TOWN OF STOW ZONING BOARD OF APPEALS APPLICATION FOR:

- [x] **SPECIAL PERMIT**
- ☐ **DIMENSIONAL VARIANCE**
- ☐ **SIGN VARIANCE**
- ☐ **APPEAL of DECISION OF BUILDING INSPECTOR/ZONING ENFORCEMENT OFFICER/SIGN OFFICER**

File one (1) copy of the Application (including plans and reports as required by the Rules and Regulations), folded to fit neatly within a legal sized file folder, to the Town Clerk.

Received and Filed with Town Clerk

_____
Date

_____
Stow Town Clerk

File ten (10) copies of the Application (including plans and reports as required by the Rules and Regulations), folded to fit neatly within a legal sized file folder, to the Zoning Board of Appeals along with an Application fee payable to "Town of Stow" in the amount required by the Rules and Regulations. Refer to the Rules and Regulations for details on the information required.

APPLICANT'S NAME Town of Stow	PHONE # 978 897 2927 EMAIL: townadministrator@stow-ma.gov
MAILING ADDRESS: 380 Great Road	
LOCATION AND STREET ADDRESS OF SITE 19 Crescent Street	
AREA OF SITE 0.35 sq. ft. (acres)	FRONTAGE 358.67 linear feet
ZONING DISTRICT Residential	TOWN OF STOW ASSESSOR'S MAP Number(s) U-10 Parcel Number(s) 33
SOUTH MIDDLESEX REGISTRY OF DEEDS BOOK AND PAGE NO.(s): 2144, 505 or LAND COURT CERTIFICATE OF TITLE NO.(s): _____	
PROPERTY OWNER(S) NAME Town of Stow	PHONE NO. 978 897 2927 EMAIL townadministrator@stow-ma.gov
APPLICATION FEE MADE PAYABLE TO TOWN OF STOW	$250.00 PLUS $2.00 FOR EACH LISTED ABUTTER $ _____

TYPE OF APPLICATION

☒ Special Permit	Check the appropriate box below
	☐ Section 3.2.2 of the Zoning Bylaw (Residential District Use)
	☐ Section 3.3.3 of the Zoning Bylaw (Business District Use)
	☐ Section 3.9 of the Zoning Bylaw (Non-Conforming Use or Structure) (attach copy of form Appendix 7 for non-conforming vacant lots)
	☐ Section 4.1.3 of the Zoning Bylaw (Two or more dwelling houses)
	☐ Section 4.1.4 of the Zoning Bylaw (Floodplain)
	☐ Section 4.1.6 of the Zoning Bylaw (Single Family dwelling on non-conforming lot in single ownership)
	☐ Section 4.4 of the Zoning Bylaw (Table of Dimensional Requirements) for expansion of an existing non-conformity.
	☐ Section 5.1.1.7 of the Zoning Bylaw (Floodplain Overlay District – Mapping Error)
	☒ Other modification to special Permit

☐ Variance (Section 4.4 (Dimensional Requirements) of the Zoning Bylaw)	**Required Setback – Current Zoning Bylaw**		**Existing Setback**	**Proposed Setback**	**Variance Requested**
	Front yard	____ feet	____ feet	____ feet	____ feet
	Side Yard	____ feet	____ feet	____ feet	____ feet
	Side Yard	____ feet	____ feet	____ feet	____ feet
	Rear Yard	____ feet	____ feet	____ feet	____ feet
	Other	(Describe)			

☐ Variance – Section 6.3..7.7 (Signs) of the Zoning Bylaw	Attach description of and justification for variance.
☐ Appeal of Decision of the Building Commissioner/Zoning Enforcement Officer/Sign Officer	Attach description of and justification for appeal.

DESCRIPTION AND JUSTIFICATION FOR THE PROPOSED REQUEST:

Attach detailed description and justification for request.

Any additional maps, plans, photographs, deeds, or documents which the Applicant wishes to submit should be enclosed with each copy of this Application.

==========

The undersigned hereby certify that the information on this Application and plans submitted herewith are correct, and that all applicable provisions of Statutes, Regulations, and Bylaws will be complied with.

The above is subscribed to and executed by the undersigned under the penalties of perjury in accordance with Section 1-A of Chapter 268, General Laws of the Commonwealth of Massachusetts.

APPLICANT

Date: 5/9/24	
Name (print) Denise Dembkoski	Signature

OWNER'S KNOWLEDGE AND CONSENT

I hereby assert that I have knowledge of and give my consent to the Application presented above.

Date: 5/9/24	
Name (print) Denise Dembkoski	Signature

TRUST, CORPORATION OR COMPANY KNOWLEDGE AND CONSENT

Date:	
Name (print)	Signature

Apr 24, 2024

Town of Stow
Randall Library Renovation + Addition
19 Crescent Street

ZBA APPLICATION
SUPPORTING MATERIALS
DRAFT

PROJECT UPDATE

The following project update is provided for the Randall Library Renovation and Addition Project located at 19 Crescent Street. Following the August 14, 2023 Special Permit and Site Plan Approval for the project, construction documents were finalized in preparation for bid in early October and bids were received in mid November. Unfortunately, the low bid that was received was considerably over budget. As a result, the project transitioned into a redesign process to consolidate scope and reduce costs.

The redesign process, which included multiple workshops with the Building Committee, commenced in December 2023 and concluded in mid-February. The redesign process was quickly followed by an accelerated documentation process to prepare the redesign project for bid. The documentation effort concluded in early April 2024 and the project is currently back out to bid. Bids are anticipated on May 8th, 2024.

The original building and site design goals have been maintained, however several aspects have been modified to consolidate scope and simplify construction with the ultimate goal of reducing the project's construction costs. In summary, the following adjustments have been made:

Building:
- Program spaces within the building have been reconsidered, reevaluated and
- consolidated. As a result, the addition footprint has decreased in size. The overall building square footage has been reduced to 7,730.
- **East side yard setback:** As a result of the reduced footprint, the proposed addition no longer encroaches beyond the existing east side yard setback (see attachment 1).
- **South front yard setback:** As a result of the reduced footprint, the proposed addition no longer encroaches beyond the existing south front yard setback (see attachment 1).

Site/Landsacpe:
- Both the original entrance and the new addition remain as accessible entries to the building. However, the historic entrance is now accessed via an accessible ramp instead of an accessible sloped walkway.

- Plantings (groundcover, shrubs, trees) have been simplified.
- Parking has been consolidated to be along Common Road (instead of Common Road and Crescent Street). The total parking provided along Common Road in the revised design is (1) ADA space and (3) regular spaces. This is a reduction in (1) ADA space and (1) regular space from the previous design. However, it is the project team's goal to reintroduce (1) ADA parking space along Crescent Street during the construction process if the project budget allows. However, this cannot be guaranteed at this time.

Drainage and Stormwater Management:
- The stormwater report has been updated to reflect the revised building and site design
- Erosion and stormwater control measures are included in the bid documents (drawings and specs published 3/29/24)

SPECIAL PERMIT CONDITIONS

As a result of the changes in both the building and site design, the following modifications to the special permit that was granted on August 14th, 2023 are requested:

Building:

Items 14 (Setback)

Due to the building's reduced footprint the east side yard and south front yard setback variances are no longer required. The reduced building footprint fits entirely within the existing footprint.

Item 15 (Total Square Footage)

The revised proposed total square footage of the Randall Library is approximately 7,230 (reduced from the previous 8,700)

Item 16 (Footprint)

The revised footprint is approximately 3,710 (reduced from the previous 4,600)

Item 17 (Setback)

Setback variances beyond the existing building footprint are no longer required due to the reduced footprint of the proposed building.

Parking:

Item 20 (Parking)

Proposed parking is provided on Common Road only: (3) perpendicular on street spaces and (1) accessible parking stall.

Item 22 (Parking)

A total of (4) parking stalls are provided (reduced from the previous (6))

Item 25 (Parking)

(1) ADA parking space is provided (reduced from the previous (2))

Item 28 (Sidewalk)
Parking is longer provided along Crescent Street, but a sidewalk is.

ATTACHMENTS
The following attachments are included to supplement the previous versions submitted in the summer of 2023 (August 1st). The attachment numbers correspond with the previously submitted materials:

- Attachment 1 - Setback Diagram
- Attachment 5 - Proposed SIte Plan
- Attachment 6 - Proposed Utility Plan
- Attachment 8 - Stormwater Management Report

END

Existing GSF: 9400 GSF
Fall 2023 GSF: 9,560 GSF
Redesign GSF: 7730 GSF

Existing Footprint: 5266 SF
Fall 2023 Footprint: 4600 SF
Redesign Footprint: 3710 SF

2023 Addition Footprint: 2,345 SF
Redesign Addition Footprint: 1399 SF

CONTEXT

The Randall Library, designed by architect George G. Adam atop Library Hil in the town of Stow, MAl, was originally constructed in 1894. The original two-story library is distinctly Richardsonian in style, constructed of load-bearing masonry walls, with a slate roof, corner turret and primary entry arch. The Whitney Room was added in 1920 followed by a larger addition in the mid 1970's. The original library is 3,390 SF, the Whitney room added approx. 250 SF and the 1970's addition 3,800 SF, totalling 7,440 SF. The library served the Stow community well in this configuration for several decades. However, as the public library paradigm shifted through the early 2000's from a book centric model to a model offering digital resources and a variety of community amenities, the constraints of the existing building have proven problematic and restrictive, limiting the types of library services, programs and spaces offered.

SITE + BUILDING CONSTRAINTS

Location + Zoning

The site address is 19 Crescent Street and is zoned Residential (Town of Stow Assessor's Map U10, Parcel 33). The site fronts three streets (Common, Crescent and Library Hill) which are defined as front yards (30' setbacks). The remaining side of the site is defined as a side yard (25' setback).

Site Geometry

The existing site geometry is irregular and constrained, bounded by three roads: Library Hill Road on the west, Crescent Street on the North and Common Road on the south. It abuts one adjacent Crescent Street property along the eastern edge. The resulting site is widest along Library Hill Road (Approx. 100 feet) and tapers towards the southeast into an acute angle point. The available building footprint, based on the required residential front and side yard setbacks, is approx. 3,290 square feet and is very irregular and limiting in shape (Refer to attachment 1). Neither the original building nor the 1970's addition conforms with these setback requirements.

Topography

The existing site has a change in grade of approx. 11 feet from the Northeast corner to the Southeast corner further limiting the buildable options and contributing to challenging accessibility (ADA) conditions.

Parking + Access

Given the nature of the existing constrained site, parking is shoehorned onto the site and along Common Room in an ad hoc manner that is inadequate and unsafe. The lack of appropriate parking is compounded by the lack of a sidewalk along Common Road.

Building System Requirements

The existing building does not have a fire protection (sprinkler) system as it was not a building code requirement at the time of construction. However, any substantial renovations and/or additions will trigger the current building code requirement to install a sprinkler system throughout both the existing building and any proposed addition. As there is not an adequate municipal water supply to support a conventional sprinkler system an onsite cistern or storage tank will be required to provide an adequate water supply. The irregular site and available space within the existing building provides limited opportunity to locate these required elements. There is also potential PFAS contamination on site which further complicates on site storage (cistern) options and could trigger potential remediation costs. This suggests an in-building storage tank solution over a site storage (cistern) solution may be the appropriate solution, which would ultimately require additional interior space.

Additionally, the existing space allocated to mechanical (HVAC) and electrical equipment is severely inadequate both in terms of space for the necessary equipment itself and safe operational clearances around the equipment. This issue is compounded by the additional mechanical and electrical equipment that will be required to modernize the building systems and meet current building and energy codes.

Accessibility

Within the existing building there are several accessibility deficiencies and non-conforming conditions including the existing stair, door clearances and restroom clearances, among clothes. Providing comparable spaces that are fully accessible and building code compliant will require additional space.

DESIGN OVERVIEW

Summary

The existing library and site will be largely transformed into a 21st century library experience. The original building will be restored with the original library entrance reactivated as a primary entrance into the building. The 70's addition will be demolished, largely due to the structural deficiencies (inability to support book stacks on the 2nd floor) and compromised layout. A new addition will be constructed in its place with a modified footprint, providing an arrangement of spaces designed to provide a contemporary library environment with a variety of program spaces. The entirety of the landscape will be reconsidered and rearranged providing a range of spaces from contemplative gardens to programmable terraces.

Parking, Pedestrian Safety + Accessibility

Properly sized and striped parking spaces will be provided on both the Common Road and Crescent Street sides of the street. A safe, accessible path along new sidewalks will be provided to both the historic entry on the upper level of the original building and lower level entry in the new addition. The footprint of the new addition will be pushed back slightly from Common Road (when compared to the current footprint) to provide a

transitional Arrival Court between the building and street further enhancing the safe and accessible path from parking into the building.

Within the building, a new fully-accessible elevator will be provided. Additionally, all new spaces will be fully accessible and code compliant.

Variety of Program Spaces
Within the building, a variety of new program spaces will be provided. Including, among others, a dedicated Teen Space, dedicated Children's Room, and small meeting rooms for library patrons to a proper processing area and breakroom for staff. The original reading room and Whitney Room within the historic building will be restored to support quiet reading and computer use. The majority of the collection will be relocated to the lower level of the existing building.

Community Room
The largest and most prominent program addition to the library will be a new dedicated Community Room. The flexibly arranged space, approx. 30' X 18' will accommodate approximately 30-35 patrons in different configurations, including presentation, meeting or event formats. The new Community Room will be paired with an entry lobby that will serve as a small anteroom for people to gather before entering the Community Room. The entry lobby and Community Room will be arranged so that they can operate and be available for Community use after the library has closed. The Community Room will also open to the adjacent landscape courtyard for interior/exterior events.

PROJECT UPDATE
(August 02, 2023)

Following the Initial July 10th ZBA Hearing, in response to discussion and comments during that hearing, as well as general refinements as the design has been finalized and a discussion with the abutting property owner, several adjustments have been made. A summary of these adjustments are as follows:

- As a result of plan layout refinements and a reduction of interior double-height spaces, the 'bump-out' on the side-yard side of the building abutting a neighbor's property has been eliminated.
- The overall footprint of the building has been reduced by 110 SF.
- The impervious area of the site has been reduced by 510 SF. As a result, the Stormwater Management Plan has been updated and the infiltration basin has been eliminated.
- In response to abutter feedback, a tree protection plan has been developed to protect select trees that are near, or on, the side yard abutting property line.
- The proposed building mechanical system has been redesigned, resulting in smaller, less visible, and quieter outdoor components.

- The angle of the community room perimeter wall has been adjusted to be parallel to the side yard property line. As a result, the side yard setback dimension variance request has adjusted from what was previously submitted. This has been updated in the subsequent materials.

These adjustments have been incorporated into updated plan drawings, site drawings, and associated attachments noted below, as applicable.

ATTACHMENTS:

- Attachment 1 - Setback Diagram *(updated,8/3/23)*
- Attachment 2 - Existing Parking *(dated 6/14/23)*
- Attachment 3 - Lower Level Plan *(updated, 8/1/23)*
- Attachment 4 - Upper Level Plan *(updated, 8/1/23)*
- Attachment 5 - Proposed Site Plan *(updated,8/1/23)*
- Attachment 6 - Proposed Utility Plan *(updated, 8/2/23)*
- Attachment 7 - Existing Condition Photos *(dated 6/14/23)*
- Attachment 8 - Stormwater Management Plan *(updated, 8/2/23)*
- Attachment 9 - Certified Plot Plan *(dated July 2023)*

- END -

Randall Library
Renovation + Addition
ZBA Application Materials
Attachment 1 - Setback Diagram Diagram
4/26/24

EXISTING FOOTPRINT - 5,266 SF
PROPOSED FOOTPRINT - 4,600 SF
HISTORIC BUILDING BOUNDARY
PROPERTY LINE
EXISTING SET BACKS
PREVIOUS DESIGN SET BACKS
BUILDABLE AREA

HISTORIC BUILDING BOUNDARY
SIDE YARD SETBACK
FRONT YARD - NORTH
FRONT YARD - SOUTH
FRONT YARD - WEST
EXISTING MECHANICAL EQUIPMENT
EXISTING RAMP
GARAGE
METAL BIKE RACK ON CONCRETE PAD
STONE DUST WITH DH HELD
STAINLESS STEEL POST WITH DH HELD

CRESCENT STREET
(PUBLIC - 50' WIDTH - 1958 RELOCATION)
R=1277.65'
L=46.99'
Δ=2°06'27"
S22°09'55"E
63.21'
S31°22'06"E
98.37'
S31°05'57"E
51.42'
COMMON ROAD
(PUBLIC - 35' WIDTH - PER PLAN RECEIVED FROM TOWN AND 1999 TOWN VOTE TO RECIND 1908 ABANDONMENT OF COMMON ROAD AS A TOWN WAY)
N71°34'59"E
29.90'
N65°55'01"W
175.54'
R=25.00'
L=22.38'
Δ=51°17'01"
R=20.00'
L=29.90'
Δ=85°39'26"
N14°38'01"W
51.00'
LIBRARY HILL ROAD
(PUBLIC - 50' WIDTH - 1964 RELOCATION)
123.43'
N14°38'01"W
R=25.07'
L=26.94'
Δ=61°34'10"

1 Survey Site Plan - Footprints
1/8" = 1'-0"

RANDALL LIBRARY
19 Crescent St
Stow, MA 01775

designLAB architects
35 Channel Center Street, Suite 103
Boston, MA 02210
t: 617.350.3005
www.designLABarch.com

Consultants:

Key Plan:

Legend:

Stamp:

REV NO	DESCRIPTION	DATE

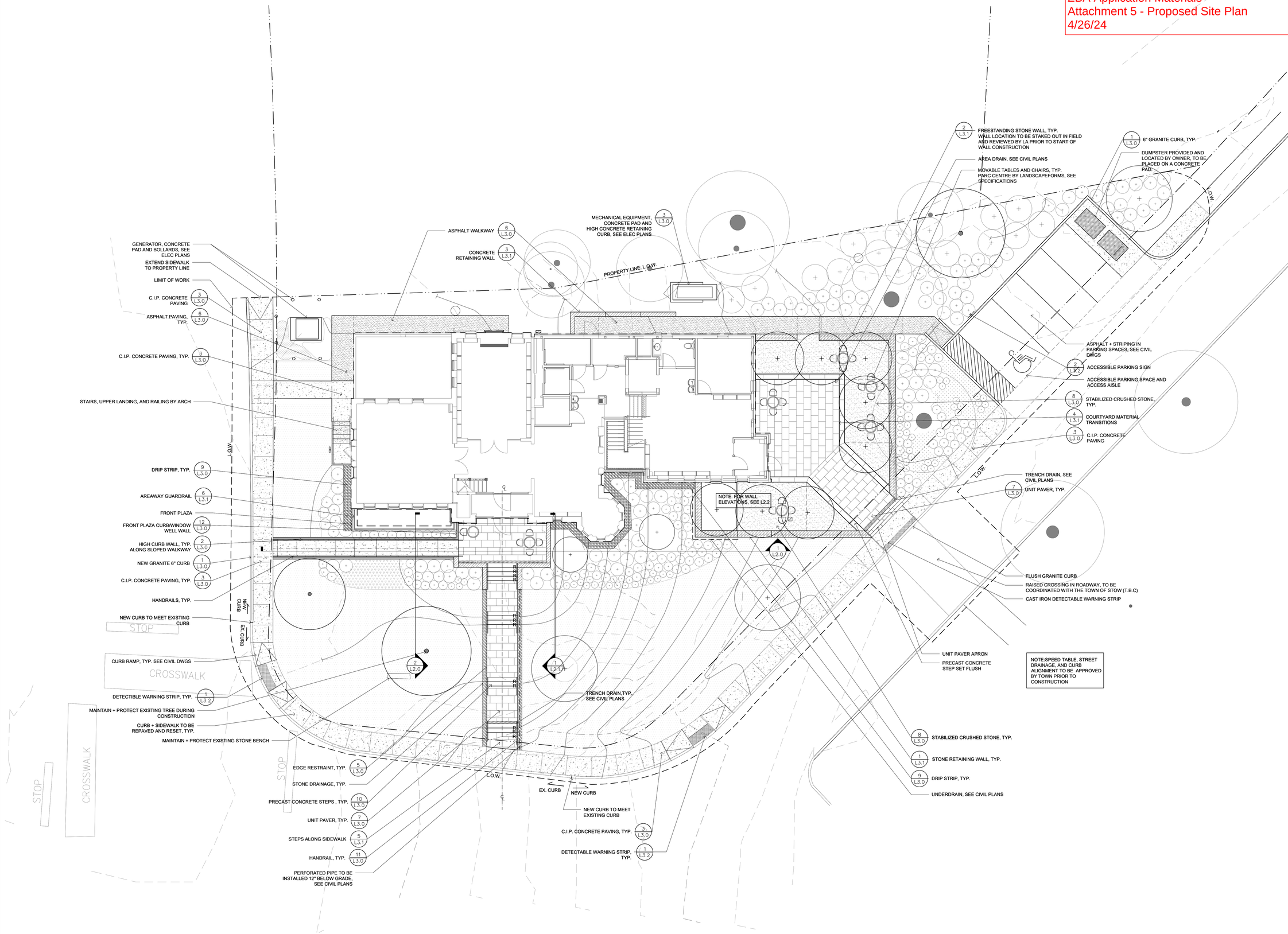
PROJECT NO: 21-007
DRAWN BY: Author
CHECKED BY: Checker
DATE: 03/29/2024

