	0	0	509,652	>75% Grass cover, Good	
128,066	0	0	11,326	0	139,392	Woods, Good	
637,718	0	0	11,326	0	649,044	TOTAL AREA	

Ground Covers (all nodes)

2944 Drainage PRE-DEV	Type III 24-hr 2-Year Rainfall=	=3.00", Ia/S=0.21
HydroCAD® 10.20-4a s/n 00650 © 2023	3 HydroCAD Software Solutions LLC	Page 6
Time span= Runoff by SC Reach routing by Dyn-Sto	=1.00-24.00 hrs, dt=0.01 hrs, 2301 points CS TR-20 method, UH=SCS, Weighted-CN or-Ind method - Pond routing by Dyn-Stor-Ind met	hod
Subcatchment 100: Majority of Site to	o Low Runoff Area=14.290 ac 0.00% Impervious F Flow Length=1,215' Tc=32.6 min CN=38 Re	Runoff Depth=0.00" unoff=0.00 cfs 0 cf
Subcatchment 200: South Portion of Flow L	Site Runoff Area=0.610 ac 0.00% Impervious F _ength=60' Slope=0.1200 '/' Tc=6.1 min CN=35 Ru	Runoff Depth=0.00" unoff=0.00 cfs 0 cf
Pond 3P: Large Low Point Di	Peak Elev=74.00' Storage=0 cf Ir iscarded=0.00 cfs 0 cf Secondary=0.00 cfs 0 cf Ou	nflow=0.00 cfs 0 cf tflow=0.00 cfs 0 cf
Link A: North Property Line	lı Pri	nflow=0.00 cfs 0 cf mary=0.00 cfs 0 cf
Link B: South Property Line	lı Pri	nflow=0.00 cfs 0 cf mary=0.00 cfs 0 cf

Total Runoff Area = 649,044 sf Runoff Volume = 0 cf Average Runoff Depth = 0.00" 100.00% Pervious = 649,044 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 100: Majority of Site to Low Point

[45] Hint: Runoff=Zero

1.00 hrs, Volume= Runoff 0.00 cfs @ = Routed to Pond 3P : Large Low Point

0 cf, Depth= 0.00"

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Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Type III 24-hr 2-Year Rainfall=3.00", Ia/S=0.21

Area ((ac) C	N Dese	cription		
2.5	500 3	30 Woo	ds, Good,	HSG A	
11.5	570 3	39 >759	% Grass co	over, Good	, HSG A
0.2	220 7	77 Woo	ds, Good,	HSG D	
14.2	290 3	38 Weig	ghted Aver	age	
14.2	290	100.	00% Pervi	ous Area	
Тс	Lenath	Slope	Velocity	Capacity	Description
(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)	
4.9	50	0.2000	0.17		Sheet Flow,
					Woods: Light underbrush n= 0.400 P2= 3.20"
1.5	65	0.0200	0.71		Shallow Concentrated Flow,
					Woodland Kv= 5.0 fps
26.2	1,100	0.0100	0.70		Shallow Concentrated Flow,
					Short Grass Pasture Kv= 7.0 fps
32.6	1,215	Total			

Subcatchment 100: Majority of Site to Low Point



[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 1.00 hrs, Volume= Routed to Link B : South Property Line 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Type III 24-hr 2-Year Rainfall=3.00", Ia/S=0.21

_	Area ((ac) (CN	Desc	ription		
	0.4	440	30	Woo	ds, Good,	HSG A	
	0.	130	39	>75%	6 Grass co	over, Good	, HSG A
0.040 77 Woods, Good, HSG D							
0.610 35 Weighted Average							
	0.	610		100.0	00% Pervi	ous Area	
	Tc	Length	S	Slope	Velocity	Capacity	Description
_	(min)	(feet)		(ft/ft)	(ft/sec)	(cfs)	
	6.0	50	0.	1200	0.14		Sheet Flow,
							Woods: Light underbrush n= 0.400 P2= 3.20"
	0.1	10	0.	1200	1.73		Shallow Concentrated Flow,
							Woodland Kv= 5.0 fps
			_				

6.1 60 Total

Subcatchment 200: South Portion of Site Near Property Line



Summary for Pond 3P: Large Low Point

[92] Warning: Device #2 is above defined storage

Inflow Area =	622,472 sf,	0.00% Impervious,	Inflow Depth = $0.00"$ f	or 2-Year event				
Inflow =	0.00 cfs @	1.00 hrs, Volume=	0 cf					
Outflow =	0.00 cfs @	1.00 hrs, Volume=	0 cf, Atten=	0%, Lag= 0.0 min				
Discarded =	0.00 cfs @	1.00 hrs, Volume=	0 cf					
Secondary =	0.00 cfs @	1.00 hrs, Volume=	0 cf					
Routed to Link A : North Property Line								

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Peak Elev= 74.00' @ 1.00 hrs Surf.Area= 30,000 sf Storage= 0 cf

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

Volume	Inve	ert Avail.Sto	rage Storage	Description	
#1	74.0	0' 95,0	00 cf Custom	Stage Data (Pri	smatic) Listed below (Recalc)
Elevatio	on et)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	
74.0 76.0	00 00	30,000 65,000	0 95,000	0 95,000	
Device	Routing	Invert	Outlet Device	S	
#1 #2	Discarde Seconda	d 74.00' ry 76.00'	8.270 in/hr Ex 50.0' long x 2 Head (feet) 0 Coef. (English	Contraction over S 20.0' breadth Bree .20 0.40 0.60 0 .20 0.40 2.60 0 .10 2.68 2.70 2.70	Surface area Dad-Crested Rectangular Weir D.80 1.00 1.20 1.40 1.60 70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.00 cfs @ 1.00 hrs HW=74.00' (Free Discharge) **1=Exfiltration** (Passes 0.00 cfs of 5.74 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 1.00 hrs HW=74.00' TW=0.00' (Dynamic Tailwater) 2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

2944 Drainage PRE-DEV

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Pond 3P: Large Low Point



Summary for Link A: North Property Line

Inflow	=	0.00 cfs @	1.00 hrs, Volume=	0 cf
Primary	=	0.00 cfs @	1.00 hrs, Volume=	0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs

Link A: North Property Line



Summary for Link B: South Property Line

Inflow /	Area	1 =	26,572 sf,	0.00% Impervious,	Inflow Depth = 0.00"	for 2-Year event
Inflow		=	0.00 cfs @	1.00 hrs, Volume=	0 cf	
Primar	у	=	0.00 cfs @	1.00 hrs, Volume=	0 cf, Atter	n= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs



Link B: South Property Line

2944 Drainage PRE-DEVType III 24-hr 10-Year Rainfall=4.40", Ia/S=0.21Prepared by Meisner-Brem CorpPrinted 1/30/2024HydroCAD® 10.20-4a s/n 00650 © 2023 HydroCAD Software Solutions LLCPage 13

Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points Runoff by SCS TR-20 method, UH=SCS, Weighted-CN Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 100: Majority of Site to Low Runoff Area=14.290 ac 0.00% Impervious Runoff Depth>0.05" Flow Length=1,215' Tc=32.6 min CN=38 Runoff=0.10 cfs 2,735 cf

Subcatchment 200: South Portion of Site Runoff Area=0.610 ac 0.00% Impervious Runoff Depth>0.01" Flow Length=60' Slope=0.1200 '/' Tc=6.1 min CN=35 Runoff=0.00 cfs 29 cf

