Stormwater Report

Town of Reading
Center for Active Living
and
Community Pickleball Courts

0 Haverhill Street / Symonds Way
Reading, MA, 01867

8/21/25

Owner:
Town of Reading
16 Lowell Street
Reading, MA 01867

Submitted To:
Town of Reading
16 Lowell Street
Reading, MA 01867

Community Planning and
Development Commission

Conservation Commission

Civil Engineer/ Landscape Architect:
Activitas, Inc.
70 Milton Street
Dedham, MA 02026
(781) 355-7040

Surveyor:
Reed Land Surveying, Inc.
109 Rhode Island Road, Suite 4A
Lakeville, MA 02347
(508) 923-1181

Architect:
Bargmann Hendrie + Archetype, Inc.
9 Channel Center Street
Suite 300
Boston, MA 02210
(617) 350-0450

July 7, 2025; Revised August 21, 2025

Applicability:
A Stormwater Permit is required if the proposed activity:

- Results in the disturbance of one or more acres of land OR
- Is part of a larger Common Plan of Development or sale that will ultimately disturb one or more acres of land

Exempt Activities:

- Normal maintenance and improvement of land in agricultural or aqua cultural use, as defined by MGL Chapter 131 Section 40 and 310 CMR 10.04
- Normal maintenance of lawns and landscaping

Projects Within Conservation Commission Jurisdiction:
In order to avoid duplicative permitting proceedings, for activities regulated that will be undertaken wholly or partly within the jurisdiction of the Reading Conservation Commission and require stormwater review under 310 CMR 10.00 or the Reading Wetlands Bylaw, the Conservation Commission shall serve as the permitting authority for the stormwater permit.

Procedures:
Applicants shall submit the following:

- Two (2) full size (24x36) copies of the required site plans
- Three (3) half size (11x17) copies of the required site plans
- Two (2) copies of the application form, narratives & any other supporting materials
- Electronic submittal of all documents

Applicants are strongly encouraged to double-side whenever possible. All plans must be to scale.

The Community Development Director shall make a determination of completeness within ten (10) days of receipt of an application for a Stormwater Permit, in accordance with the Checklist for a Stormwater Permit, and shall notify the Applicant of the determination. Upon a favorable determination of completeness, the Community Development Director shall distribute the submitted plans and supporting materials to the Town Engineer, DPW Director, Conservation Administrator, and other staff as may be appropriate, and shall schedule the Application on the next available CPDC agenda (allowing sufficient time for public notice).

When an Application for a Stormwater Permit is submitted in conjunction with a Subdivision Plan, Site Plan Review, or other Special Permit within the jurisdiction of the CPDC, the Community Development Director may combine the hearings to streamline the process as applicable. In that event, public notice of the hearings may be combined as well.

Stormwater Permit Application

Property Address: 0 Haverhill Street (final address to be confirmed per right-of-way determination)

Assessors Map: 35 Lot: 133

Applicant: Town of Reading (Ryan Percival PE)

Address: 16 Lowell Street, Reading, MA 01867

Phone Number: 781-942-9001 Email: rpercival@readingma.gov

Owner (if not Applicant):

Address:

Phone Number: Email:

Engineer: Activitas, Inc. (Meg Buczynski, PE)

Address: 70 Milton Street, Dedham, MA 02026

Phone Number: 781-326-2600 Email meb@activitas.com

Attorney:

Address:

Phone Number: Email:

Architect: Bargmann Hendrie + Archetype (BH+A)

Address: 9 Channel Center Street, Suite 300, Boston, MA 02210

Phone Number: 617-350-0450 Email: Jbargmann@bhplus.com

Current use of Property:

The site is currently undeveloped, and the site is primarily vegetated land and close to the adjacent Burbank Ice ~~Arena, Symonds Field, and the Reading Rifle and Revolver Club.~~

Proposed Use of Property:

Site improvements include new construction of a 2-story structure, surface parking lot, and a new (7) court ~~outdoor pickle ball facility~~.

Brief Description of the Project / Acres to be Disturbed:

The project will include a new 2-story structure, the Reading Center for Active Living (ReCAL), and a new seven ~~(7) court outdoor pickle ball facility consisting of athletic lighting, ADA accessible walkways, and a new parking lot.~~ Additionally, renovations to the existing roadway (Range Road). Additional improvements include landscape and ~~drainage improvements. These improvements are intended to provide quality community and recreation facilities.~~

Certifications:

The undersigned Applicant hereby certifies:

1. That the aforementioned requisite number of copies of the application, plans and all attachments have been delivered (or are being delivered herewith) to the Planning Division, and that all information in that application is correct to the best of their knowledge.
2. That a Certified List of Abutters within 300 feet of the subject property together with a stamped, plain (NO RETURN ADDRESS) envelope addressed to each abutter and interested party has been delivered to the Public Services Department.
3. That a Certified Check for the required Application Fee in the amount of $ Town Project No Fee has been delivered to the Public Services Department.
4. That they understand and hereby agree that, in addition to the Application Fee identified in Item 3 above, if the Community Development Director or the Community Planning and Development Commission determines that review of all or any part of this proposed project by an outside consultant of the Community Development Director's sole choosing is necessary for proper evaluation of this project, that they shall promptly provide a certified check(s) in an amount equal to the estimated cost of the consultant services to the Planning Division. In addition, that they further understand and hereby agree that the Town of Reading shall not issue any Certificate of Occupancy for this project until any and all such consultant fees which have been duly imposed subject to the Stormwater Management and Erosion Control Regulations have been paid in full;
5. That they understand and hereby agree that no Building Permit shall be issued by the Town of Reading until this Application is approved or approved with modifications and/or conditions; that no Certificate of Occupancy shall be issued until the project has been duly certified as completed in full accordance with approved plans, or that the remainder of the work has been bonded to the Town by the Applicant to guarantee such completion; and that the subject property shall not be occupied or used until said Certificate of Occupancy is issued, or such bonding provided;
6. That they understand and hereby agree that pursuant to law, notification of this Application and required public hearing(s) must be placed in a local newspaper at the Applicant's expense.

Applicant's Signature: _____ Date: _____

The undersigned Property Owner hereby certifies: I am the owner of the parcel identified as Reading Assessor's Map 35, Lot 133, or the authorized signatory for the entity that is the owner of that parcel. I hereby attest that I have knowledge of, and give my consent to, this application. I authorize the CPDC and its authorized agents to enter the aforementioned parcel to verify the information contained in this application and associated documents and, if a permit is granted, to inspect for compliance with permit conditions.

Owner Signature: _____ Date: _____

Date of Receipt of Application: _____

This application is Complete in accordance with Section 7.9.5 of the Reading General Bylaw and the Stormwater Management and Erosion Control Regulations, and authorized for filing with the Town Clerk.

Community Development Director, as Clerk to CPDC:

_____

Date _____

Fee Schedule:

1. Municipal Projects (carried out by or for the Town of Reading): No fee
2. Single-Family Home: $500.00
3. Other Residential: $500.00 + $200.00 per acre of land-disturbing activity
4. Commercial or Industrial: $500.00 + $500.00 per acre of land-disturbing activity
5. Other: $500.00 + $200.00 per acre of land-disturbing activity

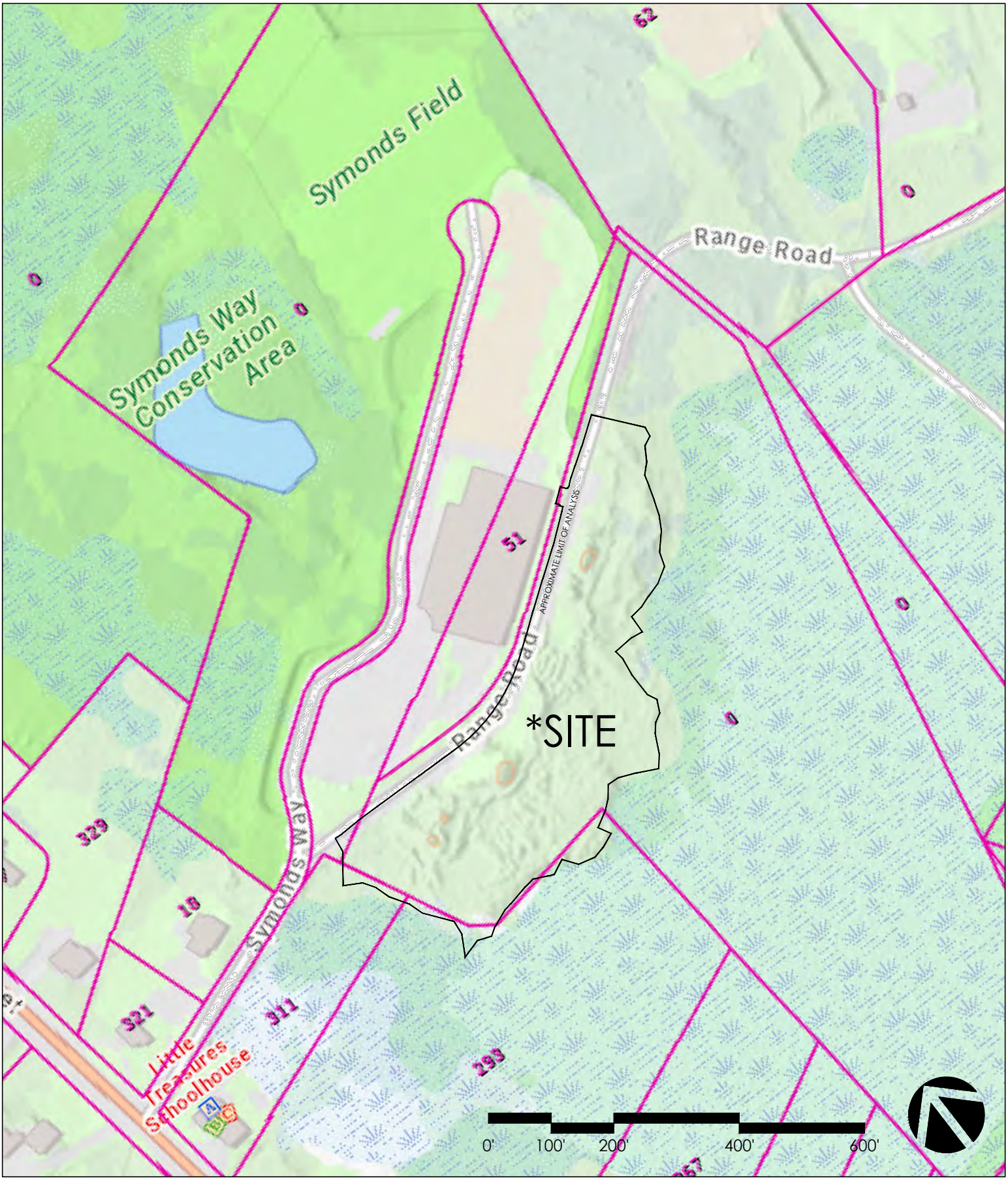
Determination of category of application shall be in the sole discretion of the Community Development Director.

Fees may be waived or reduced for government agencies or qualified non-profit organizations at the discretion of the CPDC.

Checklist for a Stormwater Permit					
A	Stormwater Permit Application – Completed & Signed			Provided	Waived
B	Fee (Certified Check)			☐	☑
C	Certified Abutters List			☑	☐
D	Plain White Envelopes Labeled with Abutters' Addresses (no return address)			☑	☐
E	Erosion and Sediment Control Plan (per 7.9.6			☑	☐
	1	Narrative containing sufficient information to describe the nature and purpose of the proposed activity, pertinent conditions of the site and adjacent areas, proposed erosion and sedimentation controls, and any other proposed pollution prevention measures		☑	☐
	2	Site plan containing the following information:		☑	☐
		a	Stamped by MA P.E. or Certified Professional in ESC	☑	☐
		b	Names, addresses, numbers of owner, applicant, design team	☑	☐
		c	Title, date, north arrow, scale, legend, locus map	☑	☐
		d	Locations of watercourses and water bodies	☐	☐
		e	Lines of existing abutting streets showing drainage (including catch basins), driveway locations and curb cuts	☑	☐
		f	Property lines of entire site with delineation and number of SF to be disturbed	☑	☐
		g	Drainage patterns and approximate slopes anticipated after major grading activities (construction phase grading plans)	☑	☐
		h	Location and details of ESC measures, including structural and non-structural measures, interim grading, material stockpiling areas	☑	☐
		I	Location, description of, and implementation schedule for temporary and permanent seeding, vegetative controls, and other stabilization measures	☑	☐
F	Stormwater Management Plan (per General Bylaw 7.9.7 and SMEC Regulations 4.1.4)			☑	☐
	1	Narrative describing the measures proposed by the Applicant for reducing adverse post-construction impacts from stormwater and how those measures meet the relevant Massachusetts Stormwater Management Standards		☑	☐
	2	Hydrologic calculations shall use NOAA Atlas 14, Vol 1, or newest volume		☑	☐
	3A	For sites discharging stormwater into impaired waters where **phosphorus** has been identified as a source of impairment (including all sites within the Aberjona watershed), specify BMPs optimized for phosphorous removal and calculations for phosphorous loading and removal		☐	☑
	3B	For sites discharging stormwater into impaired waters where **solids** have been identified as a source of impairment (including all sites within the Aberjona watershed), systems in commercial or industrial land use shall incorporate designs that allow for shutdown and containment		☐	☑
	4A	Systems on **new sites** are designed to meet 90% TSS removal and 60% TP removal, as related to the post-construction impervious surface area		☑	☐
	4B	Systems on **redevelopment sites** are designed to meet 80% TSS removal and 50% TP removal, as related to the post-construction impervious surface area		☐	☑
	5	Site plan containing the following information:		☑	☐

		A	Stamped by MA P.E.	☑	☐
		B	Names, addresses, numbers of owner, applicant, design team	☑	☐
		C	Title, date, north arrow, scale, legend, locus map	☑	☐
		D	Existing and proposed topography at 2-foot contour intervals	☑	☐
		E	Existing site hydrology, conveyances, impoundments	☑	☐
		F	Estimated seasonal high groundwater elevation (Nov – April) in areas to be used for retention, detention or infiltration	☑	☐
		G	Existing and proposed vegetation and ground surfaces with runoff coefficient for each	☑	☐
		H	Drainage area map showing pre- and post-construction watershed boundaries, drainage area, stormwater flow paths	☑	☐
		I	Drawings of all proposed drainage system components	☑	☐
G	Operation and Maintenance Plan (per 7.9.8)			☑	☐
	1		Name and signature of each owner of the project parcel(s)	☑	☐
	2		Maintenance specifications and a schedule for all drainage structures, swales, ponds, components requiring maintenance	☑	☐
	3		For stormwater BMPs serving more than one parcel, the information required by Section 7.9.8.2 of the Bylaw	☑	☐

Site Locus Map



ACTIVITAS
landscape architecture | civil engineering
70 Milton Street | Dedham, MA 02026-2915
(781) 326-2600 | activitas.com

TOWN OF READING

Reading, MA

CENTER FOR ACTIVE LIVING AND COMMUNITY PICKLEBALL COURTS

PROJECT NO.: 24057.00
REFERENCE SHEET:
PHASE: PERMITTING DOCUMENTS
DATE: JULY 7, 2025
SCALE: 1" = 200'-0"

SKETCH NO. LOCUS

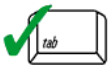
Massachusetts Stormwater Report Checklist

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 8[2]
- Operation and Maintenance Plan required by Standard 9

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

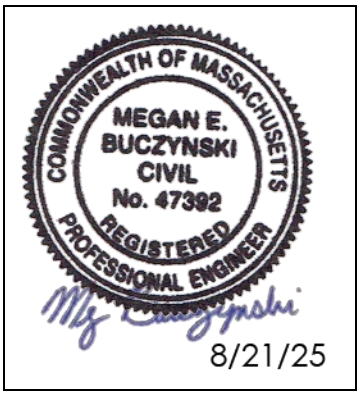
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



Signature and Date

Checklist

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

☒ New development

☐ Redevelopment

☐ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

☐ Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.

☐ Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm.

☒ Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

☐ Required Recharge volume reduced through use of the LID site Design Credits.

☐ Sizing the infiltration, BMPs is based on the following method: Check the method used.

☐ Static ☒ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

Certifications:

The undersigned Applicant hereby certifies:

1. That the aforementioned requisite number of copies of the application, plans and all attachments have been delivered (or are being delivered herewith) to the Planning Division, and that all information in that application is correct to the best of their knowledge.
2. That a Certified List of Abutters within 300 feet of the subject property together with a stamped, plain (NO RETURN ADDRESS) envelope addressed to each abutter and interested party has been delivered to the Public Services Department.
3. That a Certified Check for the required Application Fee in the amount of $ n/a Town Project has been delivered to the Public Services Department.
4. That they understand and hereby agree that, in addition to the Application Fee identified in Item 3 above, if the Community Development Director or the Community Planning and Development Commission determines that review of all or any part of this proposed project by an outside consultant of the Community Development Director's sole choosing is necessary for proper evaluation of this project, that they shall promptly provide a certified check(s) in an amount equal to the estimated cost of the consultant services to the Planning Division. In addition, that they further understand and hereby agree that the Town of Reading shall not issue any Certificate of Occupancy for this project until any and all such consultant fees which have been duly imposed subject to the Stormwater Management and Erosion Control Regulations have been paid in full;
5. That they understand and hereby agree that no Building Permit shall be issued by the Town of Reading until this Application is approved or approved with modifications and/or conditions; that no Certificate of Occupancy shall be issued until the project has been duly certified as completed in full accordance with approved plans, or that the remainder of the work has been bonded to the Town by the Applicant to guarantee such completion; and that the subject property shall not be occupied or used until said Certificate of Occupancy is issued, or such bonding provided;
6. That they understand and hereby agree that pursuant to law, notification of this Application and required public hearing(s) must be placed in a local newspaper at the Applicant's expense.

Applicant's Signature: _____ Date: 7-2-25

The undersigned Property Owner hereby certifies: I am the owner of the parcel identified as Reading Assessor's Map 35, Lot 133, or the authorized signatory for the entity that is the owner of that parcel. I hereby attest that I have knowledge of, and give my consent to, this application. I authorize the CPDC and its authorized agents to enter the aforementioned parcel to verify the information contained in this application and associated documents and, if a permit is granted, to inspect for compliance with permit conditions.

Owner Signature: SAME AS APPLICANT Date: _____

Table of Contents

Table of Tables

Project Overview

The Town of Reading proposes to construct a new Center for Active Living Facility and Outdoor Community Pickleball Courts at an undeveloped area to the south of Burbank Ice Arena. The following are the program elements associated with this project.

CENTER FOR ACTIVE LIVING (BUILDING)

The proposed project includes the construction of a new building (+/- 27,600 sf) that supports community recreation. Building program spaces include but are not limited to a gymnasium with an indoor walking track, fitness rooms, multi-purpose gathering areas, kitchens, dining areas, and restrooms.

COMMUNITY PICKLEBALL COURTS

The proposed project will include the construction of seven (7) new pickleball courts, paved accessible walkways, outdoor athletic lighting, and associated drainage improvements. Access to the proposed pickleball courts will be provided in the form of an ADA accessible walkway between Range Road and the proposed pickleball courts.

NEW PARKING LOT AREA

A parking lot area to support both the Center for Active living and the Community Pickleball Courts is proposed between the two facilities. The proposed parking lot contains six (6) accessible parking spaces (including two van spaces) and associated access aisles. Additionally, the proposed parking lot contains two (2) electric vehicle charging stations. The total number of parking spaces provided in the proposed parking lot is 89 spaces.

OTHER IMPROVEMENTS

Additional improvements include:

- The widening of Range Road to provide improved access to the project site and adjacent properties;
- Accessible walkways between the site elements and to the Burbank ice Arena site;
- Utility infrastructure including stormwater, sewer, electric, and tel/data systems;
- Landscape and plantings;
- And a new stone dust walking trail along the BVW edge.

The proposed project will disturb approximately 144,022 sf (3.30 acres) and will increase the impervious area within the limit of work by 87,054 square feet. Portions of the proposed project work are located within the 100' buffer zone to the bordering vegetated wetland and within some of the Town's 25' Zone of Natural Vegetation plus the 10' No Structure Zone (35' offset shown on the plan set).

Compliance with Stormwater Standards

The Town of Reading utilizes the policy, criteria and information including specifications and standards of the Massachusetts Department of Environmental Protection Stormwater Handbook (MA Stormwater Handbook dated 2/2008). The proposed project is considered new development under the Stormwater Standards. The project has been designed in accordance with the "Massachusetts Stormwater Handbook", the Town of Reading's Wetland Protection Regulations dated December 2023, and the Town of Reading's Stormwater Management and Erosion Control Regulations dates December 2021.

LID Measures

Key features of Low Impact Development (LID) stormwater management systems include implementing practices that maintain a site's existing hydrology, using decentralized practices to manage stormwater close to the source of generation, and maximizing onsite infiltration to reduce runoff.

The following LID techniques Best Management Practices are specified in the proposed development program to mitigate the increase in stormwater runoff from the site.
BMPs Used:

- No disturbance to any Wetland Resource Areas

Standard 1: No New Untreated Discharges

The MA Stormwater Handbook requires that projects demonstrate that there are no new untreated discharges and that new discharges will not cause erosion or scour to downstream wetlands or water of the Commonwealth.

Computations and strategies shown for Standards 4 through 6 in this report demonstrate that there will be no new untreated discharges from the site.

Standard 2: Peak Rate Attenuation

Standard 2 requires that stormwater management systems be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates for the 2-yr, 10-yr, and 100-yr storm events. The following section outlines the procedure for determining the peak rates for the existing condition as well as the methods for attenuating the peak flows and volumes in the proposed condition.

2.1 Methodology

2.1.1 Hydrologic Model Description

The drainage analysis was performed using the Soil Conservation Service (SCS) TR-55 and TR-20 methodologies and the computer program HydroCAD 10.20-6a by HydroCAD Software Solutions, LLC.

2.1.2 Soil Conditions

The National Resources Conservation Service (NRCS) soil report identifies the majority of soils within the area of analysis having a map unit/name 653/Udorthents Sandy, which is not given a hydrologic rating. In reviewing the surrounding areas to the site, the hydrologic ratings vary from A to B/D, with the majority of soils having a hydrologic rating of A. Soil borings were also conducted as part of this project. The soil borings note the seasonal high groundwater elevation at 81.5 and confirm the soils on site being coarse to fine sands. To be conservative, a B hydrologic rating has been carried throughout the hydrological analysis. The soil borings and web soil survey can be found in the Appendix.

Table 1: NRCS Soil Types

Map Designation	Soil Name	Soil Group
6A	Scarboro Mucky Fine Sandy Loam	A/D
52A	Freetown Muck	B/D
53A	Freetown Muck, Ponded	B/D
235D	Hinckley Loamy Sand	A
626B	Merrimack-Urban Land Complex	A
653	Udorthents, Sandy	B*
656	Udorthents-Urban Land	B*

*Soil group based on findings from the surrounding NRCS soils.

2.1.3 Design Storms
The analysis was performed on the 2-, 10-, and 100-year frequency rainfall events. The events were based on the 24-hour Type-III duration storms.

2.1.4 Time of Concentration
Time of Concentration (Tc) values were calculated using Average Velocities for Overland Flow, found in SCS TR-55 Urban Hydrology for Small Watersheds. The minimum Tc used was six (6) minutes as this is the minimum that HydroCAD defaults to in the calculations.

2.1.5 Curve Numbers
Curve numbers were developed for each of the different use categories and hydrologic soil group types within each sub-area. The curve numbers were based on the SCS TR-55 methodology and are included in the HydroCAD input and output found in the Attachments Section.

2.1.6 Rainfall
Rainfall data is taken from NOAA Atlas 14 Volume 10 for the project location. The following depths were used in the HydroCAD model for the 2-, 10-, and 100-yr storm events:

Table 2: Rainfall Data

Storm Event	Rainfall Depth
2-yr	3.09"
10-yr	4.65"
100-yr	8.36"

2.2 Existing Conditions
The project area limit of work is about 3.30 acres. However, for the drainage analysis a larger Area of Analysis (AOA) is used to more adequately quantify and compare the runoff in the existing and proposed conditions. The AOA is about 4.09-acres, and it includes the portions of area between the project area and the offsite wetland that are ultimately conveyed to the offsite wetland; modeled as DP-1.

2.2.1 Existing Drainage Areas
The existing project area contains one drainage area, Subcatchment-1, that flows to one Discharge Point, DP-1. See the Pre-Development Plan Attachment (Fig. 1). DP-1 is the bordering vegetated wetlands (BVW).

Subcat-1 is a 178,246-sf area that contains, grassed areas, wooded areas, and an existing paved road (Range Road). North of the project area is the Burbank Ice Arena and associated parking lot. South of the project area is the existing bordering vegetated wetland (BVW). East of the project area is the Reading Rifle and Revolver Club. Residential homes along Haverhill Street are located to the west.

2.3 Proposed Conditions
The proposed work consists of constructing a new Center for Active Living (ReCAL) Facility and Community Pickleball Courts. The proposed ReCAL facility includes a new indoor recreation building, a new seven (7) court pickleball facility with athletic lighting, construction of a new parking area, accessible walkways providing access throughout the facility, utility improvements, and new stormwater BMPs. Clearing and earthwork operations will be necessary to construct the new building, courts,

walkways, parking area, and associated infrastructure. The Area of Analysis remains the same in the proposed condition with the same discharge point (DP-1).

2.3.1 Proposed Drainage Areas

The proposed project area contains three (3) drainage areas, Subcatchment 10, Subcatchment 11, and Subcatchment 12 that flow to the Discharge Point, DP-1. See the Post-Development Plan Attachment (Fig. 2).

Subcatchment-10 is an 89,772-sf area that consists of the proposed ReCAL building, parking lot area, paved road (Range Road), a portion of the paved accessible walkways, and associated landscaped and grassed areas. Overland runoff is collected by catch basins and areas drains where it flows to water quality units that discharge into a proposed infiltration basin at the south side of the parking lot, modeled as Pond 1P. Pond 1P is designed to meet the Massachusetts Stormwater Standards as well as the Town of Reading's Stormwater Management Regulations. The underground infiltration/detention basin outlets to an outlet control structure which ultimately outlets to the existing offsite wetland to the south of the site via an outlet pipe to a rip rap basin. The wetland has been modeled as DP-1, see HydroCAD report for details.

Subcatchment-11 is a 23,769-sf area that consists of seven (7) new pickleball courts, a portion of the paved accessible walkways, and landscaped areas. Runoff flows overland and is collected by area drains along the edge of the pickleball courts. The runoff is then conveyed to a proposed underground infiltration basin, modeled as pond 2P. Pond 2P is designed to meet the Massachusetts Stormwater Standards as well as the Town of Reading's Stormwater Management Regulations. The underground infiltration/detention basin outlets to an outlet control structure which ultimately outlets to the existing offsite wetland to the south of the site via an outlet pipe to a rip rap basin. The wetland has been modeled as DP-1, see HydroCAD report for details. See Table 3 for a summary of the area take offs for the hydrologic analysis of the proposed conditions.

Subcatchment-12 is a 64,705-sf area that consists of paved accessible pathways, dust walkways, cement concrete pads, and grassed/planted areas. Runoff flows overland directly to the wetland. See Table 3 for a summary of the area take offs for the hydrologic analysis of the proposed conditions.

Table 3: Existing & Proposed Conditions Takeoff Areas (SF)

	Impervious CN=98	Gravel CN=96	Grass CN=61	Woods/Brush Good CN=55	Total Area	Weighted CN
EX. Subcat-1	11,975 sf	-	11,833 sf	154,438 sf	178,246 sf	59
EX. - TOTAL	11,975 sf	-	11,833 sf	154,438 sf	178,246 sf	59
PR. Subcat-10	77,330 sf	-	12,410 sf	32 sf	89,772 sf	93
PR. Subcat-11	18,073 sf	-	4,235 sf	1,461sf	23,769 sf	89
PR. Subcat-12	3,625 sf	599 sf	43,448 sf	17,033 sf	64,705 sf	62
PR. - TOTAL	99,029 sf	599 sf	60,093 sf	18,526 sf	178,246 sf	

2.4 Peak Discharge Runoff Rates

The peak flows were calculated for the 2-,10-, and 100-year storm events under the existing and proposed conditions to compare. Table 4 summarizes the rates of runoff.

Table 4: Summary of Runoff Rates (cfs)

		2 Year	10 Year	100 Year
DISCHARGE POINTS	DP-1E	0.65 cfs	3.29 cfs	12.90 cfs
	DP-1P	0.57 cfs	2.91 cfs	12.22 cfs

As demonstrated in the table, the proposed project decreases the rates in the proposed conditions for the 2-, 10-, and 100-year storms when compared to the existing conditions and therefore this standard is met.

Standard 3: Stormwater Recharge

3.1 Stormwater Recharge

The Stormwater Standards indicate that at a minimum, the annual recharge from the post development site shall approximate the annual recharge from pre-development conditions.

3.1.1 Stormwater Recharge; Pond-1P

The proposed work results in a net increase in impervious area on for the project. The required recharge volume for the proposed impervious areas on site is:

$$Total\ Net\ Impervious\ Area\ Increase = 99{,}029 - 11{,}975 = 87{,}054\ sf$$

$$R_v = \left(0.35\ in\ x\ \frac{1ft}{12in}\ x\ 87{,}054\ sf\right)$$

$$R_v = 2{,}539\ cf$$

Per the Stormwater Standards at least 65% of the site's total impervious cover must be directed to the recharge area to ensure it captures sufficient rainfall for recharge.

$$Total\ Impervious\ Area\ Icrease\ on\ Site = 99{,}029\ sf$$

$$Total\ Impervious\ Area\ Collected\ in\ Field\ Detention\ Area = 95{,}403\ sf$$

$$\frac{Impervious\ Area\ Collected\ in\ Detention\ Area}{Total\ Impervious\ Area\ on\ Site} = 96.3\%$$

As only a portion of the site's proposed impervious areas will be sent to the infiltration/recharge area, Standard 3 requires that an adjusted Required Recharge Volume be calculated. The adjusted volume is:

$$Recharge\ Factor = \frac{Total\ Impervious\ Area}{Impervious\ Area\ Collected\ in\ Detention\ Area}$$

$$Recharge\ Factor = \frac{99{,}029}{95{,}403}$$

$$Recharge\ Factor = 1.03$$

$$Adjusted\ Required\ Recharge\ Volume = (R_v)(Recharge\ Factor)$$

$$Adjusted\ Required\ Recharge\ Volume = (2{,}539)(1.03)$$

$$Adjusted\ Required\ Recharge\ Volume = 2{,}615\ cf$$

Recharge provided was calculated using HydroCAD. A copy of the HydroCAD reports for the proposed recharge system (Pond 1P & Pond 2P) are attached in the Attachments section.

Recharge Volume Provided: 3,332 CF

3,332 > 2,615

3.2 Drawdown Time

The MA Stormwater Handbook requires that recharge volume have a drawdown time of 72 hours or less. The time required to dewater a recharge system may be estimated by the following equation:

$$Time_{drawdown} = \frac{V_{RS}}{(K)\,x\,\left(\frac{1ft}{12in}\right)x\,(A_R)}$$

$$V_{RS} = Volume\ of\ recharge\ storage\ system\ (cf)$$

$$K = Rawls\ Rate\ \left(\frac{in}{hr}\right)$$

$$A_R = Surface\ area\ of\ recharge\ system\ (sf)$$

The drawdown time of the entire underground infiltration system (Pond 1P; assuming full capacity) is calculated as the following:

$$Time_{drawdown} = \frac{23{,}614\ cf}{\left(1.02\,\frac{in}{hr}\right)x\,\left(\frac{1\,ft}{12\,in}\right)x\,(11{,}948\ sf)}$$

$$Time_{drawdown} = 23.25\ hours$$

The drawdown time of 23.25 hours for Pond-1P is under the 72-hour maximum.

The drawdown time of the entire underground infiltration system (Pond 2P; assuming full capacity) is calculated as the following:

$$Time_{drawdown} = \frac{2{,}066\ cf}{\left(\frac{1.02\ in}{hr}\right)x\,\left(\frac{1\,ft}{12\,in}\right)x\,(1{,}090\ sf)}$$

$$Time_{drawdown} = 22.29\ hours$$

The drawdown time of 22.29 hours for Pond-2P is under the 72-hour maximum.

The drawdown time for Pond-1P and Pond-2P are both under the 72-hour maximum and therefore the standard is met.

3.3 Mounding Analysis

The proposed Infiltration Basins will be used to mitigate peak flow in the 10-year and above. However, there is less than 4' separation to groundwater and as such a mounding analysis has been completed showing compliance. Please refer to appendix for Mounding Analysis calculations.

Standard 4: Required Water Quality Volumes

4.1 Total Suspended Solids (TSS) Removal

Reading requires 90% TSS removal per the Town of Reading's Wetland Protection Regulations dated December 2023, and the Town of Reading's Stormwater Management and Erosion Control Regulations dates December 2021. The MA Stormwater Handbook states that this standard is met when:

1. Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan and thereafter are implemented and maintained.

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

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

4.1.1 Subcatchment-10

The proposed parking area and road will be paved and is anticipated to generate TSS. TSS removal at Subcatchment 10 will be achieved through the following treatment train: road / parking lot sweeping -> collection of stormwater in deep sump catch basins -> flow of stormwater through a Stormceptor (or equivalent) -> flow to a subsurface infiltration basin. This treatment train achieves 97% TSS removal. Calculations showing the treatment train can be found in the appendix. The water quality unit will be sized to treat the required water quality volume which is calculated below:

$$Subcatchment\ 10\ Impervious\ Area\ Generating\ TSS = 77{,}330\ sf$$

$$Required\ Water\ Quality\ Volume = (0.5in) * \left(\frac{1ft}{12in}\right) * (77{,}330\ sf)$$

$$Required\ Water\ Quality\ Volume = 3{,}222\ cf$$

As noted in Standard 3, the subsurface system associated with Subcatchment-10 is sized for a much larger volume.

4.1.2 Subcatchment-11

The MA Stormwater Handbook does not provide guidance in differentiating between a typical development project which would likely have roadways, driveways, and parking lots, which generate greater amounts of TSS, and a landscape project like this which is constructing pickleball courts and installing accessible pedestrian walkways that will not be treated in the winter. The proposed project has both conditions of a typical development project (parking area) and a landscape project.

The pickleball courts and adjacent walkways will not generate TSS loads comparable to a typical development project, which is what the Stormwater Handbook is aimed at regulating. The Town of Reading does not anticipate treating the pickleball courts or adjacent walkways in this project and vehicle use on any of the surfaces will be limited to maintenance vehicles which will access these surfaces on a minimum basis. TSS removal at Subcatchment 11 can be modeled through the following treatment train: road / parking lot sweeping -> collection of stormwater in deep sump catch basins -> flow to a subsurface infiltration basin. This treatment train achieves 87% TSS removal. Although street sweeping and deep sump catch basins are not provided as part of the pickleball stormwater infrastructure and maintenance plan, they can be modeled as part of the TSS removal calculations because these pollutants are not generated at this area. Calculations showing the treatment train can be found in the appendix. In consideration of the impervious surface type and use, runoff from these surfaces already meet the intent of Standard 4.