DRAWING TITLE:
SITE PLAN WITH FOOTPRINTS

100% CONSTRUCTION DOCUMENTS

SHEET NUMBER:
XSITE

Randall Library
Renovation + Addition
ZBA Application Materials
Attachment 5 - Proposed Site Plan
4/26/24



RANDALL LIBRARY

19 Crescent Street
Stow, MA 01775

designLAB architects

35 Channel Center Street, Suite 103
Boston, MA 02210
t: 617.350.3005
www.designLABarch.com

Consultants:

G2 COLLABORATIVE
LANDSCAPE ARCHITECTURE

282 Moody Street, Suite 308
Waltham, MA 02453
781.373.5945
www.g2cla.com

Key Plan:

Legend:

Stamp:

REV NO	DESCRIPTION	DATE

SCALE: 1/8" = 1'-0"

PROJECT NO: 2301
DRAWN BY: AG
CHECKED BY: GS
DATE: 410.24

DRAWING TITLE:
ZBA SUBMISSION

SITE PLAN

SHEET NUMBER:

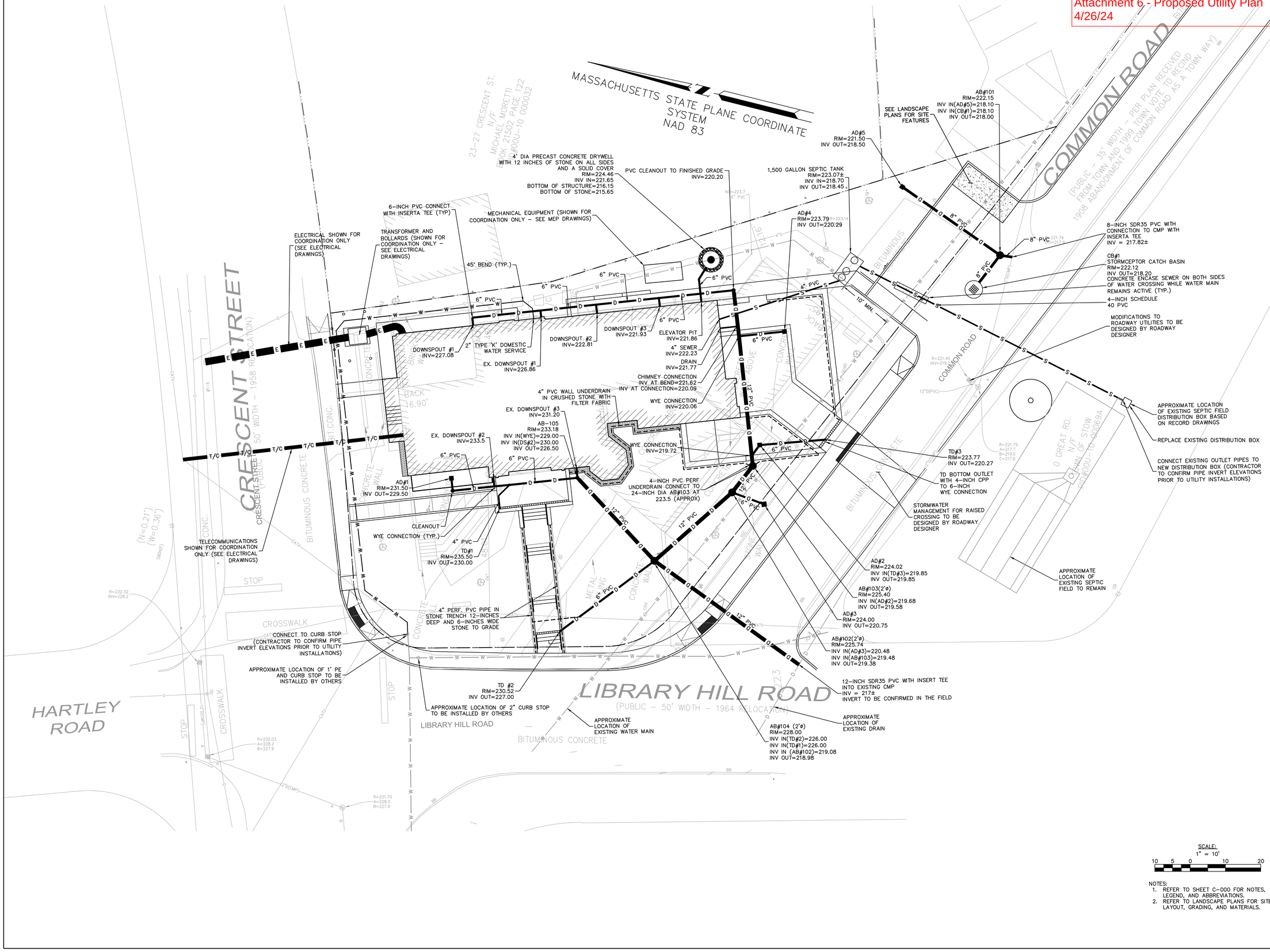
L1.1

Randall Library Renovation + Addition

ZBA Application Materials

Attachment 6 - Proposed Utility Plan

4/26/24



SCALE:
1" = 10'
10 5 0 10 20

NOTES:
1. REFER TO SHEET C–000 FOR NOTES, LEGEND, AND ABBREVIATIONS.
2. REFER TO LANDSCAPE PLANS FOR SITE LAYOUT, GRADING, AND MATERIALS.

RANDALL LIBRARY

19 Crescent St.
Stow, MA 01775

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Consultants:

Nitsch Engineering
www.nitscheng.com
370 Main Street, Suite 850
Worcester, MA 01608
T: (508) 365-1030
F: (617) 338-6472

- Civil Engineering
- Land Surveying
- Transportation Engineering
- Structural Engineering
- Green Infrastructure
- Planning
- GIS

Key Plan:

Legend:

Stamp:

REV NO	DESCRIPTION	DATE

PROJECT NO: 14631
DRAWN BY: AHC
CHECKED BY: CRC
DATE: 3/22/2024

DRAWING TITLE:

SITE UTILITY PLAN

100% CONSTRUCTION DOCUMENTS

SHEET NUMBER:

C-200

Nitsch Engineering

Building better communities with you

Randall Library

Renovation + Addition
ZBA Application Materials
Attachment 8 - Stormwater Management Report
4/26/24

November 21, 2023 (Revised)
Update April 16, 2024

Stormwater Report

Randall Library Renovation and Addition
19 Crescent Street
Stow, MA 01775

Prepared for:

designLAB Architects
35 Channel Street, Suite 103
Boston, MA 02210

Prepared by:

Nitsch Engineering
2 Center Plaza, Suite 430
Boston, MA 02108

Nitsch Project #14631

Civil Engineering | Transportation Engineering | Structural Engineering | Resilience & Green Infrastructure | Planning | Land Surveying

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Stormwater Management Standards Documentation

APPENDIX B

Existing Conditions – HydroCAD Calculations

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Proposed Conditions – HydroCAD Calculations

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Supplemental Information

APPENDIX E

Long-Term Pollution Prevention Plan and Stormwater Operation and Maintenance Plan

SECTION 1 Introduction

Nitsch Engineering has prepared this Stormwater Report to support the site plan review application to Town of Stow for the Randall Library Renovation and Addition located in Stow, MA. The Project site is located at 19 Crescent Street, Stow, MA (subsequently referred to as the "Site"). The Project includes a restoration of the original library building, removal of the existing addition and construction of a new building, landscaping, and stormwater management system.

The site improvements include the following:

1. Demolition of a portion of the existing building;
2. Construction of a new addition;
3. Installation of new utilities services; and
4. Construction of a new stormwater management system.

The proposed stormwater management system has been designed to comply with the requirements of the Town of Stow Stormwater Management Policy and the Massachusetts Department of Environmental Protection (DEP) Stormwater Management Standards.

SECTION 2 Existing Conditions

The Site is located at 19 Crescent St, Stow, MA. The Site is currently developed on the corner of Crescent Street, Library Hill Road, and Common Road.

The site is approximately 15,112 square feet including the existing building, parking areas, and associated walkways. The site is bounded by a residence to the east, the First Parish Unitarian Church to the southeast, Commons Road to the south, Library Hill Road to the west, and Crescent Street to the north.

Existing Drainage Infrastructure

Stormwater generated on the site at the existing Randall Library flows overland to the adjacent streets' stormwater infrastructure. Stormwater from the concrete entrance is collected via area drain which appears to daylight to grade southwest of the building. Stormwater from the roof is collected via downspouts that flow overland off-site. There are no known stormwater management systems on site.

NRSC Soil Designations

Based on the Natural Resources Conservation Service (NRCS) Middlesex County Soil Survey, Issued February 2010, the site of the Randall Library property is classified as Merrimac-Urban land complex with 0 to 8 percent slopes. Merrimac-Urban land complex typically consists of fine sandy loam and gravelly sandy loam and is described as somewhat excessively drained. Depth to water table is more than 80 inches.

The NRCS classifies the Merrimac-Urban land complex as Hydrologic Soil Group (HSG) 'A'. NRCS describes the soil group as follows:

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

Table 1. NRCS Soil Classification Summary

Soil Unit	Soil Series	Hydrologic Soil Group
626B	Merrimac-Urban Land Complex, 0 to 8 percent slopes	A

Onsite Soil Investigations

A subsurface investigation consisting of three soil borings was conducted by Geotechnical Consultants, Inc. in February 2023. The general subsurface conditions include fill over sand and gravel with groundwater approximately 9-10.5 feet below grade. The geotechnical report can be found in Appendix D, Supplemental Information.

Total Maximum Daily Load (TMDL)

The Site ultimately discharges into the Assabet River and therefore is also subject to the Total Maximum Daily Load (TMDL) for the SuAsCo watershed which includes a requirement for phosphorus reduction. As a redevelopment, the project will reduce phosphorus runoff to the extent practicable. Phosphorus loads will be reduced as a result of the decrease in impervious area on the site, and the installation of a water quality structure for runoff from the parking area.

SECTION 3 Proposed Conditions

Project Description

The Project includes a restoration of the original library building, removal of the existing addition and construction of a new building, landscaping, and stormwater management system. This project is considered a redevelopment and is anticipated to decrease the overall impervious area by approximately 1,253 square feet. Refer to Table 2 for a comparison of the existing and proposed land use for the Site.

Table 2. Proposed land use for 19 Crescent St, Stow, MA (in square feet)

Land Use	Existing Site (sf)	Proposed Site (sf)	Change
Buildings	5,021	3,737	-1,284
Site Pavement	2,889	2,920	+31
Landscaped Areas	7,211	8,464	+1,253
Total	15,121	15,121	---

Stormwater Management System

The Site will include the installation of a stormwater management system that is being designed to meet the MassDEP Stormwater Management Standards and the Town of Stow Stormwater Management Standards. As a redevelopment, the Project should be designed to mitigate peak flow and volume to the maximum extent practicable under the MassDEP Regulations and provide water quality treatment.

The proposed stormwater management system for the Project will include increasing pervious area, a water quality inlet structure, area drains with sumps, and trench drains. Overflow from the proposed BMPs will be discharged to the existing stormwater main in Common Road.

Stormwater Management During Construction

The Site Contractor will be responsible for stormwater management of the active construction site. Erosion and sediment controls will include at a minimum perimeter erosion control of silt fence and straw wattles and stormwater inlet protection.

SECTION 4 Stormwater Management Analysis

Methodology

Nitsch Engineering completed a hydrologic analysis of the existing project site utilizing Soil Conservation Service (SCS) Runoff Curve Number (CN) methodology. The SCS method calculates the rate at which the runoff reaches the design point considering several factors: the slope and flow lengths of the subcatchment area, the soil type of the subcatchment area, and the type of surface cover in the subcatchment area. HydroCAD Version 10.00 computer modeling software was used in conjunction with the SCS method to determine the peak runoff rates and runoff volumes for the 2-, 10-, 25-, and 100-year, 24-hour storm events. The proposed project site is being analyzed with the same methodology.

The Site was divided into multiple drainage areas, or subcatchments, which drain to the design points along the property boundary and within the site. For each subcatchment area, SCS Runoff Curve Numbers (CNs) were selected by using the cover type and hydrologic soil group of each area. The peak runoff rates and runoff volumes for the 2-, 10-, 25- and 100-year 24-hour storm events were then determined by inputting the drainage areas, CNs, and time of concentration (T_c) paths into the HydroCAD model.

The National Oceanic and Atmospheric Administration Atlas 14 precipitation frequency estimates were used to calculate the 2-, 10-, 25-, and 100- year 24-hour storm events in HydroCAD. Refer to the HydroCAD calculations in Appendix B and C for rainfall information.

HydroCAD Version 10.00

The HydroCAD computer program uses SCS and TR-20 methods to model drainage systems. TR-20 (Technical Release 20) was developed by the Soil Conservation Service to estimate runoff and peak discharges in small watersheds. TR-20 is generally accepted by engineers and reviewing authorities as the standard method for estimating runoff and peak discharges.

HydroCAD Version 10.00 uses up to four types of components to analyze the hydrology of a given site: subcatchments, reaches, basins, and links. Subcatchments are areas of land that produce surface runoff. The area, weighted CN, and T_c characterize each individual subcatchment area. Reaches are generally uniform streams, channels, or pipes that convey water from one point to another. A basin is any impoundment that fills with water from one or more sources and empties via an outlet structure. Links are used to introduce hydrographs into a project from another source or to provide a junction for more than one hydrograph within a project. The time span for the model was set for 0-48 hours in order to prevent truncation of the hydrograph.

Existing Hydrologic Conditions

As summarized in Section 2.1, Nitsch Engineering delineated the project site into one on-site subcatchment (watershed) areas discharging to one design points utilizing an existing conditions survey and on-site

observations. The HydroCAD model for existing conditions is provided in Appendix B and results from the HydroCAD calculations are summarized below in Table 3.

Proposed Hydrologic Conditions

The proposed project has been designed to mitigate the change in stormwater runoff at each of the design points as required by the DEP Stormwater Management Standards and the Town of Stow Stormwater Management Standards. The existing watershed areas were modified to reflect the proposed topography, storm drainage structures and BMPs, and roof areas. The HydroCAD model for proposed conditions is provided in Appendix C and results from the calculations are summarized in Table 3.

Peak Flow Rates

The proposed stormwater management system is expected to reduce the proposed peak runoff rates to at or below the existing rates for the Design Point. Table 3 below summarizes the existing and proposed hydrologic analyses for the site at each design point.

Table 3. Peak Rates of Runoff in Cubic Feet per Second (cfs)

	Storm Event	2-year	10-year	25-year	100-year
DP	Existing	0.33	0.85	1.20	1.77
	Proposed	0.22	0.68	1.00	1.55

SECTION 5 MassDEP Stormwater Management Standards

The Project is considered a ***redevelopment*** under the DEP Stormwater Management System. As such, the project is required to meet Standards 2, 3, and the pretreatment and structural best management practice requirements of Standards 4,5, and 6 only to the maximum extent practicable. Existing stormwater discharges need to comply with Standard 1 only to the maximum extent practicable. The project will comply with all other Standards. The site will be designed to meet or meet to the maximum extent practicable the MassDEP Stormwater Management Standards as summarized below:

Standard 1: No New Untreated Discharges

The Project will not discharge any untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth. Stormwater from the Site will be collected and treated in accordance with the MassDEP Stormwater Management Standards and stormwater outfalls will be stabilized to prevent erosion.

Standard 2: Peak Rate Attenuation

The proposed stormwater management system will be designed so that the post-development peak discharge rates do not exceed pre-development peak discharge rates. To prevent storm damage and downstream flooding, the proposed stormwater management practices will mitigate peak runoff rates for the 2-, 10-, 25- and 100-year, 24-hour storm events. Refer to Table 3 for a pre- and post- development peak runoff rate comparison.

Standard 3: Groundwater Recharge

Most of the Site is expected to be able to support groundwater recharge due to infiltration rates discovered during site investigations. Infiltration is provided through reduction of impervious area.

Standard 4: Water Quality Treatment

The proposed stormwater management system will use a proprietary water quality inlet to filter pollutants from vehicular areas. Area drains will include sediment sumps to reduce sediment flow off site from landscape areas.

Standard 5: Land Uses with Higher Potential Pollutant Loads

The project is not considered a LUHPPL and therefore, this standard is not applicable.

Standard 6: Critical Areas

The Project is not located within any critical areas. Therefore, this standard is not applicable.

Standard 7: Redevelopments

The Project is considered a redevelopment under the MassDEP Stormwater Management Standards. Therefore, the project is required to meet Standard 2, Standard 3, and the pretreatment and structural stormwater BMP requirements of Standards 4, 5, and 6 to the maximum extent practicable. The projects should comply with all other requirements of the Stormwater Management Standards and improve existing conditions. The Project meets this standard.

Standard 8: Construction Period Pollution Prevention and Sedimentation Control

A plan to control construction-related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) will be developed and implemented during the design process.

Standard 9: Operation and Maintenance Plan

A post-construction operation and maintenance plan will be prepared and will be implemented to ensure that stormwater management systems function as designed. Source control and stormwater BMP operation requirements for the site are summarized in the Long-Term Pollution Prevention Plan and Operation and Maintenance Plan provided in Appendix E.

Standard 10: Prohibition of Illicit Discharges

There will be no illicit discharges to the stormwater management system associated with the Project. An Illicit Discharge Compliance Statement is provided in Appendix A.

SECTION 6 Closed Drainage System Design

The proposed closed drainage system consists of water quality inlets, area drains, area basins, and trench drains connected with PVC pipe. The closed drainage system was designed to convey the 25-year storm event using the Rational method. Refer to Appendix D for more information.

SECTION 7 Conclusion

In conclusion, the Project's stormwater management system will reduce peak runoff rates and volumes through the reduction of impervious area and installation of stormwater infrastructure to improve the quality of stormwater being discharged from the Site. The Project is being designed to meet and exceed the MassDEP Stormwater Management Standards and the Town of Stow Stormwater Management Standards to the extend practicable.

APPENDIX A

Stormwater Management Standards Documentation

MassDEP Checklist for Stormwater Report

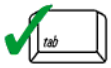
Illicit Discharge Statement

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.

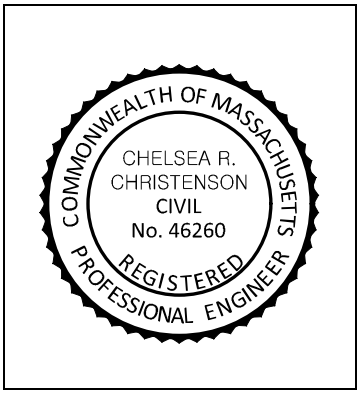
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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



4/16/2024

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.

Nitsch Engineering

2 Center Plaza, Suite 430
Boston, MA 02108-1928
T: 617-338-0063
F: 617-338-6472
www.nitscheng.com

STANDARD 10: Illicit Discharge Compliance Statement

Project Name: Randall Library	Nitsch Project #: 14631
Location: Stow, MA	Checked by: CC
Prepared by: AHC	Sheet No. 1 of 1
Date: 04/16/2024	

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

This is to verify:

1. Based on the information available there are no known or suspected illicit discharges to the stormwater management system at the Randall Library site as defined in the MassDEP Stormwater Handbook.