Pond 3P: Large Low Point Peak Elev=74.00' Storage=0 cf Inflow=0.10 cfs 2,735 cf Discarded=0.10 cfs 2,735 cf Secondary=0.00 cfs 0 cf Outflow=0.10 cfs 2,735 cf

Link A: North Property Line

Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf

Link B: South Property Line

Inflow=0.00 cfs 29 cf Primary=0.00 cfs 29 cf

Total Runoff Area = 649,044 sf Runoff Volume = 2,764 cf Average Runoff Depth = 0.05" 100.00% Pervious = 649,044 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 100: Majority of Site to Low Point

Runoff = 0.10 cfs @ 15.90 hrs, Volume= Routed to Pond 3P : Large Low Point 2,735 cf, Depth> 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Type III 24-hr 10-Year Rainfall=4.40", Ia/S=0.21

Area (ac) C	N Desc	cription		
2.500 30		0 Woo	ds, Good,	HSG A	
11.5	570 3	89 >75°	% Grass co	over, Good,	, HSG A
0.2	220 7	'7 Woo	ds, Good,	HSG D	
14.2	290 3	88 Weig	ghted Aver	age	
14.2	290	100.	00% Pervi	ous Area	
Тс	l onath	Slope	Velocity	Canacity	Description
(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)	Description
4.9	50	0.2000	0.17		Sheet Flow,
					Woods: Light underbrush n= 0.400 P2= 3.20"
1.5	65	0.0200	0.71		Shallow Concentrated Flow,
					Woodland Kv= 5.0 fps
26.2	1,100	0.0100	0.70		Shallow Concentrated Flow,
					Short Grass Pasture Kv= 7.0 fps
32.6	1,215	Total			

Subcatchment 100: Majority of Site to Low Point



Summary for Subcatchment 200: South Portion of Site Near Property Line

Runoff = 0.00 cfs @ 22.21 hrs, Volume= Routed to Link B : South Property Line 29 cf, Depth> 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Type III 24-hr 10-Year Rainfall=4.40", Ia/S=0.21

Area	(ac)	CN	Desc	ription		
0.	440	30	Woo	ds, Good,	HSG A	
0.	130	39	>75%	6 Grass co	over, Good,	, HSG A
0.	040	77	Woo	ds, Good,	HSG D	
0.	610	35	Weig	phted Aver	age	
0.	610		100.0	00% Pervi	ous Area	
Tc	Length	1 8	Slope	Velocity	Capacity	Description
(min)	(feet))	(ft/ft)	(ft/sec)	(cfs)	
6.0	50	0.	1200	0.14		Sheet Flow,
						Woods: Light underbrush n= 0.400 P2= 3.20"
0.1	10	0.	1200	1.73		Shallow Concentrated Flow,
						Woodland Kv= 5.0 fps
6.1	60) To	otal			

Subcatchment 200: South Portion of Site Near Property Line



Summary for Pond 3P: Large Low Point

[92] Warning: Device #2 is above defined storage

Inflow Area =	622,472 sf,	0.00% Imperviou	s, Inflow Depth > 0.05"	for 10-Year event			
Inflow =	0.10 cfs @	15.90 hrs, Volume	= 2,735 cf				
Outflow =	0.10 cfs @	15.90 hrs, Volume:	= 2,735 cf, Atter	n= 0%, Lag= 0.0 min			
Discarded =	0.10 cfs @	15.90 hrs, Volume:	= 2,735 cf	-			
Secondary =	0.00 cfs @	1.00 hrs, Volume	= 0 cf				
Routed to Link A : North Property Line							

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Peak Elev= 74.00' @ 1.00 hrs Surf.Area= 30,000 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow) Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume		Invert	Avail.Sto	rage Sto	rage D	escription		
#1		74.00' 95,		00 cf Custom S		itage Data (Pr	ismatic) Listed below (Recalc)	
Elevation (feet)		Surf.Area (sq-ft)		Inc.Sto (cubic-fe	re et)	Cum.Store (cubic-feet)		
74.00		30	,000		0	0		
76.0	00	65,000		95,0	00	95,000		
Device	Rou	ting	Invert	Outlet D	evices			
#1	Disc	arded	74.00'	8.270 in	hr Exfi	Itration over	Surface area	
#2 Se		condary 76.00'		50.0' long x 20.0' breadth Broad-Crested Rectangular Weir				
				Head (fe	et) 0.2	0 0.40 0.60	0.80 1.00 1.20 1.40 1.60	
				Coef. (E	nglish)	2.68 2.70 2.	70 2.64 2.63 2.64 2.64 2.63	
				Head (fe Coef. (E	et) 0.2 nglish)	20 0.40 0.60 2.68 2.70 2.	0.80 1.00 1.20 1.40 1.60 70 2.64 2.63 2.64 2.64 2.63	

Discarded OutFlow Max=0.00 cfs @ 15.90 hrs HW=74.00' (Free Discharge) **1=Exfiltration** (Passes 0.00 cfs of 5.74 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 1.00 hrs HW=74.00' TW=0.00' (Dynamic Tailwater) 2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)
2944 Drainage PRE-DEV

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Pond 3P: Large Low Point



Summary for Link A: North Property Line

Inflow	=	0.00 cfs @	1.00 hrs, Volume=	0 cf
Primary	=	0.00 cfs @	1.00 hrs, Volume=	0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs

Link A: North Property Line



Summary for Link B: South Property Line

Inflow /	Area =	26,572 sf,	0.00% lr	npervious,	Inflow Depth >	0.01"	for 10-Year event
Inflow	=	0.00 cfs @	22.21 hrs,	Volume=	29 c	f	
Primar	у =	0.00 cfs @	22.21 hrs,	Volume=	29 c	f, Atte	n= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs



Link B: South Property Line

2944 Drainage PRE-DEVType III 24-hr 25-Year Rainfall=5.20", Ia/S=0.21Prepared by Meisner-Brem CorpPrintedHydroCAD® 10.20-4a s/n 00650 © 2023 HydroCAD Software Solutions LLCPage 20

Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points Runoff by SCS TR-20 method, UH=SCS, Weighted-CN Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 100: Majority of Site to Low Runoff Area=14.290 ac 0.00% Impervious Runoff Depth>0.17" Flow Length=1,215' Tc=32.6 min CN=38 Runoff=0.34 cfs 8,801 cf

Subcatchment 200: South Portion of Site Flow Length=60' Slope=0.1200 '/' Tc=6.1 min CN=35 Runoff=0.01 cfs 187 cf

Pond 3P: Large Low Point Peak Elev=74.00' Storage=0 cf Inflow=0.34 cfs 8,801 cf Discarded=0.34 cfs 8,801 cf Secondary=0.00 cfs 0 cf Outflow=0.34 cfs 8,801 cf

Link A: North Property Line

Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf

Link B: South Property Line

Inflow=0.01 cfs 187 cf Primary=0.01 cfs 187 cf

Total Runoff Area = 649,044 sf Runoff Volume = 8,988 cf Average Runoff Depth = 0.17" 100.00% Pervious = 649,044 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 100: Majority of Site to Low Point

Runoff = 0.34 cfs @ 14.16 hrs, Volume= Routed to Pond 3P : Large Low Point 8,801 cf, Depth> 0.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=5.20", Ia/S=0.21