A long-term pollution prevention plan is required to identify practices taken for source control and pollution prevention. This information has been provided as a part of the Operation and Maintenance Plan and can be found in the Attachments Section.

4.2 Phosphorus Removal

Reading requires 60% phosphorus removal per the Town of Reading's Wetland Protection Regulations dated December 2023, and the Town of Reading's Stormwater Management and Erosion Control Regulations dates December 2021.

The existing phosphorus loading at project site produces an annual phosphorus load of 0.96 lb/year, see attached phosphorus loading calculations.

Massachusetts MS4 General Permit provides guidance on calculating phosphorus load reductions for stormwater control devices. The proposed stormwater detention/infiltration basins (Pond 1P and Pond 2P) both achieve a reduction in the cumulative phosphorus load through the storage capacity of the basins from runoff generating from impervious areas. The phosphorus load from subcatchment-10 is expected to be exfiltrated in the subsurface detention/infiltration system in a rainfall event with an average of 2.0" of rainfall over the impervious areas and therefore has not been included in the total proposed conditions phosphorus loading. The phosphorus load from subcatchment-11 is expected to be exfiltrated in the subsurface detention/infiltration system in a rainfall event with an average of 0.60" of rainfall over the impervious areas. An 86% cumulative phosphorus load reduction has been applied to subcatchment-11, see attached phosphorus loading calculations. The phosphorus load from subcatchment-12 is not reduced due to the runoff not being detained in a stormwater control device. The proposed project will achieve 63.0% phosphorus removal, and therefore this standard is met.

Standard 5: Land Uses with Higher Potential Pollutant Loads

This project is not considered a land use with Higher Potential Pollutant loads therefore Standard 5 is not applicable to this project.

Standard 6: Critical Areas

Runoff from this project does not discharge to any critical areas and therefore is not subject to additional treatment required by Standard 6.

Standard 7: Redevelopment

For the purposes of the Stormwater Management Standards, redevelopment projects are defined to include development, rehabilitation, and expansion on previously developed sites provided the redevelopment results in no net increase in impervious area. The project proposed a net increase in impervious area on site and is therefore not considered redevelopment. As such, the project has been designed in full compliance with the Massachusetts Stormwater Standards.

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

Construction period pollution prevention and erosion and sedimentation control will be implemented at the project site to control construction related impacts during construction and land disturbance activities. Refer to the Site Preparation Plan for location of erosion and sediment controls. The general contractor for the project will be responsible for the implementation of the construction period controls.

The project scope will disturb approximately 3.30-arces of land during the construction process and will require a NPDES Construction General Permit issued by the Environmental Protection Agency. As a result, a stormwater pollution prevention plan (SWPPP) will be required. The SWPPP document will satisfy the requirements of the Construction General Permit, and the construction period erosion, sedimentation and pollution prevention plan requirements outlined in Standard 9 of the Massachusetts Stormwater Handbook. A draft SWPPP has been developed and is included as part of the Stormwater Report. The SWPPP will be finalized with the awarded General Contractor for the project.

Standard 9: Operation and Maintenance Plan

The proposed project is owned by the Town of Reading. Stormwater structures and other stormwater best management practices should be maintained as directed in the Operations and Maintenance Plan. An Operation and Maintenance Plan has been included with this Stormwater Report.

Standard 10: Prohibition of Illicit Discharges

Illicit Discharge Compliance Statement

"Per the requirements of Standard 10 of the Massachusetts Stormwater Management Standards it shall be stated that No Illicit Discharges exist at the Reading Center for Active Living and Community Pickleball Courts project site located at Symonds Way, Reading, Massachusetts."

Attachments:

NRCS Soil Report/Soil Boring Logs
Pre-Development Plan
Post-Development Plan
HydroCAD Report – Peak Rate
HydroCAD Report - Recharge
HydroCAD Report – Phosphorus
Phosphorus Loading Calculations
Mounding Analysis
TSS Removal Calculations
Operation & Maintenance Plan - DRAFT
SWPPP - DRAFT

NRCS Soil Report/Soil Boring Logs

United States Department of Agriculture

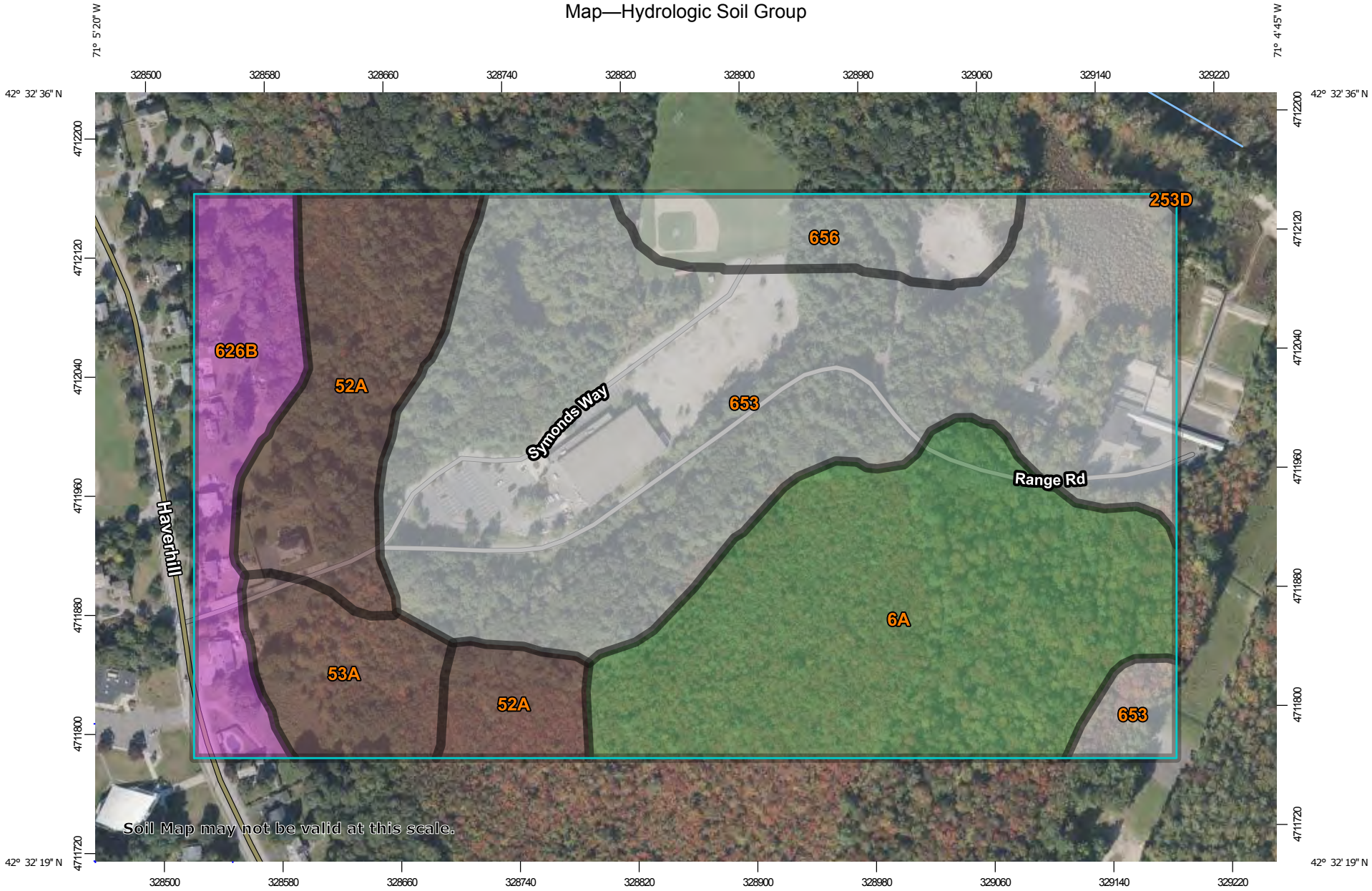
NRCS

Natural Resources Conservation Service

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

Custom Soil Resource Report for Middlesex County, Massachusetts

June 23, 2025



Map Scale: 1:3,640 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 150 300 600 900

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 1:24,000.

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

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

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

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

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

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

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 24, Aug 27, 2024

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

Date(s) aerial images were photographed: Mar 1, 2023—Sep 1, 2023

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

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
6A	Scarboro mucky fine sandy loam, 0 to 3 percent slopes	A/D	15.5	24.9%
52A	Freetown muck, 0 to 1 percent slopes	B/D	8.2	13.2%
53A	Freetown muck, ponded, 0 to 1 percent slopes	B/D	3.3	5.2%
253D	Hinckley loamy sand, 15 to 25 percent slopes	A	0.0	0.0%
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	A	4.9	7.8%
653	Udorthents, sandy		27.1	43.5%
656	Udorthents-Urban land complex		3.3	5.3%
Totals for Area of Interest			**62.3**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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Lisa R. Casselli,PE Principal - A WBE Firm

Subsurface Exploration | **Laboratory Soil Testing** | **Geothermal Testing**
Foundation Specialty Systems | **Ground Improvement** | **Earthwork Testing**

27 November 2024
File No. 2436

Town of Reading
c/o Bargmann Hendrie Archetype
9 Channel Center Street – Suite 300
Boston, MA 02210

Attention: Mason Brunnick - COO

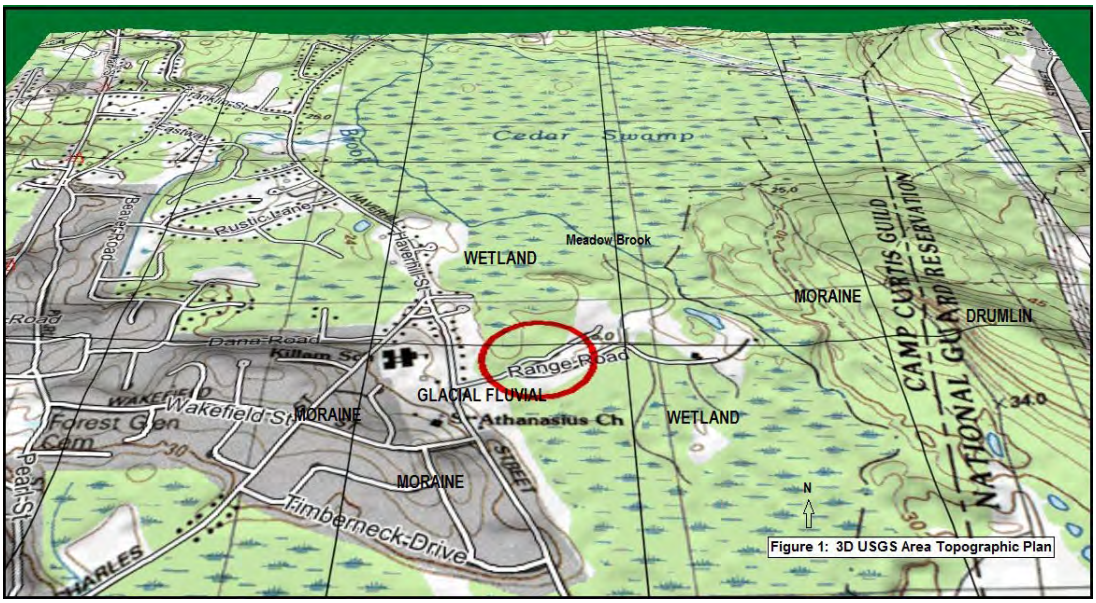
Subject: ***Geotechnical Data Summary Report***
Proposed Community Center
Range Road
Reading, Massachusetts 01867

Dear Mason:

This geotechnical data summary report gives our site background data review, subsurface explorations (soil, groundwater), field soil testing, engineering data summary, analyses and calculations for the proposed new construction on Range Road in Reading, Massachusetts (*Figure 1A*).

45 New Ocean Street – Suite A
Swampscott, MA 01907
Tel. 781/646-6982

354 Ashburnham Street
Fitchburg, MA 01420
Tel. 617/201-0914



I. Proposed Construction:

Existing Conditions:

- Plan reference:
  - *Approval Not Required Plan of Land – Haverhill Street Lot 133 Map 35 Town of Reading, Middlesex County, Commonwealth of Massachusetts*; prepared by Control Point Associates, Inc. of South Marlborough, MA; dated 22 June 2022.
  - No site utilities survey was required as the property is raw woodland.

- Direction, Datum, Elevation and Coordinates:
  - Direction:
    - Plan north: *Figure 1A, Figure 1*
    - Called north for this review: in the general direction of Symonds Way.
  - Elevation and datum:
    - Vertical elevations:
      - Site topographic elevations were provided on the site survey plan.
      - The proposed new community center building footprint is relatively level with site elevations ranging from El. 86 ft.+/- to El. 88 ft.+/-.
    - Elevation datum: NAV88.
  - Site coordinates:
    - Latitude: 42.5412° N
    - Longitude: -71.0850° W

- Existing Site Conditions:
  - No attempt has been made to undertake a detailed history of this site. Historic review is included in research for Phase I environmental site assessments.
    - No useful site area mapping was found except an undated map which showed three structures directly across Range Road (*Figure 1B*). The subject site was undeveloped.
    - During the 1950s a missile launch site was created directly across the street on Range Road. This launch site was decommissioned in 1963. A 1977 aerial map seems to show remnants of the launch site. The subject site remained undeveloped.
    - By 1994 the launch site had been redeveloped as the Burbank Ice Arena and parking area, which remain today. The subject site remained undeveloped (*Figure 1A*).

- Immediate site area topography is slightly to moderately sloping (*Figure 1*).
- Site underground utilities (water, sewer) are not relevant as this is a raw woodland property. Even so, an area utilities list is held by us.

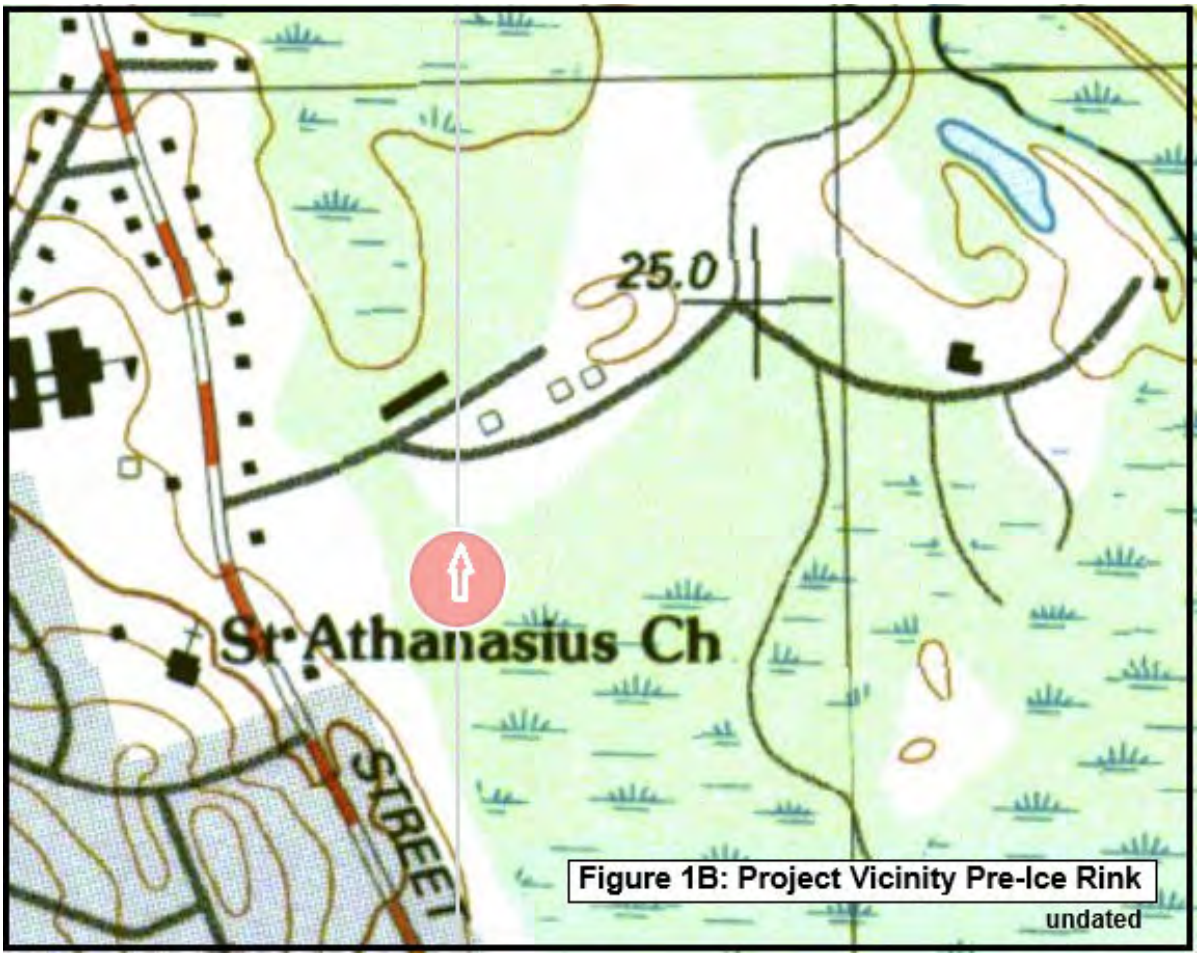


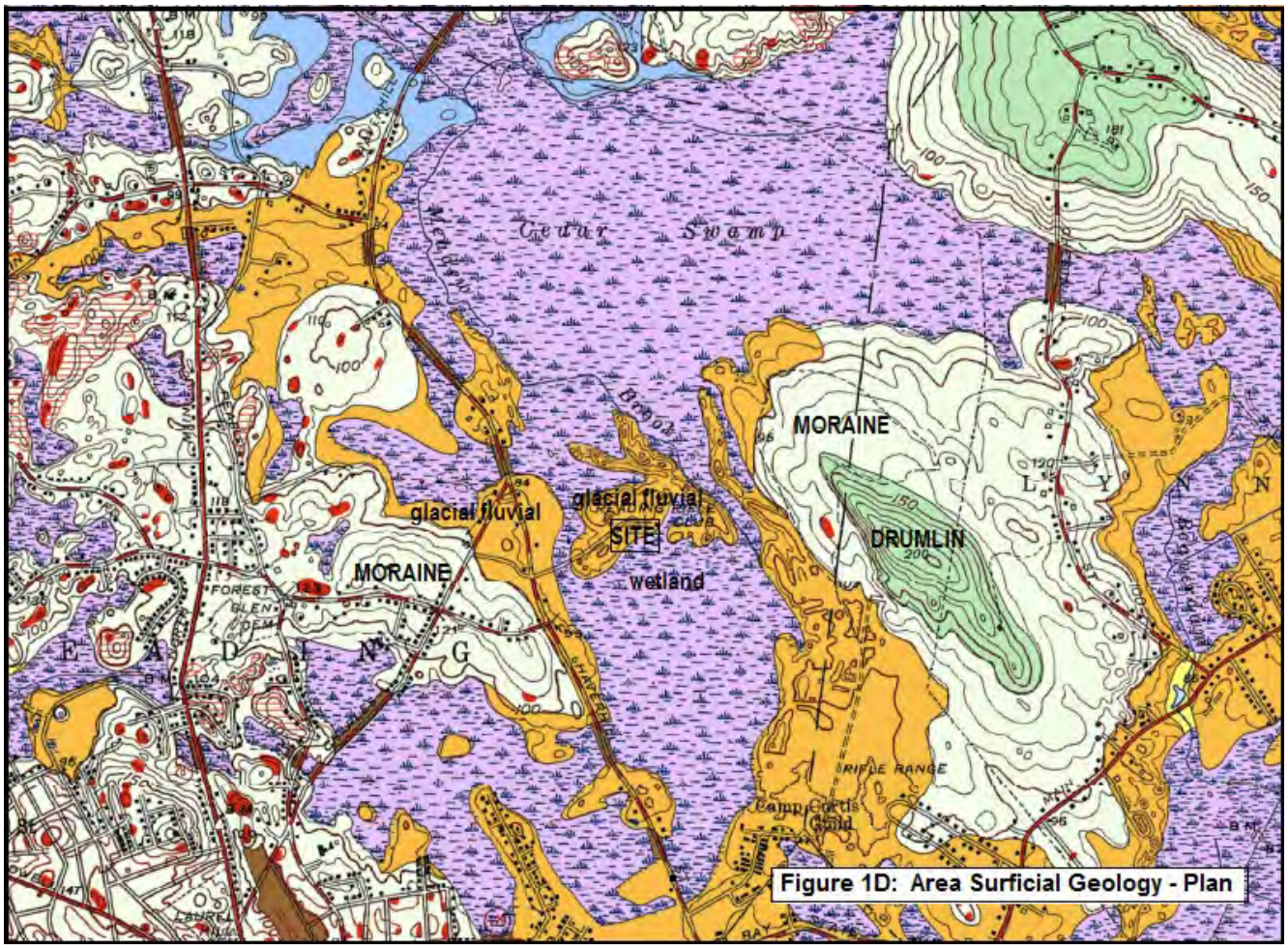
Figure 1B: Project Vicinity Pre-Ice Rink
undated

Anticipated New Construction:

- Plan Reference:
  - *Reading CAL – Town of Reading*; prepared by Bargmann Hendrie & Archetype of Boston, MA, dated 1 November 2024.

- New Building Structural Information: *Figure 1C*
  - New construction:
    - Above-grade floor levels: two (2)
    - Below-grade floor level: none currently planned
    - Elevator included in design: one (1) conventional
  - Footings:
    - Applied loads: assumed maximum
      - Columns: 100 K
      - Exterior walls: 4 KLF
    - Bottom of footing (BOF):
      - Exterior: at minimum at recommended frost depth
      - Interior: 2 feet below first floor finish floor slab
  - Ground floor elevation: assumed 1st floor FFE at El. 88 ft.+/- (NAV88).

- Ground floor loads (assumed):
  - Mechanical and storage areas: 150 PSF applied total load
  - Public use areas: 150 PSF applied total load
  - Interior equipment parking area: 450 PSF, if any are planned.
- Elevator pit: pit base at 5 ft. below 1st floor FFE; El. 83 ft.+/- (NAV88)



II. Subsurface Conditions:

Topographic Data:

- Elevation Range: the immediate site area is slightly to moderately sloping (*Figure 1D-1, Figure 1*).

- Area Surficial Geology:
  - Area surficial geology is the result of a series of glacial advances and retreats with possible occasional intrusive marine action.
    - The result in the general area was land dotted with glacial moraines and glacial drumlins with adjacent extensive low-lying glacial outwash (glacial fluvial) plains *Figure 1D*). In this area the outwash is overshadowed by extensive wetland.
    - Glacial drumlin and moraine formations were left behind by glacial scour and melt.
    - Areas near rivers also had alluvial (river flood) sediment contributions within their lowland formation (alluvial land; Bear Meadow Brook, northeast) as contrasted with sedimentation within glacial outwash plains (*Figure 1D-1*).
    - Glacial upland formations (drumlins, moraines) can contain extensive mapped adjacent glacial outwash soil deposits as shown in this area in *Figure 1D*.
      - Glacial moraines are an accumulation by deposition of glacial drift (silt, sand and gravel) within a glaciated region. Thrust of glacial ice (bulldozed material) occurred frequently. Exposed bedrock is common.
      - Glacial drumlins are oval hills of clay, silt, sand and gravel compacted under pressure at the base of hundreds of vertical feet of glacial ice. A drumlin's axis indicates the direction of ice movement (compacted material).
      - An alluvial plain is formed by granular soil left behind by repeated river flooding providing silt, sand and gravel commonly found in the relatively level areas beyond the river. Outwash plain soils are similarly formed within glacial meltwater.
    - According to *Figure 1D*, the site lies within mapped glacial outwash. Subsoils associated with this formation would largely include a mix of gravel, sand and silt.
  - According to area surficial geologic mapping utilizing the site latitude and longitude coordinates [*Massachusetts GIS, Surficial Geology;* Commonwealth of Massachusetts Office of Geographic Information; September 2012; updated 2018] the site was predicted to be situated upon on one or more of the following surficial native soil units:
    - Glacial outwash (water placed silt, sand and gravel); glacial fluvial
    - Glacial till

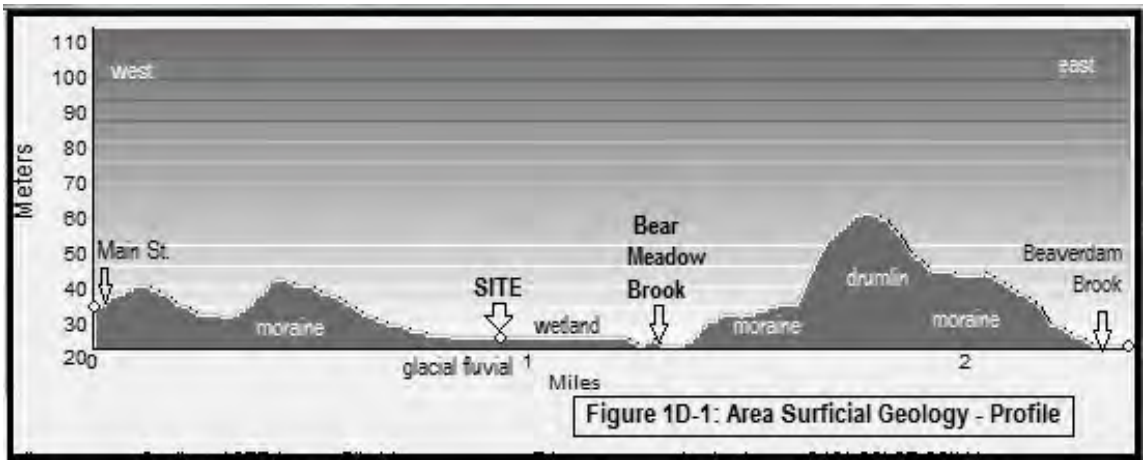
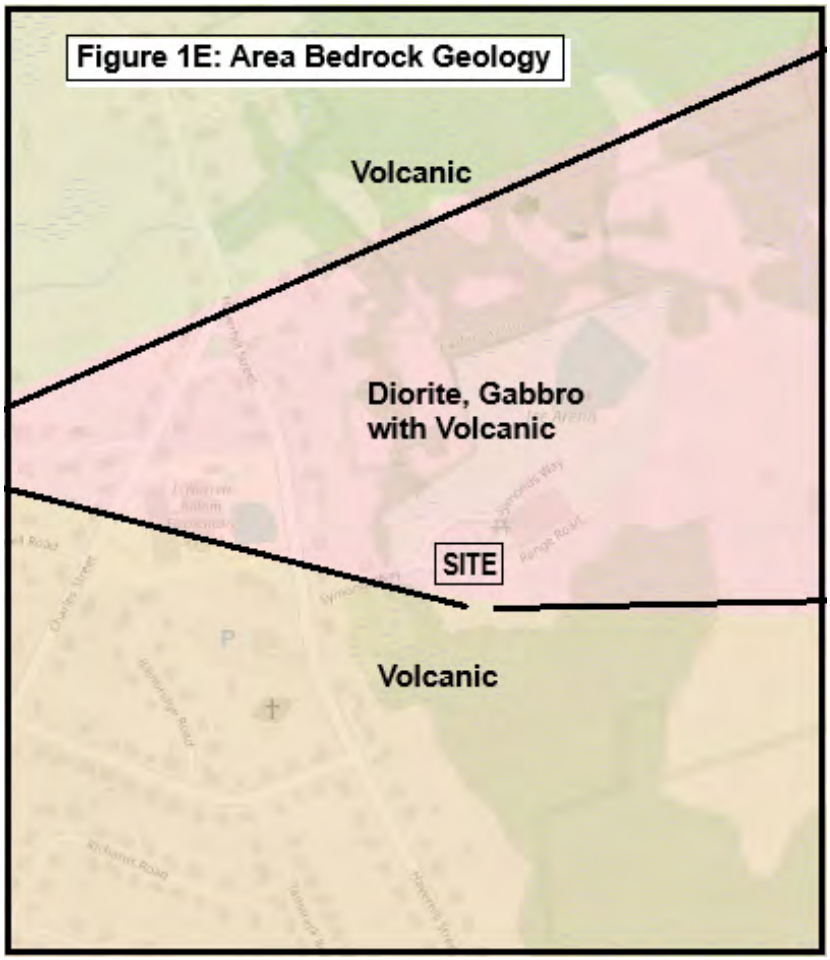


Figure 1D-1: Area Surficial Geology - Profile

- Water Bodies:
  - The following mapped water bodies are closest to the subject site:
    - Pond: 1760 ft. northeast.
    - Bear Brook: 1860 ft. northeast
    - No other significant project area water bodies (ponds, lakes, rivers, streams) are mapped on *Figure 1* within a 1-mile radius of the subject site.
  - Wetlands
    - South Cedar Swamp: adjacent south, east
    - Cedar Swamp: 500 ft. north

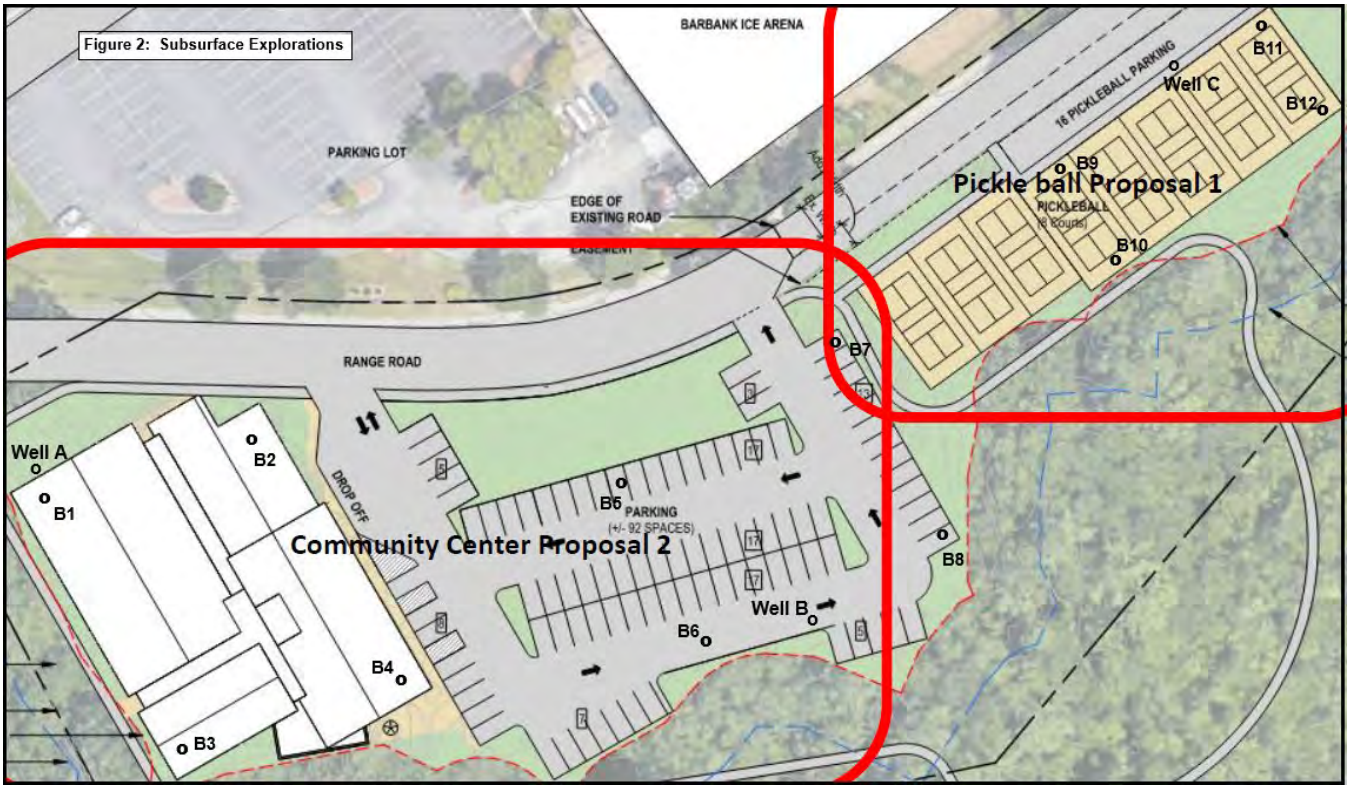
- Anticipated Site Substrata: Based upon the collected geologic and topographic data, anticipated native site substrata were considered to potentially include:
  - Man-placed fill
  - Organic soil (peat, organic silt)
  - Glacial outwash (water sorted silt, sand and gravel)
  - Glacial till (ablation till, basal till)
  - Bedrock

- Area Bedrock Geology: [US Department of the Interior; US Geological Survey, *Massachusetts State Geologic Map*; 1998; updated 2018; see *Figure 1E*]
  - Primary rock: volcanic
    - Hardness: a medium hard rock; igneous
    - Structure: fine grained
    - Mineralogy: felsic with rhyolite
  - Primary rock: gabbro
    - Hardness: a dark hard rock; igneous
    - Structure: medium to coarse grained equigranular
    - Mineralogy: feldspar with ferromagnesian minerals; no quartz
  - Primary rock: diorite
    - Hardness: a hard rock; intrusive igneous
    - Structure: medium to coarse grained granular
    - Mineralogy: feldspar; no quartz
  - Depth to bedrock data was not available from MA GIS (2018 database).



Previous Test Borings and Monitoring Wells

- On-Site Borings: no previous on-site boring records were found
- Previous Area Borings: no previous boring records were found
- Existing Groundwater Monitoring Wells:
  - Three remnant groundwater monitoring wells were found on this site (designated Well A, B, and C; *Figure 2*).
  - No wells were noted on adjacent properties.