2. The design of the stormwater system includes no proposed illicit discharges.

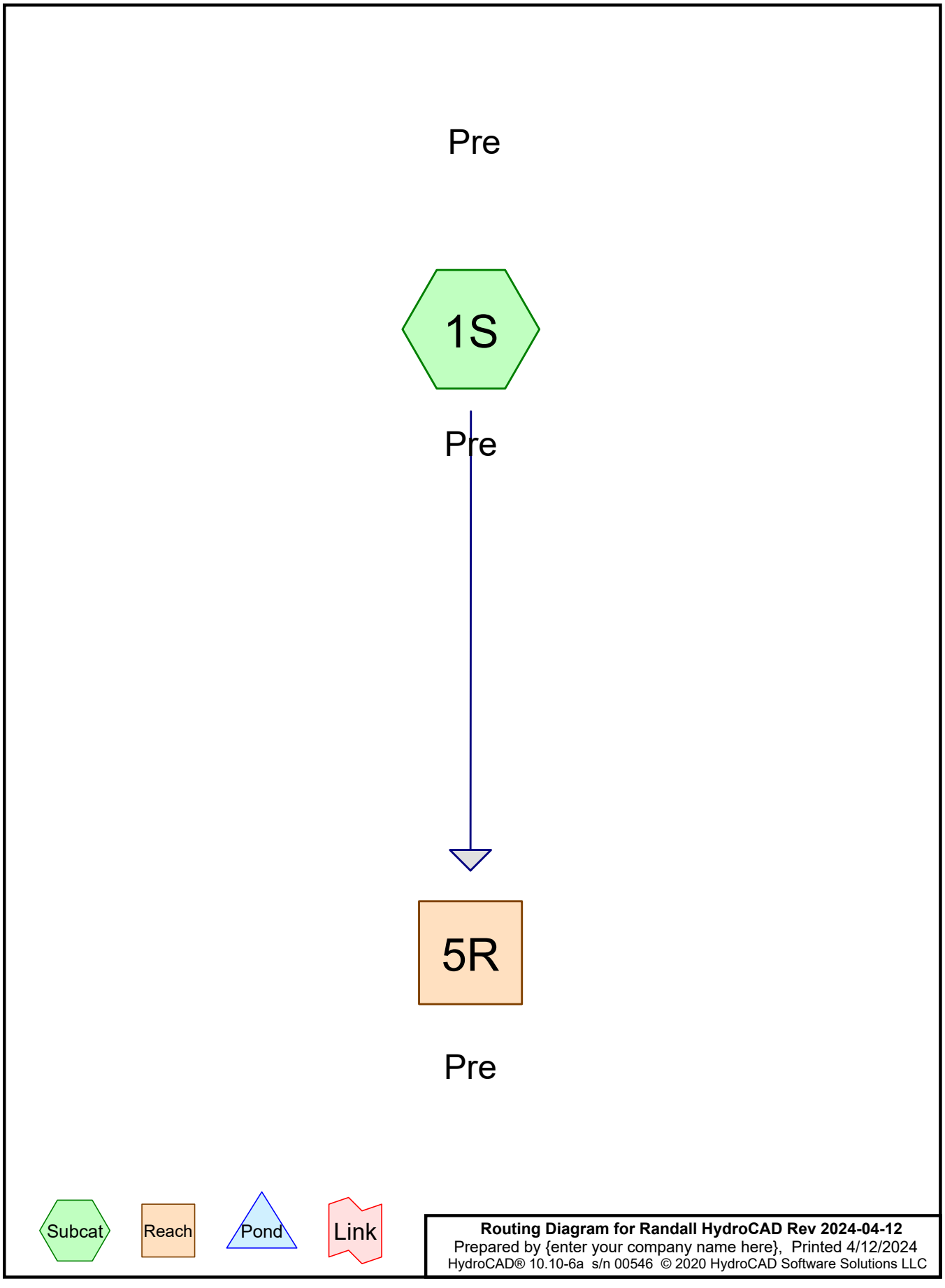
Chelsea Christenson, PE

4/16/2024

Date

APPENDIX B

Existing Conditions – HydroCAD Calculations


Pre
1S
Pre
5R
Pre
Subcat
Reach
Pond
Link

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-year	NOAA 24-hr	D	Default	24.00	1	3.27	2
2	10-year	NOAA 24-hr	D	Default	24.00	1	5.05	2
3	25-year	NOAA 24-hr	D	Default	24.00	1	6.15	2
4	100-year	NOAA 24-hr	D	Default	24.00	1	7.86	2

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
7,211	39	>75% Grass cover, Good, HSG A (1S)
2,889	98	Paved parking, HSG A (1S)
5,021	98	Roofs, HSG A (1S)
15,121	**70**	**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Pre Runoff Area=15,121 sf 52.31% Impervious Runoff Depth>0.87"
Tc=6.0 min CN=70 Runoff=0.33 cfs 1,093 cf

Reach 5R: Pre Inflow=0.33 cfs 1,093 cf
Outflow=0.33 cfs 1,093 cf

Total Runoff Area = 15,121 sf Runoff Volume = 1,093 cf Average Runoff Depth = 0.87"
47.69% Pervious = 7,211 sf 52.31% Impervious = 7,910 sf

Summary for Subcatchment 1S: Pre

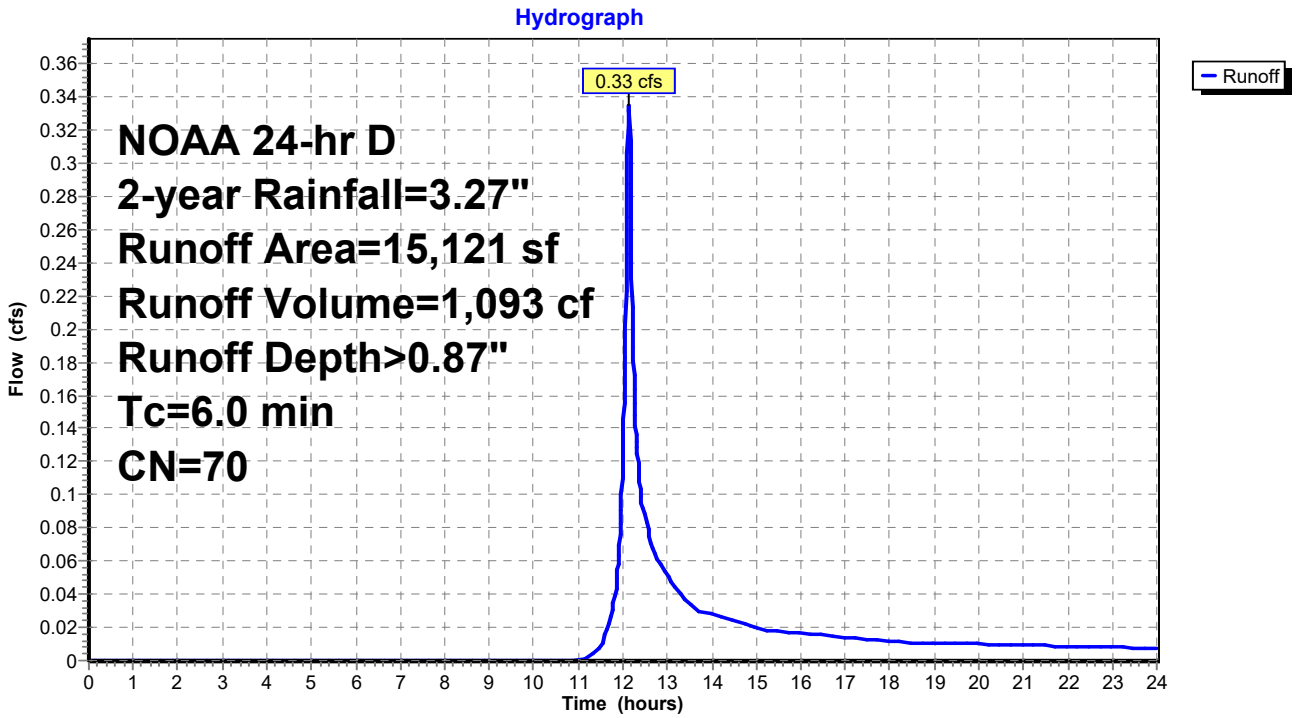
Runoff = 0.33 cfs @ 12.14 hrs, Volume= 1,093 cf, Depth> 0.87"
Routed to Reach 5R : Pre

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2-year Rainfall=3.27"

Area (sf)	CN	Description
5,021	98	Roofs, HSG A
2,889	98	Paved parking, HSG A
7,211	39	>75% Grass cover, Good, HSG A
15,121	70	Weighted Average
7,211		47.69% Pervious Area
7,910		52.31% Impervious Area

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

Subcatchment 1S: Pre

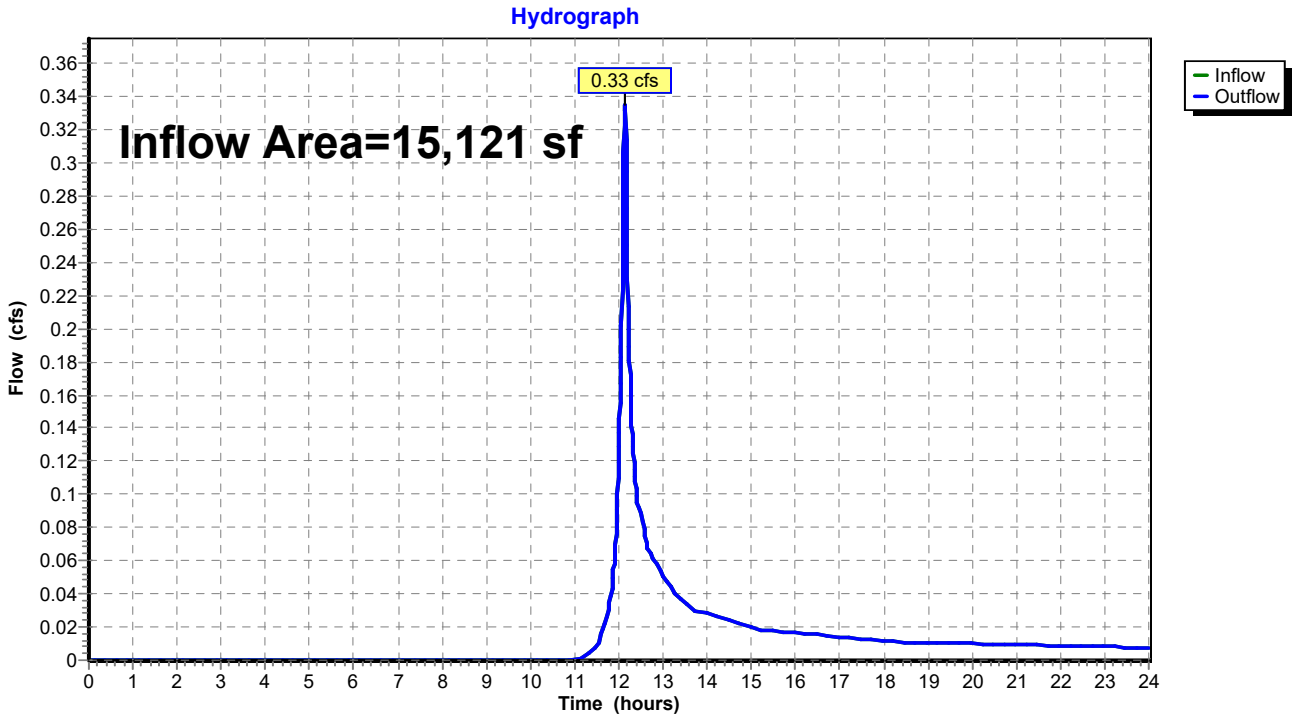


Summary for Reach 5R: Pre

Inflow Area = 15,121 sf, 52.31% Impervious, Inflow Depth > 0.87" for 2-year event
Inflow = 0.33 cfs @ 12.14 hrs, Volume= 1,093 cf
Outflow = 0.33 cfs @ 12.14 hrs, Volume= 1,093 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach 5R: Pre



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Pre Runoff Area=15,121 sf 52.31% Impervious Runoff Depth>2.07"
Tc=6.0 min CN=70 Runoff=0.85 cfs 2,608 cf

Reach 5R: Pre Inflow=0.85 cfs 2,608 cf
Outflow=0.85 cfs 2,608 cf

Total Runoff Area = 15,121 sf Runoff Volume = 2,608 cf Average Runoff Depth = 2.07"
47.69% Pervious = 7,211 sf 52.31% Impervious = 7,910 sf

Summary for Subcatchment 1S: Pre

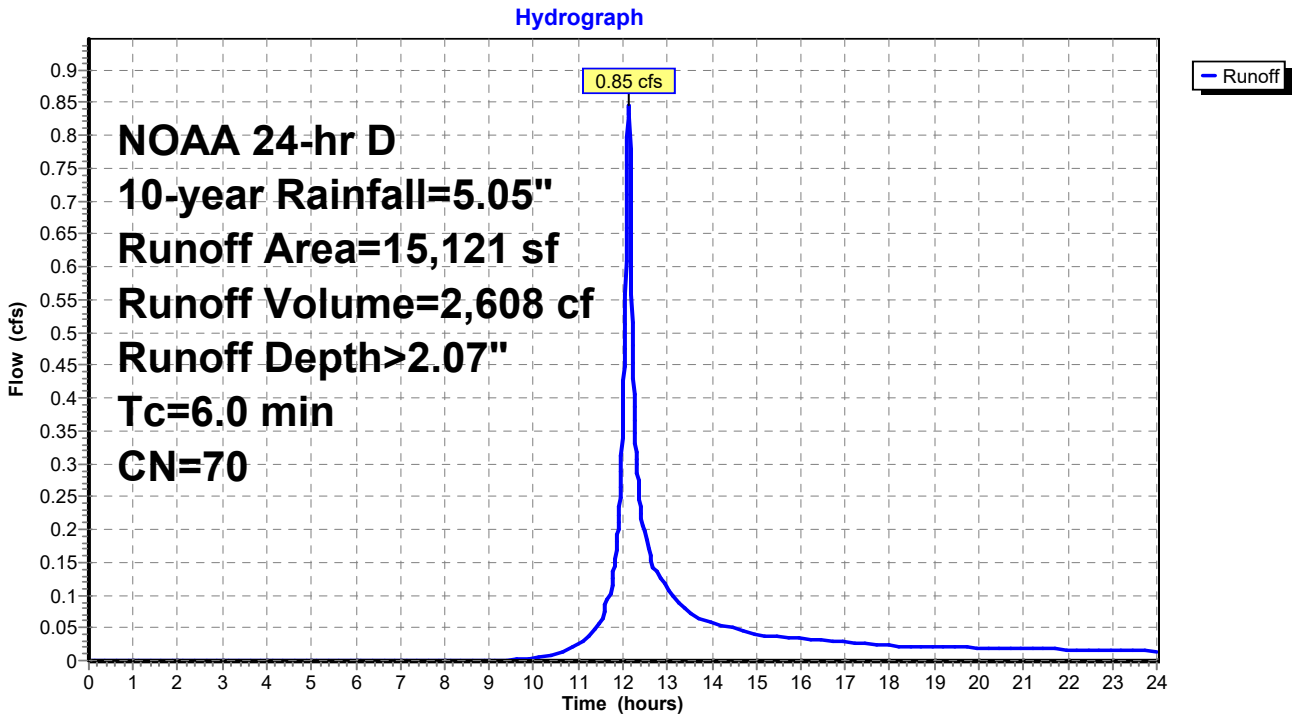
Runoff = 0.85 cfs @ 12.13 hrs, Volume= 2,608 cf, Depth> 2.07"
Routed to Reach 5R : Pre

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10-year Rainfall=5.05"

Area (sf)	CN	Description
5,021	98	Roofs, HSG A
2,889	98	Paved parking, HSG A
7,211	39	>75% Grass cover, Good, HSG A
15,121	70	Weighted Average
7,211		47.69% Pervious Area
7,910		52.31% Impervious Area

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

Subcatchment 1S: Pre

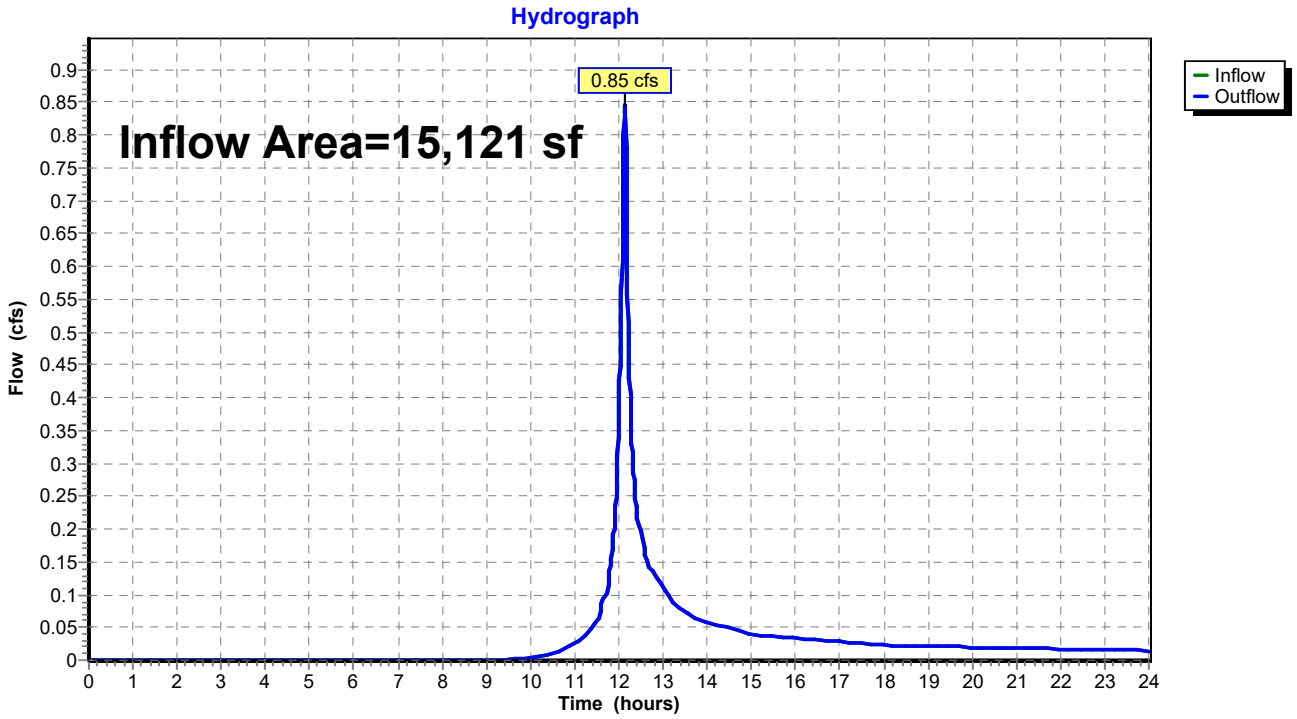


Summary for Reach 5R: Pre

Inflow Area = 15,121 sf, 52.31% Impervious, Inflow Depth > 2.07" for 10-year event
Inflow = 0.85 cfs @ 12.13 hrs, Volume= 2,608 cf
Outflow = 0.85 cfs @ 12.13 hrs, Volume= 2,608 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach 5R: Pre



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Pre Runoff Area=15,121 sf 52.31% Impervious Runoff Depth>2.92"
Tc=6.0 min CN=70 Runoff=1.20 cfs 3,679 cf

Reach 5R: Pre Inflow=1.20 cfs 3,679 cf
Outflow=1.20 cfs 3,679 cf

Total Runoff Area = 15,121 sf Runoff Volume = 3,679 cf Average Runoff Depth = 2.92"
47.69% Pervious = 7,211 sf 52.31% Impervious = 7,910 sf