Area (ac) C	N Desc	cription		
2.5	500 3	0 Woo	ds, Good,	HSG A	
11.5	570 3	89 >75°	% Grass co	over, Good	, HSG A
0.2	220 7	'7 Woo	ds, Good,	HSG D	
14.2	290 3	8 Weig	ghted Aver	age	
14.2	290	100.	00% Pervi	ous Area	
То	Longth	Slope	Volooity	Consoity	Description
(min)	(foot)	(ft/ft)		Capacity (cfc)	Description
				(013)	
4.9	50	0.2000	0.17		Sheet Flow,
					Woods: Light underbrush n= 0.400 P2= 3.20"
1.5	65	0.0200	0.71		Shallow Concentrated Flow,
					Woodland Kv= 5.0 fps
26.2	1,100	0.0100	0.70		Shallow Concentrated Flow,
					Short Grass Pasture Kv= 7.0 fps
32.6	1,215	Total			

Subcatchment 100: Majority of Site to Low Point



Summary for Subcatchment 200: South Portion of Site Near Property Line

Runoff 0.01 cfs @ 15.23 hrs, Volume= = Routed to Link B : South Property Line

187 cf, Depth> 0.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=5.20", Ia/S=0.21

	Area	(ac) (CN	Desc	ription		
	0.	440	30	Woo	ds, Good,	HSG A	
	0.	130	39	>75%	6 Grass co	over, Good,	HSG A
	0.	040	77	Woo	ds, Good,	HSG D	
	0.	610	35	Weig	hted Aver	age	
	0.	610		100.0	0% Pervi	ous Area	
	Tc	Length	S	Slope	Velocity	Capacity	Description
_	(min)	(feet)		(ft/ft)	(ft/sec)	(cfs)	
	6.0	50	0.1	1200	0.14		Sheet Flow,
							Woods: Light underbrush n= 0.400 P2= 3.20"
	0.1	10	0.1	1200	1.73		Shallow Concentrated Flow,
							Woodland Kv= 5.0 fps
	61	60	To	otal			

Subcatchment 200: South Portion of Site Near Property Line



Hydrograph

Summary for Pond 3P: Large Low Point

[92] Warning: Device #2 is above defined storage

Inflow Area =	622,472 sf,	0.00% Impervi	ous, Inflow Depth >	0.17" for 25-Year event
Inflow =	0.34 cfs @	14.16 hrs, Volui	ne= 8,801 cf	
Outflow =	0.34 cfs @	14.16 hrs, Volui	ne= 8,801 cf.	Atten= 0%, Lag= 0.0 min
Discarded =	0.34 cfs @	14.16 hrs, Volui	ne= 8,801 cf	-
Secondary =	0.00 cfs @	1.00 hrs, Volu	ne= 0 cf	
Routed to Link	A : North Pro	perty Line		

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Peak Elev= 74.00' @ 1.00 hrs Surf.Area= 30,000 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow) Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume		Invert	Avail.Sto	rage Sto	rage D	escription	
#1		74.00' 95,00		00 cf Cu	0 cf Custom Stage Data (Prismatic)		ismatic) Listed below (Recalc)
Elevatio	on et)	Surf. (s	Area sq-ft)	Inc.Sto (cubic-fee	re et)	Cum.Store (cubic-feet)	
74.	00	30	,000		0	0	
76.	00	65	5,000	95,00	00	95,000	
Device	Rou	ting	Invert	Outlet D	evices		
#1	Disc	arded	74.00'	8.270 in/	hr Exfi	Itration over	Surface area
#2	Seco	ondary	76.00'	50.0' lon	g x 20	.0' breadth B	road-Crested Rectangular Weir
				Head (fe	et) 0.2	0 0.40 0.60	0.80 1.00 1.20 1.40 1.60
				Coef. (E	nglish)	2.68 2.70 2.	70 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.00 cfs @ 14.16 hrs HW=74.00' (Free Discharge) **1=Exfiltration** (Passes 0.00 cfs of 5.74 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 1.00 hrs HW=74.00' TW=0.00' (Dynamic Tailwater) 2=Broad-Crested Rectangular Weir (Controls 0.00 cfs) Prepared by Meisner-Brem Corp HydroCAD® 10.20-4a s/n 00650 © 2023 HydroCAD Software Solutions LLC

Pond 3P: Large Low Point



Summary for Link A: North Property Line

Inflow	=	0.00 cfs @	1.00 hrs, Volume=	0 cf
Primary	=	0.00 cfs @	1.00 hrs, Volume=	0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs

Link A: North Property Line



Summary for Link B: South Property Line

Inflow A	rea =	26,572 sf,	0.00% Impervious,	Inflow Depth > 0.	08" for 25-Year event
Inflow	=	0.01 cfs @	15.23 hrs, Volume=	187 cf	
Primary	' =	0.01 cfs @	15.23 hrs, Volume=	187 cf, 7	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs



Link B: South Property Line

2944 Drainage PRE-DEVType III 24-hr 100-Year Rainfall=6.30", Ia/S=0.21Prepared by Meisner-Brem CorpPrinted 1/30/2024HydroCAD® 10.20-4a s/n 00650 © 2023 HydroCAD Software Solutions LLCPage 27

Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points Runoff by SCS TR-20 method, UH=SCS, Weighted-CN Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 100: Majority of Site to Low Runoff Area=14.290 ac 0.00% Impervious Runoff Depth>0.42" Flow Length=1,215' Tc=32.6 min CN=38 Runoff=1.51 cfs 21,925 cf

Subcatchment 200: South Portion of Site Flow Length=60' Slope=0.1200 '/' Tc=6.1 min CN=35 Runoff=0.03 cfs 606 cf

Pond 3P: Large Low Point Peak Elev=74.00' Storage=0 cf Inflow=1.51 cfs 21,925 cf Discarded=1.51 cfs 21,925 cf Secondary=0.00 cfs 0 cf Outflow=1.51 cfs 21,925 cf

Link A: North Property Line

Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf

Link B: South Property Line

Inflow=0.03 cfs 606 cf Primary=0.03 cfs 606 cf

Total Runoff Area = 649,044 sf Runoff Volume = 22,531 cf Average Runoff Depth = 0.42" 100.00% Pervious = 649,044 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 100: Majority of Site to Low Point

Runoff = 1.51 cfs @ 12.78 hrs, Volume= Routed to Pond 3P : Large Low Point

21,925 cf, Depth> 0.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=6.30", Ia/S=0.21

Area (ac) C	N Desc	cription		
2.5	500 3	0 Woo	ds, Good,	HSG A	
11.5	570 3	89 >759	% Grass co	over, Good,	, HSG A
0.2	220 7	'7 Woo	ds, Good,	HSG D	
14.2	290 3	88 Weig	ghted Aver	age	
14.2	290	100.	00% Pervi	ous Area	
Тс	Length	Slope	Velocity	Capacity	Description
(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)	·
4.9	50	0.2000	0.17		Sheet Flow,
					Woods: Light underbrush n= 0.400 P2= 3.20"
1.5	65	0.0200	0.71		Shallow Concentrated Flow,
					Woodland Kv= 5.0 fps
26.2	1,100	0.0100	0.70		Shallow Concentrated Flow,
					Short Grass Pasture Kv= 7.0 fps
32.6	1,215	Total			

Subcatchment 100: Majority of Site to Low Point



Summary for Subcatchment 200: South Portion of Site Near Property Line

Runoff = 0.03 cfs @ 12.47 hrs, Volume= Routed to Link B : South Property Line 606 cf, Depth> 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=6.30", Ia/S=0.21