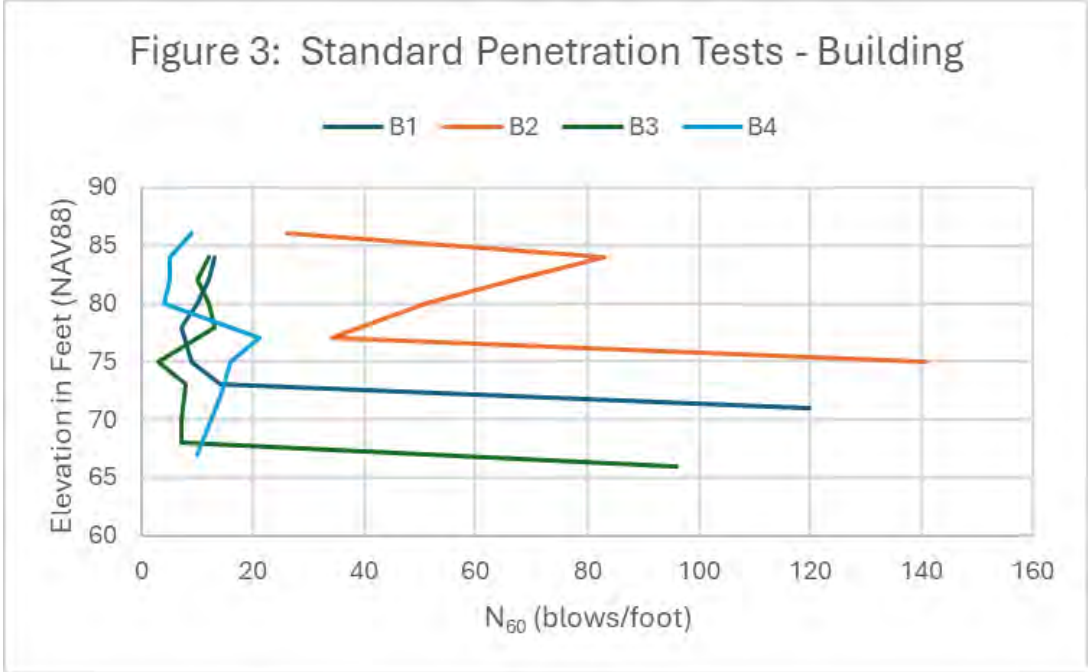


Test Borings Undertaken for this Study

- Dig Safe: was performed by us

- Test Borings:
  - Drilling was performed by Cosmo Drilling of Ocean Bluffs, MA:
    - Twelve (12) structural test borings (designated B1 through B12) were drilled on-site during November 2024 (*Figure 2*). Drilling dates for the individual borings are provided on the boring logs in *Appendix A*.
    - Refer to *Figure 2: Subsurface Explorations* for approximate as-drilled test boring locations.
  - A tripod mounted (portable) drill-rig equipped with a drop hammer drilled and sampled soils in the borings below grade.
    - 3-in. dia. BW cased drive and wash borings were advanced
    - Community center borings B1 to B4 were terminated either to top of possible bedrock or 22 ft. below existing site grade (*Table I, Figure 5A, Figure 5B*).
    - Paved area and pickleball court borings (B5 to B12; *Figure 2*) to shallow depths, typically to either possible top of bedrock or dense glacial soil.
  - Soil samples were generally taken in 2-foot increments continuously from ground surface to up to 12 ft. depth and at 5-foot intervals thereafter (*Appendix A*).

- Digital Boring Logs:
  - Recovered test boring soil samples were digitally logged by the geotechnical engineer in accordance with *ASTM D-5434-97: Standard Guide for Logging of Subsurface Explorations of Soil and Rock*.
  - Boring logs prepared by the engineer are presented in soil boring log sheets in *Appendix A.* Log details soil type, boundary elevation or depth, density, consistency, thickness, coloration, moisture and composition.



III. Geotechnical Testing:

Field Testing Performed:

- Standard Penetration Tests (SPT) (N_{60} in blows/foot)
- Field Gradation Tests

Standard Penetration Testing (SPT):

- SPT Presentation and Definition:
  - A standard penetration test is defined as the number of blows of a 140 lb. hammer falling 30 inches to drive a standard soil split spoon sampler 12 vertical inches. The number of blows is designated as "N"
  - Standard penetration tests (SPT) N are summarized for the four building borings with depth on the boring logs in *Appendix A* and for the borings in *Figure 5A, Figure 5B.*
  - Field SPT N (blows/foot) is taken from blow count graphs provided on the boring logs.
  - Standard penetration test N is plotted for the four building borings in *Figure 3.*

- SPT Type:
  - The borings drilled (see *Appendix A*) used a drop hammer sampler drive system.
  - Borings were advanced using drive and wash methodology. This drilling technique is known to yield more accurate N values than either auger or percussion drilling.

- SPT N Data Analysis of this Site: see also *Appendix A*
  - Note that in the plot of N with depth in *Figure 3:*
    - Boring N values are variable within the near surface existing fill soil.
    - Boring N values are also variable with depth within the sandy glacial fluvial soils and then generally increase with additional depth.
    - No casing or split spoon refusal was found in any of the four borings, which could have indicated the top of possible bedrock.
  - See also the N pattern variation with respect to soil type in *Figure 5A, Figure 5B* as well as in the blow count graphs on individual boring logs in *Appendix A.*

- SPT N Engineering Uses: SPT data can be useful in determination of values of soil bearing capacity, Young's Modulus for footing settlement evaluation, as well as input to footing base soil friction angle, seismic site class and slab subgrade modulus determination.

Field Gradation Tests:

- Test Use:
  - Limited field gradation tests were performed to better determine the relative percents of coarse gravel, fine gravel, coarse sand, and medium sand and fines (silt and fine sand) in recovered site granular fill and sandy glacial fluvial subsoil samples.

- Limitations:
  - Field tests are limited to recovered dry or field air dried soil samples.
  - 4-sieve method does not allow for separation of silt from fine sand.

Laboratory Soil Tests:

- Test Boring Sampling:
  - No laboratory soil particle gradation testing was undertaken for this review.
  - Test boring samples are typically too small in recovered volume for accurate lab testing.

- Quality of Sampled Soils for Re-use: refer to the final section of this report.

IV. Soil Strata:

Data Summaries:

- Subsoil Profile Data Summary: general summaries of soil substrata found in the subsurface explorations are provided in:
  - *Table I: Exploration Summary*.
  - The subsoil profile drawings (*Figure 5A, Figure 5B*); and
  - The test boring logs (*Appendix A*).
  - Report section: Site Subsoil Descriptions

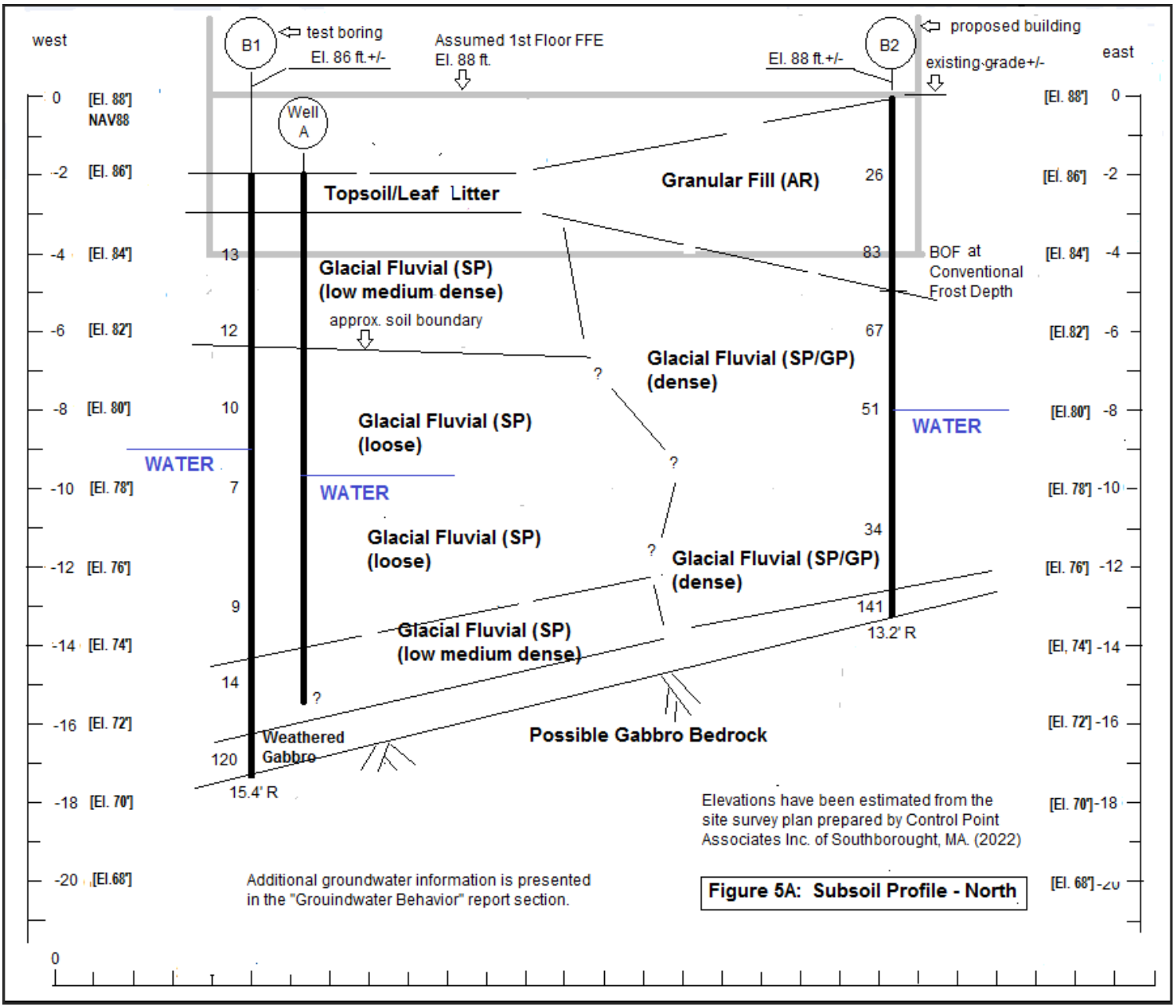
- Exploration Summary Table: refer to *Table I*

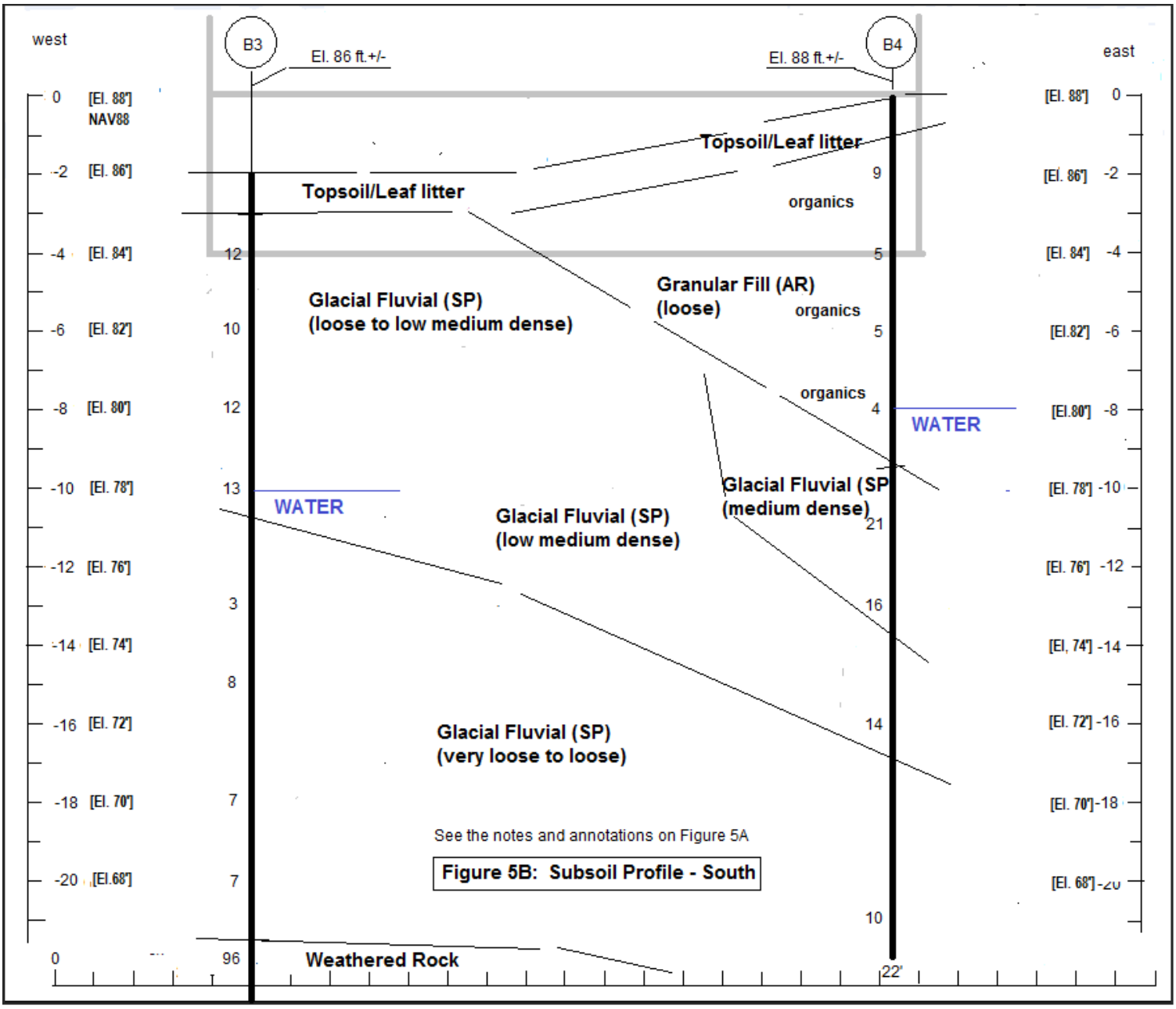
Table I: Exploration Summary – Community Center Building

Location	***Surface El. (ft.) (NAV88)***	***Depth Drilled (ft.)***	***AR Existing Fill (ft.)***	***All SP & SP-GP Glacial Fluvial (medium dense to dense) (ft.)***	***All SP Glacial Fluvial (low medium dense) (ft.)***	***All SP Glacial Fluvial (very loose to loose) (ft.)***	***Depth to Possible Gabbro Bedrock (ft.)***
B1	86+/-	15.4R	1	---	5	9.4	15.4
B2	88+/-	13.2R	5	8.2	---	---	13.2
B3	86+/-	21R	1	---	8	11	20
B4	88+/-	22	9.5	4	3	>5.5	>22

- Subsurface Profile Drawings:
  - Refer to the subsoil profiles sketched in *Figure 5A, Figure 5B* to gain an initial overview of site subsurface soil conditions at the locations drilled (*Figure 2*).
  - Subsoil profiles' orientations are parallel to Range Road (*Figure 2)* and are at the perimeter of the proposed new site building.

- Subsoil Profile Field Log Descriptions: Detailed field subsoil descriptions are given in the logs of the borings presented in *Appendix A*.





Soil Classification System Used for this Site Investigation:

- Soil Classification System: Project soils have been classified in accordance with the Unified Soil Classification System (USCS; MIT System). This is reflected in the test boring logs in *Appendix A*.

- Soil Descriptions: Soils are described in terms of color, grain size, moisture content, density (coarse grained soils), consistency (fine grained soils), plasticity and cementation, as appropriate.

Grain	Size Boundaries (dia.)	Common Size Example
Boulder	>12 in.	>Basketball
Cobble	3-in. to 12-in.	Grapefruit size

Coarse Gravel	¾-in. to 3-in.	Lemon size
Fine Gravel	#4 Sieve (4.75mm) to ¾-in.	Pea to grape size
Coarse Sand	#10 Sieve (2 mm) to #4 Sieve	Peppercorn size
Medium Sand	# 40 Sieve (.425 mm) to #10 Sieve	Sugar to table salt size
Fine Sand	#200 Sieve (.075 mm) to #40 Sieve	Powdered sugar size
Silt/Clay	<#200 Sieve (.075 mm)	Flour particle or finer

- Soil Moisture Content:
  - Dry: no moisture noted
  - Moist: some moisture observed
  - Very moist: very moist, but not saturated (possible vadose zone)
  - Wet: saturated above the liquid limit (likely groundwater zone)

- Soil Density and Consistency:
  - Density of coarse grained soils (non-plastic silts, sands, gravels): defined in terms of standard penetration test blowcount N values (refer to the summary table at the bottom of any boring log)
  - Consistency (plastic silts, clay, and organics): defined secondarily in terms of blowcount N values and primarily with respect to field unconfined compressive strength in TSF (refer to the summary table at the bottom of any boring log).

- Soil Particle Percentage Field Designation: Relative soil particle size percentages (trace, few, little, some, mostly [capitalized soil unit]): refer to summary table at bottom of any boring log. These are more accurately tallied by laboratory soil particle gradation tests.

- Subsoil Classes on this Site: USCS soil type designations utilized in this report:
  - AR = man placed fill, artificial soil stratum
  - SP = glacial fluvial sand; uniform
  - GP = glacial fluvial gravel
  - GT = glacial till; ablation till

Site Subsoil Descriptions: community center building

- Existing Fill (AR):
  - Fill types: two (2) general types of fill were found on-site: *Figure 5A, Figure 5B*
    - Granular fill: cohesionless soil with a lesser silt content (≤ 15%)
    - Common fill/urban fill: cohesionless soil with included unsuitable material (organics).
  - Coloration:
    - Granular fill: black, dark-brown, brown, tan
    - Common fill/urban fill: dark-brown, brown, light gray
  - Existing Fill thickness (t) at the borings drilled: 1 ft. ≤ t ≤ 9.5 ft.
  - Density:
    - Granular fill: medium dense to dense
    - Common fill/urban fill: very loose to loose
  - Fill source:
    - Granular fill: likely imported neighborhood glacial fluvial sand (SP)
    - Common fill/urban fill: mix of organics (topsoil, peat, organic silt) and granular fill (likely imported neighborhood glacial fluvial sand (SP)).
  - Competence:
    - Granular fill:
      - Could be re-used as earthwork phase engineered fill from >1 ft. depth below a floor slab pending the results of earthwork phase laboratory soil gradation tests and removal of any included unsuitable organic material.
      - Some of the granular fill has inadequate (low) gravel content (*Appendix A*).

- Common fill/urban fill:
  - No common fill or urban fill observed should be allowed to remain in-place below conventional structural units (footings, grade slabs).
  - Re-use of common fill would be limited as backfill in planted areas
  - Re-use of urban fill could have environmental engineering limitations with associated off-site disposal restrictions.

- Organics:
  - Although mapped adjacent, no woodland wetland organic soils (peat, organic silt) were found in the on-site borings drilled
  - Organic soil was found mixed with the existing fill in boring B4 (*Figure 5B*).

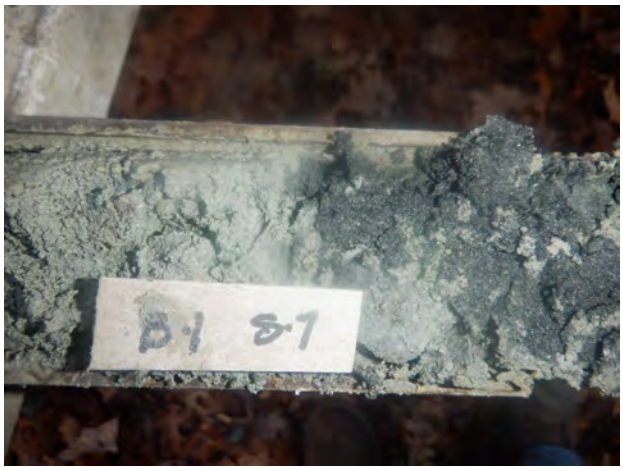
Photo 1: SP Glacial Fluvial in B3 at 1 ft; sand .

Photo 2: SP Glacial Fluvial in B3 at 5 ft; sand

- Glacial Fluvial Soil (Glacial Outwash; Alluvial): glacial fluvial soil was mapped for this site (*Figure 1D*), and glacial outwash was found in the borings (*Photo 1, Photo 2, Photo 3*).
  - Definition and source:
    - Glacial fluvial (outwash) soils were deposited during glacial melt cycles within meltwater. Soil particles (silt, sand, gravel) were water sorted. Formation of glacial outwash lowland occurs within topographic lowlands adjacent to moraines and drumlins (*Figure 1D*, *Figure 1D-1*).
    - Alluvial soils are deposited during repeated river flood events (Bear Meadow Brook).

Photo 3: SP in B3 at 10 ft.; fine sand, wet

Photo 4: Weathered gabbro rock (rt.) in B1 at 14 ft.



- Description: soil types found:
  - SP: medium to fine sand (*Photo 1, Photo 2*) or fine sand (*Photo 3*) with a low non-plastic silt content; and absent to low gravel content; has a poorly graded, fairly uniform sand particle size (*Appendix A*); soil particles are water sorted; loose to dense found in-situ density.
  - GP: gravel with sand and minor (non-plastic) silt content. Found primarily in boring B2.
- Thickness (t): refer to *Table I*
- Coloration: dark-brown, rust brown, brown, light brown, tan, light gray, gray
- Competency: highly variable; very loose to dense
- Re-use:
  - SP soil could, dependent upon found gravel content, possibly be re-used as engineered fill per earthwork phase soil particle gradation test results.
  - GP soil likely can be re-used as engineered fill.

- Glacial Till:
  - Types: two varieties of glacial till are typically found
    - Ablation till: a cohesionless, sandy granular till
    - Basal till: a cohesive and/or strongly cemented granular till
  - One or both, of the two glacial till types were expected to be found at depth. However, neither was found to the depths drilled.

- Bedrock:
  - Rock outcropping was not noted on-site or in the immediate site area.
  - Weathered gabbro bedrock was encountered in some of the borings (*Photo 4; Appendix A*).
  - Rock type expected is either gabbro, diorite or volcanic (see "Area Bedrock Geology" report section and *Figure 1E*).

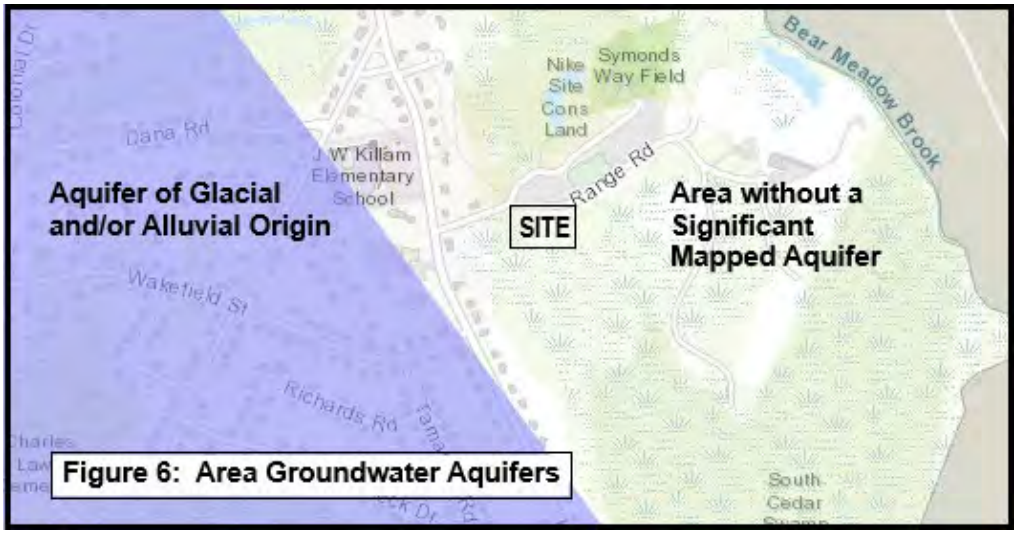


Figure 6: Area Groundwater Aquifers

V. Groundwater Behavior – Community Building

- Free Water:
  - Wet (saturated) soil zones were encountered in all borings drilled (*Figure 5A, Figure 5B, Appendix A, Table II*).
  - The borings continued to remain wet at depth within the sandy (SP) glacial fluvial soil zone (*Appendix A*).
  - No groundwater monitoring well was installed in a completed borehole as the likely excavation depths should not encounter groundwater and Well A exists here (*Table II*).

Table II: Groundwater Data – Community Building

Loc.	Elevation	Date	Observation	Groundwater Depth	Groundwater El.
B1	86'+/-	11/23/24	Wet SP sand	7.0 ft.	79 ft.+/-
B2	88'+/-	11/23/24	Wet SP sand	8.0 ft.	80 ft.+/-
B3	86'+/-	11/24/24	Wet SP sand	8.0 ft.	78 ft.+/-
B4	88'+/-	11/24/24	Wet SP sand	8.0 ft.	80 ft.+/-
Well A	86'+/-	11/27/24	Well Reading	7.7 ft.	78.3 ft.+/-
Other wells elsewhere on-site (see *Figure 2* for approximate well locations):					
Well B		11/27/24	Well Reading	4.6 ft.	
Well C		11/27/24	Well Reading	8.2 ft.	

- Groundwater Level Variation:
  - This site does not contain a significant mapped groundwater aquifer *(Figure 6)*
  - Clear soil mottling (color variation, typically splotches, due to past or current water presence), and/or rust staining was not seen in site soil borings.
    - Rust staining and mottling give an indication of a past higher water level possibly indicative of seasonal high groundwater level.
    - Wet soils were found in all borings (*Figure 5A, Figure 5B, Table II, Appendix A*) but no useful soil mottling or rust staining was seen above the wet soils.
    - Note also that mottling and staining, if found, is considered unreliable in fill soils.
  - Localized temporary and long-term changes to groundwater level can be natural or man-made. These include:
    - Alternating dry and wet precipitation periods now seem to be the norm, such as:
      - The 2016 extreme drought condition, the relatively dry summer of 2017, and the recent 2020, early 2021 and 2022 and 2024 drought periods.
      - A notably wetter 2018, parts of 2019 and summer 2021 and 2023 with included near record high water levels in eastern Massachusetts.
    - Winter drier season water levels.
    - Heavy rainstorms or lengthy precipitation periods
    - Leaky underground structures (pipes, tunnels)
    - Underground flow retarders (buried structures, walls, rock outcrops)
    - Percent of land surface covered by pavement and buildings without ability to recharge.
    - Nearby construction dewatering.
    - Changes to the existing surface drainage pattern due to new site topography, trenches, infiltrators, bio-retention basins and subgrade structures.
  - Groundwater impact based upon the data collected to date (*Table II, Appendix A*):
    - Based on the data collected Seasonal High Groundwater is estimated at El. 81.5 ft. (NAV88)
    - Groundwater (seasonal or found, *Table II*) would not impact expected conventional depth building excavations (≤ 4 ft. depth (El. 84 ft).
    - Underground utilities on some sites are designed to be installed deeper than foundations, however such data has not been provided us to-date for this project.

Hydraulic Conductivity (K in GPD/ft.^{2}):

- Scope: Laboratory soil gradation testing was not undertaken for this study and associated calculations and estimations of soil hydraulic conductivity (K) were not undertaken for any site subsoil unit.

- K Determination:
  - Many input factors go into determination of K. K is a function of particle grain sizes, soil density, soil particle uniformity, gravel content, soil cementation and soil layering.
  - Granular fill and SP sandy glacial fluvial soil are expected to be of moderate soil permeability (*Figure 5A, Figure 5B*).
  - GP glacial fluvial soil is expected to be of higher soil permeability.
  - K determination is the domain of the site civil engineer.

Site Civil and Environmental Site Investigation and Remediation Structural Unit Impact:

- Intrusive Site Civil and Environmental Testing and Remediation:
  - Site civil and environmental exploration (test pits and test trenches) can damage anticipated building structural unit bearing soils by lowering native bearing capacity.
  - Site remediation work including underground tank removal and soil replacement can remove significant volumes of contaminated soil materials from within proposed new construction footprints and inadvertently cause structural unit bearing soil degradation at the excavation base.
  - Any new site soil remediation work should be reviewed by the design team for quality of soil material placed to replace removed soils and/or tanks, as well as documentation that replacement soils were placed in compacted lifts.

- Protection of Structural Unit Bearing Subgrade: to protect structural bearing areas, project specifications should require:
  - Test pit and test trench areas avoid proposed project footing and slab bearing zones.
  - Test pit and test trench depths be limited to structural bearing depths minus one foot.
  - Where contaminated soil removal is required, replacement soil should be structural fill placed in compacted lifts, verified by field soil density testing to a laboratory Proctor standard for the placed soil.

VI. Foundation Review and Recommendations: Community Building

Foundation System:

- Groundwater impact: no groundwater impact on normal frost depth foundation excavation is anticipated *Figure 5A, Figure 5B*). This is also true for seasonal high groundwater estimated at El. 81.5 ft. (NAV88; page 15).

- Subsoil impact: weak soil bearing zones as well as a thin deep bearing layer were found throughout the site which limits the type of foundation that can be economically utilized here *(Figure 5A, Figure 5B*).

- Subsoil and groundwater impact to support of walls, columns and lowest level floor slab:
  - Foundation and slab type: primarily impacted by existing fill currently in place
    - ***Conventional shallow foundations****:* spread and continuous wall footings with a 1st floor slab on grade.
      - ***Deep Bulk excavation and replacement*** of existing fill and weak glacial fluvial soil would be required within the building limits.
        - Excavation to near top of bedrock would be required in most site areas which is well below groundwater and thus not practicable without massive site dewatering (well points).
        - See *Table I, Figure 5A, Figure 5B, Appendix A*.
        - This approach is not economically feasible for site development with conventional structural units (footings, slab).

- Alternative foundation support methods (piles, ground improvement):
  - ***Helical piles***: not practicable on this site as there is inadequate thickness of competent bearing soil for pile plate bearing in many parts of the site. These piles are not expected to be end bearing.
  - ***Drilled concrete micropiles***: piles drilled and grouted into bedrock; cost prohibitive
  - ***Ground improvement with aggregate piers***: there is usually not enough base soil thickness to properly seat the piers; not readily practicable. The size of project is likely too small for area contractors to consider in any case.
  - ***Driven timber piles***:
    - This approach is practicable but possibly not cost effective. Piles would be driven to tip bearing in dense glacial fluvial sand or weathered rock.
    - Due to small diameter pile tips, the pile capacity could be as low as 20 K/pile.
    - Pile breakage during driving could occur in the vicinity of boring B2.
  - ***Drilled concrete shafts***: this method is likely practicable with shaft end bearing on weathered rock or dense glacial fluvial sand (*Figure 5A, Figure 5B*).
    - Net allowable bearing pressure on weathered rock is on the order of 16 KSF.
    - Shallower shaft bearing take up in the vicinity of boring B2 should be expected (*Figure 5A*) in dense sand with net allowable bearing on the order of 12 KSF.
  - ***Ductile iron piles***: piles pushed to bear on weathered rock or dense glacial fluvial sand and gravel (*Figure 5A, Figure 5B*). Pile capacity should be provided by the installer's engineer and could be at least 30 K/pile dependent upon pile sizing.

- Existing uncontrolled on-site fill (*Figure 5A, Figure 5B, Table I, Appendix AI*):
  - The quality of some portion of the existing granular fill soil as seen in the borings may meet classification for engineered fill (see later report section: "Engineered Fills and their Uses". If so, it could be placed and compacted in lifts.
  - Excavated granular fill soil would need to be reviewed during earthwork with laboratory soil particle gradation testing of collected samples.
  - However, any large diameter solid waste debris (wood, asphalt, brick) and cobbles and boulders would have to be culled from the granular fill soil (*Appendix A*). Included topsoil and organics would have to be removed as well.

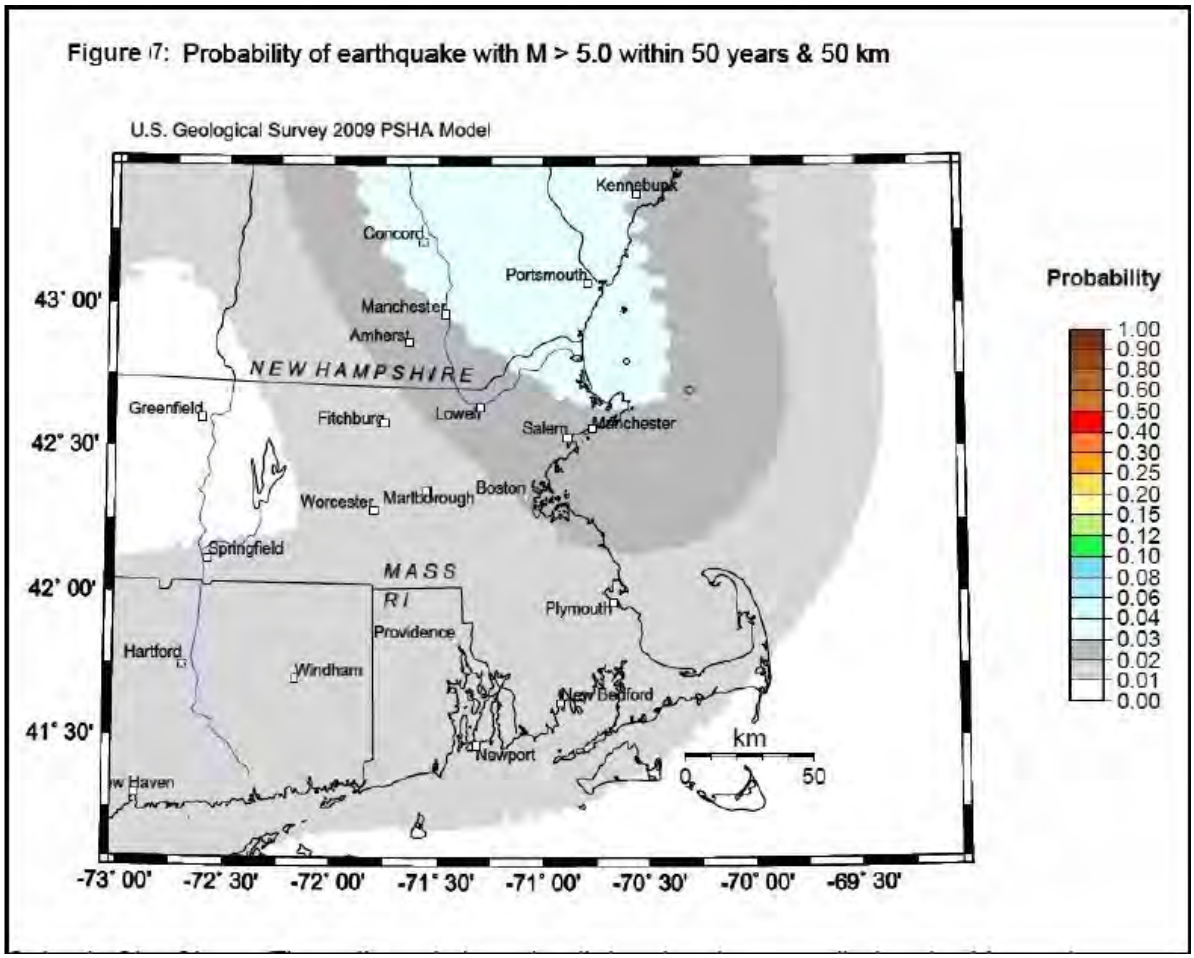
Seismic Recommendations:

- Seismic Site Hazard Review:
  - Probabilistic Site Hard Analysis [*PSHA Interactive Deagregation*; Geologic Hazards Science Center, US Geologic Survey; 2008 v.2]
    - Decimal site latitude and longitude utilized in this review: (42.5412° N, -71.0850° W)
    - Probability of magnitude 5 (M5.0) or greater earthquake occurrence within 50 miles of the subject site within a 50-year building design life is considered relatively low (< 2.5%+/-) according to *Figure 7*.
  - Area earthquake history:
    - Typical measured earthquakes within the past 40 years have magnitude ≤ 3.5+/-
    - Past significant earthquakes with area impact recreated from the geologic record:

Year	Magnitude	Location	Intensity in Boston
1638	6.5	Central New Hampshire	MMI: V-VII
1663	7.0	Charlevoix, Quebec	MMI: V-VI
1727	5.6	Newbury, MA	MMI: V-VI
1755	5.9	Scituate, MA	MMI: IX

MMI: Modified Mercalli Scale (subjective; observed damage and effects)

- Seismic Site Class: The collected site subsoil data has been applied to the Massachusetts adopted *International Building Code (2015)*. According to the *Building Code*
  - Analytic depth:
    - The upper 100 feet of soil and bedrock are subject to analysis.
    - Soil data on-site has generally been collected to likely top of bedrock (*Table I, Figure 5A, Figure 5B*).
    - Native soils tested indicated variable density glacial fluvial soil over likely bedrock (*Table I, Figure 5A, Figure 5B*).
  - Bedrock:
    - Bedrock expected is gabbro (see *Appendix A* and "Area Bedrock Geology" report section).
    - The depth to bedrock ranged from about 13 ft. to 25 ft. depth from existing ground surface.
    - Based upon the data collected this site is classified as seismic Site Class D.