Summary for Subcatchment 1S: Pre

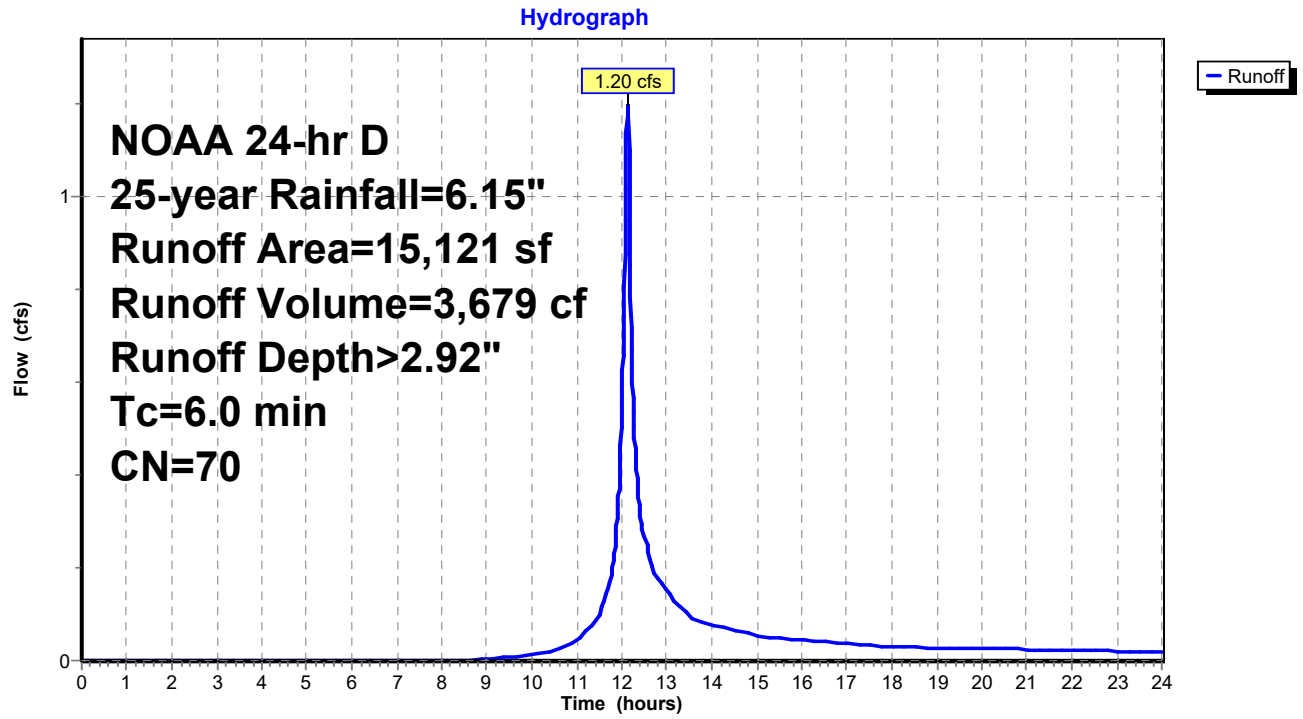
Runoff = 1.20 cfs @ 12.13 hrs, Volume= 3,679 cf, Depth> 2.92"
Routed to Reach 5R : Pre

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 25-year Rainfall=6.15"

Area (sf)	CN	Description
5,021	98	Roofs, HSG A
2,889	98	Paved parking, HSG A
7,211	39	>75% Grass cover, Good, HSG A
15,121	70	Weighted Average
7,211		47.69% Pervious Area
7,910		52.31% Impervious Area

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

Subcatchment 1S: Pre

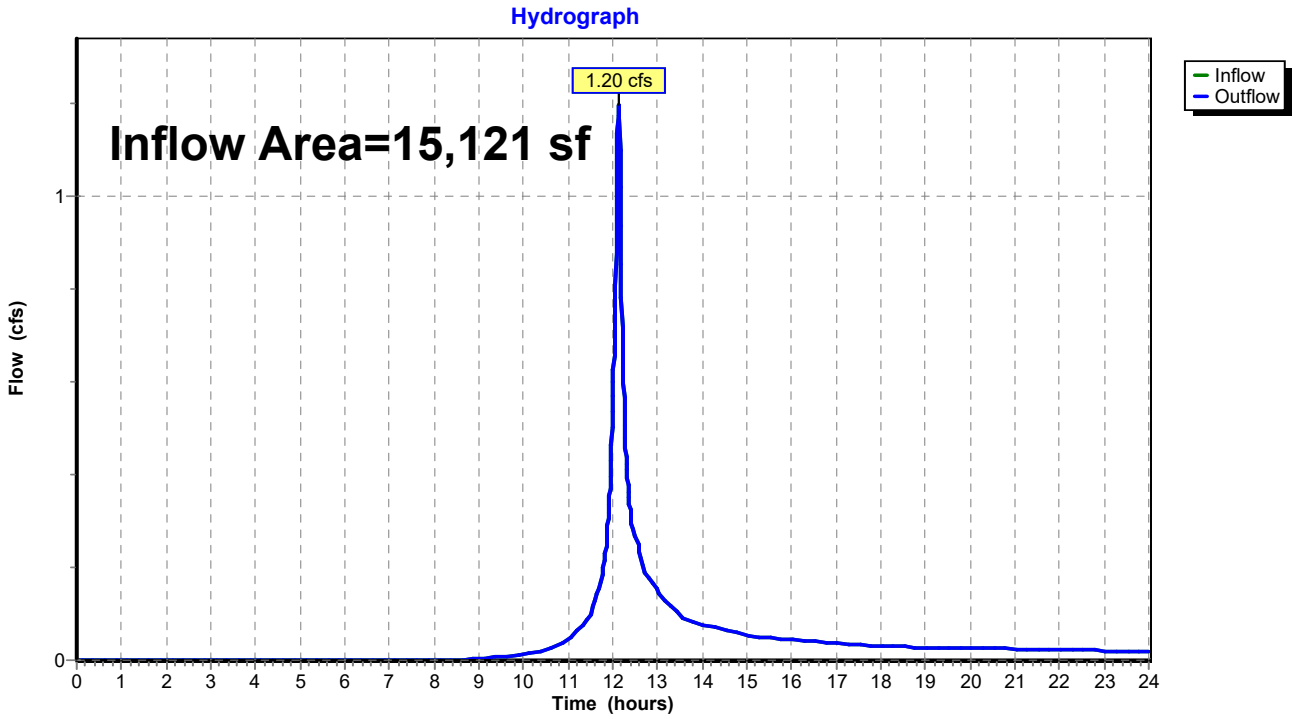


Summary for Reach 5R: Pre

Inflow Area = 15,121 sf, 52.31% Impervious, Inflow Depth > 2.92" for 25-year event
Inflow = 1.20 cfs @ 12.13 hrs, Volume= 3,679 cf
Outflow = 1.20 cfs @ 12.13 hrs, Volume= 3,679 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach 5R: Pre



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment1S: Pre Runoff Area=15,121 sf 52.31% Impervious Runoff Depth>4.34"
Tc=6.0 min CN=70 Runoff=1.77 cfs 5,466 cf

Reach 5R: Pre Inflow=1.77 cfs 5,466 cf
Outflow=1.77 cfs 5,466 cf

Total Runoff Area = 15,121 sf Runoff Volume = 5,466 cf Average Runoff Depth = 4.34"
47.69% Pervious = 7,211 sf 52.31% Impervious = 7,910 sf

Summary for Subcatchment 1S: Pre

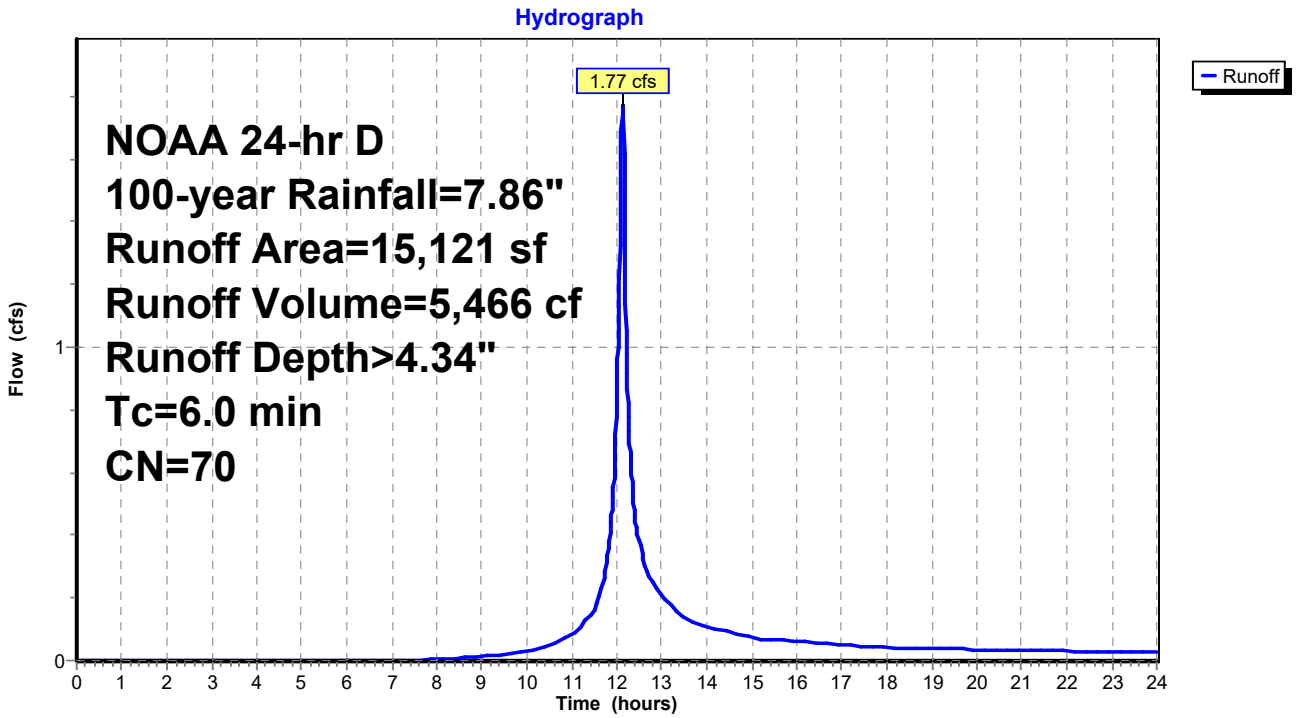
Runoff = 1.77 cfs @ 12.13 hrs, Volume= 5,466 cf, Depth> 4.34"
Routed to Reach 5R : Pre

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100-year Rainfall=7.86"

Area (sf)	CN	Description
5,021	98	Roofs, HSG A
2,889	98	Paved parking, HSG A
7,211	39	>75% Grass cover, Good, HSG A
15,121	70	Weighted Average
7,211		47.69% Pervious Area
7,910		52.31% Impervious Area

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

Subcatchment 1S: Pre

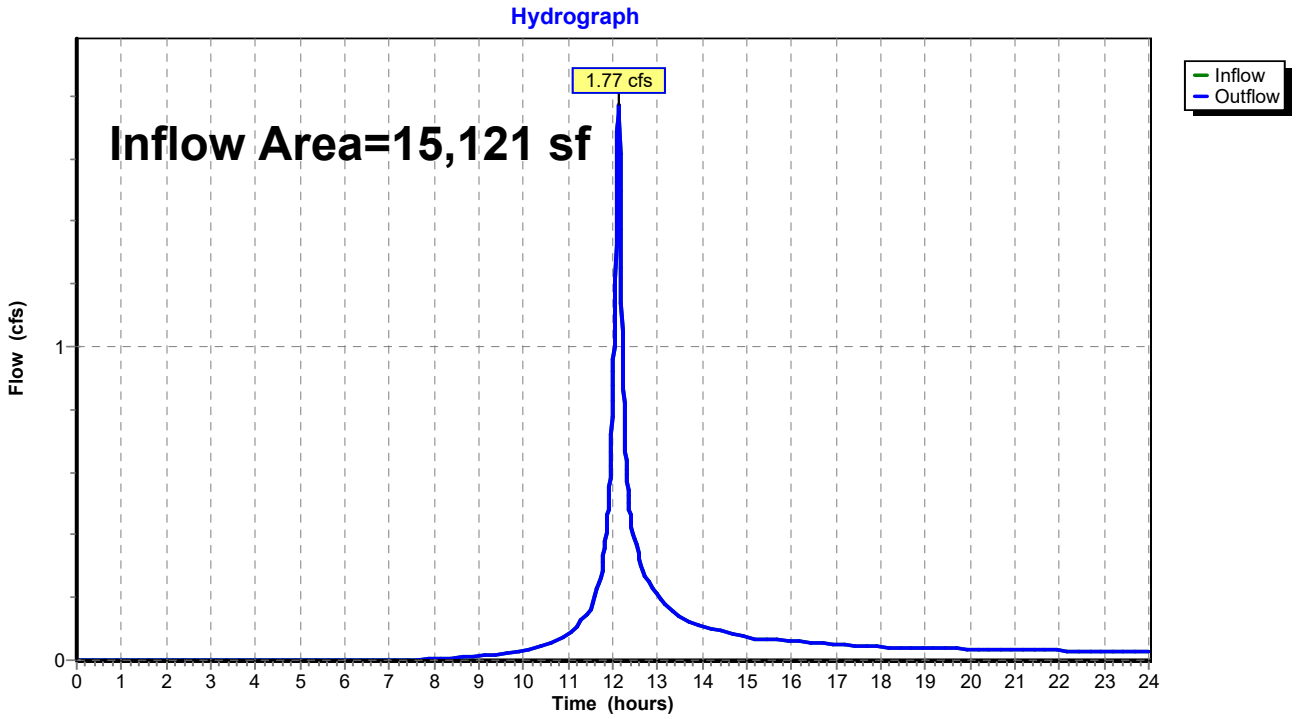


Summary for Reach 5R: Pre

Inflow Area = 15,121 sf, 52.31% Impervious, Inflow Depth > 4.34" for 100-year event
Inflow = 1.77 cfs @ 12.13 hrs, Volume= 5,466 cf
Outflow = 1.77 cfs @ 12.13 hrs, Volume= 5,466 cf, Atten= 0%, Lag= 0.0 min

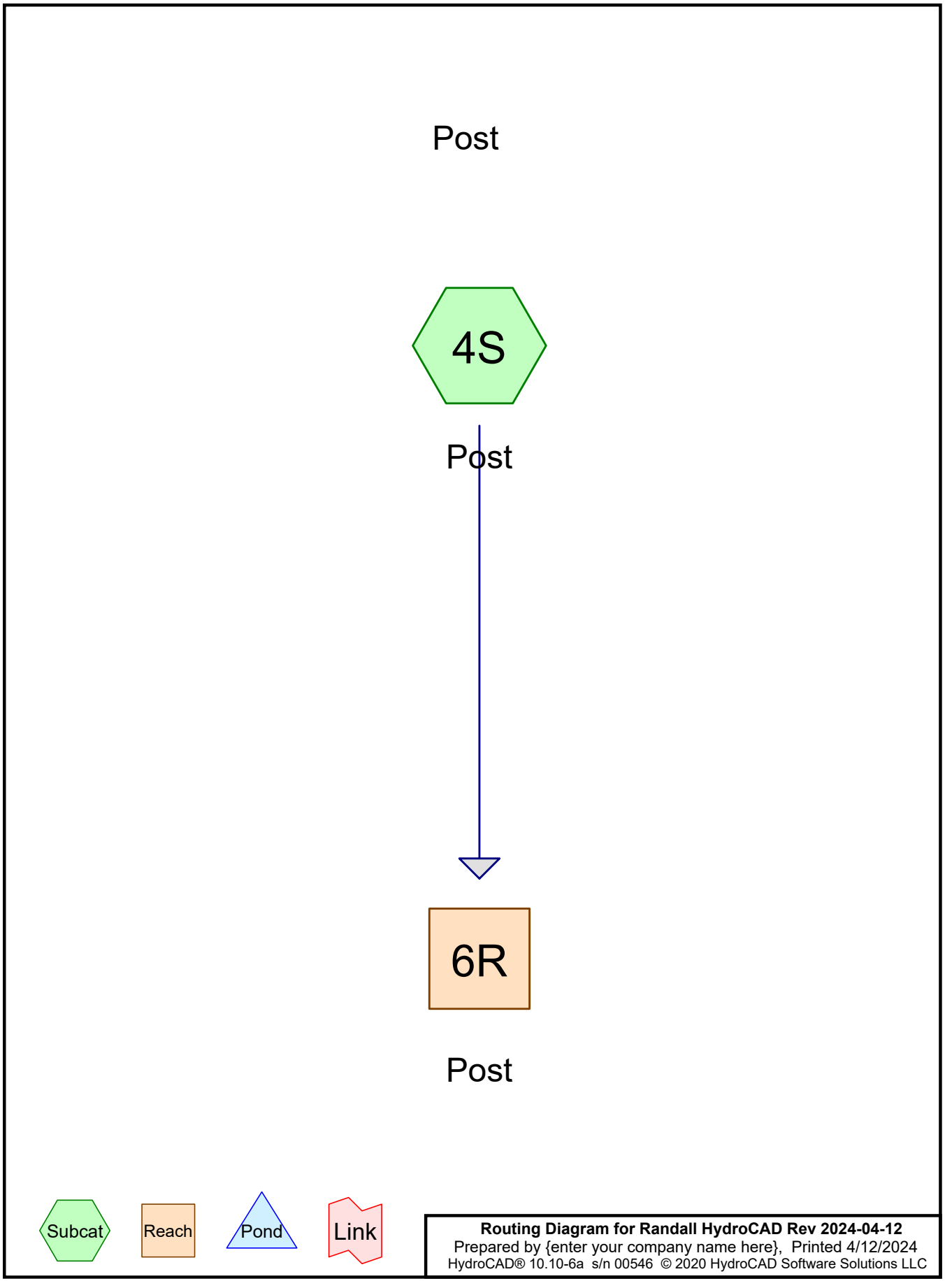
Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach 5R: Pre



APPENDIX C

Proposed Conditions – HydroCAD Calculations



Routing Diagram for Randall HydroCAD Rev 2024-04-12
Prepared by {enter your company name here}, Printed 4/12/2024

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-year	NOAA 24-hr	D	Default	24.00	1	3.27	2
2	10-year	NOAA 24-hr	D	Default	24.00	1	5.05	2
3	25-year	NOAA 24-hr	D	Default	24.00	1	6.15	2
4	100-year	NOAA 24-hr	D	Default	24.00	1	7.86	2

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
8,464	39	>75% Grass cover, Good, HSG A (4S)
3,737	98	Roof, Walkway, Stairs, Patio, HSG A (4S)
2,920	98	Unconnected pavement, HSG A (4S)
15,121	**65**	**TOTAL AREA**

Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment4S: Post Runoff Area=15,121 sf 44.02% Impervious Runoff Depth>0.63"
Tc=6.0 min CN=65 Runoff=0.22 cfs 798 cf

Reach 6R: Post Inflow=0.22 cfs 798 cf
Outflow=0.22 cfs 798 cf

Total Runoff Area = 15,121 sf Runoff Volume = 798 cf Average Runoff Depth = 0.63"
55.98% Pervious = 8,464 sf 44.02% Impervious = 6,657 sf

Summary for Subcatchment 4S: Post

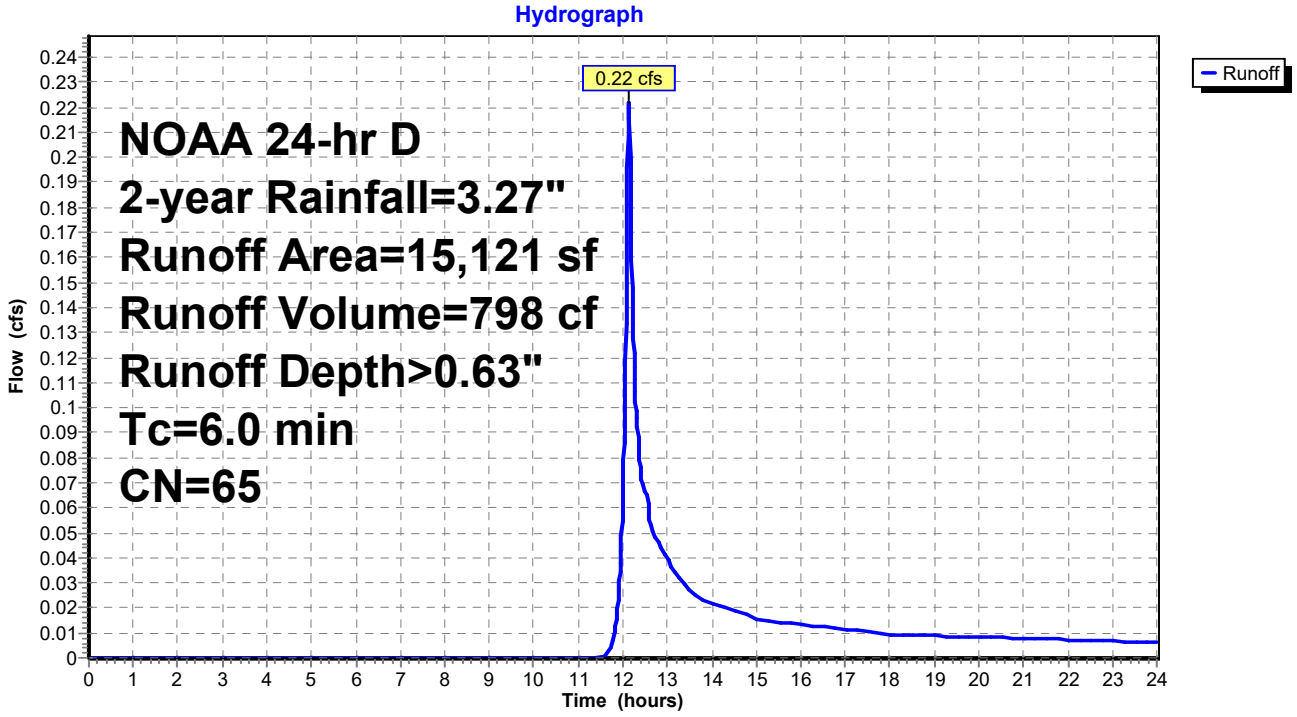
Runoff = 0.22 cfs @ 12.14 hrs, Volume= 798 cf, Depth> 0.63"
Routed to Reach 6R : Post