_	Area	(ac) (CN	Desc	ription		
	0.	440	30	Woo	ds, Good,	HSG A	
	0.	130	39	>75%	6 Grass co	over, Good,	HSG A
	0.	040	77	Woo	ds, Good,	HSG D	
	0.	610	35	Weig	hted Aver	age	
	0.	610		100.0	0% Pervi	ous Area	
	Тс	Length	5	Slope	Velocity	Capacity	Description
_	(min)	(feet)		(ft/ft)	(ft/sec)	(cfs)	
	6.0	50	0.	1200	0.14		Sheet Flow,
							Woods: Light underbrush n= 0.400 P2= 3.20"
	0.1	10	0.	1200	1.73		Shallow Concentrated Flow,
							Woodland Kv= 5.0 fps
	6.1	60	To	otal			

Subcatchment 200: South Portion of Site Near Property Line



Summary for Pond 3P: Large Low Point

[92] Warning: Device #2 is above defined storage

Inflow Area =	622,472 sf	0.00% Impervious,	Inflow Depth > 0.42"	for 100-Year event
Inflow =	1.51 cfs @	12.78 hrs, Volume=	21,925 cf	
Outflow =	1.51 cfs @	12.78 hrs, Volume=	21,925 cf, Atten	= 0%, Lag= 0.0 min
Discarded =	1.51 cfs @	12.78 hrs, Volume=	21,925 cf	
Secondary =	0.00 cfs @	1.00 hrs, Volume=	0 cf	
Routed to Link	A : North Pro	perty Line		

Routing by Dyn-Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Peak Elev= 74.00' @ 1.00 hrs Surf.Area= 30,000 sf Storage= 0 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow) Center-of-Mass det. time= (not calculated: outflow precedes inflow)

Volume	Invert	Avail.Stor	rage Storage De	escription	
#1	74.00'	95,00	00 cf Custom S	tage Data (Pris	matic) Listed below (Recalc)
Elevatio (feet	n Surf t) (.Area sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	
74.0 76.0	0 30 0 65	0,000 5,000	0 95,000	0 95,000	
Device	Routing	Invert	Outlet Devices		
#1 #2	Discarded Secondary	74.00' 76.00'	8.270 in/hr Exfi 50.0' long x 20 Head (feet) 0.2 Coef. (English)	Itration over Su .0' breadth Bro 0 0.40 0.60 0. 2.68 2.70 2.70	urface area ad-Crested Rectangular Weir .80 1.00 1.20 1.40 1.60 0 2.64 2.63 2.64 2.64 2.63

Discarded OutFlow Max=0.00 cfs @ 12.78 hrs HW=74.00' (Free Discharge) **1=Exfiltration** (Passes 0.00 cfs of 5.74 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 1.00 hrs HW=74.00' TW=0.00' (Dynamic Tailwater) 2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

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Hydrograph InflowOutflow 1.51 cfs Inflow Area=622,472 Discarded Secondary Peak Elev=74.00' Storage=0 cf Flow (cfs) 0.00 0-4 2 3 4 5 9 10

Pond 3P: Large Low Point

11 12 13 14 15 16 17 18 19 20 21 22 23 24 Time (hours)

6 Ż 8

Summary for Link A: North Property Line

Inflow	=	0.00 cfs @	1.00 hrs, Volume=	0 cf
Primary	=	0.00 cfs @	1.00 hrs, Volume=	0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs

Link A: North Property Line



Summary for Link B: South Property Line

Inflow	Area =	:	26,572 sf	, 0.00% Ir	mpervious,	Inflow Depth >	0.27	7" for 100-Year event
Inflow	=		0.03 cfs @	12.47 hrs,	Volume=	606 c	f	
Primar	у =		0.03 cfs @	12.47 hrs,	Volume=	606 c	f, At	ten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs



Link B: South Property Line



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Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	Type III 24-hr		Default	24.00	1	3.00	2
2	10-Year	Type III 24-hr		Default	24.00	1	4.40	2
3	25-Year	Type III 24-hr		Default	24.00	1	5.20	2
4	100-Year	Type III 24-hr		Default	24.00	1	6.30	2

Rainfall Events Listing

Area Listing (all nodes)

Area	CN	Description
(sq-ft)		(subcatchment-numbers)
422,968	39	>75% Grass cover, Good, HSG A (100, 150, 200)
86,684	98	Paved parking, HSG A (100, 150)
128,066	30	Woods, Good, HSG A (100, 200)
11,326	77	Woods, Good, HSG D (100, 200)
649,044	46	TOTAL AREA

Soil Listing (all nodes)

Area	Soil	Subcatchment
(sq-ft)	Group	Numbers
637,718	HSG A	100, 150, 200
0	HSG B	
0	HSG C	
11,326	HSG D	100, 200
0	Other	
649,044		TOTAL AREA

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HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover	Si Ni
 422,968	0	0	0	0	422,968	>75% Grass	
						cover, Good	
86,684	0	0	0	0	86,684	Paved parking	
128,066	0	0	11,326	0	139,392	Woods, Good	
637,718	0	0	11,326	0	649,044	TOTAL AREA	

Ground Covers (all nodes)

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			Pipe	Elsung (an node	S)				
Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)	Node Name
1	150	0.00	0.00	250.0	0.0080	0.013	0.0	15.0	0.0	
2	150	0.00	0.00	125.0	0.0050	0.013	0.0	18.0	0.0	

Pipe Listing (all podes)

2944 Drainage POST-DEV Type III 24-hr 2-Year Rainfall=3.00", Ia/S=0.21 Printed 1/30/2024 Prepared by Meisner-Brem Corp HydroCAD® 10.20-4a s/n 00650 © 2023 HydroCAD Software Solutions LLC Page 7 Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points Runoff by SCS TR-20 method, UH=SCS, Weighted-CN Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method Subcatchment 100: Majority of Site to Low Runoff Area=12.330 ac 5.76% Impervious Runoff Depth=0.00" Flow Length=540' Tc=16.5 min CN=41 Runoff=0.00 cfs 0 cf Subcatchment 150: Majority of Site to Low Runoff Area=1.960 ac 65.31% Impervious Runoff Depth>1.11" Flow Length=855' Tc=7.9 min CN=78 Runoff=2.31 cfs 7,874 cf Runoff Area=0.610 ac 0.00% Impervious Runoff Depth=0.00" Subcatchment 200: South Portion of Site Flow Length=60' Slope=0.1200 '/' Tc=6.1 min CN=35 Runoff=0.00 cfs 0 cf Pond 1P: Infiltration Basin Peak Elev=77.37' Storage=1,464 cf Inflow=2.31 cfs 7,874 cf Outflow=0.77 cfs 7,864 cf Link A: Peak Runoff from Site Primary=0.00 cfs 0 cf Link B: South Property Line Inflow=0.00 cfs 0 cf Primary=0.00 cfs 0 cf

> Total Runoff Area = 649,044 sf Runoff Volume = 7,874 cf Average Runoff Depth = 0.15" 86.64% Pervious = 562,360 sf 13.36% Impervious = 86,684 sf

Summary for Subcatchment 100: Majority of Site to Low Point

[45] Hint: Runoff=Zero

Runoff = 0.00 cfs @ 1.00 hrs, Volume= Routed to Pond 1P : Infiltration Basin 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Type III 24-hr 2-Year Rainfall=3.00", Ia/S=0.21

Area	(ac) C	N Des	cription		
2.	500 3	30 Woo	ods, Good,	HSG A	
0.	710 9	98 Pav	ed parking	, HSG A	
8.	900 3	39 >75°	% Grass c	over, Good	, HSG A
0.	220	77 Woo	ods, Good,	HSG D	
12.	330 4	41 Wei	ghted Aver	age	
11.	620	94.2	4% Pervio	us Area	
0.	710	5.76	% Impervi	ous Area	
Tc	Length	Slope	Velocity	Capacity	Description
(min)	(teet)	(†t/†t)	(ft/sec)	(cts)	
4.9	50	0.2000	0.17		Sheet Flow,
					Woods: Light underbrush n= 0.400 P2= 3.20"
1.5	65	0.0200	0.71		Shallow Concentrated Flow,
					Woodland Kv= 5.0 fps
10.1	425	0.0100	0.70		Shallow Concentrated Flow,
					Short Grass Pasture Kv= 7.0 fps
16.5	540	Total			

0.0 0-

i.