- Seismic Design Factors: Preliminary estimated Earthquake Design Factors for Reading, Massachusetts (*Massachusetts Amendments to the International Building Code (2017; 9th Edition))* and *IBC (2015)*:
  - S_s = 0.234g (short interval)
  - S_1 = 0.072g (1-second interval)
  - F_a = 1.6 (site coefficient, classification as Site Class D)
  - F_v = 2.4 (site coefficient, classification as Site Class D)

Liquefaction:

- Liquefaction Factors:
  - Earthquake magnitude
  - Earthquake amplitude (duration)
  - Subsoil types and condition

- Earthquake Magnitude:
  - Collected data indicates that the probability of occurrence of an earthquake of magnitude 5 or higher is low probable during a 50-year building design life.
  - However, with a time period measured in centuries instead of decades, earthquakes of magnitude 5 or greater can be expected to occur as the earthquakes listed above indicate.

- Earthquake Duration: This topic is beyond the scope of this review.

- Subsoil Data Input: Review of the site subsoil profile was necessary for soil liquefaction determination below structural units:
  - Relevant test boring information: no significant thickness (> 10 ft.; *Table I*) of post compaction, loose to very loose saturated native silty to clean sands and non-plastic silts (SM, SP, SW, ML) would be found below structural units.
  - Drill rig, site groundwater level and measured soil strength data with depth:
    - Drill rig hammer type: drop hammer
    - Groundwater level: El. 81.5 ft. (NAV88), seasonal high (page 15).
    - Plotted field N_{60}-values from the borings with depth (*Figure 3*).

- Site Liquefaction Determination:
  - Review of field auto hammer N_{60} from the borings with depth with respect to *Figure 1806.a* of the *Massachusetts Amendments (2017; 9th Edition)* for preliminary liquefaction exclusion review compared to a range of (seasonal high) groundwater levels.
  - Assumption that site subgrade preparation will be performed as described in the "Excavated Base and Working Base" report section.
  - Result: liquefaction settlement is not of concern for this site were a 5M or greater earthquake to occur here.

Structural Unit Frost Protection Depth:

- Definition:
  - Frost depth, freezing depth or frost line is the depth to which moisture in subsoil is expected to freeze.
  - Frost line varies in position (elevation) during seasonal freeze and thaw.

- *Massachusetts State Building Code* Mandated Frost Protection Depth Changes:
  - 7th Edition: "All foundations for buildings and structures shall extend to a minimum of 4 ft. below (exterior) finished grades…"
  - 8th Edition: Foundations and permanent building supports should be protected by "extending below the frost line of the locality…" **This suggests a 4 ft. frost depth is too deep for coastal and southern areas and too shallow for northern or topographically elevated locales.**

- Site Structural Unit Frost Protection Depth:
  - Frost line:
    - Average area frost line value: 0.9 m = 35.5 in. [J.E. *Bowles; Foundation Analysis and Design 5th Ed.*; 1997; Figure 7-1].

- Extreme frost line based upon state average: 53 in. [NAVFAC DM-7.1; *Soil Mechanics Design Manual 7.1*; Figure 7; 1982].
- Deepest frost observed by us in test borings in eastern Massachusetts: 28 in. (40-year period) coupled with the comment above about coastal area frost depth the recommended minimum site structural unit frost protection depth in soil bearing for this property as measured from exterior grade: = **36 in. (3 ft.)**

- Cold Weather Work Soil Protection:
  - During construction earthwork the contractor must be prepared to provide protection and/or thawing of foundation bearing soils against freezing.
    - Footings: insulation blankets and/or ground heating hoses should be utilized if footing subgrade is exposed to freezing during cold weather periods.
    - Lowest Level Slabs:
      - Typically slab subgrade areas are thawed once basic framing is up by providing heaters after enclosing the lowest level in plastic sheeting.
      - Then any remaining required grade raise fill, treatment and placement of the slab base pad can be properly performed.

Foundation Wall Design (Restrained Walls): no below grade foundation walls in design

Cantilever Earth Retaining Wall Design:

- Retaining Wall Construction:
  - It is not known if a cantilever wall will be required in site design.
  - Clean, free-draining granular backfill should be placed behind a new wall.
  - Weep holes should be provided in the wall to prevent hydrostatic pressure build up behind the wall.
  - Wall should be founded upon compacted structural fill placed upon an undisturbed glacial till subgrade or native conglomerate rock.

- Retaining Wall Design:
  - Backfill design factors: soil at 120 PCF; Φ=30°; k_a = 0.33; triangular soil load distribution
  - Equivalent fluid pressure behind the wall: 40 PCF; level backfill, no surcharge loads; resultant (P), located at P = 1/3 H above base of wall.
  - Surcharge load (Q): an additional, uniform load on the wall = k_a x Q (resultant at 0.5 H)

Drainage and Waterproofing:

- General Comments/Good Practice:
  - Exterior grading at the building should be designed to carry surface water runoff away from the structure.
  - Planted areas or pavements should enhance the exterior grading performed to ensure surface water runoff beyond building limits.
  - Roof downspout water or other water should not be allowed to pool near the building.

- Review Summary of Groundwater and Structural Unit Elevation Data:
  - Building structural unit elevations are estimated as shown on *Figure 5A, Figure 5B*:
  - Groundwater elevation*:* all borings encountered groundwater
    - Found high groundwater elevation in the borings: about El. 80 ft. (NAV88) *(Table II)*
    - Seasonal high groundwater level: estimated at El. 81.5 ft. (NAV88; page 15).
    - Likely deepest bulk excavation point: El. 64 ft.+/- (NAV88; *Table I*)
  - Site flooding: not reviewed by us; review flood potential with project site civil engineer.

- Building Foundation Wall Drainage and Waterproofing:
  - Based upon the data collected, 1st floor frost wall foundation drains are unnecessary.
  - As there is no basement planned, basement level wall drains are irrelevant.

- Lowest Level Floor Slab Drainage and Waterproofing: normally two options exist for the lowest level;
  - Waterproofing Option 1: ground floor slab underdrains: unnecessary
  - Waterproofing Option 2: ground floor level membrane waterproofing such as Preprufe from WR Grace with hydrostatic slab: unnecessary
  - Damp proofing: only normal damp proofing need be provided:
    - Loose laid plastic sheeting; or
    - An under-slab membrane such as Florprufe by WR Grace.

Lowest Level Floor Slabs:

- Floor Slab Type:
  - Lowest level floor as a grade slab would only be expected if the **full** bulk excavation and replacement option is selected which is not practicable on this site.
  - The lowest level slab is a structural slab with any of the other alternative foundation approaches (pages 16-17).

- Groundwater Levels and Lowest Level Slab:
  - The lowest level floor slab itself is not expected to be impacted by groundwater (see Review on page 20; *Figure 5A, Figure 5B*).
  - Refer to the groundwater information provided in the "Groundwater Behavior" report section on pages 14-15.

- Subgrade Modulus: no 1st floor slab or elevator pit slab modulus of subgrade reaction is needed as no grade slabs can safely be installed on this site.

- Under Slab Pads and Slab Control Joints:
  - Lowest level slab base pads will be provided as either compacted ¾ inch crushed stone or compacted structural fill.
  - Slab control joints are usually unnecessary with a 1st floor structural slab.

Excavation and Bracing:

- Excavation Depth ≤ 4 ft.+/- in Soil:
  - Common practice is to maintain a 1H:1V temporary side slope for shallow excavation (≤ 4 ft.+/-) during construction. Benched steps can also be executed.
  - Note that the sidewall stability will be undermined by:
    - Minor sloughing when sidewall bleeding occurs either from release of trapped water in soil or drainage following storm events; and
    - Surficial exposed granular sidewall soil drying and subsequent caving or sloughing.

  - Excavation > 4 ft. in Soil:
    - Excavation here is not expected to exceed 4 ft. depth (*Figure 5A, Figure 5B*) in general and slightly deeper at the elevator pit.
    - Any excavation > 4 ft. depth would take place within site granular soils which can be classified as **OSHA Type C** subsoils (*Appendix A*).
      - Excavate with a 1.5 H:1 V sidewall layback. A braced excavation is required where adequate lateral space does not exist for a temporary sloped excavation (**layback**).
      - Since layback space is adequate on this site, support of excavation is unlikely to be required.

Elevator:

- Elevator Pit Support:
  - The elevator pit base is assumed to bear at about 5 feet below lowest level slab.
    - Elevator system will likely be supported upon perimeter piles or a pile supported structural mat.

- Elevator Pit Uplift, Drainage and Waterproofing:
  - Groundwater will not impact either elevator pit installation or the pit base by uplift.
  - Pit waterproofing is typically provided as the pit is the lowest elevation excavation point in the structure. Here it is above groundwater.
    - Pit waterproofing should consist of installation of a positive side membrane system such as PrePrufe or equivalent.
    - Elevator pit construction should require properly tied continuous water stops in construction joints.

Construction Dewatering:

- Groundwater Impact:
  - Based upon the data collected to-date, groundwater seepage into recommended depth excavations for foundations and floor slab is unlikely (*Table II, Figure 5A, Figure 5B*).
  - Rain and melt seepage water into excavations should be expected.
  - Refer also to the "Groundwater Behavior" report section on pages 14-15, and the foundation preparation sections on pages 16-17.

- Dewatering Required:
  - Intruding water into normal level site excavation would be from rain and melt events.
  - Water at this level can be controlled by ditching to filtered sumps.

- Pumped Discharge:
  - Discharge of any pumped water should be performed in accord with all City, Commonwealth and Federal regulations. Filtering of pumped water prior to discharge should be expected.
  - Permitting required by the USEPA, MWRA, or the City should be reviewed. Assessment by the Project Civil Engineer should be sought.
  - The contractor would be responsible for obtaining all permits and any associated laboratory testing required for construction dewatering.
  - Based upon City requirements the contractor may be required to use frac tanks to temporarily store pumped water at the work site. This possibility should be reviewed in conjunction with the Project Civil Engineer.

Paved Area and Pickleball Court Borings:

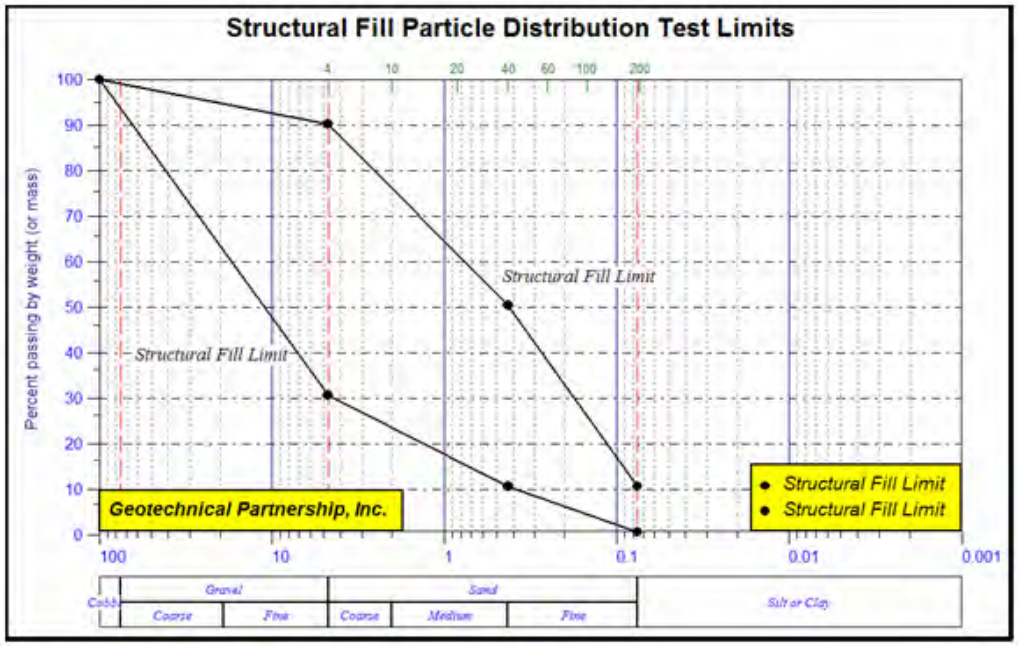
- Structural borings B5 through B12 (*Appendix A*) were drilled in the proposed paved parking and pickleball court areas (see *Figure 2*).
- The same mix of soils (fill, glacial fluvial) were found in these borings (*Appendix A)* at variable density as has been reported for the Community Building.
- Remnant groundwater monitoring wells designated B and C also exist in these areas (see *Figure 2*). Water level depths from ground surface were found to be 4.6 ft. and 8.2 ft., respectively.
- Ground surface elevations at the borings can be determined by others from the existing site survey plan.
- The logs of the borings should be shared with the site civil engineer as well as the landscape architect to help them with their design of pavement sections and consideration of the need of excavation and replacement and/or deep compaction base preparation in these areas.

Engineered Fills and their Uses:

- Crushed stone: ¾ in. clean, hard, durable crushed stone; uses:
  - As a construction working pad
  - As a surface protection below footings
  - As drainage media in wall and under slab drainage systems.

- Gravel: sandy gravel, bank run gravel; max. 3-in. gravel; limit No. 200 sieve content to about 6%; uses:
  - As base in a pavement section

- Structural fill: hard, durable sand and gravel.
  - Common gradation limits for structural fill are given in the plot shown below.
  - Gradation adjustments: gradations often specify
    - Minimum of 2% passing No. 200 to aid compaction
    - Maximum of 15% passing No. 200 with the assumption that work may not proceed during wet conditions using this material (Dense Grade can be substituted)
  - Structural Fill Uses (in lieu of crushed stone):
    - To form a protective base directly below footings or pile caps
    - As a slab base pad
    - As a replacement fill below structural units (over-excavated soft areas)
    - As sub base in a pavement section



- Dense Grade Structural Fill/2-in. Crushed Stone: Structural fill/crushed stone meeting the following minimum requirements

Sieve Size	Percent Finer by Weight
2 in.	100
1.5 in.	70 – 100
¾ in.	50 – 85
No. 4	30 – 55
No. 50	8 – 24
No. 200	3 – 10

- Dense grade structural fill uses:
  - As a readily workable replacement for conventional or recycled concrete type structural fill when work must proceed during cold and/or wet conditions.
  - As a base pad for lowest level floor slabs, footings or pile caps

- Granular Fill: minor gravel; primarily medium to fine sand and silt meeting the following

Sieve Size	Percent Finer by Weight
4 in.	100
No. 10	30 – 95
No. 40	10 – 70
No. 200	0 – 15*

** May be as high as 20% if field compaction can be verified in **dry** conditions*

  - Granular Fill Uses:
    - As under slab fill below 12 in. depth as measured from the slab base.
    - As densified trench backfill

Re-use of Existing Site Subsoils as Engineered Fill:

- Existing Granular Fill:
  - Granular fill has been found from 1 ft. to 9.5 ft. depth within the community building area (*Figure 5A, Figure 5B, Appendix A*).
    - It tends to be a coarse to fine sand with zones of siltier sand and those of more predominant gravel (*Appendix A*).
    - It can contain scant gravel (*Appendix A*).
    - It can contain included organics and topsoil (*Appendix A*).
  - If the sandy granular fill has adequate gravel content and can be separated from the undesirable included material, it may be re-used as engineered fill (see previous section: "Engineered Fills and their Uses") pending results of construction phase soil particle gradation test results.
  - Any found excavated granular fill soil should be considered non-engineered:
    - Thus, undertaking laboratory Proctor and associated field compaction tests is not useful as the silt-sand-gravel ratios will vary.
    - Re-use of these soils on-site would require experienced third-party field observation of compaction equipment behavior, supported by consideration of addition of water to dry soil or drying of saturated soils (harrowing, land spreading) as needed.

- Existing SP Sandy Glacial Fluvial Soil: this native soil material where excavated can be treated as described above for granular fill (*Figure 5A, Figure 5B, Appendix A*).

Thank you for inviting us to perform this site study. Please contact us with any questions.

Sincerely yours,
Geotechnical Partnership, Inc.

Lisa R. Casselli, PE
Principal

Attachments: *Appendix A*: *Logs of Test Borings B1 to B12*

APPENDIX A: Logs of Structural Test Borings B1 through B12

51 Symonds Way
Reading, Massachusetts

Geotechnical Partnership, Inc.
Fitchburg, MA
File No. 2436

Geotechnical Partnership, Inc. Fitchburg, MA Geotechnical Services	Date Drilled : 23 November 2024 Boring Location : Refer to Report Figure 2 Drilling Contractor : Cosmo Drilling : Ocean Bluff, MA Driller : E. Sviokla Rock Core : --- GPI Field Engineer : F. Sviokla Elevation and Datum : El. 86 ft. (NAV88) Drilling Mud Utilized : Not necessary Constant Water Head : Drive & Wash	**Test Boring No. B-1** (1 of 1) Drill Rig Type : Tripod Mounted Hammer Type : Drop Cat-Head or Winch : Cat-Head Soil Casing Type : 3 in. BW Sampler Type : SS - 1.375 in. I.D.; unlined Sampler Hammer Fall : 140 lbs. / 30 in.
PROJECT: New Construction New Communinity Center - Range Rd. Reading, Massachusetts CLIENT: Bargmann Hendrie & Archtype, Inc. File No. 2436		

Depth in Feet	Elev. in Feet	DESCRIPTIONS	USCS	Sample No.	Blow Count	Blow Count Graph (10 50)	Average qu-Field	Average qu-Field (TSF) (0 1 2 3 4)	REMARKS
0	86	LEAF LITTER, DUFF & FIBROUS TOPSOIL	AR						Groundwater=7.0' Well Set: no
1	85	Brown, fine SAND, few silt, trace fine gravel (sub-angular), (loose to medium dense, dry to moist)	SP	1	11 9 4 4				SS-1: 1' - 3' R=9 N=13
2	84								
3	83	Brown, coarse to fine SAND, trace fine gravel (sub-rounded), and silt, (loose to medium dense, dry)		2	6 7 5 6				SS-2: 3' - 5' R=14 N=12
4	82								
5	81	Brown, coarse to fine SAND, trace fine gravel (sub-rounded), and silt, (loose, very moist) 6.0 ft. -GLACIAL FLUVIAL-		3	6 5 5 5				SS-3: 5' - 7' R=13 N=10
6	80								
7	79	Light brown, fine SAND (uniform), trace silt, (loose, wet)		4	4 4 3 3				SS-4: 7' - 9' R=12 N=7
8	78								
9	77								
10	76	Light gray, fine SAND (uniform), trace silt, (loose, wet)		5	5 5 4 6				SS-5: 10' - 12' R=18 N=9
11	75								
12	74	Light brown, fine SAND (uniform), trace silt, (medium dense, wet)		6	7 7 7 16				SS-6: 12' - 14' R=19 N=14
13	73								
14	72	14.0 ft. -GLACIAL FLUVIAL-							
15	71	Light gray, coarse to fine SAND, few silt, (dense, wet), over black weathered gabbro fragments 15.4 ft. -GLACIAL FLUVIAL-	SP	7	22 20 100				SS-7: 14' - 15.4' R=13 N=120
16	70	END OF BORING @ 15.4 FT DEPTH POSSIBLE BEDROCK							P=Penetrometer
17	69	Particle Size: trace: <5%; few: 5-10%; little: 15-20%; some 30-45%; mostly: 50-100%							
18									

COHESIONLESS SOILS: (DENSITY) L: Sands; R: Gravels	0-6 Very Loose 0-8 6-10 Loose 8-15 11-30 Med-Dense 16-40 >30 Dense 41-50 Very Dense >50	COHESIVE SOILS: (CONSISTENCY) 0-2 Very Soft (<0.25 TSF) 2-4 Soft (0.25-0.5 TSF) 4-8 Med. Stiff (0.5-1.0 TSF) 9-20 Stiff (1.0-4.0 TSF) >20 Hard (>4.0 TSF)

Test Boring No. B-1
(1 of 1)

Geotechnical Partnership, Inc.
Fitchburg, MA

Geotechnical Services

PROJECT: New Construction
New Communinity Center - Range Rd.
Reading, Massachusetts

CLIENT: Bargmann Hendrie & Archtype, Inc.

File No. 2436

Date Drilled	: 23 November 2024
Boring Location	: Refer to Report Figure 2
Drilling Contractor	: Cosmo Drilling
	: Ocean Bluff, MA
Driller	: E. Sviokla
Rock Core	: ---
GPI Field Engineer	: F. Sviokla
Elevation and Datum	: El. 88 ft.+/- (NAV88)
Drilling Mud Utilized	: Not necessary
Constant Water Head	: Drive & Wash

Test Boring No. B-2
(1 of 1)

Drill Rig Type	: Tripod Mounted
Hammer Type	: Drop
Cat-Head or Winch	: Cat-Head
Soil Casing Type	: 3 in. BW
Sampler Type	: SS - 1.375 in. I.D.; unlined
Sampler Hammer Fall	: 140 lbs. / 30 in.

Depth in Feet	Elev. in Feet	DESCRIPTIONS	USCS	Sample No.	Blow Count	Blow Count Graph (10 50)	Average qu-Field	Average qu-Field (TSF) (0 1 2 3 4)	REMARKS
0	88	MOSS & CRUSHED STONE OVER GRANULAR FILL	AR						Groundwater=8.0'
1	87	Dark brown, coarse to fine SAND, little coarse to fine gravel (angular to sub-angular), few silt, (medium dense, moist)		1	20 11 15 99				Well Set: no SS-1: 1' - 3' R=16 N=26
2	86								
3	85	Brown, coarse to fine GRAVEL (angular to sub-rounded), some coarse to fine sand, few silt, (dense, moist)	AR	2	52 49 34 32				SS-2: 3' - 5' R=14 N=83
4	84								
5	83	5.0 ft. -GRANULAR FILL- Light brown/tan, fine SAND (uniform), little fine gravel (sub-angular), few silt, (dense, moist)		3	25 28 39 23				SS-3: 5' - 7' R=20 N=67
6	82								
7	81	Brown, coarse to fine SAND, some coarse to fine gravel (angular to sub-angular), few silt, (dense, wet)		4	18 21 30 21				SS-4: 7' - 9' R=16 N=51
8	80								
9	79		SP/GP						
10	78	Brown, fine GRAVEL (angular to sub-rounded), few coarse to fine sand, and silt, (dense, wet)		5	8 12 22 18				SS-5: 10' - 12' R=15 N=34
11	77								
12	76	Black & brown, coarse GRAVEL (angular), little coarse to fine sand, trace silt, (dense, wet)		6	35 41 100				SS-6: 12' - 13.2' R=11 N=141
13	75	13.2 ft. -GLACIAL FLUVIAL-							P=Penetrometer
14	74	END OF BORING @ 13.2 FT DEPTH POSSIBLE GABBRO BEDROCK							
15		Particle Size: trace: <5%; few: 5-10%; little: 15-20%; some 30-45%; mostly: 50-100%							

COHESIONLESS SOILS: (DENSITY) L: Sands; R: Gravels
0-6 Very Loose 0-8
6-10 Loose 8-15
11-30 Med-Dense 16-40
>30 Dense 41-50
Very Dense >50

COHESIVE SOILS: (CONSISTENCY)
0-2 Very Soft (<0.25 TSF)
2-4 Soft (0.25-0.5 TSF)
4-8 Med. Stiff (0.5-1.0 TSF)
9-20 Stiff (1.0-4.0 TSF)
>20 Hard (>4.0 TSF)

Test Boring No. B-2
(1 of 1)

Geotechnical Partnership, Inc.
Fitchburg, MA

Geotechnical Services

PROJECT: New Construction
New Communinity Center - Range Rd.
Reading, Massachusetts

CLIENT: Bargmann Hendrie & Archtype, Inc.

File No. 2436

Date Drilled	: 24 November 2024
Boring Location	: Refer to Report Figure 2
Drilling Contractor	: Cosmo Drilling
	: Ocean Bluff, MA
Driller	: E. Sviokla
Rock Core	: ---
GPI Field Engineer	: F. Sviokla
Elevation and Datum	: El. 86 ft.+/- (NAV88)
Drilling Mud Utilized	: Not necessary
Constant Water Head	: Drive & Wash

Test Boring No. B-3
(1 of 1)

Drill Rig Type	: Tripod Mounted
Hammer Type	: Drop
Cat-Head or Winch	: Cat-Head
Soil Casing Type	: 3 in. BW
Sampler Type	: SS - 1.375 in. I.D.; unlined
Sampler Hammer Fall	: 140 lbs. / 30 in.

Depth in Feet	Elev. in Feet	DESCRIPTIONS	USCS	Sample No.	Blow Count	Blow Count Graph (10 50)	Average qu-Field	Average qu-Field (TSF) (0 1 2 3 4)	REMARKS
0	86	LEAF LITTER, DUFF & TOPSOIL	AR						Groundwater=8 ft. Well Set: no
1	85	Light brown, coarse to fine SAND, little coarse to fine gravel (sub-rounded), trace silt, (medium dense, moist)		1	3 5 7 8				SS-1: 1' - 3' R=14 N=12
2	84								
3	83	Brown & rust-brown, coarse to fine SAND, few fine gravel (sub-rounded), trace silt, (loose, moist)		2	8 6 4 5				SS-2: 3' - 5' R=11 N=10
4	82								
5	81	Light brown, coarse to fine SAND, little fine gravel (sub-rounded), trace silt, (medium dense, moist)	SP	3	6 6 6 7				SS-3: 5' - 7' R=9 N=12
6	80								
7	79	Tan & rust-brown, coarse to fine SAND, few fine gravel (sub-rounded), (loose to medium dense, moist to wet)		4	7 7 6 4				SS-4: 7' - 9' R=16 N=13
8	78								
9	77	9.0 ft. -GLACIAL FLUVIAL-							
10	76	Gray-brown, fine SAND (uniform), trace silt, (very loose, wet)		5	4 1 2 2				SS-5: 10' - 12' R=17 N=3
11	75								
12	74	Gray, fine SAND (uniform), trace silt, (loose, wet)		6	4 4 4 5				SS-6: 12' - 14' R=19 N=8
13	73								
14	72		SP						
15	71	Gray, fine SAND (uniform), trace silt, (loose, wet)		7	3 4 3 3				SS-7: 15' - 17' R=19 N=7
16	70								
17	69	Gray, fine SAND (uniform), trace silt, (loose, wet)		8	3 3 4 4				SS-7: 17 - 19' R=20 N=7
18	68								
19	67	19.5 ft. -GLACIAL FLUVIAL-							SS-7: 19' - 21' R=14 N=96
20	66	Black & gray, coarse gravel (rock fragments), few silt, (very dense, wet)	GR	9	8 30 66 61				P=Penetrometer
21	65	21.0 ft. -WEATHERED/BROKEN /ROCK-							
22	64	END OF BORING @ 21 FT DEPTH POSSIBLE GABBRO BEDROCK							
23		Particle Size: trace: <5%; few: 5-10%; little: 15-20%; some 30-45%; mostly: 50-100%							

COHESIONLESS SOILS: (DENSITY) L: Sands; R: Gravels
0-6 Very Loose 0-8
6-10 Loose 8-15
11-30 Med-Dense 16-40
>30 Dense 41-50
Very Dense >50

COHESIVE SOILS: (CONSISTENCY)
0-2 Very Soft (<0.25 TSF)
2-4 Soft (0.25-0.5 TSF)
4-8 Med. Stiff (0.5-1.0 TSF)
9-20 Stiff (1.0-4.0 TSF)
>20 Hard (>4.0 TSF)

Test Boring No. B-3
(1 of 1)

Geotechnical Partnership, Inc.
Fitchburg, MA

Geotechnical Services

PROJECT: New Construction
New Communinity Center - Range Rd.
Reading, Massachusetts

CLIENT: Bargmann Hendrie & Archtype, Inc.

File No. 2436

Date Drilled	: 24 November 2024
Boring Location	: Refer to Report Figure 2
Drilling Contractor	: Cosmo Drilling
	: Ocean Bluff, MA
Driller	: E. Sviokla
Rock Core	: ---
GPI Field Engineer	: F. Sviokla
Elevation and Datum	: El. 88 ft.+/- (NAV88)
Drilling Mud Utilized	: Not necessary
Constant Water Head	: Drive & Wash

Test Boring No. B-4.
(1 of 1)

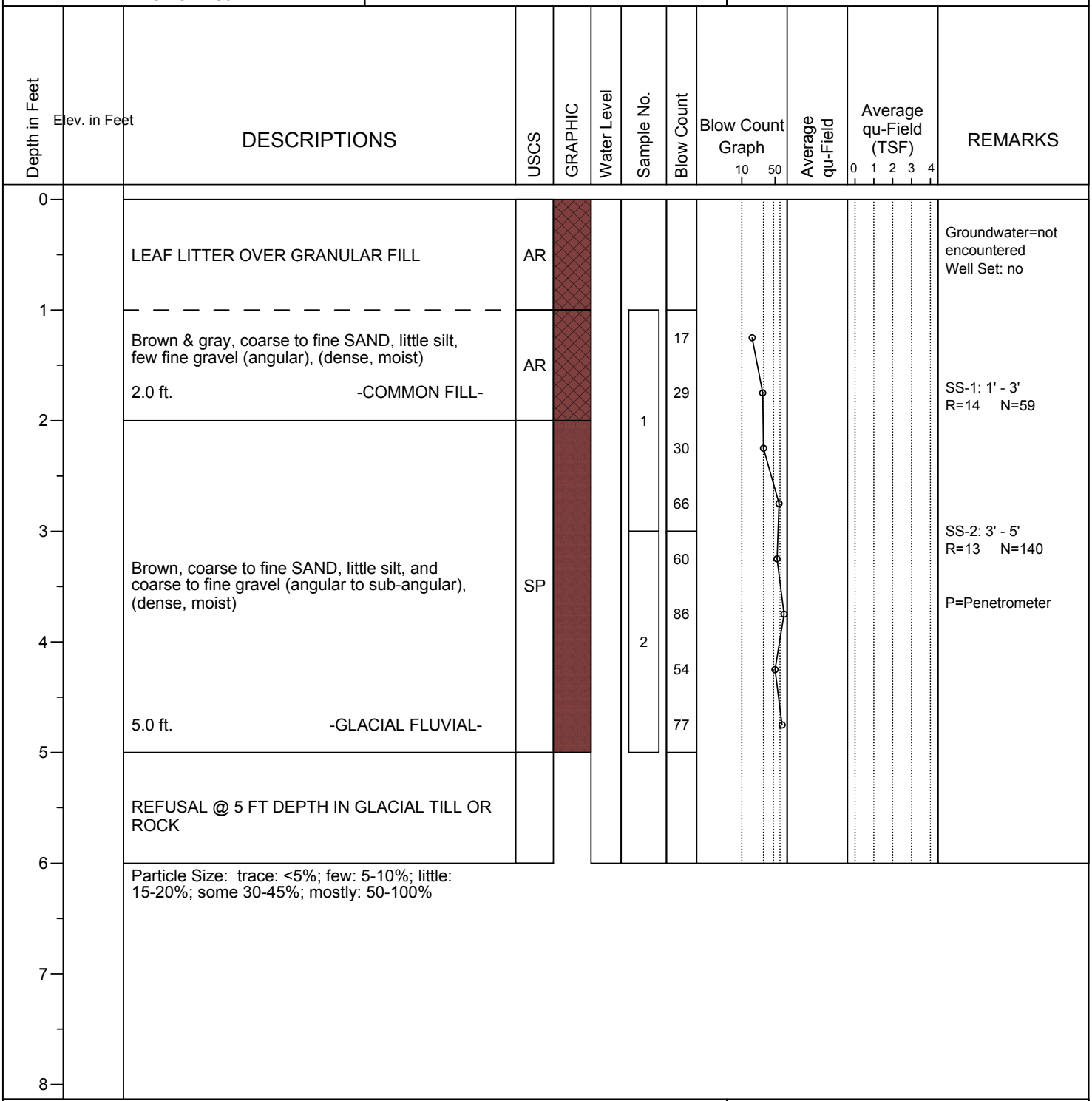
Drill Rig Type	: Tripod Mounted
Hammer Type	: Drop
Cat-Head or Winch	: Cat-Head
Soil Casing Type	: 3 in. BW
Sampler Type	: SS - 1.375 in. I.D.; unlined
Sampler Hammer Fall	: 140 lbs. / 30 in.