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 2-year Rainfall=3.27"

	Area (sf)	CN	Description
*	3,737	98	Roof, Walkway, Stairs, Patio, HSG A
	8,464	39	>75% Grass cover, Good, HSG A
	2,920	98	Unconnected pavement, HSG A
	15,121	65	Weighted Average
	8,464		55.98% Pervious Area
	6,657		44.02% Impervious Area
	2,920		43.86% Unconnected

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

Subcatchment 4S: Post

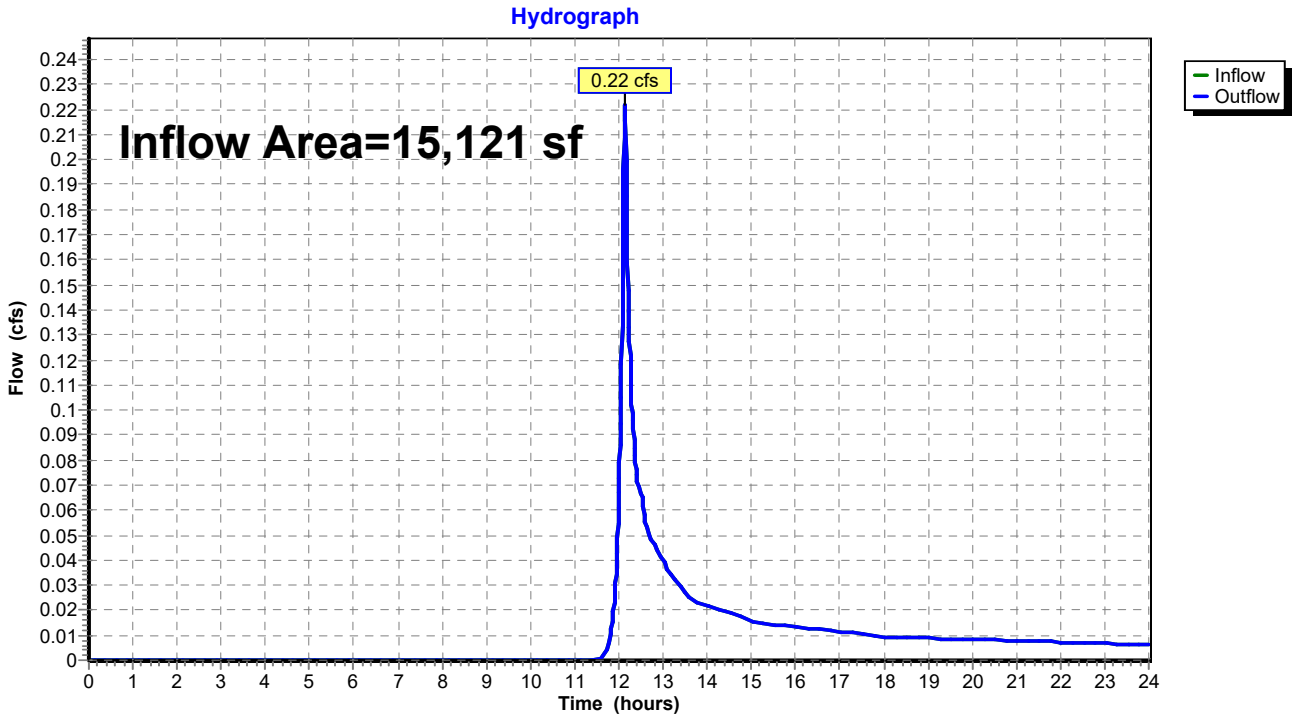


Summary for Reach 6R: Post

Inflow Area = 15,121 sf, 44.02% Impervious, Inflow Depth > 0.63" for 2-year event
Inflow = 0.22 cfs @ 12.14 hrs, Volume= 798 cf
Outflow = 0.22 cfs @ 12.14 hrs, Volume= 798 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach 6R: Post



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment4S: Post Runoff Area=15,121 sf 44.02% Impervious Runoff Depth>1.68"
Tc=6.0 min CN=65 Runoff=0.68 cfs 2,122 cf

Reach 6R: Post Inflow=0.68 cfs 2,122 cf
Outflow=0.68 cfs 2,122 cf

Total Runoff Area = 15,121 sf Runoff Volume = 2,122 cf Average Runoff Depth = 1.68"
55.98% Pervious = 8,464 sf 44.02% Impervious = 6,657 sf

Summary for Subcatchment 4S: Post

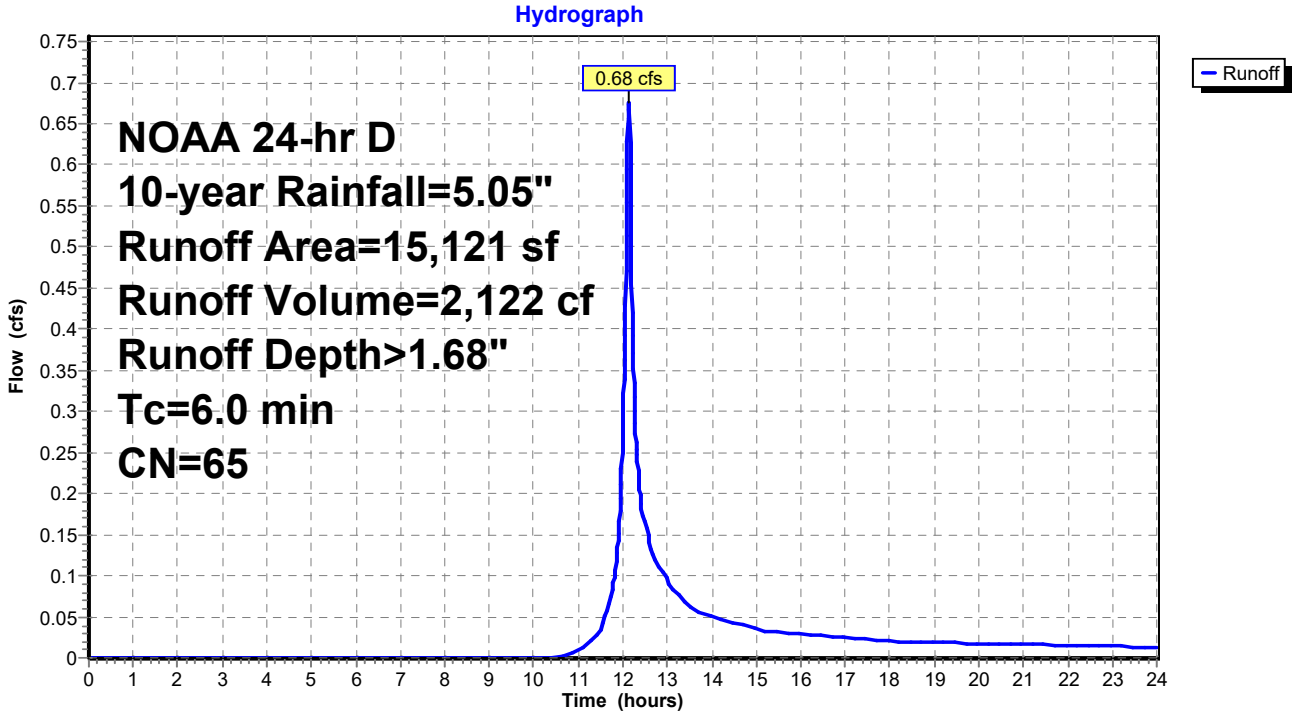
Runoff = 0.68 cfs @ 12.14 hrs, Volume= 2,122 cf, Depth> 1.68"
Routed to Reach 6R : Post

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 10-year Rainfall=5.05"

	Area (sf)	CN	Description
*	3,737	98	Roof, Walkway, Stairs, Patio, HSG A
	8,464	39	>75% Grass cover, Good, HSG A
	2,920	98	Unconnected pavement, HSG A
	15,121	65	Weighted Average
	8,464		55.98% Pervious Area
	6,657		44.02% Impervious Area
	2,920		43.86% Unconnected

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

Subcatchment 4S: Post

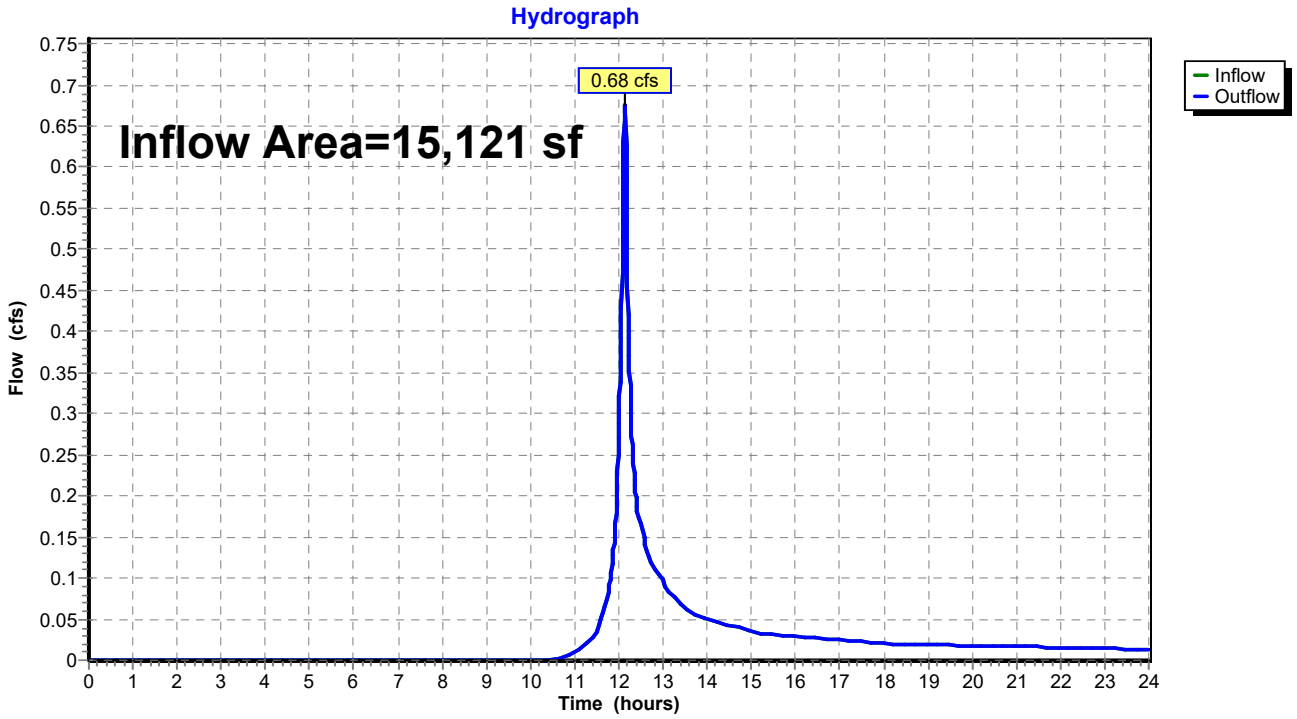


Summary for Reach 6R: Post

Inflow Area = 15,121 sf, 44.02% Impervious, Inflow Depth > 1.68" for 10-year event
Inflow = 0.68 cfs @ 12.14 hrs, Volume= 2,122 cf
Outflow = 0.68 cfs @ 12.14 hrs, Volume= 2,122 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach 6R: Post



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment4S: Post Runoff Area=15,121 sf 44.02% Impervious Runoff Depth>2.46"
Tc=6.0 min CN=65 Runoff=1.00 cfs 3,096 cf

Reach 6R: Post Inflow=1.00 cfs 3,096 cf
Outflow=1.00 cfs 3,096 cf

Total Runoff Area = 15,121 sf Runoff Volume = 3,096 cf Average Runoff Depth = 2.46"
55.98% Pervious = 8,464 sf 44.02% Impervious = 6,657 sf

Summary for Subcatchment 4S: Post

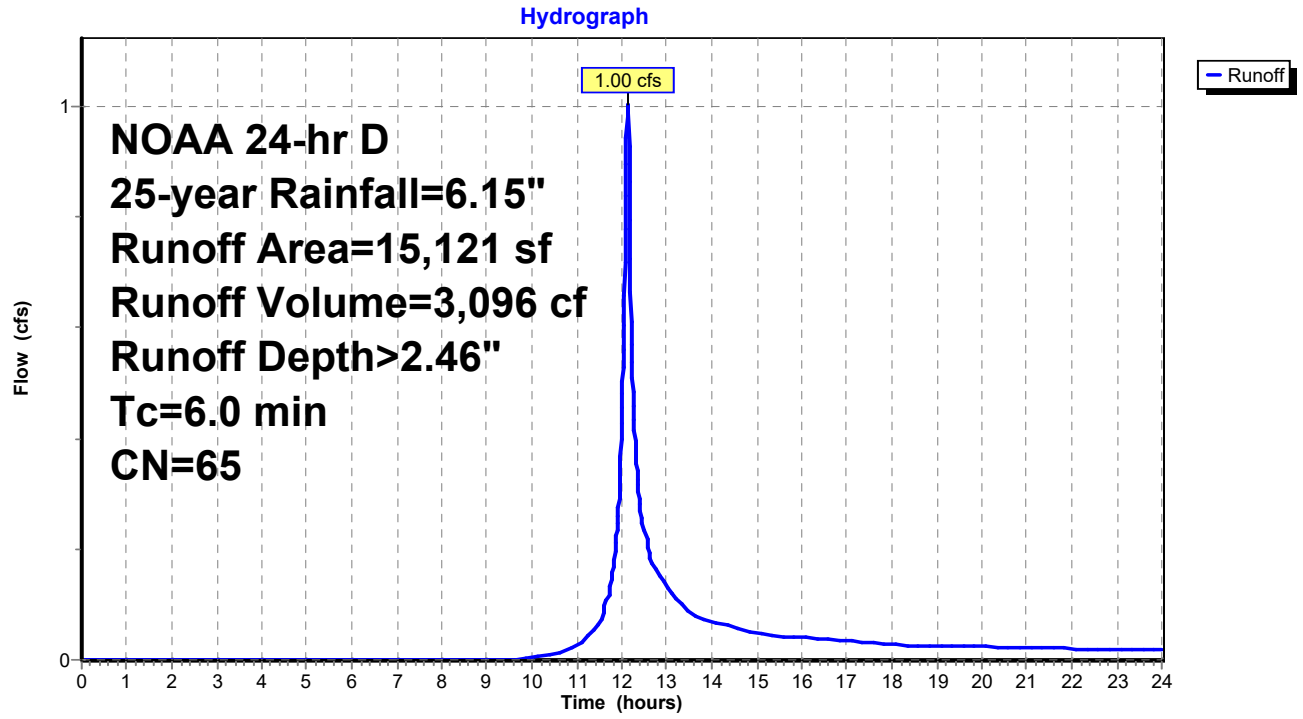
Runoff = 1.00 cfs @ 12.13 hrs, Volume= 3,096 cf, Depth> 2.46"
Routed to Reach 6R : Post

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 25-year Rainfall=6.15"

	Area (sf)	CN	Description
*	3,737	98	Roof, Walkway, Stairs, Patio, HSG A
	8,464	39	>75% Grass cover, Good, HSG A
	2,920	98	Unconnected pavement, HSG A
	15,121	65	Weighted Average
	8,464		55.98% Pervious Area
	6,657		44.02% Impervious Area
	2,920		43.86% Unconnected

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

Subcatchment 4S: Post

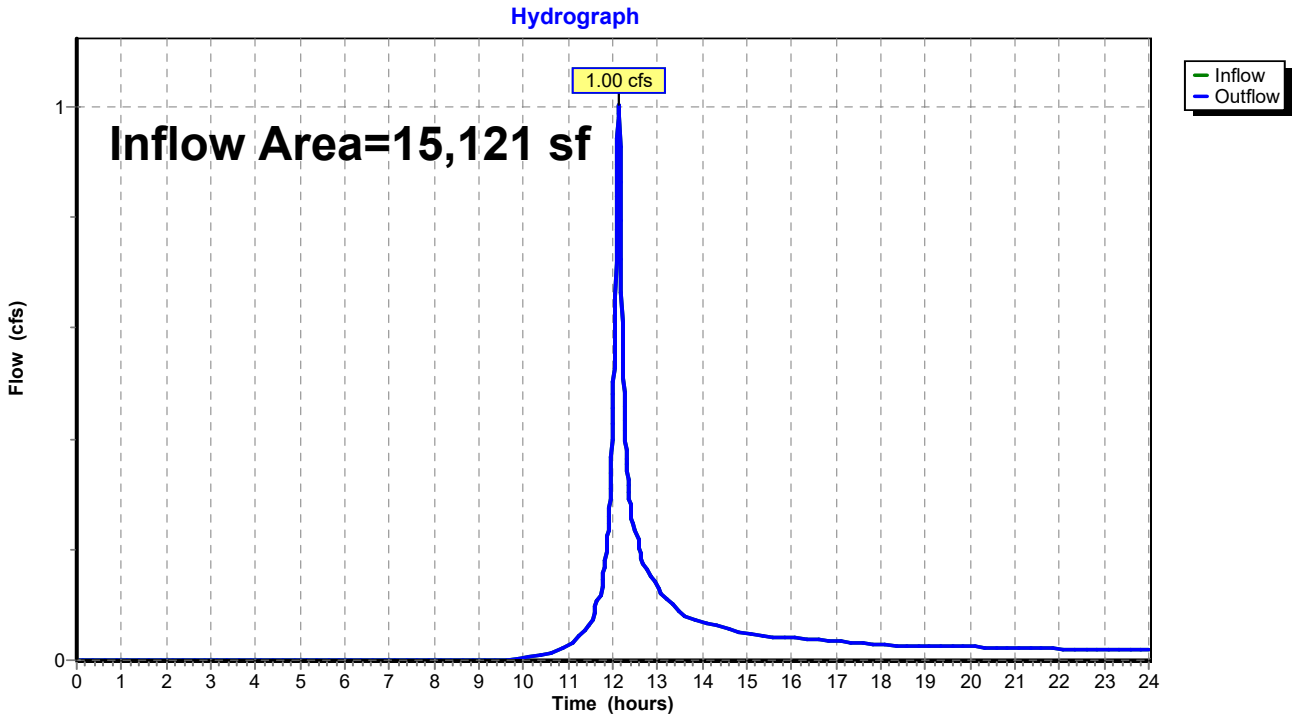


Summary for Reach 6R: Post

Inflow Area = 15,121 sf, 44.02% Impervious, Inflow Depth > 2.46" for 25-year event
Inflow = 1.00 cfs @ 12.13 hrs, Volume= 3,096 cf
Outflow = 1.00 cfs @ 12.13 hrs, Volume= 3,096 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach 6R: Post



Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment4S: Post Runoff Area=15,121 sf 44.02% Impervious Runoff Depth>3.78"
Tc=6.0 min CN=65 Runoff=1.55 cfs 4,757 cf