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8 ġ 10 11 15 16 17 18 19 20 21 22 23 24

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Subcatchment 100: Majority of Site to Low Point

12 13 14 Time (hours)

Summary for Subcatchment 150: Majority of Site to Low Point

Runoff = 2.31 cfs @ 12.12 hrs, Volume= Routed to Pond 1P : Infiltration Basin 7,874 cf, Depth> 1.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Type III 24-hr 2-Year Rainfall=3.00", Ia/S=0.21

Area	(ac) C	N Dese	cription		
0.	680 3	39 >75°	% Grass co	over, Good	, HSG A
1.	280 9	8 Pave	ed parking	, HSG A	
1.	960 7	78 Weig	ghted Aver	age	
0.	680	34.6	9% Pervio	us Area	
1.	280	65.3	1% Imperv	vious Area	
Тс	Length	Slope	Velocity	Capacity	Description
(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)	
4.7	40	0.0200	0.14		Sheet Flow,
					Grass: Short n= 0.150 P2= 3.20"
1.8	440	0.0400	4.06		Shallow Concentrated Flow,
					Paved Kv= 20.3 fps
0.9	250	0.0080	4.71	5.78	Pipe Channel,
					15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31'
					n= 0.013 Corrugated PE, smooth interior
0.5	125	0.0050	4.20	7.43	Pipe Channel,
					18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38'
					n= 0.013 Corrugated PE, smooth interior
7.9	855	Total			



Subcatchment 150: Majority of Site to Low Point

Summary for Subcatchment 200: South Portion of Site Near Property Line

[45] Hint: Runoff=Zero

1.00 hrs, Volume= Runoff 0.00 cfs @ = Routed to Link B : South Property Line

0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Type III 24-hr 2-Year Rainfall=3.00", Ia/S=0.21

	Area ((ac)	CN	Desc	ription				
	0.4	440	30	Woo	ds, Good,	HSG A			
	0.	130	39	>75%	6 Grass co	over, Good	, HSG A		
	0.	040	77	Woo	ds, Good,	HSG D			
	0.610 35 Weighted Average								
	0.610 100.00% Pervious Area								
	Тс	Length	ר	Slope	Velocity	Capacity	Description		
_	(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)			
	6.0	50) (.1200	0.14		Sheet Flow,		
							Woods: Light underbrush n= 0.400 P2= 3.20"		
	0.1	1() (.1200	1.73		Shallow Concentrated Flow,		
_							Woodland Kv= 5.0 fps		

6.1 Total 60

Subcatchment 200: South Portion of Site Near Property Line



Summary for Pond 1P: Infiltration Basin

Inflow Area	ι =	622,472 sf,	13.93% Impervious,	Inflow Depth >	0.15"	for 2-Y	ear event
Inflow	=	2.31 cfs @	12.12 hrs, Volume=	7,874 c	f		
Outflow	=	0.77 cfs @	12.49 hrs, Volume=	7,864 c	f, Atten	= 67%,	Lag= 22.4 min
Discarded	=	0.77 cfs @	12.49 hrs, Volume=	7,864 c	f		

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Peak Elev= 77.37' @ 12.49 hrs Surf.Area= 4,033 sf Storage= 1,464 cf Flood Elev= 82.00' Surf.Area= 7,923 sf Storage= 28,073 cf

Plug-Flow detention time= 12.1 min calculated for 7,864 cf (100% of inflow) Center-of-Mass det. time= 11.4 min (866.8 - 855.4)

Volume	Invert	Avail.Sto	rage Storage	Storage Description		
#1	77.00'	28,07	73 cf Custor	n Stage Data (Pri	smatic) Listed below (Recalc)	
Elevatio (fee	n Si t)	urf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)		
77.0 78.0 80.0 82.0	0 0 0 0	3,936 4,201 5,940 7,923	0 4,069 10,141 13,863	0 4,069 14,210 28,073		
Device	Routing	Invert	Outlet Devic	es		
#1	Discarded	77.00'	8.270 in/hr E	Exfiltration over S	Surface area	
-						

Discarded OutFlow Max=0.77 cfs @ 12.49 hrs HW=77.37' (Free Discharge) **1=Exfiltration** (Exfiltration Controls 0.77 cfs)

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Flow (cfs)

0-

1

2 3 4

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7 8

56

9

10 11



1 12 13 14 15 16 17 18 19 20 21 22 23 24 Time (hours)

Pond 1P: Infiltration Basin

Summary for Link A: Peak Runoff from Site

[43] Hint: Has no inflow (Outflow=Zero)

Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf Routed to nonexistent node 1L

Primary outflow = Inflow, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs



Link A: Peak Runoff from Site

Summary for Link B: South Property Line

Inflow /	Area	1 =	26,572 sf,	0.00% Impervious,	Inflow Depth = 0.00"	for 2-Year event
Inflow		=	0.00 cfs @	1.00 hrs, Volume=	0 cf	
Primar	у	=	0.00 cfs @	1.00 hrs, Volume=	0 cf, Atter	n= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs



Link B: South Property Line

2944 Drainage POST-DEV Type III 24-hr 10-Year Rainfall=4.40", Ia/S=0.21 Printed 1/30/2024 Prepared by Meisner-Brem Corp HydroCAD® 10.20-4a s/n 00650 © 2023 HydroCAD Software Solutions LLC Page 17 Time span=1.00-24.00 hrs, dt=0.01 hrs, 2301 points Runoff by SCS TR-20 method, UH=SCS, Weighted-CN Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method Subcatchment 100: Majority of Site to Low Runoff Area=12.330 ac 5.76% Impervious Runoff Depth>0.12" Flow Length=540' Tc=16.5 min CN=41 Runoff=0.20 cfs 5,319 cf Subcatchment 150: Majority of Site to Low Runoff Area=1.960 ac 65.31% Impervious Runoff Depth>2.18" Flow Length=855' Tc=7.9 min CN=78 Runoff=4.71 cfs 15,537 cf Runoff Area=0.610 ac 0.00% Impervious Runoff Depth>0.01" Subcatchment 200: South Portion of Site Flow Length=60' Slope=0.1200 '/' Tc=6.1 min CN=35 Runoff=0.00 cfs 29 cf Pond 1P: Infiltration Basin Peak Elev=78.15' Storage=4,690 cf Inflow=4.71 cfs 20,856 cf Outflow=0.83 cfs 20,819 cf Link A: Peak Runoff from Site Primary=0.00 cfs 0 cf

Link B: South Property Line

Inflow=0.00 cfs 29 cf Primary=0.00 cfs 29 cf

Total Runoff Area = 649,044 sf Runoff Volume = 20,885 cf Average Runoff Depth = 0.39" 86.64% Pervious = 562,360 sf 13.36% Impervious = 86,684 sf