Depth in Feet	Elev. in Feet	DESCRIPTIONS	USCS	Sample No.	Blow Count	Blow Count Graph (10 50)	Average qu-Field	Average qu-Field (TSF) (0 1 2 3 4)	REMARKS
0	88	LEAF LITTER & DUFF	AR						Groundwater=8 ft. Well Set: no
1	87	Dark brown, coarse to fine SAND, some coarse gravel (angular to sub-rounded), (loose, moist), infillings of dark-brown fibrous topsoil & leaves		1	3 3 6 6				SS-1: 1' - 3' R=14 N=9
2	86								
3	85	Brown, coarse to fine SAND, few silt & organic silt, (very loose, moist)		2	5 2 3 3				SS-2: 3' - 5' R=9 N=5
4	84								
5	83	Dark brown, SILT LOAM TOPSOIL/PEAT (remolded, filled), little coarse gravel (sub-angular), (very loose, very moist)	AR	3	4 3 2 2				SS-3: 5' - 7' R=11 N=5
6	82								
7	81	Light gray, coarse to fine SAND, few coarse gravel (angular to sub-rounded) and organic silt, (very loose, wet)		4	4 2 2 2				SS-4: 7' - 9' R=9 N=4
8	80								
9	79	9.5 ft. -FILL WITH ORGANICS-							
10	78	Light brown/tan, coarse to fine SAND, little coarse gravel (angular), trace silt, (medium dense, wet)		5	8 12 9 10				SS-5: 10' - 12' R=12 N=21
11	77								
12	76	Light brown, coarse to fine SAND, few coarse to fine gravel (angular), trace silt, (medium dense, wet)	SP	6	9 8 8 8				SS-6: 12' - 14' R=14 N=16
13	75								
14	74								
15	73	Brown, coarse to fine SAND, trace fine gravel (sub-angular to sub-rounded) and silt, (medium dense, wet)		7	8 8 6 4				SS-7: 15' - 17' R=16 N=14
16	72								
17	71	17.5 ft. -GLACIAL FLUVIAL-							
18	70								
19	69								
20	68	Brown/tan, coarse to fine SAND, trace fine gravel (sub-rounded) and silt, (loose, wet)	SP	8	5 5 5 6				SS-8: 20' - 22' R=18 N=10
21	67								
22	66	22.0 ft. -GLACIAL FLUVIAL-							P=Penetrometer
		END OF BORING @ 22 FT DEPTH							
23	65	Particle Size: trace: <5%; few: 5-10%; little: 15-20%; some 30-45%; mostly: 50-100%							
24									

COHESIONLESS SOILS: (DENSITY) L: Sands; R: Gravels	0-6 Very Loose	0-8	COHESIVE SOILS: (CONSISTENCY) 0-2 Very Soft (<0.25 TSF)
	6-10 Loose	8-15	2-4 Soft (0.25-0.5 TSF)
	11-30 Med-Dense	16-40	4-8 Med. Stiff (0.5-1.0 TSF)
	>30 Dense	41-50	9-20 Stiff (1.0-4.0 TSF)
	Very Dense	>50	>20 Hard (>4.0 TSF)

Test Boring No. B-4.
(1 of 1)

Geotechnical Partnership, Inc. Fitchburg, MA Geotechnical Services	Date Drilled : 27 November 2024 Boring Location : Refer to Report Figure 2 Drilling Contractor : Cosmo Drilling : Ocean Bluff, MA Driller : E. Sviokla Rock Core : --- GPI Field Engineer : F. Sviokla Elevation and Datum : Drilling Mud Utilized : Not necessary Constant Water Head : Drive & Wash	**Test Boring No. B-5** (1 of 1) Drill Rig Type : Tripod Mounted Hammer Type : Drop Cat-Head or Winch : Cat-Head Soil Casing Type : 3 in. BW Sampler Type : SS - 1.375 in. I.D.; unlined Sampler Hammer Fall : 140 lbs. / 30 in.
PROJECT: New Construction New Communinity Center - Range Rd. Reading, Massachusetts CLIENT: Bargmann Hendrie & Archtype, Inc. File No. 2436		



COHESIONLESS SOILS: (DENSITY) L: Sands; R: Gravels	0-6 Very Loose 6-10 Loose 11-30 Med-Dense >30 Dense Very Dense	0-8 8-15 16-40 41-50 >50	COHESIVE SOILS: (CONSISTENCY) 0-2 Very Soft (<0.25 TSF) 2-4 Soft (0.25-0.5 TSF) 4-8 Med. Stiff (0.5-1.0 TSF) 9-20 Stiff (1.0-4.0 TSF) >20 Hard (>4.0 TSF)

Test Boring No. B-5
(1 of 1)

Geotechnical Partnership, Inc. Fitchburg, MA Geotechnical Services	Date Drilled : 25 November 2024 Boring Location : Refer to Report Figure 2 Drilling Contractor : Cosmo Drilling : Ocean Bluff, MA Driller : E. Sviokla Rock Core : --- GPI Field Engineer : F. Sviokla Elevation and Datum : Drilling Mud Utilized : Not necessary Constant Water Head : Drive & Wash	**Test Boring No. B-6** (1 of 1) Drill Rig Type : Tripod Mounted Hammer Type : Drop Cat-Head or Winch : Cat-Head Soil Casing Type : 3 in. BW Sampler Type : SS - 1.375 in. I.D.; unlined Sampler Hammer Fall : 140 lbs. / 30 in.
PROJECT: New Construction New Communinity Center - Range Rd. Reading, Massachusetts CLIENT: Bargmann Hendrie & Archtype, Inc. File No. 2436		

Depth in Feet	Elev. in Feet	DESCRIPTIONS	USCS	GRAPHIC	Water Level	Sample No.	Blow Count	Blow Count Graph (10 50)	Average qu-Field	Average qu-Field (TSF) (0 1 2 3 4)	REMARKS
0											Groundwater=7' Well Set: no
1		LEAF LITTER & DUFF	AR								
2		TOPSOIL, LEAVES, VINES & ROOTS				1	1 1 1 2				SS-1: 1' - 3' R=7 N=2
3		Black & dark brown, fine SAND, trace fine gravel (sub-angular), and organic silt, (loose, moist), frequent infillings of remolded topsoil	AR			2	4 4 3 3				SS-2: 3' - 5' R=10 N=7
4											
5		Dark brown, fine SAND, (loose, moist), frequent root clusters				3	6 4 5 6				SS-3: 5' - 7' R=14 N=9
6		6.5 ft. -FILL WITH ORGANICS-									
7		Dark brown to brown, medium to fine SAND, trace fine gravel (rounded), (medium dense, very moist)	SP		▼	4	6 7 8 8				SS-4: 7' - 9' R=15 N=15 P=Penetrometer
8		9.0 ft. -GLACIAL FLUVIAL-									
9		END OF BORING @ 9 FT DEPTH									
10		Particle Size: trace: <5%; few: 5-10%; little: 15-20%; some 30-45%; mostly: 50-100%									
11											

COHESIONLESS SOILS: (DENSITY) L: Sands; R: Gravels	0-6 Very Loose 0-8 6-10 Loose 8-15 11-30 Med-Dense 16-40 >30 Dense 41-50 Very Dense >50	COHESIVE SOILS: (CONSISTENCY) 0-2 Very Soft (<0.25 TSF) 2-4 Soft (0.25-0.5 TSF) 4-8 Med. Stiff (0.5-1.0 TSF) 9-20 Stiff (1.0-4.0 TSF) >20 Hard (>4.0 TSF)

Test Boring No. B-6
(1 of 1)

Geotechnical Partnership, Inc.
Fitchburg, MA

Geotechnical Services

PROJECT: New Construction
New Communinity Center - Range Rd.
Reading, Massachusetts

CLIENT: Bargmann Hendrie & Archtype, Inc.

File No. 2436

Date Drilled	: 25 November 2024
Boring Location	: Refer to Report Figure 2
Drilling Contractor	: Cosmo Drilling
	: Ocean Bluff, MA
Driller	: E. Sviokla
Rock Core	: ---
GPI Field Engineer	: F. Sviokla
Elevation and Datum	:
Drilling Mud Utilized	: Not necessary
Constant Water Head	: Drive & Wash

Test Boring No. B-7
(1 of 1)

Drill Rig Type	: Tripod Mounted
Hammer Type	: Drop
Cat-Head or Winch	: Cat-Head
Soil Casing Type	: 3 in. BW
Sampler Type	: SS - 1.375 in. I.D.; unlined
Sampler Hammer Fall	: 140 lbs. / 30 in.

Depth in Feet	Elev. in Feet	DESCRIPTIONS	USCS	GRAPHIC	Water Level	Sample No.	Blow Count	Blow Count Graph (10 50)	Average qu-Field	Average qu-Field (TSF) (0 1 2 3 4)	REMARKS
0		LEAF LITTER OVER TOPSOIL	AR								Groundwater=not encountered Well Set: no
1		Brown, coarse to fine SAND, some coarse to fine gravel (angular to sub-rounded), few silt, (medium dense, moist)	SP			1	6 9 12				SS-1: 1' - 3' R=12 N=21
2											
3						2	10 12				SS-2: 3' - 5' R=16 N=31
		Brown/tan, fine SAND, few silt, trace fine gravel (sub-rounded to rounded), (dense, moist)					18				
4		4.5 ft. -GLACIAL FLUVIAL-					13				
		Brown, coarse GRAVEL (angular), little coarse to fine sand, few silt, (dense, moist)	GP				77				
5		5.4 ft. -GLACIAL FLUVIAL-				3	100				SS-3: 5' - 5.4' R=4 N=100 P=Penetrometer
		REFUSAL @ 5.4 FT DEPTH									
6											
7		Particle Size: trace: <5%; few: 5-10%; little: 15-20%; some 30-45%; mostly: 50-100%									
8											

COHESIONLESS SOILS: (DENSITY) L: Sands; R: Gravels	0-6 Very Loose	0-8	COHESIVE SOILS: (CONSISTENCY) 0-2 Very Soft (<0.25 TSF)
	6-10 Loose	8-15	2-4 Soft (0.25-0.5 TSF)
	11-30 Med-Dense	16-40	4-8 Med. Stiff (0.5-1.0 TSF)
	>30 Dense	41-50	9-20 Stiff (1.0-4.0 TSF)
	Very Dense	>50	>20 Hard (>4.0 TSF)

Test Boring No. B-7
(1 of 1)

Geotechnical Partnership, Inc. Fitchburg, MA Geotechnical Services	Date Drilled : 25 November 2024 Boring Location : Refer to Report Figure 2 Drilling Contractor : Cosmo Drilling : Ocean Bluff, MA Driller : E. Sviokla Rock Core : --- GPI Field Engineer : F. Sviokla Elevation and Datum : Drilling Mud Utilized : Not necessary Constant Water Head : Drive & Wash	**Test Boring No. B-8** (1 of 1) Drill Rig Type : Tripod Mounted Hammer Type : Drop Cat-Head or Winch : Cat-Head Soil Casing Type : 3 in. BW Sampler Type : SS - 1.375 in. I.D.; unlined Sampler Hammer Fall : 140 lbs. / 30 in.
PROJECT: New Construction New Communinity Center - Range Rd. Reading, Massachusetts CLIENT: Bargmann Hendrie & Archtype, Inc. File No. 2436		

Depth in Feet	Elev. in Feet	DESCRIPTIONS	USCS	GRAPHIC	Water Level	Sample No.	Blow Count	Blow Count Graph (10 50)	Average qu-Field	Average qu-Field (TSF) (0 1 2 3 4)	REMARKS
0		LEAF LITTLER OVER TOPSOIL	AR								Groundwater=not encountered Well Set: no
1		Tan, fine SAND (uniform), few silt, trace fine gravel (rounded), (loose, moist)				1	4 3 4 6				SS-1: 1' - 3' R=13 N=7
3											SS-2: 3' - 5' R=15 N=10
4		Light gray, fine SAND (uniform), trace silt, (loose, moist)	SP			2	6 5 5 6				
5											SS-3: 5' - 7' R=12 N=11 P=Penetrometer
6		Light gray, coarse to fine SAND, little coarse to fine gravel (angular to sub-rounded), trace silt, (loose to medium dense, moist) 7.0 ft. -GLACIAL FLUVIAL-				3	6 7 4 4				
7		Bottom of Exploration at 7 feet Depth									
8		Particle Size: trace: <5%; few: 5-10%; little: 15-20%; some 30-45%; mostly: 50-100%									
9											

COHESIONLESS SOILS: (DENSITY) L: Sands; R: Gravels	0-6 Very Loose 0-8 6-10 Loose 8-15 11-30 Med-Dense 16-40 >30 Dense 41-50 Very Dense >50	COHESIVE SOILS: (CONSISTENCY) 0-2 Very Soft (<0.25 TSF) 2-4 Soft (0.25-0.5 TSF) 4-8 Med. Stiff (0.5-1.0 TSF) 9-20 Stiff (1.0-4.0 TSF) >20 Hard (>4.0 TSF)

Test Boring No. B-8
(1 of 1)

Geotechnical Partnership, Inc. Fitchburg, MA Geotechnical Services	Date Drilled : 25 November 2024 Boring Location : Refer to Report Figure 2 Drilling Contractor : Cosmo Drilling : Ocean Bluff, MA Driller : E. Sviokla Rock Core : --- GPI Field Engineer : F. Sviokla Elevation and Datum : Drilling Mud Utilized : Not necessary Constant Water Head : Drive & Wash	**Test Boring No. B-9** (1 of 1) Drill Rig Type : Tripod Mounted Hammer Type : Drop Cat-Head or Winch : Cat-Head Soil Casing Type : 3 in. BW Sampler Type : SS - 1.375 in. I.D.; unlined Sampler Hammer Fall : 140 lbs. / 30 in.

PROJECT: New Construction
New Communinity Center - Range Rd.
Reading, Massachusetts

CLIENT: Bargmann Hendrie & Archtype, Inc.

File No. 2436

Depth in Feet	Elev. in Feet	DESCRIPTIONS	USCS	GRAPHIC	Water Level	Sample No.	Blow Count	Blow Count Graph (10 50)	Average qu-Field	Average qu-Field (TSF) (0 1 2 3 4)	REMARKS
0		LEAF LITTER OVER FIBROUS TOPSOIL	AR								Groundwater=not encountered Well Set: no
1		Brown, coarse to fine SAND, little coarse to fine gravel (angular), trace silt, (medium dense, moist)	SP			1	4 8				SS-1: 1' - 3' R=16 N=24
2		2.0 ft. -GLACIAL FLUVIAL-					16				
3		Gray, coarse to fine SAND, some coarse to fine gravel (sub-angular), few silt, (dense, moist) 3.5 ft. -GLACIAL FLUVIAL-	SP			2	35 100				SS-2: 3' - 3.5' R=4 N=100 P=Penetrometer
4		END OF BORING @ 3.5 FT DEPTH REFUSAL IN NESTED BOULDERS									
5		Particle Size: trace: <5%; few: 5-10%; little: 15-20%; some 30-45%; mostly: 50-100%									
6											
7											
8											

COHESIONLESS SOILS: (DENSITY) L: Sands; R: Gravels			COHESIVE SOILS: (CONSISTENCY)	
0-6	Very Loose	0-8	0-2	Very Soft (<0.25 TSF)
6-10	Loose	8-15	2-4	Soft (0.25-0.5 TSF)
11-30	Med-Dense	16-40	4-8	Med. Stiff (0.5-1.0 TSF)
>30	Dense	41-50	9-20	Stiff (1.0-4.0 TSF)
	Very Dense	>50	>20	Hard (>4.0 TSF)

Test Boring No. B-9
(1 of 1)

Geotechnical Partnership, Inc. Fitchburg, MA Geotechnical Services	Date Drilled : 26 November 2024 Boring Location : Refer to Report Figure 2 Drilling Contractor : Cosmo Drilling : Ocean Bluff, MA Driller : E. Sviokla Rock Core : --- GPI Field Engineer : F. Sviokla Elevation and Datum : Drilling Mud Utilized : Not necessary Constant Water Head : Drive & Wash
PROJECT: New Construction New Communinity Center - Range Rd. Reading, Massachusetts CLIENT: Bargmann Hendrie & Archtype, Inc. File No. 2436	

Test Boring No. B-10

(1 of 1)

Drill Rig Type	: Tripod Mounted
Hammer Type	: Drop
Cat-Head or Winch	: Cat-Head
Soil Casing Type	: 3 in. BW
Sampler Type	: SS - 1.375 in. I.D.; unlined
Sampler Hammer Fall	: 140 lbs. / 30 in.

Depth in Feet	Elev. in Feet	DESCRIPTIONS	USCS	Sample No.	Blow Count	Blow Count Graph (10 50)	Average qu-Field	Average qu-Field (TSF) (0 1 2 3 4)	REMARKS
0		LEAF LITTER & DUFF	AR						Groundwater=not encountered Well Set: no
1					1				
					1				SS-1: 1' - 3' R=7 N=2
2		Light brown, fine SAND, little fine gravel (rounded), trace silt and organic silt, (very loose, moist), frequent infillings of decomposed vegetation	AR	1	1				
					0				
3		3.5 -FILL WITH ORGANICS-			7				SS-2: 3' - 4.9' R=15 N=88
		Brown, coarse to fine SAND, some coarse gravel (angular) and rock fragments, few silt, (dense, moist)	SP	2	22				P=Penetrometer
4		4.9 ft. -GLACIAL FLUVIAL-			60				
					100				
5		REFUSAL @ 4.9 FT DEPTH POSSIBLE BEDROCK							
6		Particle Size: trace: <5%; few: 5-10%; little: 15-20%; some 30-45%; mostly: 50-100%							
7									
8									

COHESIONLESS SOILS: (DENSITY) L: Sands; R: Gravels	0-6 Very Loose 0-8 6-10 Loose 8-15 11-30 Med-Dense 16-40 >30 Dense 41-50 Very Dense >50	COHESIVE SOILS: (CONSISTENCY) 0-2 Very Soft (<0.25 TSF) 2-4 Soft (0.25-0.5 TSF) 4-8 Med. Stiff (0.5-1.0 TSF) 9-20 Stiff (1.0-4.0 TSF) >20 Hard (>4.0 TSF)

Test Boring No. B-10

(1 of 1)

Geotechnical Partnership, Inc. Fitchburg, MA Geotechnical Services	Date Drilled : 27 November 2024 Boring Location : Refer to Report Figure 2 Drilling Contractor : Cosmo Drilling : Ocean Bluff, MA Driller : E. Sviokla Rock Core : --- GPI Field Engineer : F. Sviokla Elevation and Datum : Drilling Mud Utilized : Not necessary Constant Water Head : Drive & Wash	**Test Boring No. B-11** (1 of 1) Drill Rig Type : Tripod Mounted Hammer Type : Drop Cat-Head or Winch : Cat-Head Soil Casing Type : 3 in. BW Sampler Type : SS - 1.375 in. I.D.; unlined Sampler Hammer Fall : 140 lbs. / 30 in.
PROJECT: New Construction New Communinity Center - Range Rd. Reading, Massachusetts CLIENT: Bargmann Hendrie & Archtype, Inc. File No. 2436		

Depth in Feet	Elev. in Feet	DESCRIPTIONS	USCS	GRAPHIC	Water Level	Sample No.	Blow Count	Blow Count Graph (10 50)	Average qu-Field	Average qu-Field (TSF) (0 1 2 3 4)	REMARKS
0		LEAF LITTER & TOPSOIL	AR								Groundwater=not encountered Well Set: no
1		Light brown, coarse to fine SAND, trace fine gravel (sub-angular to sub-rounded) and silt, (medium dense, moist)	SP			1	6 5				SS-1: 1' - 3' R=14 N=14
2		2.5 ft. -GLACIAL FLUVIAL-					9 21				
3		Brown, coarse to fine SAND, some coarse to fine gravel (angular to sub-angular), few silt, (dense, moist)	SP			2	42 71				SS-2: 3' - 4.4' R=12 N=171 P=Penetrometer
4		4 ft. -GLACIAL FLUVIAL-					100				
5		END OF BORING @ 4.9 FT DEPTH REFUSAL IN POSSIBLE GLACIAL TILL OR ROCK									
6		Particle Size: trace: <5%; few: 5-10%; little: 15-20%; some 30-45%; mostly: 50-100%									
7											
8											

COHESIONLESS SOILS: (DENSITY) L: Sands; R: Gravels	0-6 Very Loose 0-8 6-10 Loose 8-15 11-30 Med-Dense 16-40 >30 Dense 41-50 Very Dense >50	COHESIVE SOILS: (CONSISTENCY) 0-2 Very Soft (<0.25 TSF) 2-4 Soft (0.25-0.5 TSF) 4-8 Med. Stiff (0.5-1.0 TSF) 9-20 Stiff (1.0-4.0 TSF) >20 Hard (>4.0 TSF)

Test Boring No. B-11
(1 of 1)

Geotechnical Partnership, Inc. Fitchburg, MA Geotechnical Services	Date Drilled : 26 November 2024 Boring Location : Refer to Report Figure 2 Drilling Contractor : Cosmo Drilling : Ocean Bluff, MA Driller : E. Sviokla Rock Core : --- GPI Field Engineer : F. Sviokla Elevation and Datum : Drilling Mud Utilized : Not necessary Constant Water Head : Drive & Wash	**Test Boring No. B-12** (1 of 1) Drill Rig Type : Tripod Mounted Hammer Type : Drop Cat-Head or Winch : Cat-Head Soil Casing Type : 3 in. BW Sampler Type : SS - 1.375 in. I.D.; unlined Sampler Hammer Fall : 140 lbs. / 30 in.

PROJECT: New Construction
New Communinity Center - Range Rd.
Reading, Massachusetts

CLIENT: Bargmann Hendrie & Archtype, Inc.

File No. 2436

Depth in Feet	Elev. in Feet	DESCRIPTIONS	USCS	GRAPHIC	Water Level	Sample No.	Blow Count	Blow Count Graph (10 50)	Average qu-Field	Average qu-Field (TSF) (0 1 2 3 4)	REMARKS
0		LEAF LITTER & TOPSOIL	AR								Groundwater=not encountered Well Set: no
1		Rust-brown, coarse to fine SAND, little coarse to fine gravel (sub-angular to sub-rounded), few silt, (loose, moist)	SP			1	3 2 3 7				SS-1: 1' - 3' R=15 N=5
3		3.5 ft. -GLACIAL FLUVIAL-					12				SS-2: 3' - 5' R=16 N=116
4		Brown, coarse to fine SAND, some coarse gravel (sub-angular to sub-rounded), few silt, (dense, moist)	SP			2	31 85				P=Penetrometer
5		5.0 ft. -GLACIAL FLUVIAL- END OF BORING @ 5.0 FT DEPTH REFUSAL IN GLACIAL TILL oR ROCK					60				
6		Particle Size: trace: <5%; few: 5-10%; little: 15-20%; some 30-45%; mostly: 50-100%									
7											
8											

COHESIONLESS SOILS: (DENSITY) L: Sands; R: Gravels
0-6 Very Loose 0-8
6-10 Loose 8-15
11-30 Med-Dense 16-40
>30 Dense 41-50
Very Dense >50

COHESIVE SOILS: (CONSISTENCY)
0-2 Very Soft (<0.25 TSF)
2-4 Soft (0.25-0.5 TSF)
4-8 Med. Stiff (0.5-1.0 TSF)
9-20 Stiff (1.0-4.0 TSF)
>20 Hard (>4.0 TSF)

Test Boring No. B-12
(1 of 1)

Pre-Development Plan

EXISTING WATERSHED PLAN NOTES

1. EXISTING CONDITIONS INFORMATION IS REPRODUCED FROM THE BOUNDARY AND WETLAND LOCATION SURVEY PREPARED BY CONTROL POINT ASSOCIATES, INC., LOCATED AT 352 TURNPIKE ROAD, SOUTHBOROUGH, MA, AND DATED FEBRUARY 18TH, 2025.

EXISTING WATERSHED PLAN LEGEND

PROPERTY LINE

WETLAND EDGE — WLF #BVW–A3

35' WETLAND BUFFER

100' WETLAND BUFFER

FLOW ARROW

DRAINAGE ANALYSIS POINT — DP-1

SUBCATCHMENT AREA 1

MAP 41 LOT 56
N/F
LANDS OF TOWN OF READING
BOOK 11189 PAGE 431

SEE DEED OF EASEMENT BK.11490,PG. 145 (1968) TOWN OF READING TO READING RIFLE AND REVOLVER CLUB, INC– R.O WAY OVER EXISTING ROADWAY INCLUDING POLE LINE FOR TEL, ELEC, ETC. FROM HAVERHILL STREET (PER REF #3)

N/F LANDS OF TOWN OF READING ICE ARENA BK. 11189 PG. 431

MAP 41 LOT 54

RANGE ROAD
ACCESS & UTILITY EASEMENT (PER REF #3)
TWO WAY TRAFFIC

IRON ROD FOUND

"BURBANK ICE ARENA" LS#

N27°24'37"W 27.80'

P.O.B BK. 73040 PG. 267

N/F LANDS OF TOWN OF READING BK. 73040 PG. 267

MAP 35 LOT 133

MAP 41 LOT 37

N53°53'52"E 629.36'

S87°56'08"E 132.82'

S87°56'08"E 185.10'

R=283.00'
Δ=038°10'03"
L=188.52'
CHB=N72° 58' 51"E
CHD=185.05'

R=320.00'
Δ=038°09'58"
L=213.16'
CHB=N72°58'53"E
CHD=209.24'

100' WETLAND BUFFER

35' WETLAND BUFFER

PROPOSED PARCEL A (PER REF #7)

PROPOSED PARCEL B (PER REF #7)

PROPOSED PROPERTY LINE (PER REF #5 & #7)

WETLANDS

EDGE OF WETLANDS

1

A

B

DP-1

CONTACT DIGSAFE:
UNDERGROUND UTILITIES SHOWN ON THE PLAN ARE COMPILED FROM PLANS AND FIELD SURVEY. UTILITY LOCATIONS SHOULD BE CONSIDERED APPROXIMATE ONLY. DIGSAFE AND OR THE OTHER RESPECTIVE UTILITY COMPANIES SHALL BE CONTACTED 72 BUSINESS HOURS IN ADVANCE OF CONSTRUCTION OPERATIONS. PHONE DIGSAFE 1-888-344-7233.

SITE PLAN REVIEW SET ONLY - NOT FOR CONSTRUCTION

ARCHITECT

bh+a

Bargmann Hendrie + Archetype, Inc.
9 Channel Center Street, Suite 300
Boston, MA 02210
617 350 0450

PROJECT NAME

Reading Center for Active Living (ReCAL) + Outdoor Community Pickleball Courts

Symonds Way
Reading, MA 01867

CLIENT

Town of Reading

16 Lowell Street
Reading, MA 01867

PROJECT TEAM

Civil and Landscape Engineer
Activitas
70 Milton Street
Dedham, MA 02026
(781) 326-2600

Structural Engineer
Foley Buhl Roberts & Associates, Inc.
2227 Washington Street
Newton, MA 02462
(617) 527-9600

MEPFP Engineer
Allied Consulting Engineering
270 Littleton Road, Suite 11
Westford, MA 01886
(978) 443-7888

AV / IT / Security
Building Technology Consulting
992 Bedford St.
Bridgewater, MA 02324
(617) 799-4309

Food Service
Colburn Guyette
100 Ledgewood Pl #104
Rockland, MA 02370
(781) 826-5522

Wetland Scientist
Epsilon Associates, Inc.
3 Mill and Main Place, Suite 250
Maynard, MA 01754
(978) 897-7100

REVISIONS

DATE	PLANNING + CONSERVATION COMMENTS - 8/13/25

DRAWING TITLE

EXISTING CONDITIONS WATERSHED PLAN

DRAWING INFORMATION

COMMONWEALTH OF MASSACHUSETTS
MEGAN E. BUCZYNSKI
CIVIL
No. 47392
REGISTERED PROFESSIONAL ENGINEER

8/21/25

07/07/2025 — DATE OF ISSUE
SITE PLAN REVIEW — DESCRIPTION
1"=30'-0" — SCALE
BJM — DRAWN BY
3513 — PROJECT #
FILE NAME

DRAWING NUMBER

EXWS

 V.3.0

Post-Development Plan

PROPOSED WATERSHED PLAN NOTES

1. EXISTING CONDITIONS INFORMATION IS REPRODUCED FROM THE BOUNDARY AND WETLAND LOCATION SURVEY PREPARED BY CONTROL POINT ASSOCIATES, INC., LOCATED AT 352 TURNPIKE ROAD, SOUTHBOROUGH, MA, AND DATED FEBRUARY 18TH, 2025.

PROPOSED WATERSHED PLAN LEGEND

PROPERTY LINE

WETLAND EDGE

35' WETLAND BUFFER

100' WETLAND BUFFER

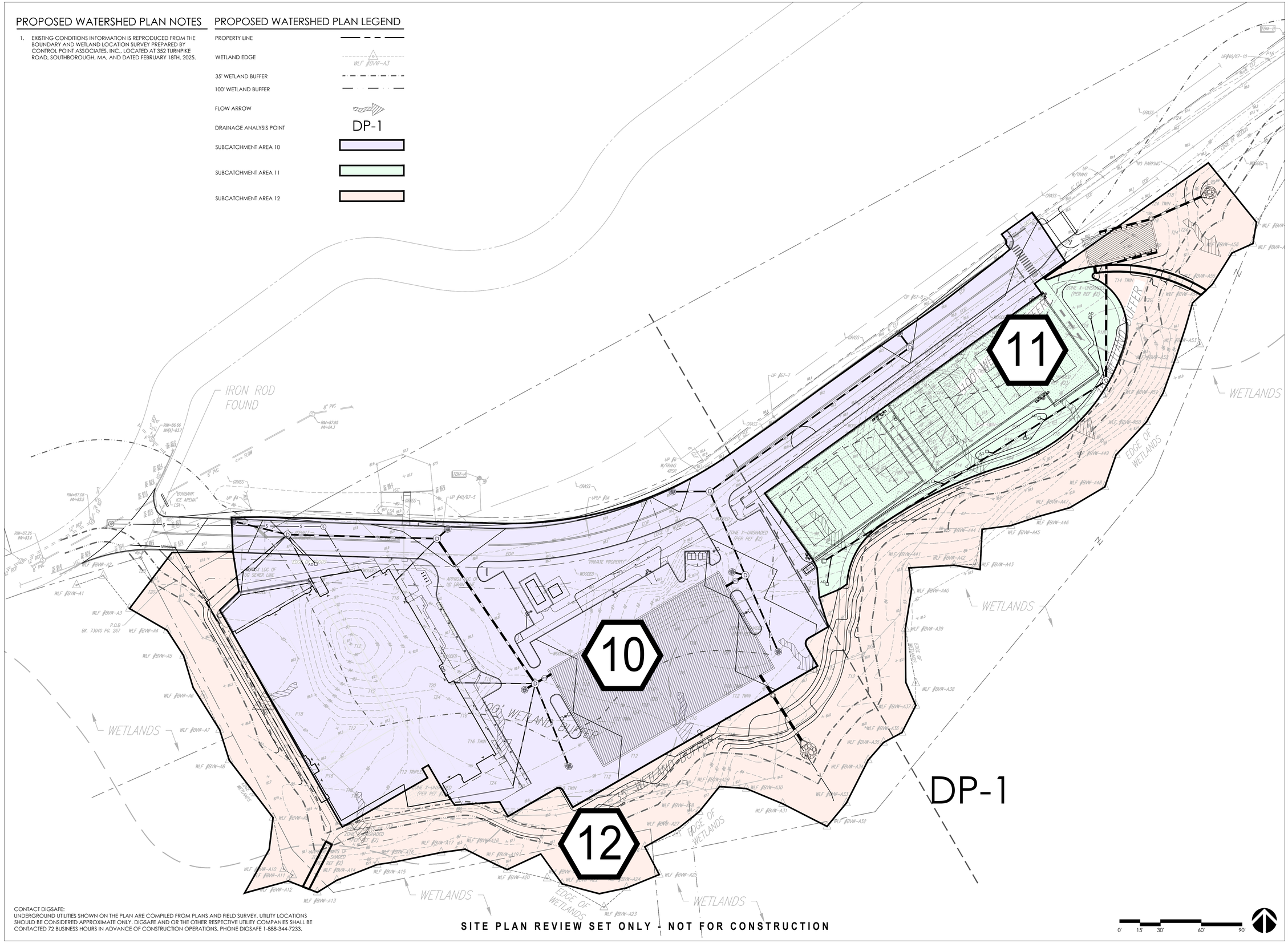
FLOW ARROW

DRAINAGE ANALYSIS POINT — DP-1

SUBCATCHMENT AREA 10

SUBCATCHMENT AREA 11

SUBCATCHMENT AREA 12



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SITE PLAN REVIEW SET ONLY - NOT FOR CONSTRUCTION

0' 15' 30' 60' 90'

ARCHITECT

bh+a

Bargmann Hendrie + Archetype, Inc.
9 Channel Center Street, Suite 300
Boston, MA 02210
617 350 0450

PROJECT NAME

Reading Center for Active Living (ReCAL) + Outdoor Community Pickleball Courts

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16 Lowell Street
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REVISIONS

PLANNING + CONSERVATION COMMENTS - 8/13/25

DATE

DRAWING TITLE

PROPOSED CONDITIONS WATERSHED PLAN

DRAWING INFORMATION

COMMONWEALTH OF MASSACHUSETTS
MEGAN E. BUCZYNSKI
CIVIL
No. 47392
REGISTERED PROFESSIONAL ENGINEER

8/21/25

07/07/2025
DATE OF ISSUE

SITE PLAN REVIEW
DESCRIPTION

1"=30'-0" SCALE | BJM DRAWN BY

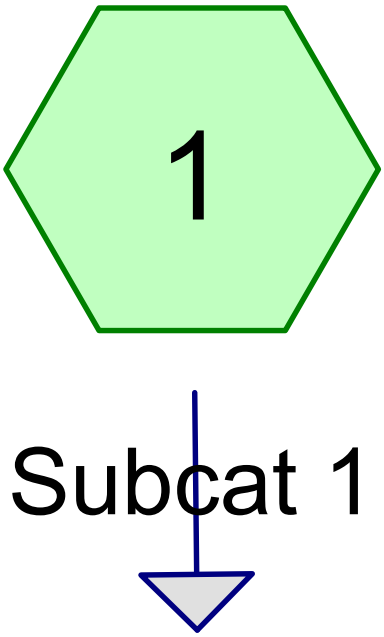
3513 PROJECT # | FILE NAME

DRAWING NUMBER

PRWS

 V.3.0

HydroCAD Report – Peak Rate



Subcat Reach Pond Link

Routing Diagram for 24057-Ex_Cond
Prepared by Activitas, Inc, Printed 7/2/2025

Rainfall Events Listing

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	3.09	2
2	10-Year	Type III 24-hr		Default	24.00	1	4.65	2
3	100-Year	Type III 24-hr		Default	24.00	1	8.36	2

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 1: Subcat 1 Runoff Area=178,246 sf 6.72% Impervious Runoff Depth=0.33"
Flow Length=126' Tc=13.6 min CN=59 Runoff=0.65 cfs 4,964 cf

Reach DP-1: Wetland Inflow=0.65 cfs 4,964 cf
Outflow=0.65 cfs 4,964 cf

Total Runoff Area = 178,246 sf Runoff Volume = 4,964 cf Average Runoff Depth = 0.33"
93.28% Pervious = 166,271 sf 6.72% Impervious = 11,975 sf

Summary for Subcatchment 1: Subcat 1

Runoff = 0.65 cfs @ 12.37 hrs, Volume= 4,964 cf, Depth= 0.33"
Routed to Reach DP-1 : Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.09"

Area (sf)	CN	Description
11,833	69	50-75% Grass cover, Fair, HSG B
11,975	98	Paved parking, HSG B
154,438	55	Woods, Good, HSG B
178,246	59	Weighted Average
166,271		93.28% Pervious Area
11,975		6.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	50	0.0200	0.07		**Sheet Flow, A** Woods: Light underbrush n= 0.400 P2= 3.09"
1.0	76	0.0650	1.27		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
13.6	126	Total			