Reach 6R: Post Inflow=1.55 cfs 4,757 cf
Outflow=1.55 cfs 4,757 cf

Total Runoff Area = 15,121 sf Runoff Volume = 4,757 cf Average Runoff Depth = 3.78"
55.98% Pervious = 8,464 sf 44.02% Impervious = 6,657 sf

Summary for Subcatchment 4S: Post

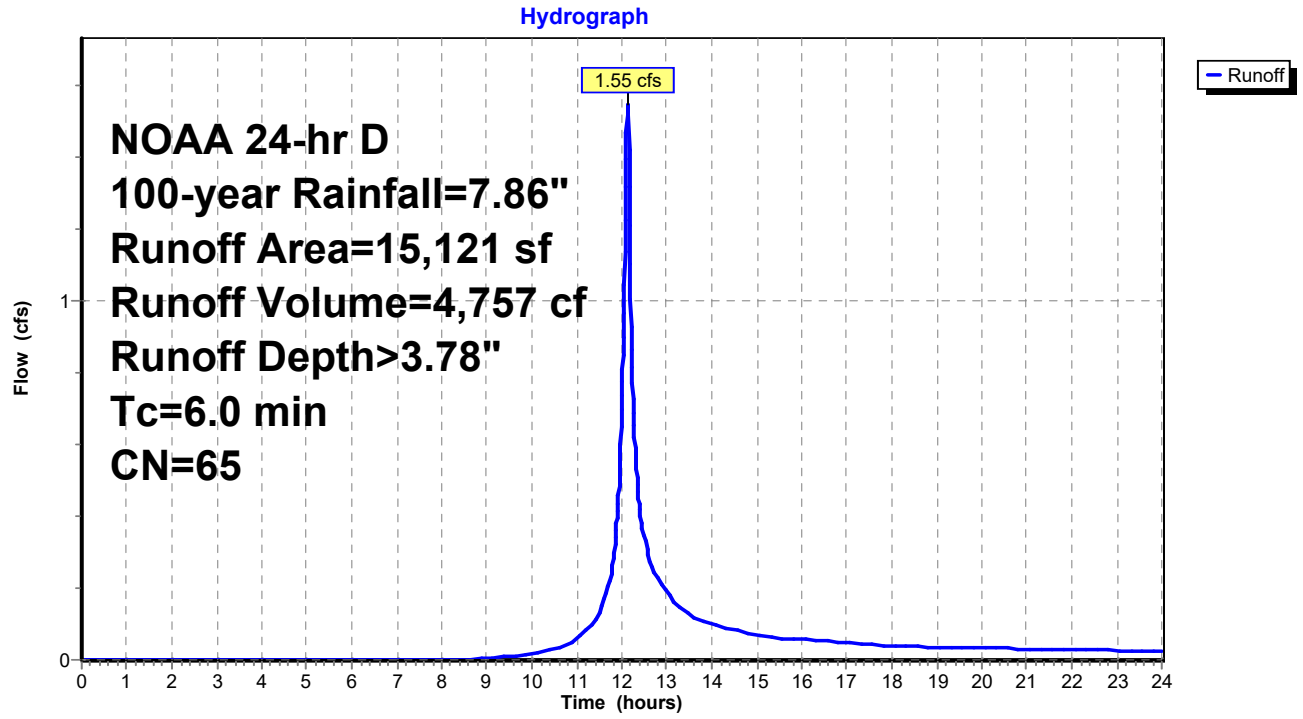
Runoff = 1.55 cfs @ 12.13 hrs, Volume= 4,757 cf, Depth> 3.78"
Routed to Reach 6R : Post

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
NOAA 24-hr D 100-year Rainfall=7.86"

	Area (sf)	CN	Description
*	3,737	98	Roof, Walkway, Stairs, Patio, HSG A
	8,464	39	>75% Grass cover, Good, HSG A
	2,920	98	Unconnected pavement, HSG A
	15,121	65	Weighted Average
	8,464		55.98% Pervious Area
	6,657		44.02% Impervious Area
	2,920		43.86% Unconnected

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

Subcatchment 4S: Post

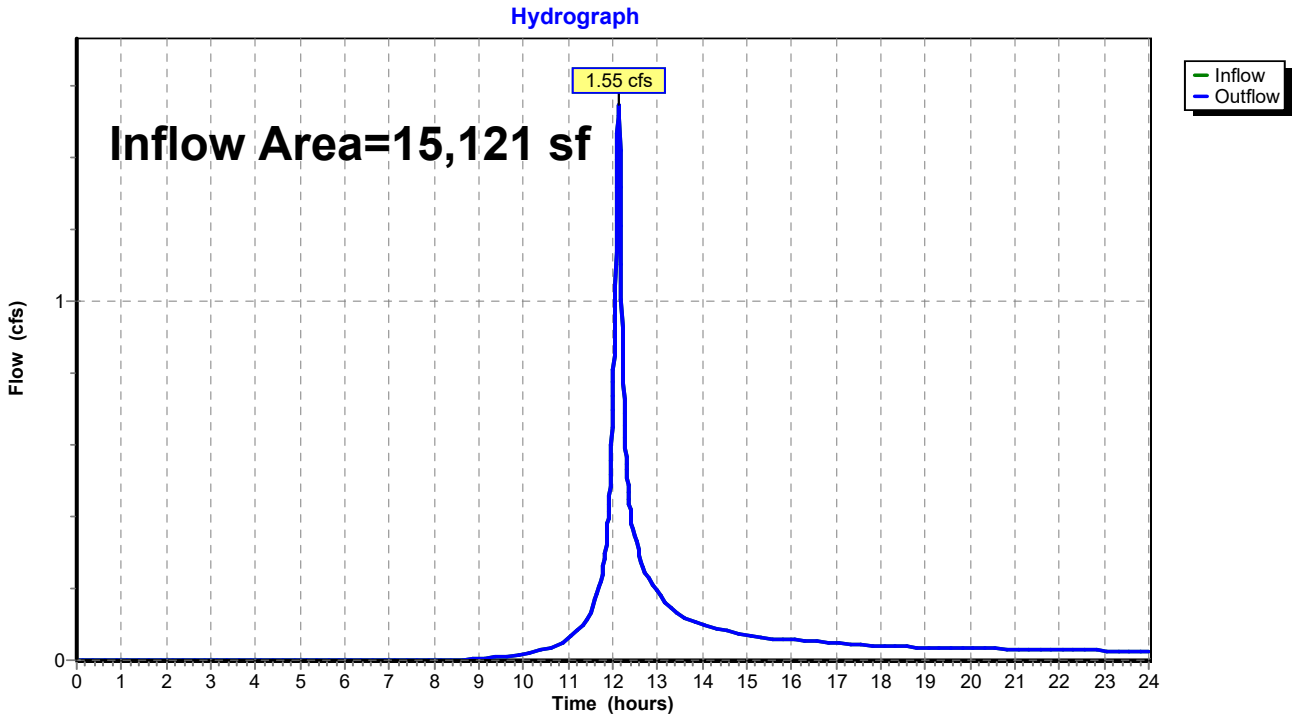


Summary for Reach 6R: Post

Inflow Area = 15,121 sf, 44.02% Impervious, Inflow Depth > 3.78" for 100-year event
Inflow = 1.55 cfs @ 12.13 hrs, Volume= 4,757 cf
Outflow = 1.55 cfs @ 12.13 hrs, Volume= 4,757 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Reach 6R: Post



APPENDIX D

Supplemental Information

NRCS Soil Maps and Descriptions

Geotechnical Report

Closed Drainage Report

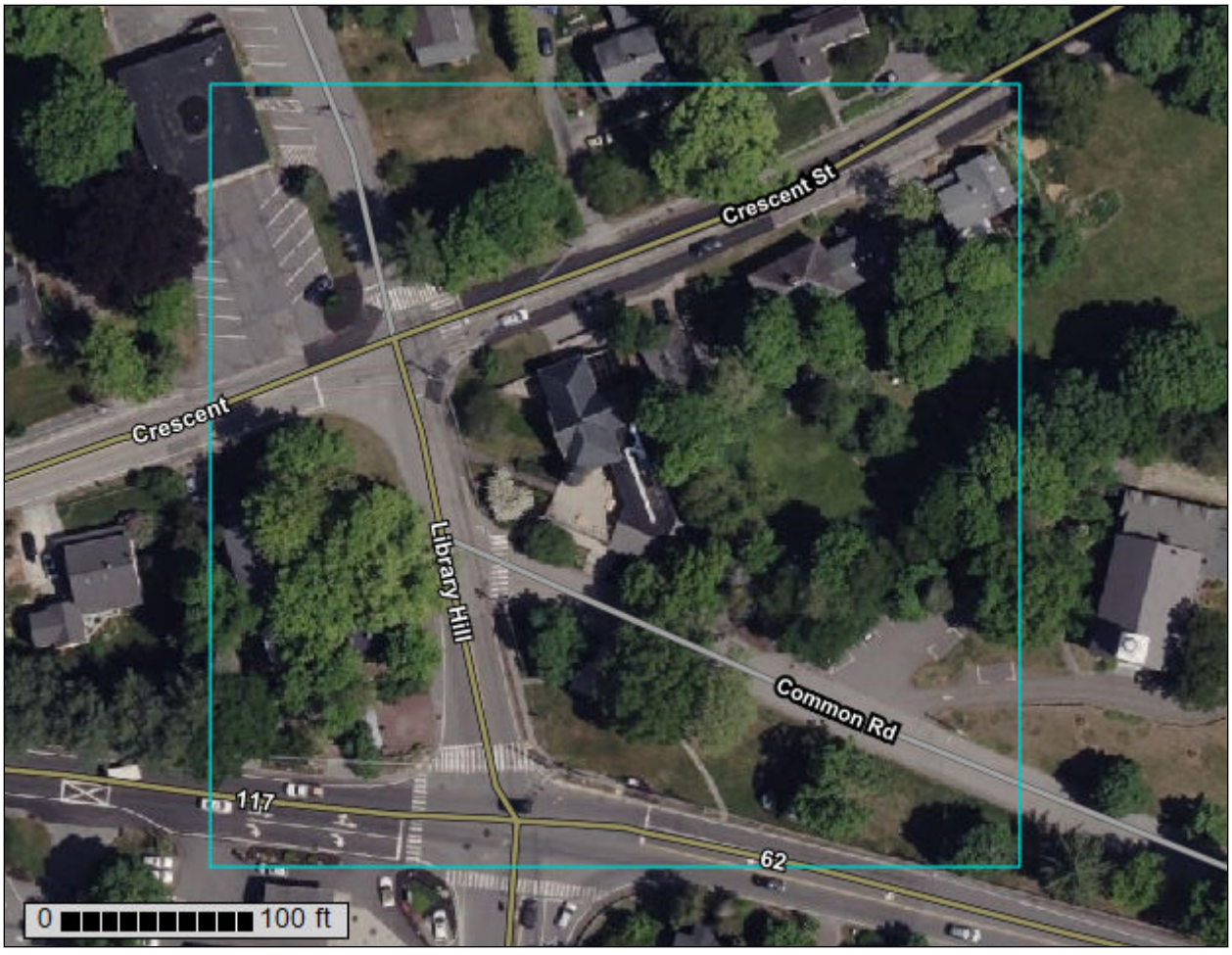
United States Department of Agriculture

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 22, 2023

Preface

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

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

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

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

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

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

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Contents

How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

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

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

Soil Map

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

Custom Soil Resource Report
Soil Map

Map Scale: 1:1,040 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

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 Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
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 22, Sep 9, 2022

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

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
626B	Merrimac-Urban land complex, 0 to 8 percent slopes	3.9	100.0%
Totals for Area of Interest		**3.9**	**100.0%**

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

Middlesex County, Massachusetts

626B—Merrimac-Urban land complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2tyr9
Elevation: 0 to 820 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Merrimac and similar soils: 45 percent
Urban land: 40 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Merrimac

Setting

Landform: Outwash plains, outwash terraces, moraines, eskers, kames
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Crest, side slope, riser, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Loamy glaciofluvial deposits derived from granite, schist, and gneiss over sandy and gravelly glaciofluvial deposits derived from granite, schist, and gneiss

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bw1 - 10 to 22 inches: fine sandy loam
Bw2 - 22 to 26 inches: stratified gravel to gravelly loamy sand
2C - 26 to 65 inches: stratified gravel to very gravelly sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 2 percent
Maximum salinity: Nonsaline (0.0 to 1.4 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Low (about 4.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: A

Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Description of Urban Land

Typical profile

M - 0 to 10 inches: cemented material

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 0 inches to manufactured layer
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: Unranked

Minor Components

Windsor

Percent of map unit: 5 percent
Landform: Outwash terraces, dunes, outwash plains, deltas
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Hinckley

Percent of map unit: 5 percent
Landform: Deltas, kames, eskers, outwash plains
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Head slope, nose slope, crest, side slope, rise
Down-slope shape: Convex
Across-slope shape: Convex, linear
Hydric soil rating: No

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Geotechnical Consultants, Inc.
(508)229-0900 FAX (508)229-2279

SUBSURFACE INVESTIGATION AND FOUNDATION RECOMMENDATIONS

Proposed Addition

Randall Library
19 Crescent Street
Stow, Massachusetts

prepared for

DesignLAB Architects
35 Channel Center Street, Suite 103
Boston, MA 02210

GEOTECHNICAL CONSULTANTS, INC.

Kayla J. Dooley

Kayla Dooley

Daniel Kenneally, P.E.

GCI Project No. 2235310 **20 March 2023**

Geotechnical Consultants, Inc.
(508)229-0900 FAX (508)229-2279

20 March 2023

DesignLAB Architects
35 Channel Center Street, Suite 103
Boston, MA 02210

Attention: Mr. Andrew Brookes

RE: Subsurface Investigation and Foundation Recommendations
Randall Library
19 Crescent Street- Stow, Massachusetts
GCI Project No. 2235310

Dear Mr. Brookes:

In accordance with our proposal dated 21 December 2022 and your authorization to proceed, we have completed a subsurface investigation and geotechnical evaluation for the proposed addition to the Randall Library in Stow, Massachusetts. This study has been conducted in general conformance with requirements of Section 780 CMR 1802.0 of the Massachusetts State Building Code for foundation investigations.

Presented herein and attached are the results of the investigation along with our recommendations concerning the design and construction of the proposed building addition foundation and other geotechnical related issues.

Information used to prepare this report, including existing site features, property boundaries and proposed building layout was obtained in part from the following sources:

- Electronic copy of the drawing set (28 sheets) titled "Randall Memorial Library Addition and Alterations" prepared by Finegold and Bullis Architects, dated 22 February 1974.
- The Bid Package titled "Request for Qualifications for Architect/Design Services" prepared by the Town of Stow, dated 26 October 2022.
- Discussions with the project team.

Elevations are referenced herein to the arbitrary datum on the Architectural drawings referenced above.

SITE DESCRIPTION AND PROPOSED DEVELOPMENT

The subject site is located at 19 Crescent Street on a 6,100± square foot parcel in Stow, Massachusetts. The site is located on the southeast corner of Crescent Street and West Acton Road in the town center of Stow and is known as the Randall Library. The general site vicinity is shown on the Locus Plan attached as Figure 1. and the present site building and nearby structures are shown on the Orthophoto Map attached as Figure 2.

Based on the Assessors Database for the Town of Stow, the original library building was constructed in 1894 and includes a 1½-story brick masonry structure with a finished raised basement, referred to as the first floor level. In 1920, an addition to the library's original building was constructed and is known as the Whitney Room. A larger addition was then constructed in 1975-1976. The first floor level has a slab on grade set at elevation 27.25± feet, according to the 1974 project plans and both additions have a first floor level slab on grade matching the original structure.

Surface grades throughout the site vary, sloping downward from the north to south, between elevations 22± and 36± feet.

Based on discussions with the project team, the proposed development was presented with three options and it has been decided to move forward with Option C to completely remove the existing library addition and construct a new building addition in its place. At the time of this report, the new addition is in the design/development stages and a finished floor elevation has not been provided. Based on the Option C schematics, the new addition will be at about street grade along Common Road, lower than the existing slab on grade. Underpinning of the existing structure foundations may need to be considered to ensure stability during construction.

SUBSURFACE INVESTIGATION & CONDITIONS

A subsurface investigation was conducted at the subject site on 27 February 2023 to determine the generalized subsurface conditions. The investigation consisted of three soil borings completed outside of the existing building addition and the approximate locations are shown on the Location Plan attached as Figure 3. The borings were completed by Carr Dee Corporation under the supervision and direction of Geotechnical Consultants, Inc. The boring locations were established in the field using tape surveying measurements from existing site features shown on the site plan provided. A copy of the boring logs are attached for reference.

Since the borings were completed outside the proposed addition, it is recommended that additional explorations are conducted within the building footprint area once the existing structure is demolished to confirm the soil profile encountered in this investigation.

The borings were advanced using a track drill rig using hollow stem augers. The borings extended to a depths ranging from approximately 11.5± to 20.75± feet below existing ground surface. In general, soil samples of the overburden were recovered at two to five foot intervals using a split spoon sampler driven in accordance with ASTM specification D1556. Soil samples recovered from the recently completed boring have been placed in storage in our laboratory and we will continue to store the samples for a period of not less than three months. Subsequently, the samples will be discarded unless otherwise directed.

Based on the results of the recently completed subsurface investigation, the general subsurface profile at the site includes:

- ***Fill:*** A layer consisting of medium to fine sand, little silt, little gravel with traces of loam and brick. The fill layer was approximately 3± to 6± feet thick; underlain by

- ***Sand & Gravel-*** A layer of medium dense to dense, medium to fine sand and gravel with varying proportions of silt. This layer was not penetrated as part of this investigation.

At borehole locations B-1 and B-2, “called refusal” was encountered at depths of 11.5± and 9.5± feet below the existing ground surface, respectively. Based on the surrounding site topography, it is possible that the depths to “called refusal” coincide with the top of bedrock.

During the time of our investigation, groundwater measurements were made upon completion of each borehole through the hollow stem augers. Using the short duration measurements, groundwater was encountered approximately 9± feet to 10.5± feet below the existing grade, corresponding to elevations from approximately 12± to 14± feet.

Fluctuations in groundwater levels should be expected and occur due to variations in season, precipitation, site features, and other environmental factors.

ANALYSIS AND RECOMMENDATIONS

The proposed building can be founded on conventional spread footings bearing on either the natural *Sand and Gravel* or structural backfill and the ground floor slab can be designed and constructed as a cast-in-place concrete slab-on-grade. Variations in the thickness of the fill should be anticipated and some over excavation may be required to ensure that all the fill is completely removed. Where over excavation is necessary, placement of structural backfill as described below is required.

Spread Footing Foundations

The new building foundations can be designed and constructed as typical spread footings. Given the expected slab elevations and site grading, it is anticipated the footings will bear on either the undisturbed *Sand and Gravel* stratum, or on compacted structural backfill. Footings can be sized for allowable contact pressure of up to 2 tons per square foot (4,000 psf) for subgrade consisting of either the undisturbed sand and gravel or structural backfill.

Given the anticipated foundation loads, minimum dimensions of two feet wide for strip footings and three feet square for individual column footings will likely govern regardless of the footing subgrade material.

Exterior footings must be placed at least to the minimum local frost depth. Although not explicitly stated in the current edition of the *Massachusetts State Building Code*, the local frost depth has historic ally been prescribed by code as four feet below finished exterior grade. In our opinion, the historic minimum frost depth should be maintained for this project.

Interior footings, both isolated column footings and strip footings, may bear at the highest elevation compatible with the lowest floor level. Lightly loaded interior partition walls, including non-load bearing masonry walls, can be supported on thickened portions of the floor slab.

Ground Floor Slab

The ground floor slab can be designed as a slab-on-grade supported directly on a granular subbase layer. The slab-on-grade should be supported on a layer of compacted structural backfill meeting the gradation limits for imported structural fill material provided below. Imported structural fill subbase should be at least 8-inches thick. The slab should be reinforced for crack control and the thickness can be determined using a modulus of subgrade reaction of 150 pci using either the PCA or WRI method.

Although vapor barriers may aggravate problems associated with plastic shrinkage and cracking, we recommend placing a vapor barrier directly below the slab in areas which will receive finishes such as coatings, tile or glued carpeting. The vapor barrier should consist of a Stego Wrap Vapor Barrier® by Stego Industries LLC, or equal, with a Water Vapor Transmission Rate of 0.3 perms or lower per ASTM E 96. Seams should be sealed in accordance with the manufacture's recommendation.