Summary for Subcatchment 100: Majority of Site to Low Point

Runoff = 0.20 cfs @ 14.76 hrs, Volume= Routed to Pond 1P : Infiltration Basin 5,319 cf, Depth> 0.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Type III 24-hr 10-Year Rainfall=4.40", Ia/S=0.21

Area	(ac) C	N Des	cription					
2.	500	30 Woo	ods, Good,	HSG A				
0.	710	10 98 Paved parking, HSG A						
8.900 39		39 >75°	>75% Grass cover, Good, HSG A					
0.220 7		77 Woo	Woods, Good, HSG D					
12.	12.330 4		Weighted Average					
11.	620	94.2	4% Pervio	us Area				
0.710		5.76	5.76% Impervious Area					
Tc	Length	Slope	Velocity	Capacity	Description			
(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)				
4.9	50	0.2000	0.17		Sheet Flow,			
					Woods: Light underbrush n= 0.400 P2= 3.20"			
1.5	65	0.0200	0.71		Shallow Concentrated Flow,			
					Woodland Kv= 5.0 fps			
10.1	425	0.0100	0.70		Shallow Concentrated Flow,			
					Short Grass Pasture Kv= 7.0 fps			
16.5	540	Total						

Subcatchment 100: Majority of Site to Low Point



Summary for Subcatchment 150: Majority of Site to Low Point

Runoff = 4.71 cfs @ 12.12 hrs, Volume= Routed to Pond 1P : Infiltration Basin 15,537 cf, Depth> 2.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Type III 24-hr 10-Year Rainfall=4.40", Ia/S=0.21

Area	(ac) C	N Des	cription		
0.	680 3	39 >759	% Grass co	over, Good	, HSG A
1.	280 9	98 Pave	ed parking	, HSG A	
1.960 78 Weight			ghted Aver	rage	
0.	680	34.6	9% Pervio	us Area	
1.280		65.3	1% Imperv	vious Area	
Тс	Length	Slope	Velocity	Capacity	Description
(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)	
4.7	40	0.0200	0.14		Sheet Flow,
					Grass: Short n= 0.150 P2= 3.20"
1.8	440	0.0400	4.06		Shallow Concentrated Flow,
					Paved Kv= 20.3 fps
0.9	250	0.0080	4.71	5.78	Pipe Channel,
					15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31'
					n= 0.013 Corrugated PE, smooth interior
0.5	125	0.0050	4.20	7.43	Pipe Channel,
					18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38'
					n= 0.013 Corrugated PE, smooth interior
7.9	855	Total			


Subcatchment 150: Majority of Site to Low Point

Summary for Subcatchment 200: South Portion of Site Near Property Line

Runoff = 0.00 cfs @ 22.21 hrs, Volume= Routed to Link B : South Property Line 29 cf, Depth> 0.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Type III 24-hr 10-Year Rainfall=4.40", Ia/S=0.21

Area	(ac) (CN	Desc	cription		
0.	440	30	Woo	ds, Good,	HSG A	
0.	130	39	>75%	6 Grass co	over, Good	, HSG A
0.	040	77	Woo	ds, Good,	HSG D	
0.	610	35	Weig	ghted Aver	age	
0.	610		100.	00% Pervi	ous Area	
Tc	Length	SI	ope	Velocity	Capacity	Description
(min)	(feet)	(1	ft/ft)	(ft/sec)	(cfs)	
6.0	50	0.1	200	0.14		Sheet Flow,
						Woods: Light underbrush n= 0.400 P2= 3.20"
0.1	10	0.1	200	1.73		Shallow Concentrated Flow,
						Woodland Kv= 5.0 fps
6.1	60	Tot	al			

Subcatchment 200: South Portion of Site Near Property Line



Summary for Pond 1P: Infiltration Basin

Inflow Area	ι =	622,472 sf,	13.93% Impervious	Inflow Depth >	0.40"	for 10-	Year event	
Inflow	=	4.71 cfs @	12.12 hrs, Volume=	20,856 cf	F			
Outflow	=	0.83 cfs @	12.64 hrs, Volume=	20,819 cf	f, Atten=	= 82%,	Lag= 31.7 mi	in
Discarded	=	0.83 cfs @	12.64 hrs, Volume=	20,819 cf	f			

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Peak Elev= 78.15' @ 12.64 hrs Surf.Area= 4,328 sf Storage= 4,690 cf Flood Elev= 82.00' Surf.Area= 7,923 sf Storage= 28,073 cf

Plug-Flow detention time= 41.9 min calculated for 20,819 cf (100% of inflow) Center-of-Mass det. time= 40.9 min (931.4 - 890.6)

Volume	Inver	t Avail.Sto	rage Storag	ge Description	
#1	77.00	' 28,0	73 cf Custo	m Stage Data (Pr	ismatic) Listed below (Recalc)
Elevatio (fee	n S t)	urf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	
77.0	0	3,936	0	0	
78.0	0	4,201	4,069	4,069	
80.0	0	5,940	10,141	14,210	
82.0	0	7,923	13,863	28,073	
Device	Routing	Invert	Outlet Device	ces	
#1	Discarded	77.00'	8.270 in/hr	Exfiltration over \$	Surface area

Discarded OutFlow Max=0.83 cfs @ 12.64 hrs HW=78.15' (Free Discharge) **1=Exfiltration** (Exfiltration Controls 0.83 cfs)

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Pond 1P: Infiltration Basin

Summary for Link A: Peak Runoff from Site

[43] Hint: Has no inflow (Outflow=Zero)

Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf Routed to nonexistent node 1L

Primary outflow = Inflow, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs



Link A: Peak Runoff from Site

Summary for Link B: South Property Line

Inflow A	rea =	26,572 sf,	0.00% Imper	vious, l	Inflow Depth >	0.01"	for 10-Year event
Inflow	=	0.00 cfs @ 2	22.21 hrs, Volu	ume=	29 c	f	
Primary	=	0.00 cfs @ 2	22.21 hrs, Volu	ume=	29 c	f, Atter	n= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs



Link B: South Property Line

2944 Drainage POST-DEV Prepared by Meisner-Brem Corp	<i>Type III 24-hr 25-Year Rainfall=5.20", Ia/S=0.21</i> Printed 1/30/2024
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Time span=1.00-24 Runoff by SCS TR-20 Reach routing by Stor-Ind+Trans	.00 hrs, dt=0.01 hrs, 2301 points) method, UH=SCS, Weighted-CN s method - Pond routing by Stor-Ind method
Subcatchment 100: Majority of Site to Low Flow	Runoff Area=12.330 ac 5.76% Impervious Runoff Depth>0.28" Length=540' Tc=16.5 min CN=41 Runoff=0.86 cfs 12,692 cf
Subcatchment 150: Majority of Site to Low Flow	Runoff Area=1.960 ac 65.31% Impervious Runoff Depth>2.85" v Length=855' Tc=7.9 min CN=78 Runoff=6.17 cfs 20,303 cf
Subcatchment 200: South Portion of Site Flow Length=60'	Runoff Area=0.610 ac 0.00% Impervious Runoff Depth>0.08" Slope=0.1200 '/' Tc=6.1 min CN=35 Runoff=0.01 cfs 187 cf
Pond 1P: Infiltration Basin	Peak Elev=79.00' Storage=8,710 cf Inflow=6.17 cfs 32,995 cf Outflow=0.97 cfs 32,938 cf
Link A: Peak Runoff from Site	Primary=0.00 cfs 0 cf
Link B: South Property Line	Inflow=0.01 cfs 187 cf Primary=0.01 cfs 187 cf