Summary for Reach DP-1: Wetland

Inflow Area = 178,246 sf, 6.72% Impervious, Inflow Depth = 0.33" for 2-Year event
Inflow = 0.65 cfs @ 12.37 hrs, Volume= 4,964 cf
Outflow = 0.65 cfs @ 12.37 hrs, Volume= 4,964 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 1: Subcat 1 Runoff Area=178,246 sf 6.72% Impervious Runoff Depth=1.04"
Flow Length=126' Tc=13.6 min CN=59 Runoff=3.29 cfs 15,464 cf

Reach DP-1: Wetland Inflow=3.29 cfs 15,464 cf
Outflow=3.29 cfs 15,464 cf

Total Runoff Area = 178,246 sf Runoff Volume = 15,464 cf Average Runoff Depth = 1.04"
93.28% Pervious = 166,271 sf 6.72% Impervious = 11,975 sf

Summary for Subcatchment 1: Subcat 1

Runoff = 3.29 cfs @ 12.22 hrs, Volume= 15,464 cf, Depth= 1.04"
Routed to Reach DP-1 : Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.65"

Area (sf)	CN	Description
11,833	69	50-75% Grass cover, Fair, HSG B
11,975	98	Paved parking, HSG B
154,438	55	Woods, Good, HSG B
178,246	59	Weighted Average
166,271		93.28% Pervious Area
11,975		6.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	50	0.0200	0.07		**Sheet Flow, A** Woods: Light underbrush n= 0.400 P2= 3.09"
1.0	76	0.0650	1.27		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
13.6	126	Total			

Summary for Reach DP-1: Wetland

Inflow Area = 178,246 sf, 6.72% Impervious, Inflow Depth = 1.04" for 10-Year event
Inflow = 3.29 cfs @ 12.22 hrs, Volume= 15,464 cf
Outflow = 3.29 cfs @ 12.22 hrs, Volume= 15,464 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 1: Subcat 1 Runoff Area=178,246 sf 6.72% Impervious Runoff Depth=3.49"
Flow Length=126' Tc=13.6 min CN=59 Runoff=12.90 cfs 51,845 cf

Reach DP-1: Wetland Inflow=12.90 cfs 51,845 cf
Outflow=12.90 cfs 51,845 cf

Total Runoff Area = 178,246 sf Runoff Volume = 51,845 cf Average Runoff Depth = 3.49"
93.28% Pervious = 166,271 sf 6.72% Impervious = 11,975 sf

Summary for Subcatchment 1: Subcat 1

Runoff = 12.90 cfs @ 12.19 hrs, Volume= 51,845 cf, Depth= 3.49"
Routed to Reach DP-1 : Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.36"

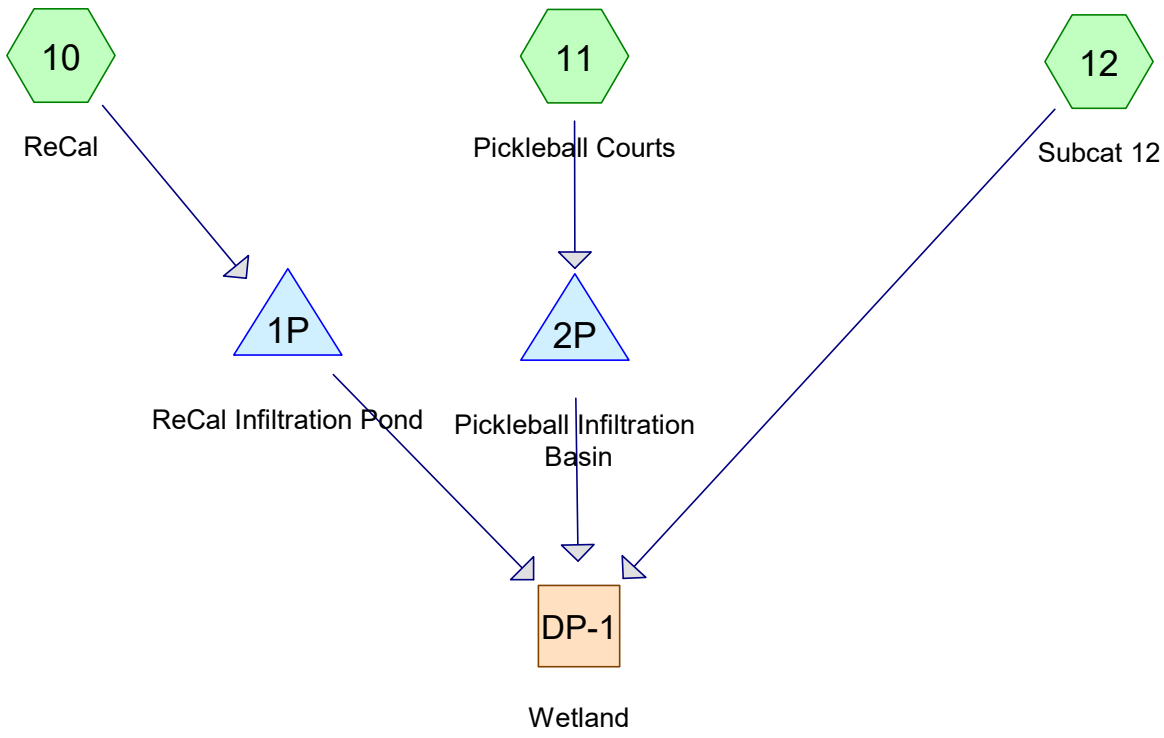
Area (sf)	CN	Description
11,833	69	50-75% Grass cover, Fair, HSG B
11,975	98	Paved parking, HSG B
154,438	55	Woods, Good, HSG B
178,246	59	Weighted Average
166,271		93.28% Pervious Area
11,975		6.72% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	50	0.0200	0.07		**Sheet Flow, A** Woods: Light underbrush n= 0.400 P2= 3.09"
1.0	76	0.0650	1.27		**Shallow Concentrated Flow, B** Woodland Kv= 5.0 fps
13.6	126	Total			

Summary for Reach DP-1: Wetland

Inflow Area = 178,246 sf, 6.72% Impervious, Inflow Depth = 3.49" for 100-Year event
Inflow = 12.90 cfs @ 12.19 hrs, Volume= 51,845 cf
Outflow = 12.90 cfs @ 12.19 hrs, Volume= 51,845 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs



Subcat Reach Pond Link

Routing Diagram for 24057-Pr_Cond
Prepared by Activitas, Inc, Printed 8/12/2025

Rainfall Events Listing

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	3.09	2
2	10-Year	Type III 24-hr		Default	24.00	1	4.65	2
3	100-Year	Type III 24-hr		Default	24.00	1	8.36	2

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 10: ReCal Runoff Area=89,772 sf 86.14% Impervious Runoff Depth=2.34"
Tc=6.0 min CN=93 Runoff=5.49 cfs 17,507 cf

Subcatchment 11: Pickleball Courts Runoff Area=23,769 sf 76.04% Impervious Runoff Depth=1.98"
Tc=6.0 min CN=89 Runoff=1.26 cfs 3,925 cf

Subcatchment 12: Subcat 12 Runoff Area=64,705 sf 5.60% Impervious Runoff Depth=0.43"
Flow Length=55' Tc=12.6 min CN=62 Runoff=0.38 cfs 2,344 cf

Reach DP-1: Wetland Inflow=0.57 cfs 4,804 cf
Outflow=0.57 cfs 4,804 cf

Pond 1P: ReCal Infiltration Pond Peak Elev=84.67' Storage=8,353 cf Inflow=5.49 cfs 17,507 cf
Discarded=0.28 cfs 17,507 cf Primary=0.00 cfs 0 cf Outflow=0.28 cfs 17,507 cf

Pond 2P: Pickleball Infiltration Basin Peak Elev=86.69' Storage=1,493 cf Inflow=1.26 cfs 3,925 cf
Discarded=0.03 cfs 1,465 cf Primary=0.23 cfs 2,460 cf Outflow=0.26 cfs 3,925 cf

Total Runoff Area = 178,246 sf Runoff Volume = 23,776 cf Average Runoff Depth = 1.60"
44.44% Pervious = 79,217 sf 55.56% Impervious = 99,029 sf

Summary for Subcatchment 10: ReCal

Runoff = 5.49 cfs @ 12.09 hrs, Volume= 17,507 cf, Depth= 2.34"
Routed to Pond 1P : ReCal Infiltration Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.09"

Area (sf)	CN	Description
12,410	61	>75% Grass cover, Good, HSG B
55,638	98	Paved parking, HSG B
21,692	98	Roofs, HSG B
32	55	Woods, Good, HSG B
89,772	93	Weighted Average
12,442		13.86% Pervious Area
77,330		86.14% Impervious Area

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

Summary for Subcatchment 11: Pickleball Courts

Runoff = 1.26 cfs @ 12.09 hrs, Volume= 3,925 cf, Depth= 1.98"
Routed to Pond 2P : Pickleball Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.09"

Area (sf)	CN	Description
4,235	61	>75% Grass cover, Good, HSG B
18,073	98	Paved parking, HSG B
1,461	55	Woods, Good, HSG B
23,769	89	Weighted Average
5,696		23.96% Pervious Area
18,073		76.04% Impervious Area

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

Summary for Subcatchment 12: Subcat 12

Runoff = 0.38 cfs @ 12.24 hrs, Volume= 2,344 cf, Depth= 0.43"
Routed to Reach DP-1 : Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 2-Year Rainfall=3.09"

Area (sf)	CN	Description
43,448	61	>75% Grass cover, Good, HSG B
599	96	Gravel surface, HSG B
3,617	98	Paved parking, HSG B
8	98	Roofs, HSG B
17,033	55	Woods, Good, HSG B
64,705	62	Weighted Average
61,080		94.40% Pervious Area
3,625		5.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	50	0.0200	0.07		**Sheet Flow, A** Woods: Light underbrush n= 0.400 P2= 3.09"
0.0	5	0.0150	1.97		**Shallow Concentrated Flow, B** Unpaved Kv= 16.1 fps
12.6	55	Total			

Summary for Reach DP-1: Wetland

Inflow Area = 178,246 sf, 55.56% Impervious, Inflow Depth = 0.32" for 2-Year event
Inflow = 0.57 cfs @ 12.25 hrs, Volume= 4,804 cf
Outflow = 0.57 cfs @ 12.25 hrs, Volume= 4,804 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: ReCal Infiltration Pond

Inflow Area = 89,772 sf, 86.14% Impervious, Inflow Depth = 2.34" for 2-Year event
Inflow = 5.49 cfs @ 12.09 hrs, Volume= 17,507 cf
Outflow = 0.28 cfs @ 10.91 hrs, Volume= 17,507 cf, Atten= 95%, Lag= 0.0 min
Discarded = 0.28 cfs @ 10.91 hrs, Volume= 17,507 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach DP-1 : Wetland

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 4
Peak Elev= 84.67' @ 14.30 hrs Surf.Area= 11,948 sf Storage= 8,353 cf

Plug-Flow detention time= 269.2 min calculated for 17,501 cf (100% of inflow)
Center-of-Mass det. time= 269.2 min (1,063.0 - 793.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	83.50'	7,802 cf	**82.25'W x 145.27'L x 3.50'H Field A** 41,819 cf Overall - 15,813 cf Embedded = 26,006 cf x 30.0% Voids
#2A	84.00'	15,813 cf	**Cultec R-300HD** x 340 Inside #1 Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap 340 Chambers in 17 Rows Cap Storage= 2.7 cf x 2 x 17 rows = 90.3 cf
		23,614 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	83.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Device 4	84.66'	**10.0" W x 2.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 4	86.00'	**21.0" W x 10.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	85.37'	**18.0" Round Culvert** L= 37.0' Ke= 0.900 Inlet / Outlet Invert= 85.37' / 85.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.28 cfs @ 10.91 hrs HW=83.54' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.28 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=83.50' (Free Discharge)
└**4=Culvert** (Controls 0.00 cfs)
  ├**2=Orifice/Grate** (Controls 0.00 cfs)
  └**3=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 2P: Pickleball Infiltration Basin

Inflow Area = 23,769 sf, 76.04% Impervious, Inflow Depth = 1.98" for 2-Year event
Inflow = 1.26 cfs @ 12.09 hrs, Volume= 3,925 cf
Outflow = 0.26 cfs @ 12.53 hrs, Volume= 3,925 cf, Atten= 80%, Lag= 26.3 min
Discarded = 0.03 cfs @ 9.85 hrs, Volume= 1,465 cf
Primary = 0.23 cfs @ 12.53 hrs, Volume= 2,460 cf
Routed to Reach DP-1 : Wetland

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 86.69' @ 12.53 hrs Surf.Area= 1,090 sf Storage= 1,493 cf

Plug-Flow detention time= 84.8 min calculated for 3,925 cf (100% of inflow)
Center-of-Mass det. time= 84.8 min (897.3 - 812.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	84.50'	750 cf	**20.50'W x 53.18'L x 3.50'H Field A** 3,816 cf Overall - 1,316 cf Embedded = 2,500 cf x 30.0% Voids
#2A	85.00'	1,316 cf	**Cultec R-300HD** x 28 Inside #1 Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap 28 Chambers in 4 Rows Cap Storage= 2.7 cf x 2 x 4 rows = 21.2 cf
		2,066 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	84.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	85.00'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	86.66'	**12.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	87.50'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.03 cfs @ 9.85 hrs HW=84.54' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.23 cfs @ 12.53 hrs HW=86.69' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.21 cfs @ 6.07 fps)
├**3=Orifice/Grate** (Orifice Controls 0.02 cfs @ 0.60 fps)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 10: ReCal Runoff Area=89,772 sf 86.14% Impervious Runoff Depth=3.85"
Tc=6.0 min CN=93 Runoff=8.80 cfs 28,837 cf

Subcatchment 11: Pickleball Courts Runoff Area=23,769 sf 76.04% Impervious Runoff Depth=3.44"
Tc=6.0 min CN=89 Runoff=2.15 cfs 6,809 cf

Subcatchment 12: Subcat 12 Runoff Area=64,705 sf 5.60% Impervious Runoff Depth=1.23"
Flow Length=55' Tc=12.6 min CN=62 Runoff=1.54 cfs 6,618 cf

Reach DP-1: Wetland Inflow=2.91 cfs 12,679 cf
Outflow=2.91 cfs 12,679 cf

Pond 1P: ReCal Infiltration Pond Peak Elev=85.52' Storage=15,838 cf Inflow=8.80 cfs 28,837 cf
Discarded=0.28 cfs 22,707 cf Primary=0.10 cfs 997 cf Outflow=0.38 cfs 23,704 cf

Pond 2P: Pickleball Infiltration Basin Peak Elev=87.33' Storage=1,843 cf Inflow=2.15 cfs 6,809 cf
Discarded=0.03 cfs 1,746 cf Primary=1.38 cfs 5,064 cf Outflow=1.41 cfs 6,809 cf

Total Runoff Area = 178,246 sf Runoff Volume = 42,264 cf Average Runoff Depth = 2.85"
44.44% Pervious = 79,217 sf 55.56% Impervious = 99,029 sf

Summary for Subcatchment 10: ReCal

Runoff = 8.80 cfs @ 12.08 hrs, Volume= 28,837 cf, Depth= 3.85"
Routed to Pond 1P : ReCal Infiltration Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.65"

Area (sf)	CN	Description
12,410	61	>75% Grass cover, Good, HSG B
55,638	98	Paved parking, HSG B
21,692	98	Roofs, HSG B
32	55	Woods, Good, HSG B
89,772	93	Weighted Average
12,442		13.86% Pervious Area
77,330		86.14% Impervious Area

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

Summary for Subcatchment 11: Pickleball Courts

Runoff = 2.15 cfs @ 12.09 hrs, Volume= 6,809 cf, Depth= 3.44"
Routed to Pond 2P : Pickleball Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.65"

Area (sf)	CN	Description
4,235	61	>75% Grass cover, Good, HSG B
18,073	98	Paved parking, HSG B
1,461	55	Woods, Good, HSG B
23,769	89	Weighted Average
5,696		23.96% Pervious Area
18,073		76.04% Impervious Area

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

Summary for Subcatchment 12: Subcat 12

Runoff = 1.54 cfs @ 12.19 hrs, Volume= 6,618 cf, Depth= 1.23"
Routed to Reach DP-1 : Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 10-Year Rainfall=4.65"

Area (sf)	CN	Description
43,448	61	>75% Grass cover, Good, HSG B
599	96	Gravel surface, HSG B
3,617	98	Paved parking, HSG B
8	98	Roofs, HSG B
17,033	55	Woods, Good, HSG B
64,705	62	Weighted Average
61,080		94.40% Pervious Area
3,625		5.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	50	0.0200	0.07		**Sheet Flow, A** Woods: Light underbrush n= 0.400 P2= 3.09"
0.0	5	0.0150	1.97		**Shallow Concentrated Flow, B** Unpaved Kv= 16.1 fps
12.6	55	Total			

Summary for Reach DP-1: Wetland

Inflow Area = 178,246 sf, 55.56% Impervious, Inflow Depth = 0.85" for 10-Year event
Inflow = 2.91 cfs @ 12.19 hrs, Volume= 12,679 cf
Outflow = 2.91 cfs @ 12.19 hrs, Volume= 12,679 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: ReCal Infiltration Pond

Inflow Area = 89,772 sf, 86.14% Impervious, Inflow Depth = 3.85" for 10-Year event
Inflow = 8.80 cfs @ 12.08 hrs, Volume= 28,837 cf
Outflow = 0.38 cfs @ 14.82 hrs, Volume= 23,704 cf, Atten= 96%, Lag= 164.4 min
Discarded = 0.28 cfs @ 9.63 hrs, Volume= 22,707 cf
Primary = 0.10 cfs @ 14.82 hrs, Volume= 997 cf
Routed to Reach DP-1 : Wetland

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 4
Peak Elev= 85.52' @ 14.82 hrs Surf.Area= 11,948 sf Storage= 15,838 cf

Plug-Flow detention time= 406.9 min calculated for 23,704 cf (82% of inflow)
Center-of-Mass det. time= 336.3 min (1,116.8 - 780.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	83.50'	7,802 cf	**82.25'W x 145.27'L x 3.50'H Field A** 41,819 cf Overall - 15,813 cf Embedded = 26,006 cf x 30.0% Voids
#2A	84.00'	15,813 cf	**Cultec R-300HD** x 340 Inside #1 Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap 340 Chambers in 17 Rows Cap Storage= 2.7 cf x 2 x 17 rows = 90.3 cf
		23,614 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	83.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Device 4	84.66'	**10.0" W x 2.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 4	86.00'	**21.0" W x 10.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	85.37'	**18.0" Round Culvert** L= 37.0' Ke= 0.900 Inlet / Outlet Invert= 85.37' / 85.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.28 cfs @ 9.63 hrs HW=83.54' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.28 cfs)

Primary OutFlow Max=0.10 cfs @ 14.82 hrs HW=85.52' (Free Discharge)
└**4=Culvert** (Inlet Controls 0.10 cfs @ 1.05 fps)
  └**2=Orifice/Grate** (Passes 0.10 cfs of 0.26 cfs potential flow)
  └**3=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond 2P: Pickleball Infiltration Basin

Inflow Area = 23,769 sf, 76.04% Impervious, Inflow Depth = 3.44" for 10-Year event
Inflow = 2.15 cfs @ 12.09 hrs, Volume= 6,809 cf
Outflow = 1.41 cfs @ 12.18 hrs, Volume= 6,809 cf, Atten= 34%, Lag= 5.4 min
Discarded = 0.03 cfs @ 8.40 hrs, Volume= 1,746 cf
Primary = 1.38 cfs @ 12.18 hrs, Volume= 5,064 cf
Routed to Reach DP-1 : Wetland

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 87.33' @ 12.18 hrs Surf.Area= 1,090 sf Storage= 1,843 cf

Plug-Flow detention time= 70.9 min calculated for 6,807 cf (100% of inflow)
Center-of-Mass det. time= 70.9 min (867.9 - 797.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	84.50'	750 cf	**20.50'W x 53.18'L x 3.50'H Field A** 3,816 cf Overall - 1,316 cf Embedded = 2,500 cf x 30.0% Voids
#2A	85.00'	1,316 cf	**Cultec R-300HD** x 28 Inside #1 Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap 28 Chambers in 4 Rows Cap Storage= 2.7 cf x 2 x 4 rows = 21.2 cf
		2,066 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	84.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	85.00'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	86.66'	**12.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	87.50'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.03 cfs @ 8.40 hrs HW=84.54' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=1.38 cfs @ 12.18 hrs HW=87.33' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.24 cfs @ 7.18 fps)
├**3=Orifice/Grate** (Orifice Controls 1.13 cfs @ 3.40 fps)
└**4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 10: ReCal Runoff Area=89,772 sf 86.14% Impervious Runoff Depth=7.52"
Tc=6.0 min CN=93 Runoff=16.53 cfs 56,257 cf

Subcatchment 11: Pickleball Courts Runoff Area=23,769 sf 76.04% Impervious Runoff Depth=7.04"
Tc=6.0 min CN=89 Runoff=4.23 cfs 13,945 cf

Subcatchment 12: Subcat 12 Runoff Area=64,705 sf 5.60% Impervious Runoff Depth=3.84"
Flow Length=55' Tc=12.6 min CN=62 Runoff=5.34 cfs 20,692 cf

Reach DP-1: Wetland Inflow=12.22 cfs 55,812 cf
Outflow=12.22 cfs 55,812 cf

Pond 1P: ReCal Infiltration Pond Peak Elev=86.94' Storage=23,410 cf Inflow=16.53 cfs 56,257 cf
Discarded=0.28 cfs 25,152 cf Primary=5.78 cfs 23,220 cf Outflow=6.06 cfs 48,372 cf

Pond 2P: Pickleball Infiltration Basin Peak Elev=87.84' Storage=2,014 cf Inflow=4.23 cfs 13,945 cf
Discarded=0.03 cfs 2,044 cf Primary=4.18 cfs 11,901 cf Outflow=4.21 cfs 13,945 cf

Total Runoff Area = 178,246 sf Runoff Volume = 90,894 cf Average Runoff Depth = 6.12"
44.44% Pervious = 79,217 sf 55.56% Impervious = 99,029 sf

Summary for Subcatchment 10: ReCal

Runoff = 16.53 cfs @ 12.08 hrs, Volume= 56,257 cf, Depth= 7.52"
Routed to Pond 1P : ReCal Infiltration Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.36"

Area (sf)	CN	Description
12,410	61	>75% Grass cover, Good, HSG B
55,638	98	Paved parking, HSG B
21,692	98	Roofs, HSG B
32	55	Woods, Good, HSG B
89,772	93	Weighted Average
12,442		13.86% Pervious Area
77,330		86.14% Impervious Area

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

Summary for Subcatchment 11: Pickleball Courts

Runoff = 4.23 cfs @ 12.08 hrs, Volume= 13,945 cf, Depth= 7.04"
Routed to Pond 2P : Pickleball Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.36"

Area (sf)	CN	Description
4,235	61	>75% Grass cover, Good, HSG B
18,073	98	Paved parking, HSG B
1,461	55	Woods, Good, HSG B
23,769	89	Weighted Average
5,696		23.96% Pervious Area
18,073		76.04% Impervious Area

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

Summary for Subcatchment 12: Subcat 12

Runoff = 5.34 cfs @ 12.18 hrs, Volume= 20,692 cf, Depth= 3.84"
Routed to Reach DP-1 : Wetland

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr 100-Year Rainfall=8.36"

Area (sf)	CN	Description
43,448	61	>75% Grass cover, Good, HSG B
599	96	Gravel surface, HSG B
3,617	98	Paved parking, HSG B
8	98	Roofs, HSG B
17,033	55	Woods, Good, HSG B
64,705	62	Weighted Average
61,080		94.40% Pervious Area
3,625		5.60% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.6	50	0.0200	0.07		**Sheet Flow, A** Woods: Light underbrush n= 0.400 P2= 3.09"
0.0	5	0.0150	1.97		**Shallow Concentrated Flow, B** Unpaved Kv= 16.1 fps
12.6	55	Total			

Summary for Reach DP-1: Wetland

Inflow Area = 178,246 sf, 55.56% Impervious, Inflow Depth = 3.76" for 100-Year event
Inflow = 12.22 cfs @ 12.23 hrs, Volume= 55,812 cf
Outflow = 12.22 cfs @ 12.23 hrs, Volume= 55,812 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Pond 1P: ReCal Infiltration Pond

Inflow Area = 89,772 sf, 86.14% Impervious, Inflow Depth = 7.52" for 100-Year event
Inflow = 16.53 cfs @ 12.08 hrs, Volume= 56,257 cf
Outflow = 6.06 cfs @ 12.33 hrs, Volume= 48,372 cf, Atten= 63%, Lag= 14.7 min
Discarded = 0.28 cfs @ 7.54 hrs, Volume= 25,152 cf
Primary = 5.78 cfs @ 12.33 hrs, Volume= 23,220 cf
Routed to Reach DP-1 : Wetland

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 4
Peak Elev= 86.94' @ 12.33 hrs Surf.Area= 11,948 sf Storage= 23,410 cf

Plug-Flow detention time= 245.1 min calculated for 48,372 cf (86% of inflow)
Center-of-Mass det. time= 183.6 min (947.8 - 764.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	83.50'	7,802 cf	**82.25'W x 145.27'L x 3.50'H Field A** 41,819 cf Overall - 15,813 cf Embedded = 26,006 cf x 30.0% Voids
#2A	84.00'	15,813 cf	**Cultec R-300HD** x 340 Inside #1 Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap 340 Chambers in 17 Rows Cap Storage= 2.7 cf x 2 x 17 rows = 90.3 cf
		23,614 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	83.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Device 4	84.66'	**10.0" W x 2.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 4	86.00'	**21.0" W x 10.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	85.37'	**18.0" Round Culvert** L= 37.0' Ke= 0.900 Inlet / Outlet Invert= 85.37' / 85.00' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.28 cfs @ 7.54 hrs HW=83.54' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.28 cfs)

Primary OutFlow Max=5.78 cfs @ 12.33 hrs HW=86.94' (Free Discharge)
└**4=Culvert** (Passes 5.78 cfs of 6.09 cfs potential flow)
  ├**2=Orifice/Grate** (Orifice Controls 0.84 cfs @ 6.04 fps)
  └**3=Orifice/Grate** (Orifice Controls 4.94 cfs @ 3.39 fps)

Summary for Pond 2P: Pickleball Infiltration Basin

Inflow Area = 23,769 sf, 76.04% Impervious, Inflow Depth = 7.04" for 100-Year event
Inflow = 4.23 cfs @ 12.08 hrs, Volume= 13,945 cf
Outflow = 4.21 cfs @ 12.09 hrs, Volume= 13,945 cf, Atten= 0%, Lag= 0.5 min
Discarded = 0.03 cfs @ 5.88 hrs, Volume= 2,044 cf
Primary = 4.18 cfs @ 12.09 hrs, Volume= 11,901 cf
Routed to Reach DP-1 : Wetland

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 87.84' @ 12.09 hrs Surf.Area= 1,090 sf Storage= 2,014 cf

Plug-Flow detention time= 55.0 min calculated for 13,945 cf (100% of inflow)
Center-of-Mass det. time= 55.0 min (832.8 - 777.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	84.50'	750 cf	**20.50'W x 53.18'L x 3.50'H Field A** 3,816 cf Overall - 1,316 cf Embedded = 2,500 cf x 30.0% Voids
#2A	85.00'	1,316 cf	**Cultec R-300HD** x 28 Inside #1 Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap 28 Chambers in 4 Rows Cap Storage= 2.7 cf x 2 x 4 rows = 21.2 cf
		2,066 cf	Total Available Storage

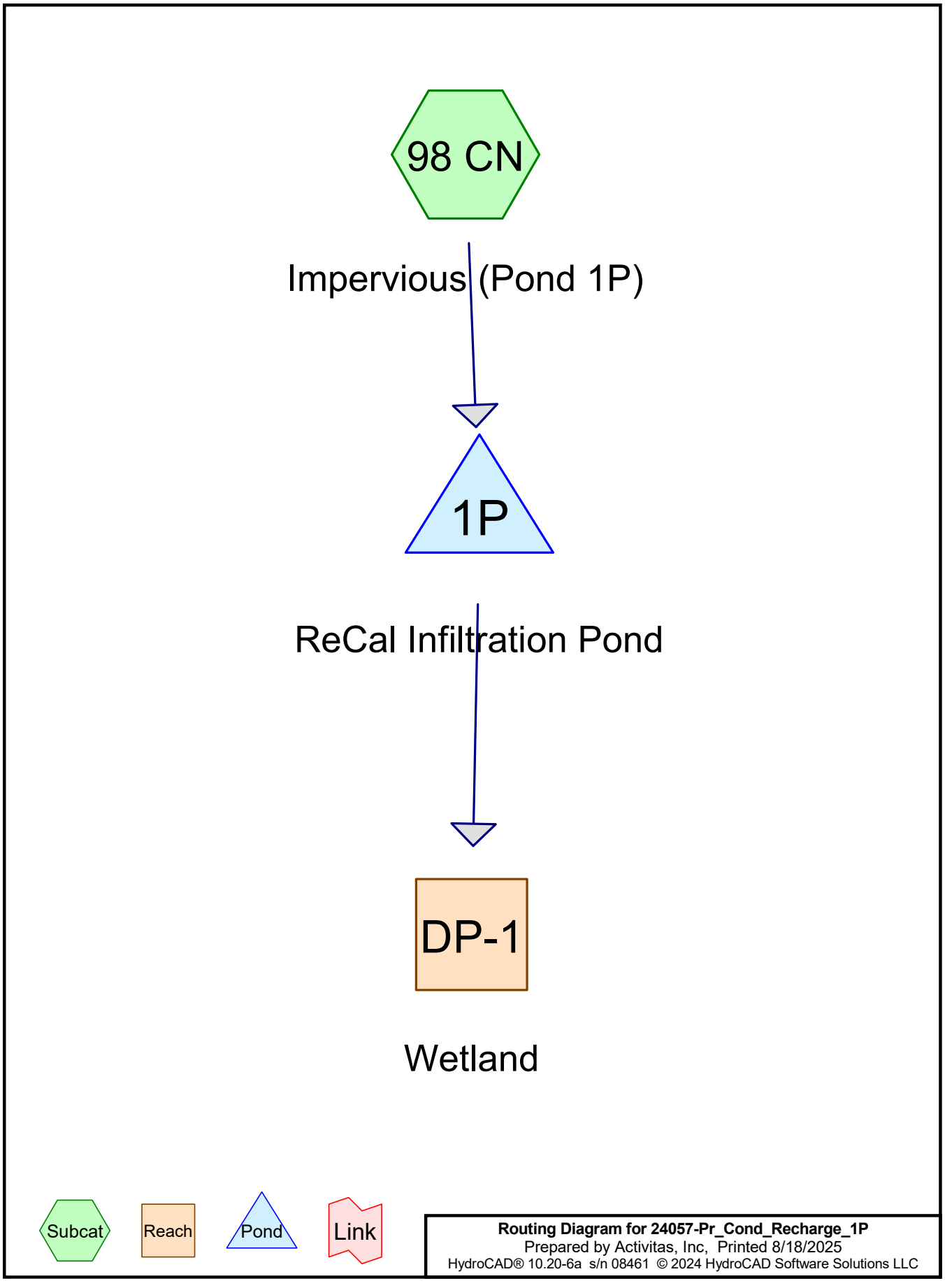
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	84.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	85.00'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	86.66'	**12.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	87.50'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.03 cfs @ 5.88 hrs HW=84.54' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=4.17 cfs @ 12.09 hrs HW=87.84' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.27 cfs @ 7.96 fps)
├**3=Orifice/Grate** (Orifice Controls 1.61 cfs @ 4.84 fps)
└**4=Broad-Crested Rectangular Weir** (Weir Controls 2.29 cfs @ 1.68 fps)

HydroCAD Report – Recharge



Routing Diagram for 24057-Pr_Cond_Recharge_1P
Prepared by Activitas, Inc, Printed 8/18/2025

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	Recharge	Type III 24-hr		Default	24.00	1	1.05	2

Time span=11.00-13.00 hrs, dt=0.01 hrs, 201 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 98 CN: Impervious (Pond Runoff Area=77,330 sf 100.00% Impervious Runoff Depth>0.47"
Tc=6.0 min CN=98 Runoff=1.67 cfs 3,027 cf

Reach DP-1: Wetland Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Pond 1P: ReCal Infiltration Pond Peak Elev=83.94' Storage=1,564 cf Inflow=1.67 cfs 3,027 cf
Discarded=0.28 cfs 1,615 cf Primary=0.00 cfs 0 cf Outflow=0.28 cfs 1,615 cf

Total Runoff Area = 77,330 sf Runoff Volume = 3,027 cf Average Runoff Depth = 0.47"
0.00% Pervious = 0 sf 100.00% Impervious = 77,330 sf

Summary for Subcatchment 98 CN: Impervious (Pond 1P)

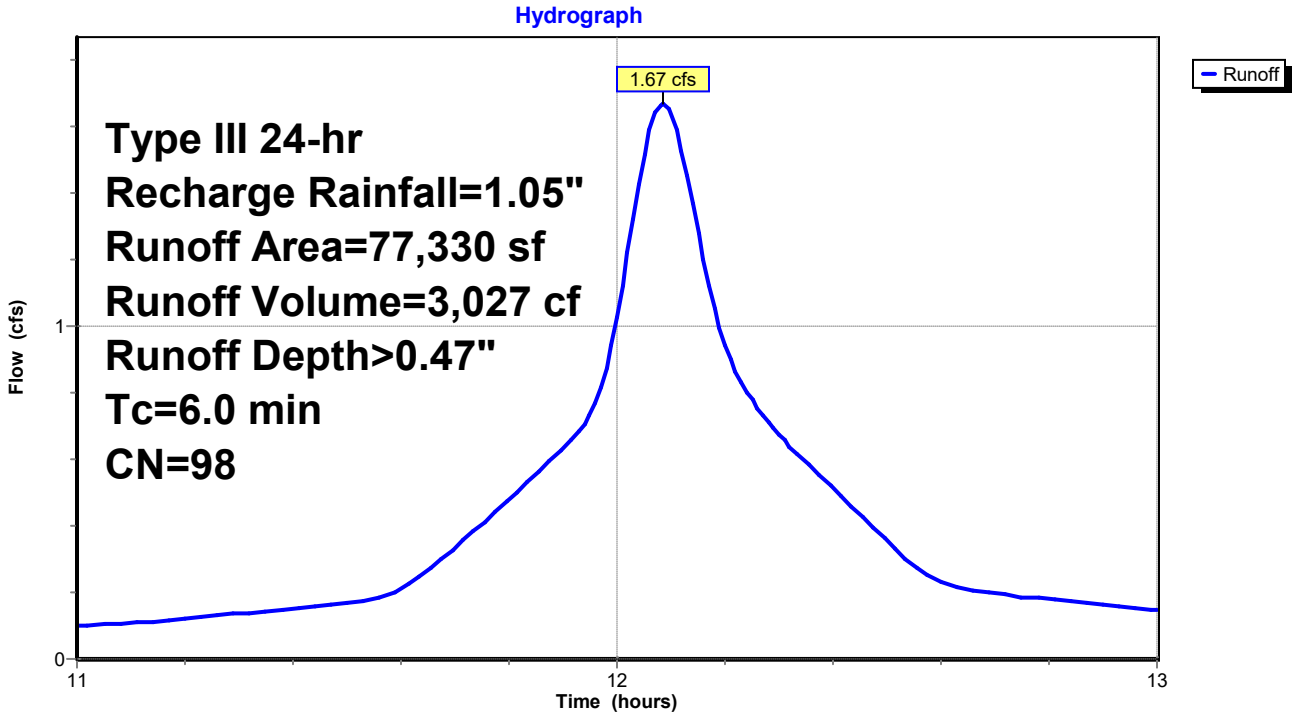
Runoff = 1.67 cfs @ 12.08 hrs, Volume= 3,027 cf, Depth> 0.47"
Routed to Pond 1P : ReCal Infiltration Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 11.00-13.00 hrs, dt= 0.01 hrs
Type III 24-hr Recharge Rainfall=1.05"