Where trenches are required for the placement of underslab utilities, backfill within the trenches must be adequately compacted to provide continuity of slab support. Trench backfill material should be consistent with the gradation of the slab subbase or as required for the specific utility application.

Waterproofing

The groundwater depths measured at the time of the borings indicate that groundwater is below the proposed addition slab level. Structures constructed below the slab level, such as the elevator pit, may be affected by the presence of groundwater.

We recommend below slab concrete structures be waterproofed using a chemical compound that crystallizes and chemically fuses to concrete and masonry to provide a watertight barrier. Products such as Xypex® or similar have proven to be effective and cost competitive. Xypex can be applied to the exposed concrete surface or mixed with the concrete at the time of placement. All concrete expansion joints and construction joints below grade should utilize adequate water stops.

Seismic Considerations

Earthquake loadings must be considered with respect to the requirements of Section 1613 of the *Massachusetts State Building Code*. In addition, the liquefaction potential of the underlying soils must be evaluated in accordance with Section 1806.4 of the *Massachusetts Code Amendments*.

Site classifications are based on the average density, and hence the ability of the soil to transmit shear waves during a seismic event. The average density is based on the material, both soil and rock, within 100 feet below the building. The site classification is then used to determine the site coefficient and mapped spectral response for a given structure.

The applicable seismic design criteria are as follows:

Site Class D: stiff soil profile

Spectral Response Acceleration at short period, S_s (Table 1604.11):	0.204g
Spectral Response Acceleration at 1 sec., S_1 (Table 1604.11):	0.069g
Site Coefficient, F_a (Table 1613.5.3(1)):	1.6
Site Coefficient, F_v (Table 1613.5.3(2)):	2.4
Adjusted spectral response, S_{Ms} (Equation 16-36):	0.326g
Adjusted spectral response, S_{M1} (Equation 16-37):	0.166g

Based on the result of the borings and in accordance with the provisions of the *Code*, the soils at the site are not considered susceptible to liquefaction.

CONSTRUCTION CONSIDERATIONS

The primary purpose of this section of the report is to comment on items related to excavation, foundation construction, earthwork and related geotechnical aspects of the proposed construction. It is written for the Architect and Engineer having responsibility for preparation of plans and specifications. Since it identifies potential construction problems related to foundations and earthwork, it will also aid personnel who monitor construction activities. Prospective contractors for this project must evaluate construction problems on the basis of their own knowledge and experience in the area, and on the basis of similar projects in other localities, taking into account their proposed construction procedures.

Excavation, Handling and Disposal of Fill Soils

Prior to construction, the fill and natural soils should be sampled and tested for the purpose of pre-classification for disposal, recycling, or reuse. The construction documents should include provisions for soil management and require the Contractor to develop, implement, and supervise a Worker Health and Safety Program. The construction phase-specific plan, should incorporate, at a minimum, a general Health and Safety Program to limit safety-related accidents and to promote health in the construction workplace. The Program should include provisions which will limit exposures of workers to contaminants through ingestion, dermal contact and inhalation.

The soil management plan must be developed in cooperation with the project environmental consultant. The contents of the soil management plan will depend upon the nature and character of the fill soils. Disposal and recycling of all classified soils from excavation activities must be performed in general conformance with applicable Federal, State and Local regulations governing Oils and Hazardous Materials (OHMs).

Cuts and Excavations

All excavations must comply with the Occupational Safety and Health Administration (OSHA) Regulations concerning sloped cuts. The strata encountered at the test pits can be classified as follows:

Fill layer:	Type "C" - maximum allowable slope of 1.5H:1V
Sand & Gravel:	Type "C" - maximum allowable slope of 1.5H:1V

These classifications are provided only as a preliminary construction guide and may not reflect the actual soil conditions encountered during excavation. Soil conditions of sloped or benched cuts should be inspected by a qualified engineer to determine actual soil conditions and allowable slope.

Underpinning

Based on the information provided at the time of this report, the new addition will likely be set at a finished floor elevation lower than the existing structure. The existing structure is founded on rubble foundations and, prior to construction, test pits should be performed to expose a portion of the existing foundation and determine the bearing depth. Depending on the existing conditions underpinning may be required to ensure stability of the foundations during construction of the new spread footing foundations.

Subgrade Preparation and Maintenance

Recommendations regarding the design of the spread footings and slab-on-grade at the ground floor level are only valid if the site is prepared as described below. It is presumed the existing addition will be completely demolished and removed from the site within the proposed footprint of the new addition.

Beneath all building footings and the slab-on-grade area, all fill must be completely removed. Based on the recent boring information, the fill soils outside of the addition footprint extend approximately 3± to 6± feet below the existing ground surface, corresponding to elevations between 16.5± and 21± feet.

After excavation to the required depths it is recommended the exposed subgrade be heavily proof compacted using a vibratory drum roller having a minimum drum width of at least eight feet and a rated dynamic weight of at least 20 tons. In order to maximize the vibratory densification process, proof-rolling should be performed with the roller operating at maximum amplitude. Each roller pass should be made in perpendicular directions to one another to ensure full coverage.

Should "weak" spots be encountered during the proof-rolling operation, they should be investigated by excavating test pits to identify the specific, localized conditions. Unsuitable soils, including highly organic, deleterious, or decayable materials, must be

removed. Where over excavation is required to remove the fill or other materials unsuitable for load support, the subgrade should be proof compacted in preparation for the placement of compacted structural backfill.

All backfill placed within the building area, whether consisting of previously excavated granular soil or imported material must be placed in 12-inch loose lifts and compacted to a modified Proctor density of 95 per cent (ASTM D1557). Imported material used for structural backfill and the subbase below the slab, must consist of clean, well-graded granular soil or other dense processed aggregate free of organic material, loam, asphalt, snow, ice, frozen soil and other objectionable materials. Gradation limits for imported material used for structural backfill should be as follows and have no stones larger than 3" (three inches):

Sieve Size	Percent Passing
3"	100
½"	50-85
No. 4	40-75
No. 50	8-28
No. 200	0-8

Based on the groundwater measurements made at the time of our investigation, we do not anticipate general site dewatering will be needed during site preparation or foundation construction. However, adequate site drainage must be provided to preclude the accumulation of surface water within the building footprint area. Drainage or dewatering, where needed, must be done so that all work can proceed in-the-dry. It is imperative that all exposed subgrade soils be protected from water and prolonged exposure to freezing temperatures.

Excavation for footings and exposed subgrade should be inspected by a qualified geotechnical engineer to ensure adequacy of the subgrade soils. The placement of all structural backfill must be inspected and certified as to its adequacy and conformity to the requirements of the *Massachusetts State Building Code*.

Backfill soil placed outside the building footprint in areas of non-load support may be "ordinary fill". Ordinary fill should consist of granular soil containing no decayable matter such as roots, wood, organic soil, etc. Ordinary fill should be placed in layers and compacted with available construction equipment to reduce future settlement.

Construction Monitoring

We recommend that you retain Geotechnical Consultants, Inc. to review your foundation and construction plans for compliance with our geotechnical recommendations. We recommend that Geotechnical Consultants, Inc. also be retained to provide construction observation services during construction to prepare reports in order to satisfy the Massachusetts State Building Code's Special Inspections Reporting requirements (refer to Chapter 17). We strongly recommend that Geotechnical Consultants, Inc. be retained to observe and document the following key geotechnical components of construction:

- Site preparation;
- Placement and compaction of fill materials;
- Final preparation of foundation and slab subgrades;
- Placement of all concrete; and
- Erection of structural steel and/or timber.

Our involvement during construction will allow evaluation of actual conditions exposed during excavation, and to allow a prompt response should unanticipated conditions be encountered. Our involvement will also efficiently facilitate the field-assessment of areas where partial over excavation of existing soils may be warranted, thereby saving the Owner time and money.

LIMITATIONS

This report has been prepared for specific application to the proposed addition located at 19 Crescent Street in Stow, Massachusetts in accordance with generally accepted geotechnical engineering practices. The recommendations provided herein are based on information of subsurface conditions and proposed construction that is available to us at this time. As the design development progresses, implementation of these recommendations must consider any variations from the currently anticipated construction. The nature and extent of variations in the subsurface conditions between explorations may not be evident until construction. If significant variations appear, it will be necessary to re-evaluate the recommendations presented in this report.

We request that we be provided the opportunity for a general review of the applicable contract drawings and specifications, to determine that our recommendations have been interpreted and implemented as they were intended. If any changes in the nature, design or location of the proposed building is made, we should review the applicability of our recommendations.

It has been our pleasure serving you and we trust that the foregoing and attached are sufficient for your immediate needs. Should you have any questions, or need further assistance, please do not hesitate to contact this office.

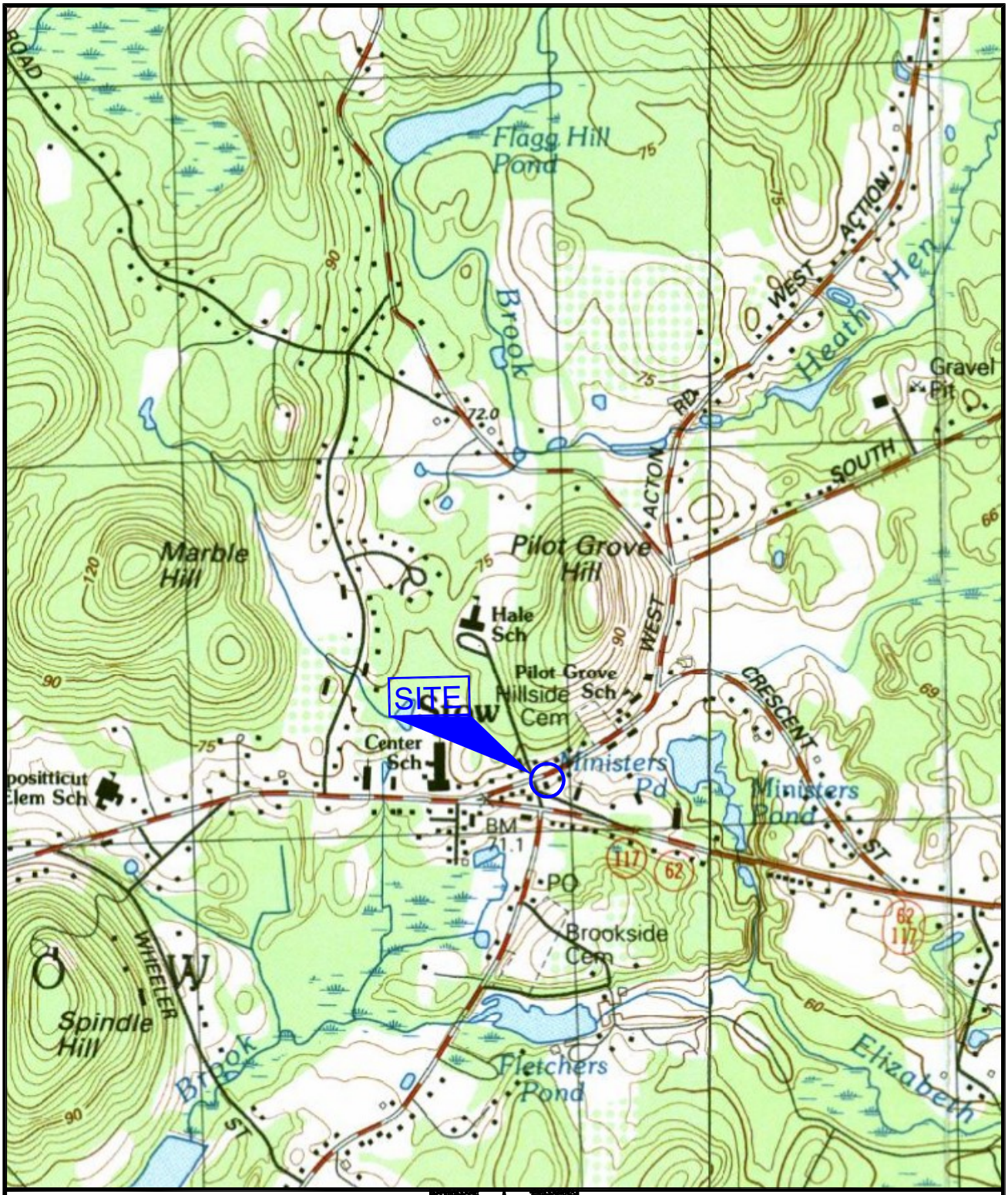
Sincerely,
GEOTECHNICAL CONSULTANTS, INC.

Kayla J. Doobley

Kayla Doobley

Daniel Kenneally, P.E.

DK/kd
Attachments



Randall Library
19 Crescent Street
Stow, Massachusetts

LOCUS PLAN
U.S.G.S. HUDSON QUADRANGLE
APPROX. SCALE 1:24 000

Geotechnical Consultants, Inc.
201 Boston Post Road West
Marlborough, MA 01752
(508)229-0900 FAX (508)229-2279

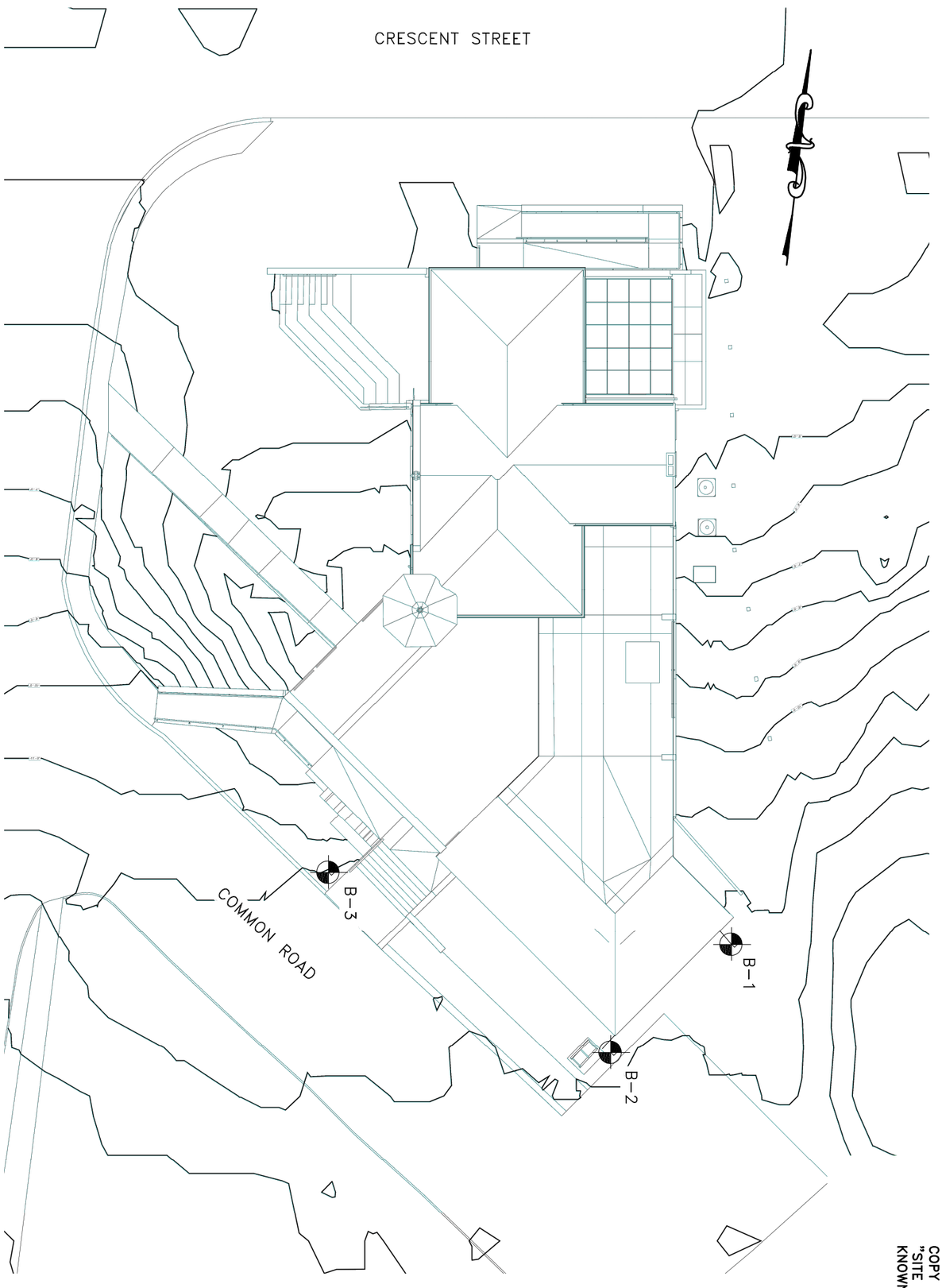
GCI Project # 2235310

Figure 1.

Randall Library
19 Crescent Street
Stow, Massachusetts
GCI Project No. 2235310

Figure 2.
Color Orthophoto Map

Geotechnical Consultants, Inc.
201 Boston Post Road West
Marlborough, MA 01752
(508)229-0900 FAX (508)229-2279



LEGEND

APPROXIMATE LOCATION OF BORINGS PERFORMED BY CARR-DEE CORP., UNDER THE DIRECTION OF GEOTECHNICAL CONSULTANTS, INC. ON 27 FEBRUARY 2023.

BASE PLAN TAKEN FROM AN ELECTRONIC COPY OF A DRAWING XC1.3 ENTITLED "SITE PLAN" PREPARED BY POINT KNOWN, DATED 3 FEBRUARY 2023.

FIGURE 3.

GCI Project No. 2235310

Randall Library
19 Crescent Street
Stow, Massachusetts

LOCATION PLAN

MARCH 2023

(feet)
0 10 20

Geotechnical Consultants, Inc.
201 Boston Post Road West
Marlborough, MA 01752
(508)229-0900 FAX (508)229-2279

APPENDIX A
Boring Logs

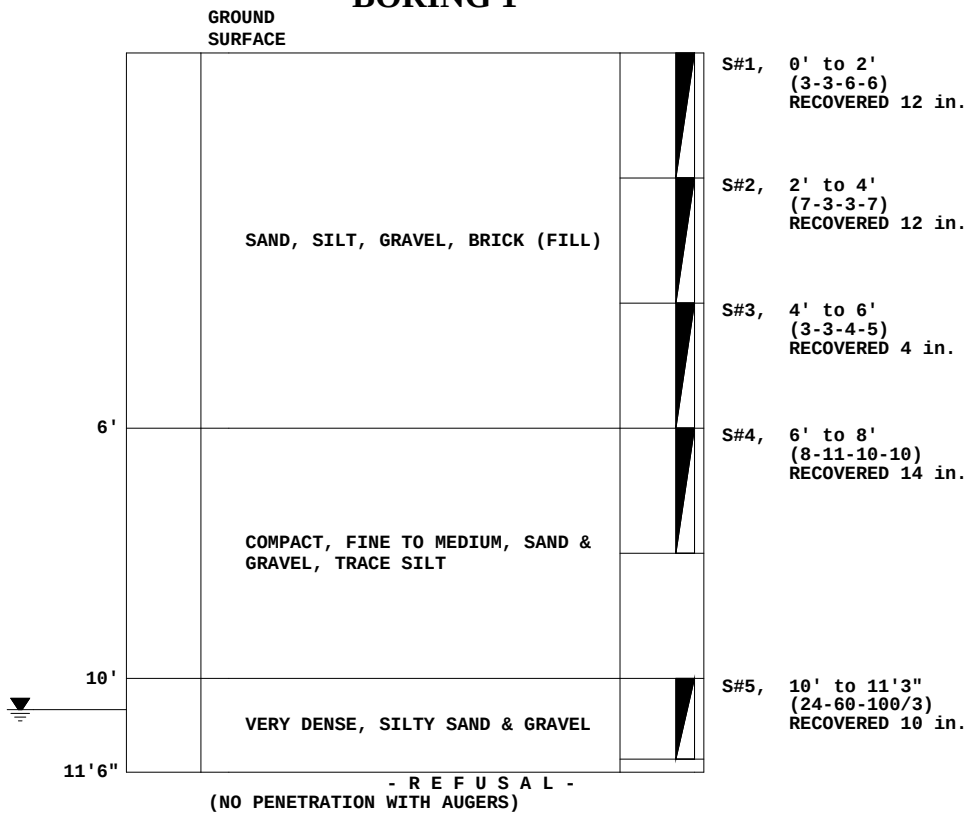
CARR-DEE CORP.