Total Runoff Area = 649,044 sfRunoff Volume = 33,182 cfAverage Runoff Depth = 0.61"86.64% Pervious = 562,360 sf13.36% Impervious = 86,684 sf

Summary for Subcatchment 100: Majority of Site to Low Point

Runoff	=	0.86 cfs @	12.57 hrs,	Volume=
Routed	I to Pond	1 1 P : Infiltrati	on Basin	

12,692 cf, Depth> 0.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=5.20", Ia/S=0.21

Area	(ac) C	N Dese	cription		
2.	500 3	30 Woo	ds, Good,	HSG A	
0.	710 9	8 Pave	ed parking	, HSG A	
8.	900 3	89 >75°	% Grass c	over, Good	, HSG A
0.2	220 7	7 Woo	ds, Good,	HSG D	
12.3	330 4	1 Weig	ghted Aver	age	
11.	620	94.2	4% Pervio	us Area	
0.	710	5.76	% Impervi	ous Area	
Tc	Length	Slope	Velocity	Capacity	Description
(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)	
4.9	50	0.2000	0.17		Sheet Flow,
					Woods: Light underbrush n= 0.400 P2= 3.20"
1.5	65	0.0200	0.71		Shallow Concentrated Flow,
					Woodland Kv= 5.0 fps
10.1	425	0.0100	0.70		Shallow Concentrated Flow,
					Short Grass Pasture Kv= 7.0 fps
16.5	540	Total			

Subcatchment 100: Majority of Site to Low Point



Summary for Subcatchment 150: Majority of Site to Low Point

- [47] Hint: Peak is 107% of capacity of segment #3
- Runoff = 6.17 cfs @ 12.11 hrs, Volume= Routed to Pond 1P : Infiltration Basin

20,303 cf, Depth> 2.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=5.20", Ia/S=0.21

Area	(ac) C	N Des	cription		
0.	680 3	39 >759	% Grass co	over, Good	, HSG A
1.:	280 9	98 Pave	ed parking	, HSG A	
1.	960 7	78 Weig	ghted Aver	age	
0.	680	34.6	9% Pervio	us Area	
1.:	280	65.3	1% Imperv	vious Area	
Tc	Length	Slope	Velocity	Capacity	Description
(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)	
4.7	40	0.0200	0.14		Sheet Flow,
					Grass: Short n= 0.150 P2= 3.20"
1.8	440	0.0400	4.06		Shallow Concentrated Flow,
					Paved Kv= 20.3 fps
0.9	250	0.0080	4.71	5.78	Pipe Channel,
					15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31'
					n= 0.013 Corrugated PE, smooth interior
0.5	125	0.0050	4.20	7.43	Pipe Channel,
					18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38'
					n= 0.013 Corrugated PE, smooth interior
7.9	855	Total			

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Subcatchment 150: Majority of Site to Low Point

Summary for Subcatchment 200: South Portion of Site Near Property Line

Runoff = 0.01 cfs @ 15.23 hrs, Volume= Routed to Link B : South Property Line 187 cf, Depth> 0.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Type III 24-hr 25-Year Rainfall=5.20", Ia/S=0.21

	Area ((ac) (CN	Desc	ription		
	0.4	440	30	Woo	ds, Good,	HSG A	
	0.	130	39	>75%	6 Grass co	over, Good,	, HSG A
	0.	040	77	Woo	ds, Good,	HSG D	
	0.	610	35	Weig	hted Aver	age	
	0.	610		100.0	00% Pervi	ous Area	
	Тс	Length	1 8	Slope	Velocity	Capacity	Description
_	(min)	(feet))	(ft/ft)	(ft/sec)	(cfs)	
	6.0	50) 0.	1200	0.14		Sheet Flow,
							Woods: Light underbrush n= 0.400 P2= 3.20"
	0.1	10) ().	1200	1.73		Shallow Concentrated Flow,
							Woodland Kv= 5.0 fps
	61	60) T	otal			

Subcatchment 200: South Portion of Site Near Property Line



Summary for Pond 1P: Infiltration Basin

Inflow Area	ι =	622,472 sf,	13.93% Impervious,	Inflow Depth >	0.64"	for 25-	Year event
Inflow	=	6.17 cfs @	12.11 hrs, Volume=	32,995 cf	F		
Outflow	=	0.97 cfs @	13.85 hrs, Volume=	32,938 cf	, Atten	= 84%,	Lag= 104.0 min
Discarded	=	0.97 cfs @	13.85 hrs, Volume=	32,938 cf	F		

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Peak Elev= 79.00' @ 13.85 hrs Surf.Area= 5,071 sf Storage= 8,710 cf Flood Elev= 82.00' Surf.Area= 7,923 sf Storage= 28,073 cf

Plug-Flow detention time= 89.9 min calculated for 32,924 cf (100% of inflow) Center-of-Mass det. time= 88.9 min (979.6 - 890.6)

Volume	Inver	t Avail.Sto	orage Stora	ge Description	
#1	77.00)' 28,0	73 cf Custo	om Stage Data (Pr	ismatic) Listed below (Recalc)
Elevatic (fee	on S et)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	
77.0 78.0 80.0)0)0)0	3,936 4,201 5,940 7,923	0 4,069 10,141 13,863	0 4,069 14,210 28,073	
Device	Routing	Invert	Outlet Devi	ces	
#1	Discardeo	77.00'	8.270 in/hr	Exfiltration over	Surface area

Discarded OutFlow Max=0.97 cfs @ 13.85 hrs HW=79.00' (Free Discharge) **1=Exfiltration** (Exfiltration Controls 0.97 cfs)

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Pond 1P: Infiltration Basin

Summary for Link A: Peak Runoff from Site

[43] Hint: Has no inflow (Outflow=Zero)

Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf Routed to nonexistent node 1L

Primary outflow = Inflow, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs



Link A: Peak Runoff from Site

Summary for Link B: South Property Line

Inflow A	rea =	26,572 sf,	0.00% Impervious,	Inflow Depth > 0.	08" for 25-Year event
Inflow	=	0.01 cfs @	15.23 hrs, Volume=	187 cf	
Primary	' =	0.01 cfs @	15.23 hrs, Volume=	187 cf, 7	Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs



Link B: South Property Line

2944 Drainage POST-DEV	<i>Type III 24-hr 100-Year Rainfall=6.30", Ia/S=0.21</i>
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Time span=1.00-2	4.00 hrs, dt=0.01 hrs, 2301 points
Runoff by SCS TR-2	20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Tra	ns method - Pond routing by Stor-Ind method
Subcatchment 100: Majority of Site to Low	Runoff Area=12.330 ac 5.76% Impervious Runoff Depth>0.60"
Flow	v Length=540' Tc=16.5 min CN=41 Runoff=3.13 cfs 27,016 cf
Subcatchment 150: Majority of Site to Low	Runoff Area=1.960 ac 65.31% Impervious Runoff Depth>3.81"
Flo	w Length=855' Tc=7.9 min CN=78 Runoff=8.22 cfs 27,138 cf
Subcatchment 200: South Portion of Site	Runoff Area=0.610 ac 0.00% Impervious Runoff Depth>0.27"
Flow Length=60	Slope=0.1200 '/' Tc=6.1 min CN=35 Runoff=0.03 cfs 606 cf
Pond 1P: Infiltration Basin	Peak Elev=80.74' Storage=18,873 cf Inflow=8.50 cfs 54,154 cf Outflow=1.28 cfs 50,794 cf
Link A: Peak Runoff from Site	Primary=0.00 cfs 0 cf
Link B: South Property Line	Inflow=0.03 cfs 606 cf