Area (sf)	CN	Description
77,330	98	Paved parking, HSG B
77,330		100.00% Impervious Area

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

Subcatchment 98 CN: Impervious (Pond 1P)

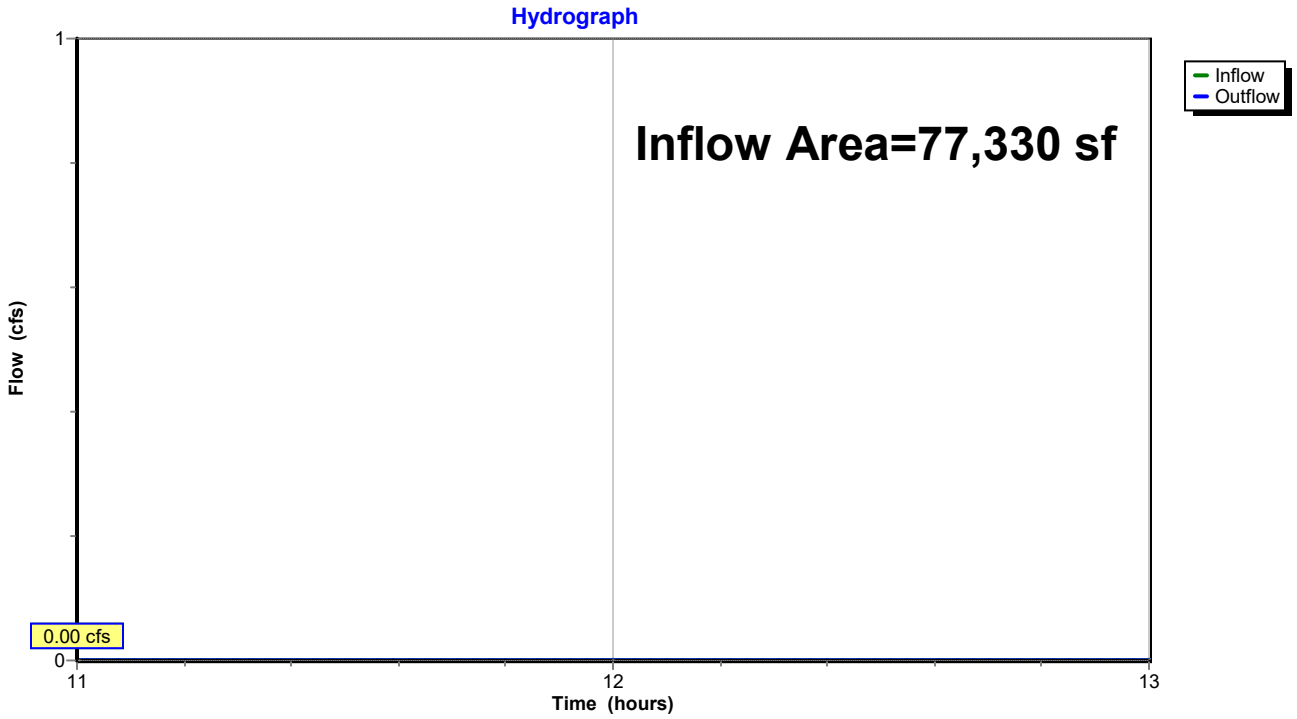


Summary for Reach DP-1: Wetland

Inflow Area = 77,330 sf,100.00% Impervious, Inflow Depth = 0.00" for Recharge event
Inflow = 0.00 cfs @ 11.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 11.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 11.00-13.00 hrs, dt= 0.01 hrs

Reach DP-1: Wetland



Summary for Pond 1P: ReCal Infiltration Pond

Inflow Area = 77,330 sf,100.00% Impervious, Inflow Depth > 0.47" for Recharge event
Inflow = 1.67 cfs @ 12.08 hrs, Volume= 3,027 cf
Outflow = 0.28 cfs @ 11.76 hrs, Volume= 1,615 cf, Atten= 83%, Lag= 0.0 min
Discarded = 0.28 cfs @ 11.76 hrs, Volume= 1,615 cf
Primary = 0.00 cfs @ 11.00 hrs, Volume= 0 cf
Routed to Reach DP-1 : Wetland

Routing by Stor-Ind method, Time Span= 11.00-13.00 hrs, dt= 0.01 hrs / 4
Peak Elev= 83.94' @ 12.55 hrs Surf.Area= 11,948 sf Storage= 1,564 cf

Plug-Flow detention time= 21.4 min calculated for 1,607 cf (53% of inflow)
Center-of-Mass det. time= 6.1 min (731.2 - 725.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	83.50'	7,802 cf	**82.25'W x 145.27'L x 3.50'H Field A** 41,819 cf Overall - 15,813 cf Embedded = 26,006 cf x 30.0% Voids
#2A	84.00'	15,813 cf	**Cultec R-300HD** x 340 Inside #1 Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap 340 Chambers in 17 Rows Cap Storage= 2.7 cf x 2 x 17 rows = 90.3 cf
		23,614 cf	Total Available Storage

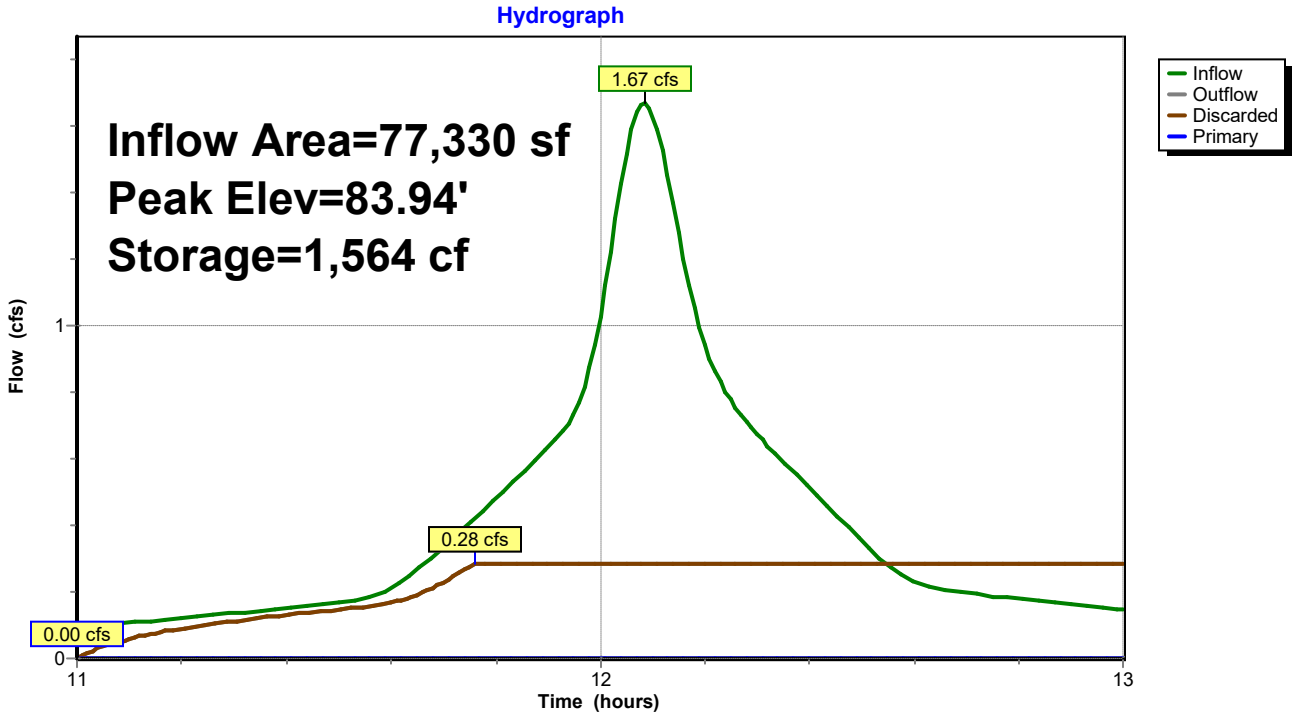
Storage Group A created with Chamber Wizard

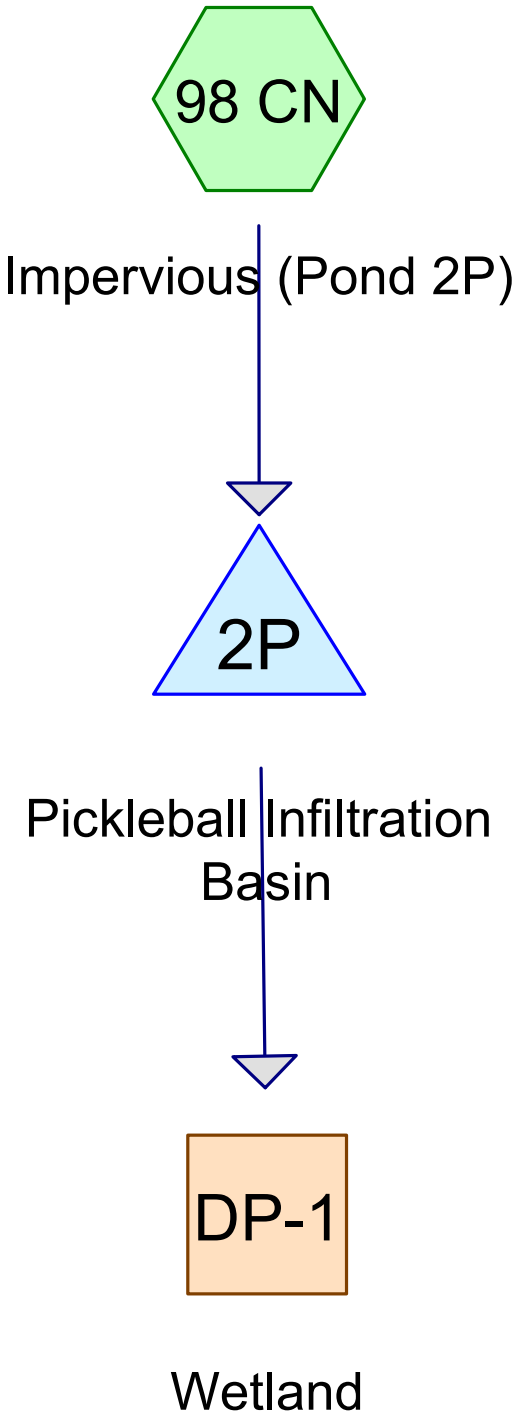
Device	Routing	Invert	Outlet Devices
#1	Discarded	83.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	84.66'	**10.0" W x 2.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	86.00'	**21.0" W x 10.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.28 cfs @ 11.76 hrs HW=83.54' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.28 cfs)

Primary OutFlow Max=0.00 cfs @ 11.00 hrs HW=83.50' (Free Discharge)
├**2=Orifice/Grate** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: ReCal Infiltration Pond





Subcat Reach Pond Link

Routing Diagram for 24057-Pr_Cond_Recharge_2P
Prepared by Activitas, Inc, Printed 8/18/2025

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	Recharge	Type III 24-hr		Default	24.00	1	0.54	2

Time span=11.00-13.00 hrs, dt=0.01 hrs, 201 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 98 CN: Impervious (Pond Runoff Area=18,073 sf 100.00% Impervious Runoff Depth>0.20"
Tc=6.0 min CN=98 Runoff=0.17 cfs 305 cf

Reach DP-1: Wetland Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Pond 2P: Pickleball Infiltration Basin Peak Elev=85.00' Storage=168 cf Inflow=0.17 cfs 305 cf
Discarded=0.03 cfs 146 cf Primary=0.00 cfs 0 cf Outflow=0.03 cfs 146 cf

Total Runoff Area = 18,073 sf Runoff Volume = 305 cf Average Runoff Depth = 0.20"
0.00% Pervious = 0 sf 100.00% Impervious = 18,073 sf

Summary for Subcatchment 98 CN: Impervious (Pond 2P)

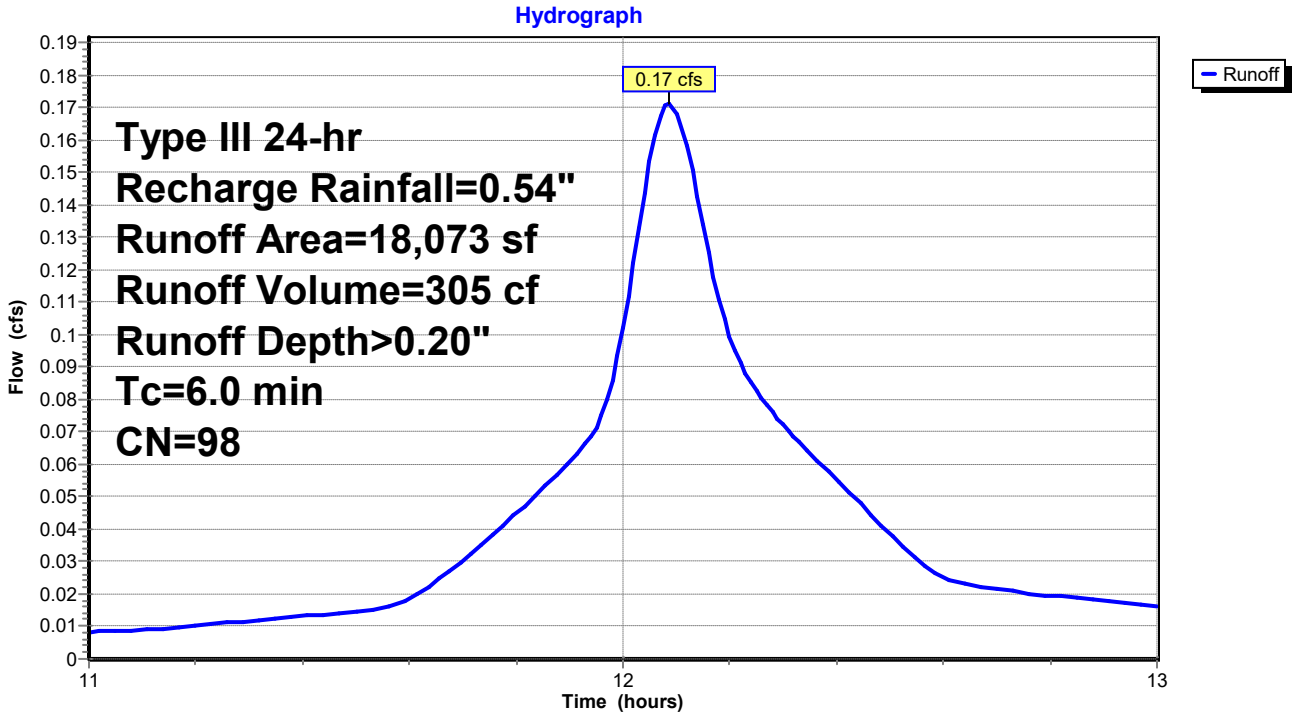
Runoff = 0.17 cfs @ 12.09 hrs, Volume= 305 cf, Depth> 0.20"
Routed to Pond 2P : Pickleball Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 11.00-13.00 hrs, dt= 0.01 hrs
Type III 24-hr Recharge Rainfall=0.54"

Area (sf)	CN	Description
18,073	98	Paved parking, HSG B
18,073		100.00% Impervious Area

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

Subcatchment 98 CN: Impervious (Pond 2P)

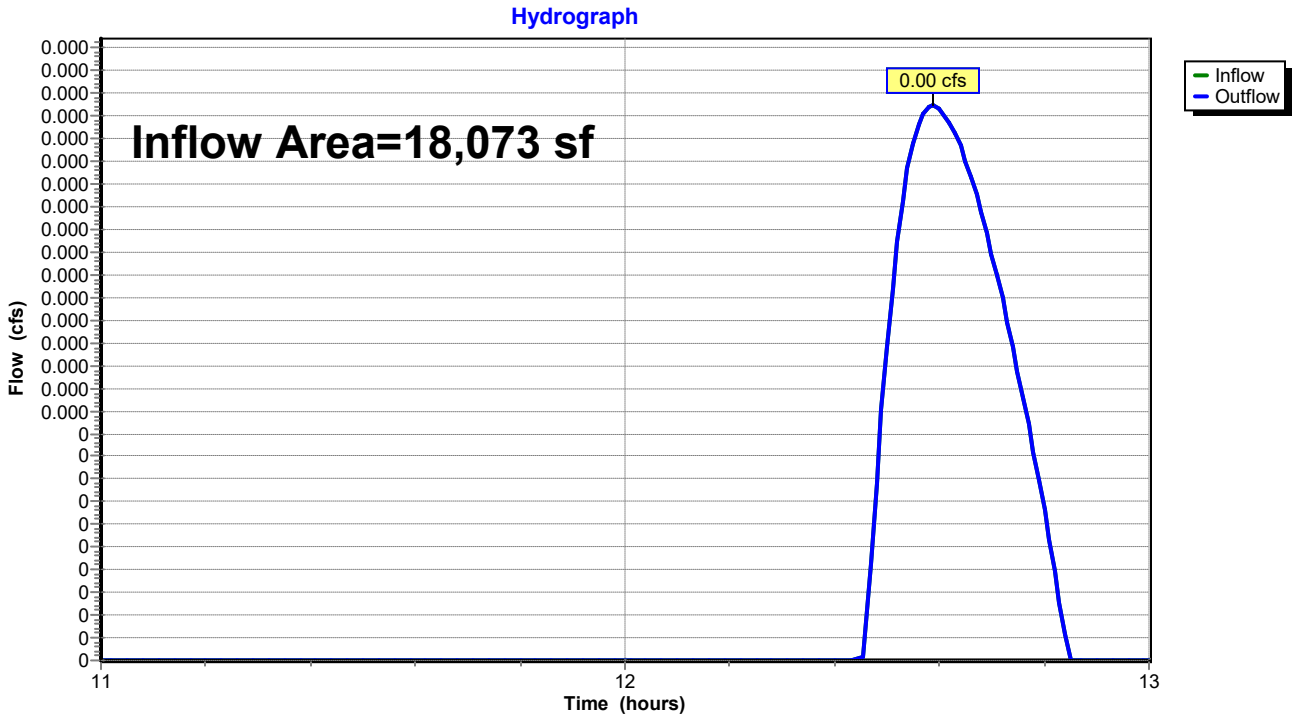


Summary for Reach DP-1: Wetland

Inflow Area = 18,073 sf,100.00% Impervious, Inflow Depth = 0.00" for Recharge event
Inflow = 0.00 cfs @ 12.59 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 12.59 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 11.00-13.00 hrs, dt= 0.01 hrs

Reach DP-1: Wetland



Summary for Pond 2P: Pickleball Infiltration Basin

Inflow Area = 18,073 sf,100.00% Impervious, Inflow Depth > 0.20" for Recharge event
Inflow = 0.17 cfs @ 12.09 hrs, Volume= 305 cf
Outflow = 0.03 cfs @ 12.59 hrs, Volume= 146 cf, Atten= 85%, Lag= 30.1 min
Discarded = 0.03 cfs @ 11.76 hrs, Volume= 146 cf
Primary = 0.00 cfs @ 12.59 hrs, Volume= 0 cf
Routed to Reach DP-1 : Wetland

Routing by Stor-Ind method, Time Span= 11.00-13.00 hrs, dt= 0.01 hrs
Peak Elev= 85.00' @ 12.59 hrs Surf.Area= 1,090 sf Storage= 168 cf

Plug-Flow detention time= 21.8 min calculated for 145 cf (48% of inflow)
Center-of-Mass det. time= 5.1 min (731.7 - 726.7)

Volume	Invert	Avail.Storage	Storage Description
#1A	84.50'	750 cf	**20.50'W x 53.18'L x 3.50'H Field A** 3,816 cf Overall - 1,316 cf Embedded = 2,500 cf x 30.0% Voids
#2A	85.00'	1,316 cf	**Cultec R-300HD** x 28 Inside #1 Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap 28 Chambers in 4 Rows Cap Storage= 2.7 cf x 2 x 4 rows = 21.2 cf
		2,066 cf	Total Available Storage

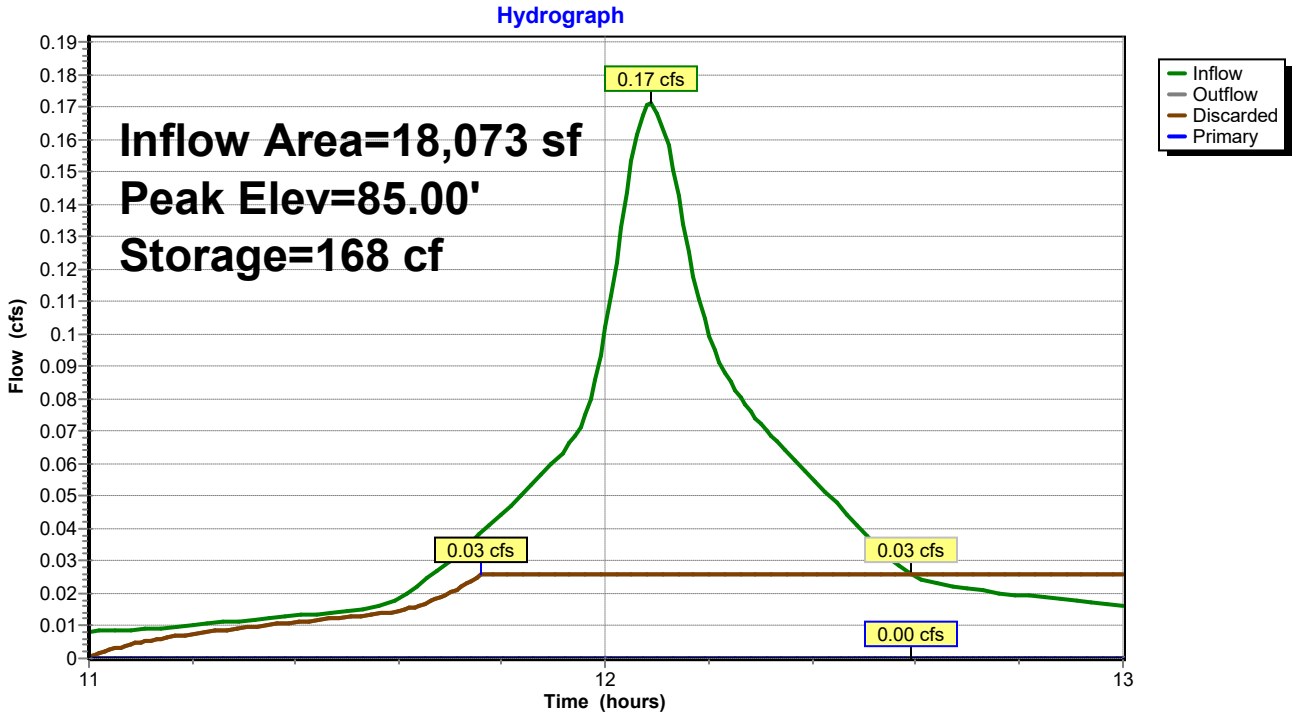
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	84.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	85.00'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	86.66'	**12.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	87.75'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

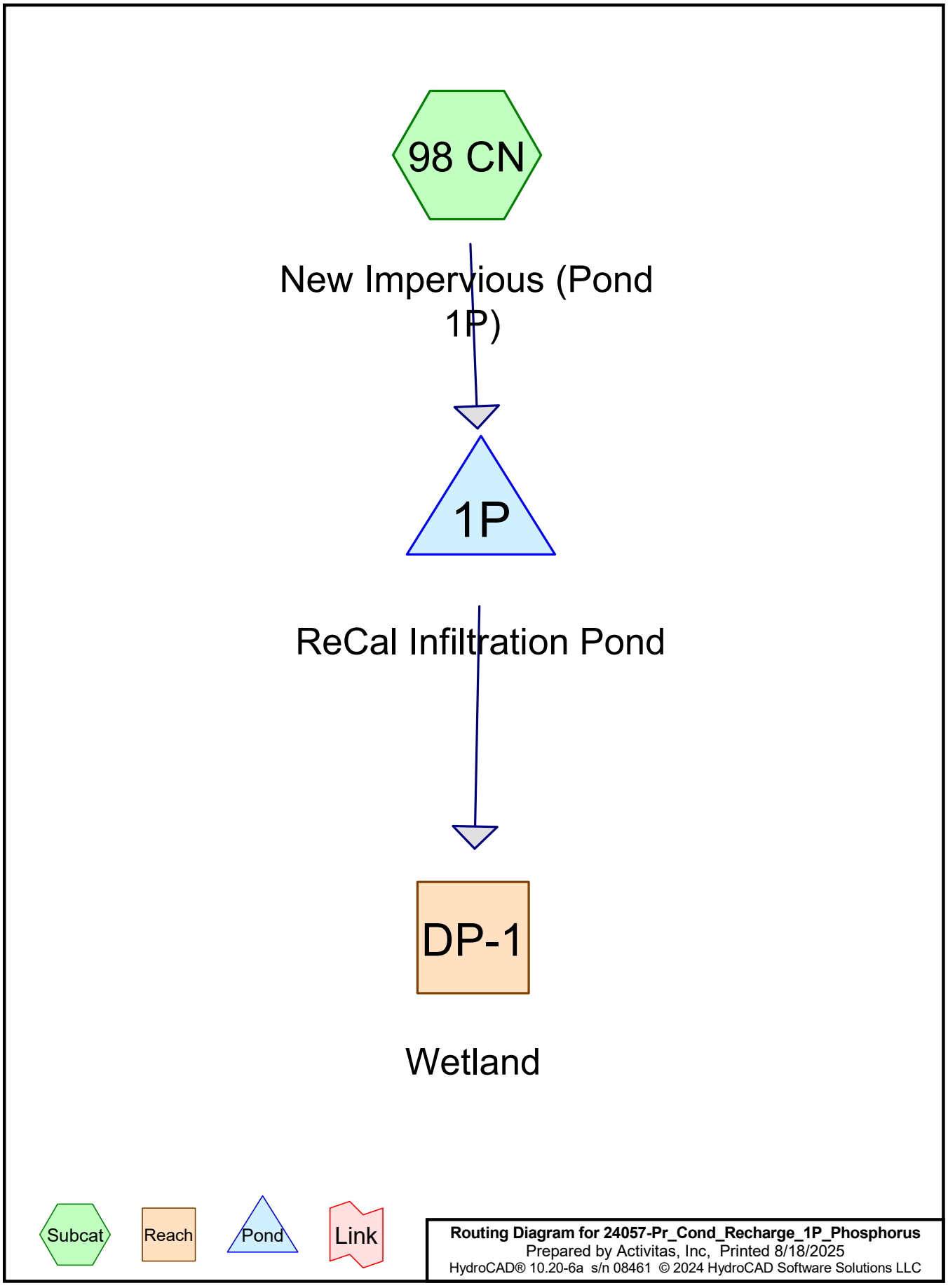
Discarded OutFlow Max=0.03 cfs @ 11.76 hrs HW=84.54' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 12.59 hrs HW=85.00' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.00 cfs @ 0.24 fps)
├**3=Orifice/Grate** (Controls 0.00 cfs)
└**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: Pickleball Infiltration Basin



HydroCAD Report – Phosphorus



Routing Diagram for 24057-Pr_Cond_Recharge_1P_Phosphorus
Prepared by Activitas, Inc, Printed 8/18/2025

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	Phosph	Type III 24-hr		Default	24.00	1	2.00	2

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 98 CN: New Impervious Runoff Area=77,330 sf 100.00% Impervious Runoff Depth=1.77"
Tc=6.0 min CN=98 Runoff=3.38 cfs 11,434 cf

Reach DP-1: Wetland Inflow=0.00 cfs 0 cf
Outflow=0.00 cfs 0 cf

Pond 1P: ReCal Infiltration Pond Peak Elev=84.25' Storage=4,301 cf Inflow=3.38 cfs 11,434 cf
Discarded=0.28 cfs 11,434 cf Primary=0.00 cfs 0 cf Outflow=0.28 cfs 11,434 cf

Total Runoff Area = 77,330 sf Runoff Volume = 11,434 cf Average Runoff Depth = 1.77"
0.00% Pervious = 0 sf 100.00% Impervious = 77,330 sf

Summary for Subcatchment 98 CN: New Impervious (Pond 1P)

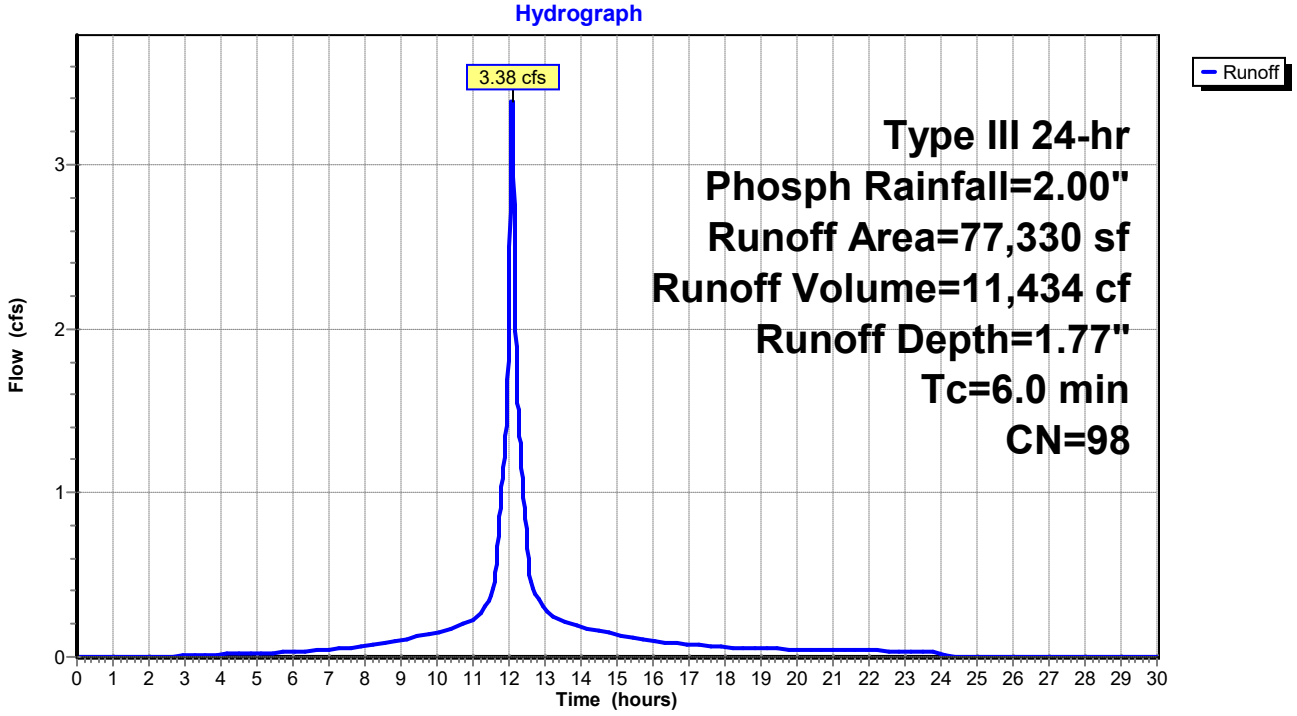
Runoff = 3.38 cfs @ 12.08 hrs, Volume= 11,434 cf, Depth= 1.77"
Routed to Pond 1P : ReCal Infiltration Pond

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr Phosph Rainfall=2.00"

Area (sf)	CN	Description
77,330	98	Paved parking, HSG B
77,330		100.00% Impervious Area

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

Subcatchment 98 CN: New Impervious (Pond 1P)

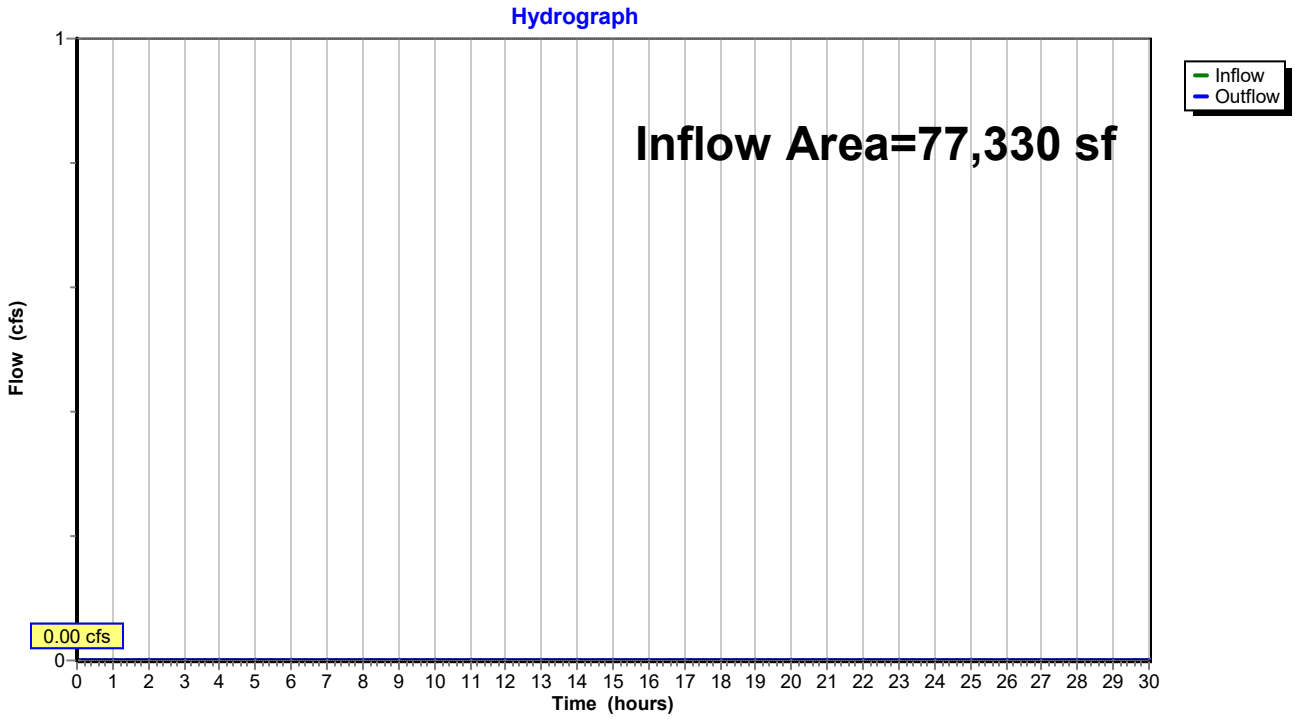


Summary for Reach DP-1: Wetland

Inflow Area = 77,330 sf,100.00% Impervious, Inflow Depth = 0.00" for Phosph event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Reach DP-1: Wetland



Summary for Pond 1P: ReCal Infiltration Pond

Inflow Area = 77,330 sf,100.00% Impervious, Inflow Depth = 1.77" for Phosph event
Inflow = 3.38 cfs @ 12.08 hrs, Volume= 11,434 cf
Outflow = 0.28 cfs @ 11.35 hrs, Volume= 11,434 cf, Atten= 92%, Lag= 0.0 min
Discarded = 0.28 cfs @ 11.35 hrs, Volume= 11,434 cf
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf
Routed to Reach DP-1 : Wetland

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs / 4
Peak Elev= 84.25' @ 13.02 hrs Surf.Area= 11,948 sf Storage= 4,301 cf

Plug-Flow detention time= 114.9 min calculated for 11,430 cf (100% of inflow)
Center-of-Mass det. time= 114.9 min (882.3 - 767.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	83.50'	7,802 cf	**82.25'W x 145.27'L x 3.50'H Field A** 41,819 cf Overall - 15,813 cf Embedded = 26,006 cf x 30.0% Voids
#2A	84.00'	15,813 cf	**Cultec R-300HD** x 340 Inside #1 Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap 340 Chambers in 17 Rows Cap Storage= 2.7 cf x 2 x 17 rows = 90.3 cf
		23,614 cf	Total Available Storage

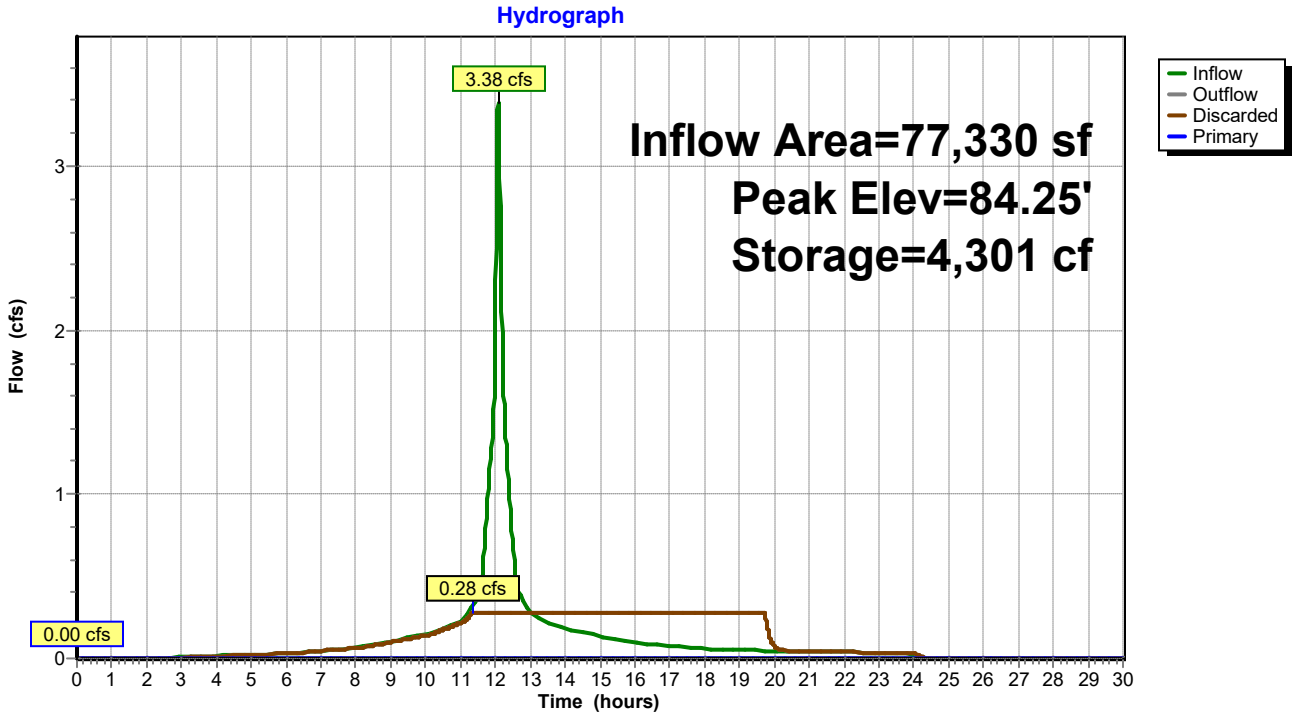
Storage Group A created with Chamber Wizard

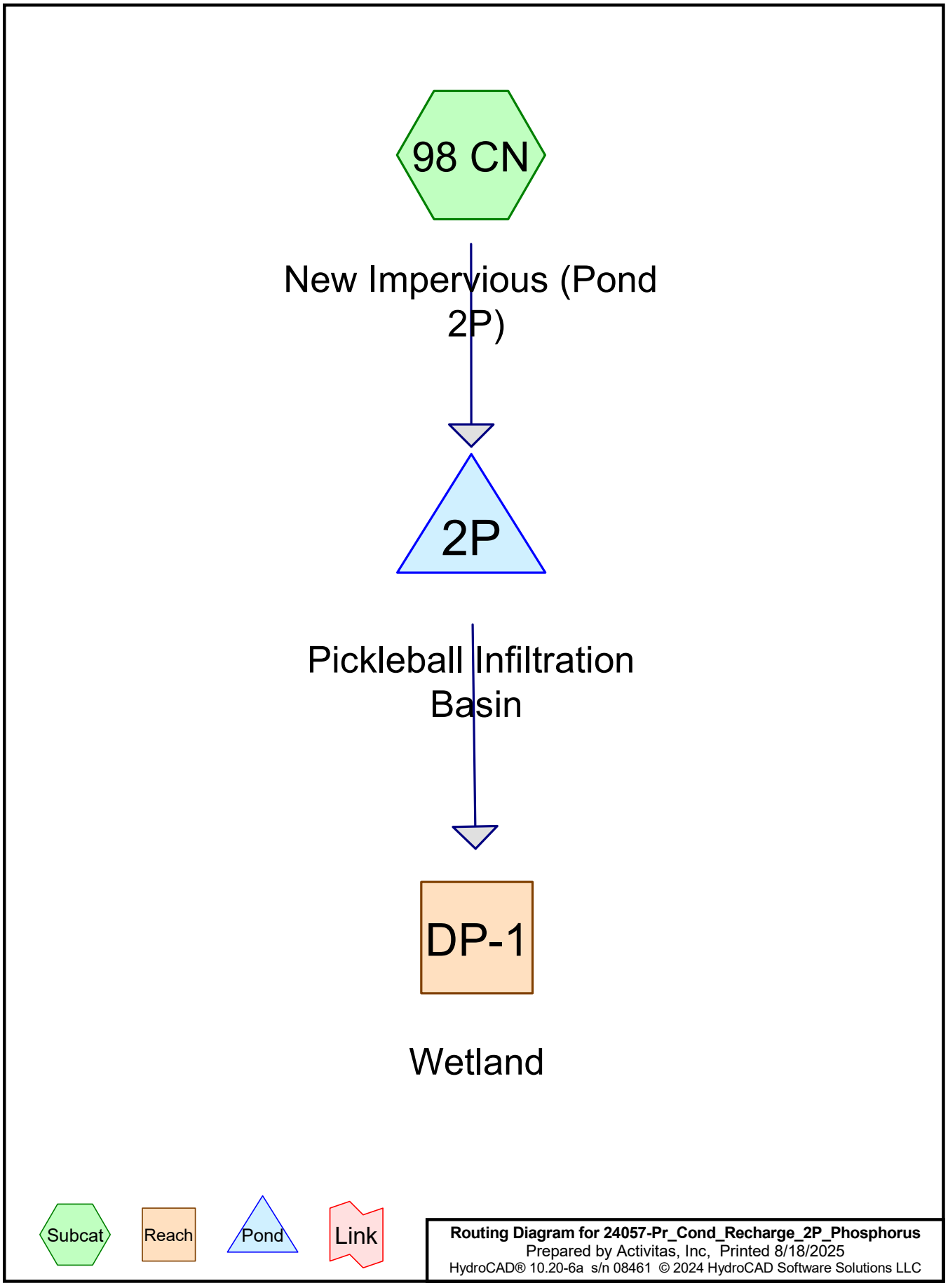
Device	Routing	Invert	Outlet Devices
#1	Discarded	83.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	84.66'	**10.0" W x 2.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	86.00'	**21.0" W x 10.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.28 cfs @ 11.35 hrs HW=83.54' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.28 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=83.50' (Free Discharge)
├**2=Orifice/Grate** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 1P: ReCal Infiltration Pond





Routing Diagram for 24057-Pr_Cond_Recharge_2P_Phosphorus
Prepared by Activitas, Inc, Printed 8/18/2025

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	Phosph	Type III 24-hr		Default	24.00	1	0.60	2

Time span=0.00-30.00 hrs, dt=0.01 hrs, 3001 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 98 CN: New Impervious Runoff Area=18,073 sf 100.00% Impervious Runoff Depth=0.41"
Tc=6.0 min CN=98 Runoff=0.20 cfs 617 cf

Reach DP-1: Wetland Inflow=0.00 cfs 11 cf
Outflow=0.00 cfs 11 cf

Pond 2P: Pickleball Infiltration Basin Peak Elev=85.04' Storage=202 cf Inflow=0.20 cfs 617 cf
Discarded=0.03 cfs 606 cf Primary=0.00 cfs 11 cf Outflow=0.03 cfs 617 cf

Total Runoff Area = 18,073 sf Runoff Volume = 617 cf Average Runoff Depth = 0.41"
0.00% Pervious = 0 sf 100.00% Impervious = 18,073 sf

Summary for Subcatchment 98 CN: New Impervious (Pond 2P)

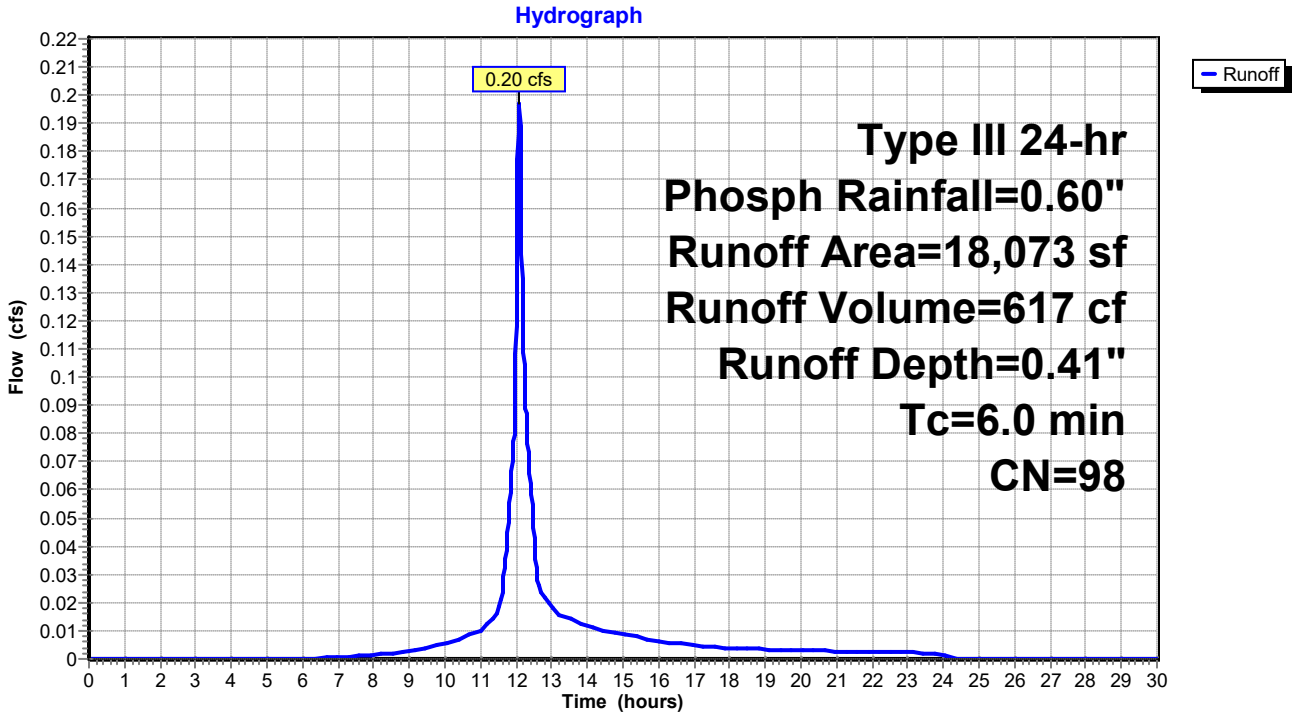
Runoff = 0.20 cfs @ 12.09 hrs, Volume= 617 cf, Depth= 0.41"
Routed to Pond 2P : Pickleball Infiltration Basin

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type III 24-hr Phosph Rainfall=0.60"

Area (sf)	CN	Description
18,073	98	Paved parking, HSG B
18,073		100.00% Impervious Area

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

Subcatchment 98 CN: New Impervious (Pond 2P)

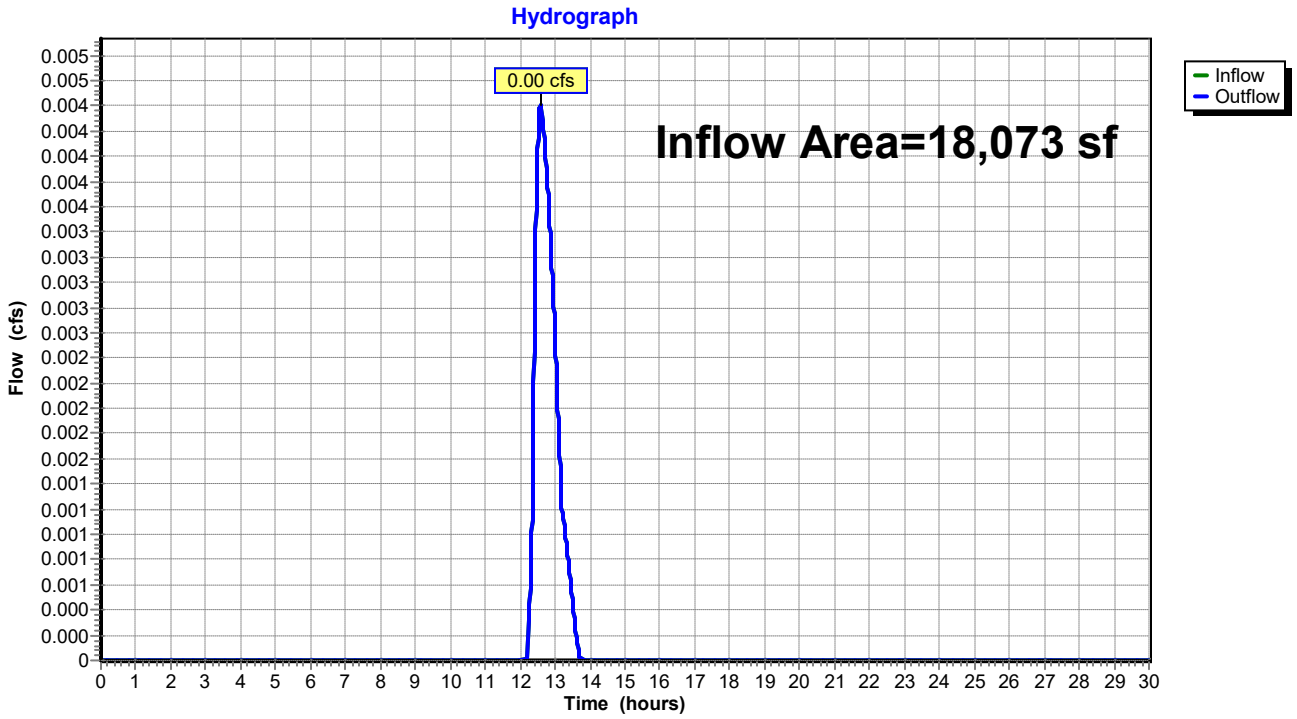


Summary for Reach DP-1: Wetland

Inflow Area = 18,073 sf,100.00% Impervious, Inflow Depth = 0.01" for Phosph event
Inflow = 0.00 cfs @ 12.58 hrs, Volume= 11 cf
Outflow = 0.00 cfs @ 12.58 hrs, Volume= 11 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Reach DP-1: Wetland



Summary for Pond 2P: Pickleball Infiltration Basin

Inflow Area = 18,073 sf,100.00% Impervious, Inflow Depth = 0.41" for Phosph event
Inflow = 0.20 cfs @ 12.09 hrs, Volume= 617 cf
Outflow = 0.03 cfs @ 12.58 hrs, Volume= 617 cf, Atten= 85%, Lag= 29.8 min
Discarded = 0.03 cfs @ 11.72 hrs, Volume= 606 cf
Primary = 0.00 cfs @ 12.58 hrs, Volume= 11 cf
Routed to Reach DP-1 : Wetland

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 85.04' @ 12.58 hrs Surf.Area= 1,090 sf Storage= 202 cf

Plug-Flow detention time= 54.7 min calculated for 617 cf (100% of inflow)
Center-of-Mass det. time= 54.6 min (860.7 - 806.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	84.50'	750 cf	**20.50'W x 53.18'L x 3.50'H Field A** 3,816 cf Overall - 1,316 cf Embedded = 2,500 cf x 30.0% Voids
#2A	85.00'	1,316 cf	**Cultec R-300HD** x 28 Inside #1 Effective Size= 45.6"W x 30.0"H => 6.53 sf x 7.08'L = 46.2 cf Overall Size= 51.0"W x 30.0"H x 7.54'L with 0.46' Overlap 28 Chambers in 4 Rows Cap Storage= 2.7 cf x 2 x 4 rows = 21.2 cf
		2,066 cf	Total Available Storage

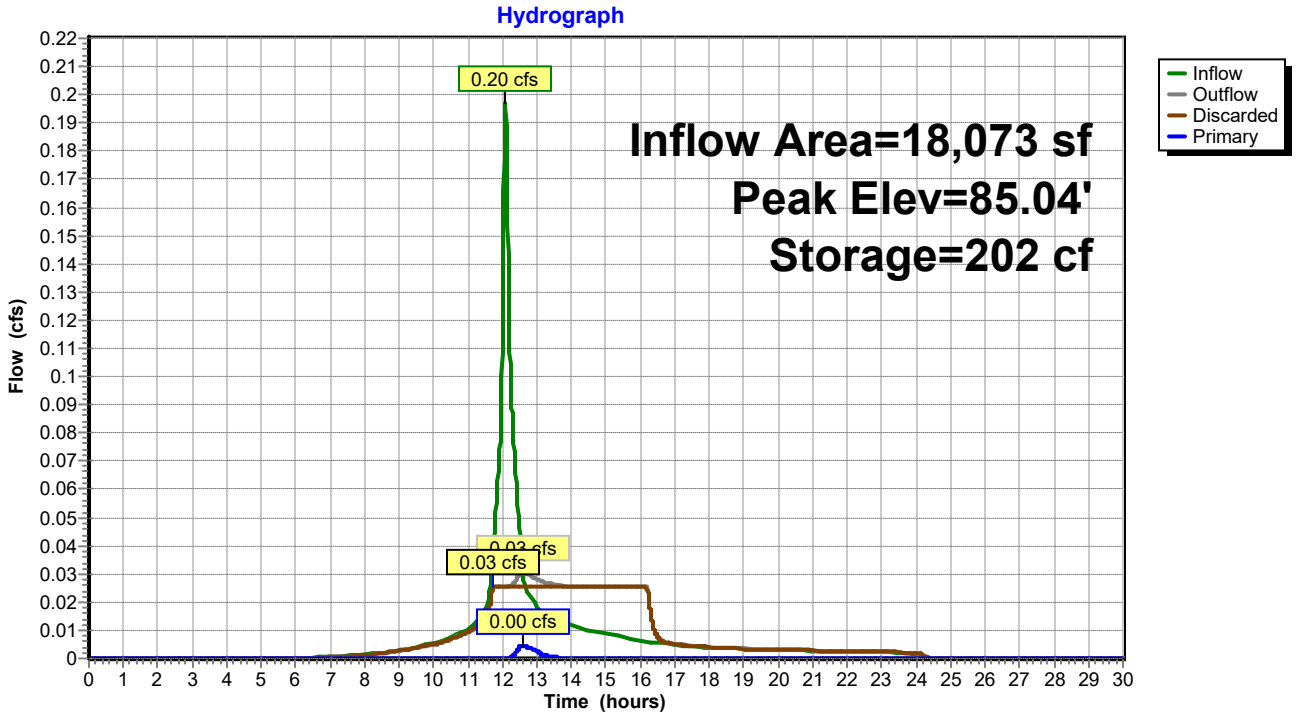
Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	84.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Primary	85.00'	**2.5" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Primary	86.66'	**12.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	87.75'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Discarded OutFlow Max=0.03 cfs @ 11.72 hrs HW=84.54' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 12.58 hrs HW=85.04' (Free Discharge)
├**2=Orifice/Grate** (Orifice Controls 0.00 cfs @ 0.72 fps)
├**3=Orifice/Grate** (Controls 0.00 cfs)
└**4=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 2P: Pickleball Infiltration Basin



Phosphorus Removal Calculations

Phosphorous Removal Calculations

	Surface Type	Soil HSG	Area (sf)	P Load Export Rate (lb/acre/yr)	P Load (lb/yr)
EXISTING CONDITIO	EX-1				
	Impervious	B*	11,975	1.78	0.49
	Grass	B*	11,833	0.03	0.01
	Bare Soil/Gravel	B*	0	1.52	0.00
	Wooded	B*	154,438	*0.13*	0.46
				TOTAL:	0.96

	Surface Type	Soil HSG	Area (sf)	P Load Export Rate (lb/acre/yr)	P Load (lb/yr)
PROPOSED CONDITIONS	PR-10				
	Impervious	B*	77,330	1.78	3.16
	Grass	B*	12,410	0.03	0.01
	Bare Soil/Gr	B*	0	1.52	0.00
	Wooded	B*	32	*0.13*	0.00
				TOTAL:	3.17
	Cumulative Phosphorus Load Reduction of 100% =				0.00
	PR-11				
	Impervious	B*	18,073	1.78	0.74
	Grass	B*	4,235	0.03	0.00
	Bare Soil/Gr	B*	0	1.52	0.00
	Wooded	B*	1,461	*0.13*	0.00
				TOTAL:	0.75
	Cumulative Phosphorus Load Reduction of 86% =				0.10
	PR-12				
	Impervious	B*	3,625	1.78	0.15
	Grass	B*	43,448	0.03	0.03
	Bare Soil/Gr	B*	599	1.52	0.02
	Wooded	B*	17,033	*0.13*	0.05
				TOTAL:	0.25
				TOTAL PR:	0.25

FINAL RESULTS

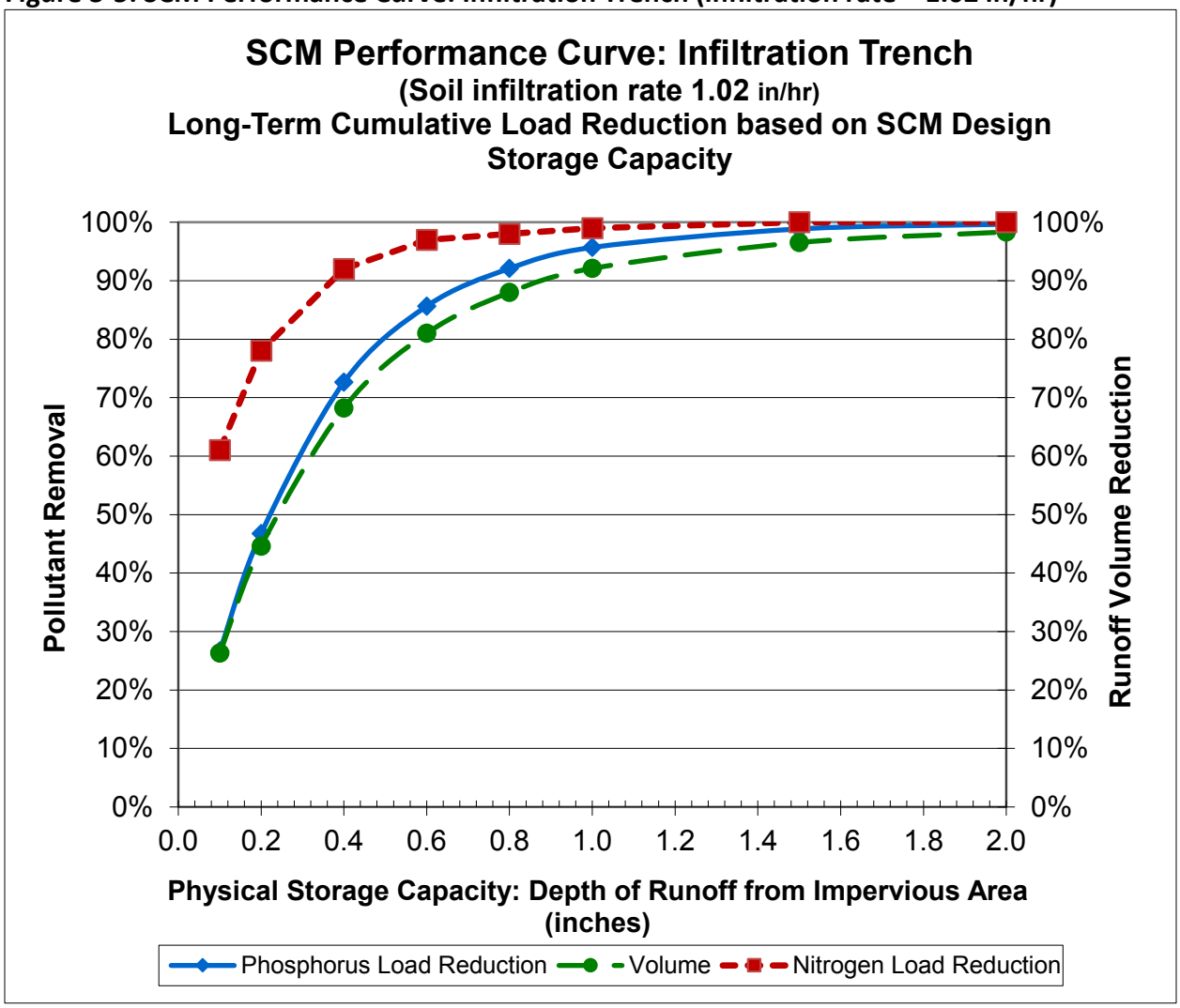
The TLP from PR-10 is expected to be exfiltrated in the water detention area 1P in a rainfall event with an average of 2.0" of runoff from impervious areas, and PR-11 is expected to be exfiltrated in the water detention area 2P in a rainfall event with average of 0.6" of rainfall. Thus, pond 1P is not expected to discharge water to DP-1 and Pond 2P has a cumulative phosphorus load reduction of 86%. Please see the TLP reduction calculation.

TLP Reduction = 63.0%

Table 3- 10: Infiltration Trench (IR = 1.02 in/hr) SCM Performance Table

Infiltration Trench (IR = 1.02 in/hr) SCM Performance Table: Long-Term Phosphorus & Nitrogen Load Reduction								
SCM Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Runoff Volume Reduction	26.3%	44.6%	68.2%	81.0%	88.0%	92.1%	96.5%	98.3%
Cumulative Phosphorus Load Reduction	27%	47%	73%	86%	92%	96%	99%	100%
Cumulative Nitrogen Load Reduction	61%	78%	92%	97%	98%	99%	100%	100%

Figure 3-5: SCM Performance Curve: Infiltration Trench (infiltration rate = 1.02 in/hr)



Mounding Analysis

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Conversion Table

inch/hour	feet/day
0.67	1.33
2.00	4.00

hours	days
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

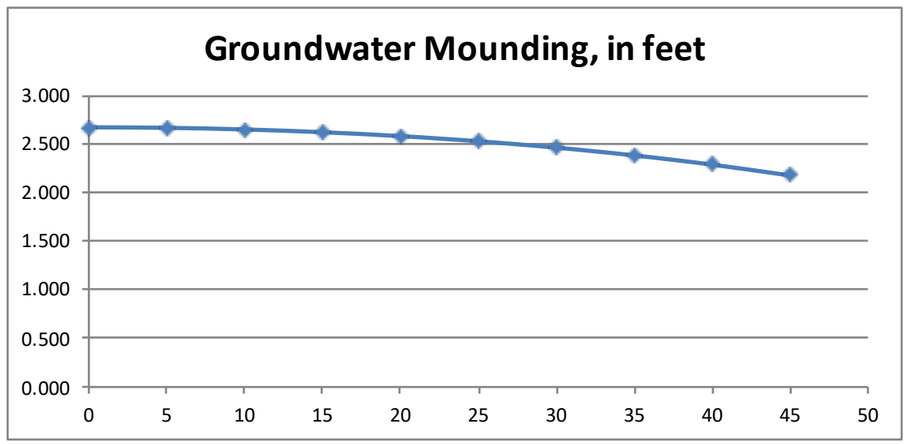
Input Values

0.7065	***R***	**Recharge (infiltration) rate (feet/day)**
0.370	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
26.18	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
62.010	**x**	**1/2 length of basin (x direction, in feet)**
41.125	**y**	**1/2 width of basin (y direction, in feet)**
3.000	**t**	**duration of infiltration period (days)**
14.000	**hi(0)**	**initial thickness of saturated zone (feet)**

16.680	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
2.680	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	Distance from center of basin in x direction, in feet
2.680	0
2.674	5
2.657	10
2.629	15
2.589	20
2.536	25
2.470	30
2.390	35
2.294	40
2.182	45

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
Cells highlighted in yellow are values that can be changed by the user. Cells highlighted in red are output values based on user-specified inputs. The user MUST click the blue "Re-Calculate Now" button each time ANY of the user-specified inputs are changed otherwise necessary iterations to converge on the correct solution will not be done and values shown will be incorrect. Use consistent units for all input values (for example, feet and days)

use consistent units (e.g. feet & days **or** inches & hours)

Conversion Table

inch/hour	**feet/day**
0.67	1.33
2.00	4.00

hours	**days**
36	1.50

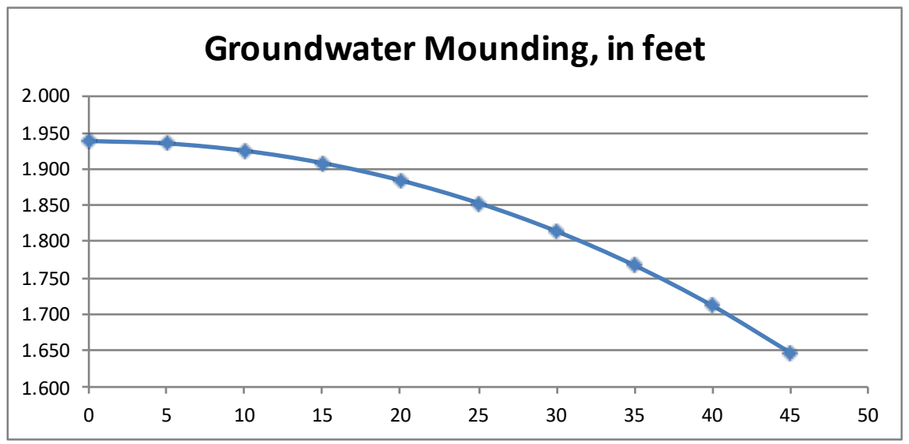
In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

Input Values		
0.7065	***R***	**Recharge (infiltration) rate (feet/day)**
0.300	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
100.00	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
26.590	**x**	**1/2 length of basin (x direction, in feet)**
10.250	**y**	**1/2 width of basin (y direction, in feet)**
3.000	**t**	**duration of infiltration period (days)**
7.000	**hi(0)**	**initial thickness of saturated zone (feet)**

8.938	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
1.938	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
1.938	**0**
1.935	**5**
1.925	**10**
1.908	**15**
1.884	**20**
1.853	**25**
1.814	**30**
1.767	**35**
1.712	**40**
1.647	**45**

Re-Calculate Now



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TSS Removal Calculations

TOTAL SUSPENDED SOLIDS (TSS) REMOVAL WORKSHEET

Project: Reading Center for Active Living and Communit Pickleball Facility
Date: July 7, 2025
Revised:
Project No: 24057
Location: Reading, MA
Prepared By: BJM
Checked By: MEB

Legend:

Discharge Location: DP-1

BMP	B TSS Removal Rate	C Starting TSS Load	D Amount Removed (BxC)	E Remaining Load (C-D)	F TSS Removal Rate
Street Sweeping - 10%	0.10	1.00	0.10	0.90	10%
Deep Sump and Hooded Catch Basin	0.25	0.90	0.23	0.68	33%
Water Quality Unit	0.75	0.68	0.51	0.17	83%
Infiltration Basin	0.80	0.17	0.14	0.03	97%

Total TSS Removal = 97%

TOTAL SUSPENDED SOLIDS (TSS) REMOVAL WORKSHEET

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BMP	B TSS Removal Rate	C Starting TSS Load	D Amount Removed (BxC)	E Remaining Load (C-D)	F TSS Removal Rate
Street Sweeping - 10%	0.10	1.00	0.10	0.90	10%
Deep Sump and Hooded Catch Basin	0.25	0.90	0.23	0.68	33%
Infiltration Basin	0.80	0.68	0.54	0.14	87%
	0.00	0.14	0.00	0.14	87%

Total TSS Removal = 87%

Operations & Maintenance Plan (O&M) – DRAFT

(Refer to separate attachment)

Stormwater Pollution Prevention Plan (SWPPP) – DRAFT

(Refer to separate attachment)