Inflow=0.03 cfs 606 cf Primary=0.03 cfs 606 cf

Total Runoff Area = 649,044 sf Runoff Volume = 54,760 cfAverage Runoff Depth = 1.01"86.64% Pervious = 562,360 sf13.36% Impervious = 86,684 sf

Summary for Subcatchment 100: Majority of Site to Low Point

Runoff = 3.13 cfs @ 12.45 hrs, Volume= Routed to Pond 1P : Infiltration Basin 27,016 cf, Depth> 0.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=6.30", Ia/S=0.21

Area	(ac) C	N Des	cription				
2.	500 3	30 Woo	Voods. Good. HSG A				
0.	710 9	98 Pav	aved parking, HSG A				
8.	900 3	39 >75°	% Grass c	over, Good	, HSG A		
0.	220	77 Woo	ods, Good,	HSG D			
12.	330 4	41 Wei	ghted Aver	age			
11.	620	94.2	4% Pervio	us Area			
0.	710	5.76	% Impervi	ous Area			
_							
Tc	Length	Slope	Velocity	Capacity	Description		
(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)			
4.9	50	0.2000	0.17		Sheet Flow,		
					Woods: Light underbrush n= 0.400 P2= 3.20"		
1.5	65	0.0200	0.71		Shallow Concentrated Flow,		
					Woodland Kv= 5.0 fps		
10.1	425	0.0100	0.70		Shallow Concentrated Flow,		
					Short Grass Pasture Kv= 7.0 fps		
16.5	540	Total					

Subcatchment 100: Majority of Site to Low Point



Summary for Subcatchment 150: Majority of Site to Low Point

[47] Hint: Peak is 142% of capacity of segment #3[47] Hint: Peak is 111% of capacity of segment #4

Runoff	=	8.22 cfs @	12.11 hrs,	Volume=
Route	d to Po	nd 1P : Infiltrati	on Basin	

27,138 cf, Depth> 3.81"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=6.30", Ia/S=0.21

Area	(ac) C	N Des	cription			
0.	680 3	39 >759	% Grass co	over, Good,	, HSG A	
1.	280 9	98 Pave	ed parking	, HSG A		
1.	960 7	78 Weig	ghted Aver	age		
0.680 34.69% Pervious Area						
1.	280	65.3	1% Imperv	vious Area		
_				- ·		
TC	Length	Slope	Velocity	Capacity	Description	
(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)		
4.7	40	0.0200	0.14		Sheet Flow,	
					Grass: Short n= 0.150 P2= 3.20"	
1.8	440	0.0400	4.06		Shallow Concentrated Flow,	
					Paved Kv= 20.3 fps	
0.9	250	0.0080	4.71	5.78	Pipe Channel,	
					15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31'	
					n= 0.013 Corrugated PE, smooth interior	
0.5	125	0.0050	4.20	7.43	Pipe Channel,	
					18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38'	
					n= 0.013 Corrugated PE, smooth interior	
7.9	855	Total				



Subcatchment 150: Majority of Site to Low Point

Summary for Subcatchment 200: South Portion of Site Near Property Line

Runoff = 0.03 cfs @ 12.47 hrs, Volume= Routed to Link B : South Property Line 606 cf, Depth> 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Type III 24-hr 100-Year Rainfall=6.30", Ia/S=0.21

Area	(ac)	CN	Desc	ription					
0	.440	30	Woo	ds, Good,	HSG A				
0	.130	39	>75%	75% Grass cover, Good, HSG A					
0	.040	77	Woo	ds, Good,	HSG D				
0	.610	35	Weig	hted Aver	age				
0	.610		100.0	00% Pervi	ous Area				
Tc	Length	n S	Slope	Velocity	Capacity	Description			
(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)				
6.0	50) 0.	1200	0.14		Sheet Flow,			
						Woods: Light underbrush n= 0.400 P2= 3.20"			
0.1	10) 0.	1200	1.73		Shallow Concentrated Flow,			
						Woodland Kv= 5.0 fps			
6.1	60) To	otal						

Subcatchment 200: South Portion of Site Near Property Line



Summary for Pond 1P: Infiltration Basin

Inflow Area	l =	622,472 sf,	13.93% Impervious,	Inflow Depth >	1.04"	for 100	-Year event	
Inflow	=	8.50 cfs @	12.12 hrs, Volume=	54,154 cf	f			
Outflow	=	1.28 cfs @	14.82 hrs, Volume=	50,794 cf	f, Atten	= 85%,	Lag= 162.0	min
Discarded	=	1.28 cfs @	14.82 hrs, Volume=	50,794 cf	f			

Routing by Stor-Ind method, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs Peak Elev= 80.74' @ 14.82 hrs Surf.Area= 6,673 sf Storage= 18,873 cf Flood Elev= 82.00' Surf.Area= 7,923 sf Storage= 28,073 cf

Plug-Flow detention time= 175.6 min calculated for 50,772 cf (94% of inflow) Center-of-Mass det. time= 143.9 min (1,027.4 - 883.5)

Volume	Inver	t Avail.Sto	rage Storag	ge Description	
#1	77.00)' 28,0	73 cf Custo	om Stage Data (Pr	ismatic) Listed below (Recalc)
Elevatio (fee	on S •t)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	
77.0 78.0 80.0 82.0	00 00 00 00	3,936 4,201 5,940 7,923	0 4,069 10,141 13,863	0 4,069 14,210 28,073	
Device	Routing	Invert	Outlet Devi	ces	
#1	Discardeo	77.00'	8.270 in/hr	Exfiltration over \$	Surface area

Discarded OutFlow Max=1.28 cfs @ 14.82 hrs HW=80.74' (Free Discharge) **1=Exfiltration** (Exfiltration Controls 1.28 cfs)

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Pond 1P: Infiltration Basin

Summary for Link A: Peak Runoff from Site

[43] Hint: Has no inflow (Outflow=Zero)

Primary = 0.00 cfs @ 1.00 hrs, Volume= 0 cf Routed to nonexistent node 1L

Primary outflow = Inflow, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs



Link A: Peak Runoff from Site

Summary for Link B: South Property Line

Inflow	Area =	=	26,572 sf	, 0.00% lr	npervious,	Inflow Depth >	0.27	" for 100-Year event
Inflow	=		0.03 cfs @	12.47 hrs,	Volume=	606 c	f	
Primar	у =		0.03 cfs @	12.47 hrs,	Volume=	606 c	f, At	ten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 1.00-24.00 hrs, dt= 0.01 hrs



Link B: South Property Line

MEISNER BREM CORPORATION 142 LITTLETON ROAD, SUITE 16, WESTFORD, MA 01886

PRELIMINARY STORMWATER MANAGEMENT REPORT HERITAGE LANDING Cow Pond Brook Rd, Groton, Massachusetts

APPENDIX A

SUBCATCHMENT AREA MAP



SOIL	S:	
7IB	_	Ridgebu
259B	_	Carver
259C	_	Carver
262B	—	Quonse
262C	—	Quonse
600	_	Gravel
653	—	Urdothe



SOIL	S:	
71B	_	Ridgebury
259B	_	Carver loc
259C	_	Carver loo
262B	_	Quonset s
262C	_	Quonset s
600	_	Gravel Pit
653	_	Urdothent