37 LINDEN STREET MEDFORD, MA 02155-0001 Telephone (781) 391-4500

To: GEOTECHNICAL CONSULTANTS INC., MARLBOROUGH, MA Date: 2-28-2023 Job No.: 2023-13

Location: PUBLIC LIBRARY, 19 CRESCENT ST., STOW, MA Scale: 1 in.= 3 ft.

BORING 1



WATER LEVEL 10'6"
SIZE OF AUGERS: 2 1/4"I.D., LENGTH: 11'6"
DRILLER: S. DESIMONE JR., INSPECTOR: V. HULTGREN
DATE STARTED & COMPLETED: 2-27-2023

All samples have been visually classified by . Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

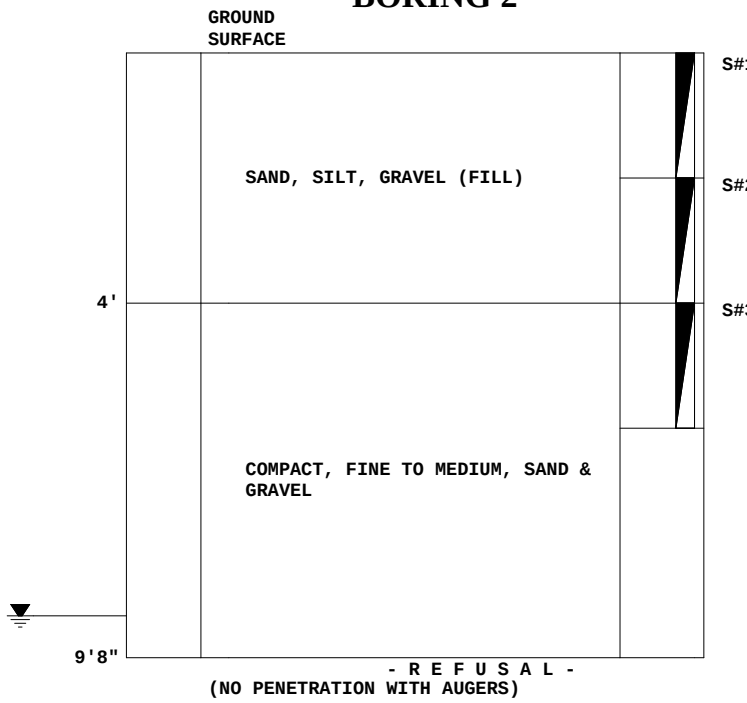
CARR-DEE CORP.

37 LINDEN STREET MEDFORD, MA 02155-0001 Telephone (781) 391-4500

To: GEOTECHNICAL CONSULTANTS INC., MARLBOROUGH, MA Date: 2-28-2023 Job No.: 2023-13

Location: PUBLIC LIBRARY, 19 CRESCENT ST., STOW, MA Scale: 1 in.= 3 ft.

BORING 2



S#1, 0' to 2'
(6-6-13-15)
RECOVERED 12 in.

S#2, 2' to 4'
(2-2-12-11)
RECOVERED 4 in.

S#3, 4' to 6'
(21-14-12-12)
RECOVERED 12 in.

WATER LEVEL 9'
SIZE OF AUGERS: 2 1/4"I.D., LENGTH: 9'8"
DRILLER: S. DESIMONE JR., INSPECTOR: V. HULTGREN
DATE STARTED & COMPLETED: 2-27-2023

All samples have been visually classified by . Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

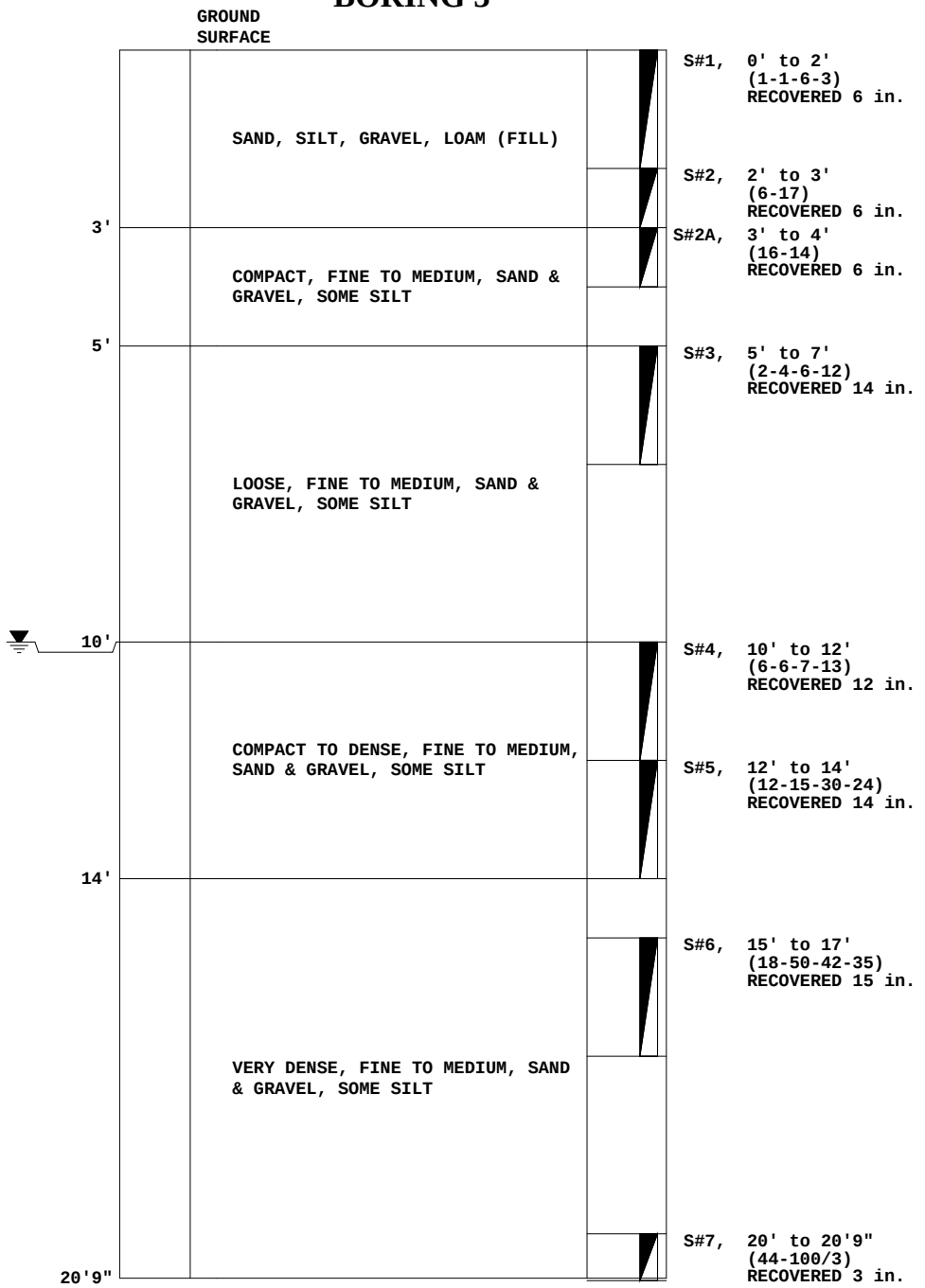
CARR-DEE CORP.

37 LINDEN STREET MEDFORD, MA 02155-0001 Telephone (781) 391-4500

To: GEOTECHNICAL CONSULTANTS INC., MARLBOROUGH, MA Date: 2-28-2023 Job No.: 2023-13

Location: PUBLIC LIBRARY, 19 CRESCENT ST., STOW, MA Scale: 1 in.= 3 ft.

BORING 3



WATER LEVEL 10'
SIZE OF AUGERS: 2 1/4"I.D., LENGTH: 20'0"
DRILLER: S. DESIMONE JR., INSPECTOR: V. HULTGREN
DATE STARTED & COMPLETED: 2-27-2023

All samples have been visually classified by . Unless otherwise specified, water levels noted were observed at completion of borings, and do not necessarily represent permanent ground water levels. Figures in parenthesis indicate the number of blows required to drive Two-inch Split Sampler 6 inches using 140 lb. weight falling 30 inches(±). Figures in column to left (if noted) indicate number of blows to drive casing one foot, using 300 lb. weight falling 24 inches (±).

SN	Element ID	Description	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (inches)	Pipe Width (inches)	Manning's Roughness	nce ses	end ses	onal ses	Initial Flow (cfs)	Flap Gate	Lengthening Factor	Peak Flow (cfs)	Time of Peak Flow (days hh:mm)	Max Flow Velocity (ft/sec)	Travel Time (min)	Design Flow Capacity (cfs)	Max Flow / Design Flow Ratio	Max Depth / Total Depth	Total Time Surcharged (min)	Max Flow Depth (ft)	Reported Condition
1	Link-01		Out-1Pipe - (194)	Out-1Pipe - (201)	10.23	221.86	0.00	221.65	0.00	0.21	2.0500	CIRCULAR	18.000	18.00	0.0150	##	##	###	0.00	NO	1.00	0.00	0 00:00	0.00		13.04	0.00	0.00	0.00	0.00	Calculated
2	Pipe - (146)		AD#3	AB#102	9.65	220.75	0.00	220.48	1.10	0.27	2.8000	CIRCULAR	6.000	6.00	0.0120	##	##	###	0.00	NO	1.00	0.28	0 00:06	4.41	0.04	1.02	0.27	0.36	0.00	0.18	Calculated
3	Pipe - (147)		AB#104	Out-1Pipe - (147)	50.39	218.98	0.00	217.00	0.00	1.98	3.9300	CIRCULAR	12.000	12.00	0.0120	##	##	###	0.00	NO	1.00	1.17	0 00:06	7.05	0.12	7.65	0.15	0.26	0.00	0.26	Calculated
4	Pipe - (150)		Structure - (324)	Structure - (323)	19.43	227.00	0.00	224.66	0.00	2.34	12.0500	CIRCULAR	6.000	6.00	0.0120	##	##	###	0.00	NO	1.00	0.14	0 00:06	6.02	0.05	2.11	0.06	0.17	0.00	0.09	Calculated
5	Pipe - (150) (5)		Structure - (322)	Structure - (321)	17.89	222.75	0.00	221.20	0.10	1.55	8.6700	CIRCULAR	6.000	6.00	0.0120	##	##	###	0.00	NO	1.00	0.22	0 00:06	6.16	0.05	1.79	0.12	0.24	0.00	0.12	Calculated
6	Pipe - (150) (5) (1)		Structure - (321)	PVC CLEANOUT TO FG	21.31	221.10	0.00	220.20	0.00	0.90	4.2200	CIRCULAR	6.000	6.00	0.0120	##	##	###	0.00	NO	1.00	0.25	0 00:06	4.97	0.07	1.25	0.20	0.30	0.00	0.15	Calculated
7	Pipe - (150) (6)		Structure - (323)	Structure - (322)	15.84	224.66	0.00	222.75	0.00	1.91	12.0500	CIRCULAR	6.000	6.00	0.0120	##	##	###	0.00	NO	1.00	0.17	0 00:06	6.46	0.04	2.11	0.08	0.19	0.00	0.10	Calculated
8	Pipe - (156)		DS	Structure - (318)	2.22	233.50	9.80	229.30	0.00	4.20	189.0700	CIRCULAR	6.000	6.00	0.0120	##	##	###	0.00	NO	1.00	0.08	0 00:06	13.22	0.00	8.36	0.01	0.07	0.00	0.03	Calculated
9	Pipe - (156) (1)		Structure - (318)	Structure - (326)	4.28	229.30	0.00	229.25	0.00	0.05	1.1700	CIRCULAR	6.000	6.00	0.0120	##	##	###	0.00	NO	1.00	0.09	0 00:06	2.32	0.03	0.66	0.13	0.25	0.00	0.12	Calculated
10	Pipe - (156) (1) (1)		Structure - (326)	Structure - (317)	19.46	229.25	0.00	229.00	2.50	0.25	1.2800	CIRCULAR	6.000	6.00	0.0120	##	##	###	0.00	NO	1.00	0.11	0 00:06	2.58	0.13	0.69	0.16	0.27	0.00	0.14	Calculated
11	Pipe - (157)		DS#2	Structure - (317)	2.53	231.20	1.20	229.00	2.50	2.20	87.0700	CIRCULAR	6.000	6.00	0.0120	##	##	###	0.00	NO	1.00	0.05	0 00:06	8.99	0.00	5.67	0.01	0.07	0.00	0.03	Calculated
12	Pipe - (157) (1) (1)		Structure - (317)	AB#104	32.21	226.50	0.00	226.00	7.02	0.50	1.5500	CIRCULAR	12.000	12.00	0.0120	##	##	###	0.00	NO	1.00	0.16	0 00:06	2.86	0.19	4.81	0.03	0.13	0.00	0.13	Calculated
13	Pipe - (171)		TD #2	AB#104	33.36	227.00	0.00	226.00	7.02	1.00	3.0000	CIRCULAR	6.000	6.00	0.0120	##	##	###	0.00	NO	1.00	0.11	0 00:06	4.04	0.14	1.05	0.10	0.22	0.00	0.11	Calculated
14	Pipe - (172)		AD#1	CLEANOUT	3.57	229.50	0.00	229.45	5.91	0.05	1.4000	CIRCULAR	6.000	6.00	0.0120	##	##	###	0.00	NO	1.00	0.01	0 00:06	1.34	0.04	0.72	0.02	0.09	0.00	0.04	Calculated
15	Pipe - (178)		PVC CLEANOUT TO FG	Structure - (327)	10.29	220.20	0.00	220.09	0.00	0.11	1.0700	CIRCULAR	12.000	12.00	0.0120	##	##	###	0.00	NO	1.00	0.25	0 00:06	2.82	0.06	3.99	0.06	0.17	0.00	0.17	Calculated
16	Pipe - (178) (1)		Structure - (319)	NodePipe - (178) (1) (2) (1)	34.08	220.06	0.00	219.72	0.00	0.34	1.0000	CIRCULAR	12.000	12.00	0.0120	##	##	###	0.00	NO	1.00	0.51	0 00:06	3.42	0.17	3.86	0.13	0.25	0.00	0.25	Calculated
17	Pipe - (178) (1) (2) (1)		NodePipe - (178) (1) (2) (1)	AB#103	2.88	219.72	0.00	219.68	0.10	0.04	1.3900	CIRCULAR	12.000	12.00	0.0120	##	##	###	0.00	NO	1.00	0.63	0 00:06	4.07	0.01	4.55	0.14	0.25	0.00	0.25	Calculated
18	Pipe - (178) (2)		Structure - (327)	Structure - (319)	2.83	220.09	0.00	220.06	0.00	0.03	1.0600	CIRCULAR	12.000	12.00	0.0120	##	##	###	0.00	NO	1.00	0.41	0 00:06	3.26	0.01	3.98	0.10	0.22	0.00	0.22	Calculated
19	Pipe - (179)		AD#4	Structure - (319)	12.94	220.29	0.00	220.06	0.00	0.23	1.7800	CIRCULAR	6.000	6.00	0.0120	##	##	###	0.00	NO	1.00	0.10	0 00:06	2.84	0.08	0.81	0.13	0.24	0.00	0.12	Calculated
20	Pipe - (180)		TD#3	AD#2	18.73	220.27	0.00	219.85	0.00	0.42	2.2400	CIRCULAR	6.000	6.00	0.0120	##	##	###	0.00	NO	1.00	0.08	0 00:06	3.07	0.10	0.91	0.09	0.20	0.00	0.10	Calculated
21	Pipe - (181)		CLEANOUT	Structure - (318)	11.88	229.45	5.91	229.30	0.00	0.15	1.2600	CIRCULAR	6.000	6.00	0.0120	##	##	###	0.00	NO	1.00	0.01	0 00:06	1.29	0.15	0.68	0.02	0.09	0.00	0.04	Calculated
22	Pipe - (188)		AB#103	AB#102	9.53	219.58	0.00	219.48	0.10	0.10	1.0500	CIRCULAR	12.000	12.00	0.0120	##	##	###	0.00	NO	1.00	0.63	0 00:06	3.68	0.04	3.95	0.16	0.27	0.00	0.27	Calculated
23	Pipe - (189)		AB#102	AB#104	29.33	219.38	0.00	219.08	0.10	0.30	1.0200	CIRCULAR	12.000	12.00	0.0120	##	##	###	0.00	NO	1.00	0.90	0 00:06	4.04	0.12	3.90	0.23	0.33	0.00	0.33	Calculated
24	Pipe - (191)		AD#5	AB#101	33.84	218.50	0.00	218.10	0.10	0.40	1.1800	CIRCULAR	8.040	8.04	0.0120	##	##	###	0.00	NO	1.00	0.13	0 00:06	3.18	0.18	1.42	0.09	0.20	0.00	0.13	Calculated
25	Pipe - (192)		AB#101	Out-1Pipe - (192)	3.49	218.00	0.00	217.82	0.00	0.18	5.1600	CIRCULAR	8.040	8.04	0.0120	##	##	###	0.00	NO	1.00	0.42	0 00:06	6.00	0.01	2.97	0.14	0.25	0.00	0.17	Calculated
26	Pipe - (193)		CB#1	AB#101	12.23	218.20	0.00	218.10	0.10	0.10	0.8200	CIRCULAR	8.040	8.04	0.0120	##	##	###	0.00	NO	1.00	0.29	0 00:06	2.80	0.07	1.18	0.24	0.34	0.00	0.22	Calculated
27	Pipe - (196)		AD#2	NodePipe - (178) (1) (2) (1)	3.78	219.85	0.00	219.72	0.00	0.13	3.4400	CIRCULAR	6.000	6.00	0.0120	##	##	###	0.00	NO	1.00	0.12	0 00:06	3.74	0.02	1.13	0.11	0.22	0.00	0.11	Calculated
28	Pipe - (198)		TD#1	Structure - (325)	3.57	230.00	0.00	229.30	0.00	0.70	19.6200	CIRCULAR	3.960	3.96	0.0120	##	##	###	0.00	NO	1.00	0.02	0 00:06	4.55	0.01	0.91	0.03	0.11	0.00	0.04	Calculated
29	Pipe - (199)		Structure - (325)	Structure - (326)	4.35	229.30	0.00	229.25	0.00	0.05	1.1500	CIRCULAR	3.960	3.96	0.0120	##	##	###	0.00	NO	1.00	0.02	0 00:06	1.68	0.04	0.22	0.11	0.23	0.00	0.08	Calculated

SN	Element ID	X Coordinate	Y Coordinate	Description	Invert Elevation	Boundary Type	Flap Gate	Fixed Water Elevation	Peak Inflow	Peak Lateral Inflow	Maximum HGL Depth Attained	Maximum HGL Elevation Attained
					(ft)			(ft)	(cfs)	(cfs)	(ft)	(ft)
1	Out-1Pipe - (147)	654828.97	2984222.68		217.00	FREE	NO		1.17	0.00	0.26	217.26
2	Out-1Pipe - (192)	654955.67	2984191.97		217.82	FREE	NO		0.42	0.00	0.17	217.99
3	Out-1Pipe - (201)	654932.39	2984275.24		221.65	FREE	NO		0.00	0.00	0.00	221.65

SN	Element ID	X Coordinate	Y Coordinate	Description	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)
1	AB#101	654955.34	2984195.45		218.00	222.15	4.15	218.00	0.00	222.15	0.00	0.00
2	AB#102	654871.75	2984252.85		219.38	225.74	6.36	219.38	0.00	225.74	0.00	0.00
3	AB#103	654880.46	2984248.97		219.58	225.40	5.82	219.58	0.00	225.40	0.00	0.00
4	AB#104	654847.61	2984269.49		218.98	228.00	9.02	218.98	0.00	228.00	0.00	0.00
5	AD#1	654856.40	2984331.00		229.50	231.50	2.00	229.50	0.00	231.50	0.00	0.00
6	AD#2	654886.66	2984248.54		219.85	224.02	4.17	219.85	0.00	224.02	0.00	0.00
7	AD#3	654870.69	2984243.26		220.75	224.00	3.25	220.75	0.00	224.00	0.00	0.00
8	AD#4	654919.58	2984249.50		220.29	223.79	3.50	220.29	0.00	223.79	0.00	0.00
9	AD#5	654967.45	2984227.04		218.50	221.50	3.00	218.50	0.00	221.50	0.00	0.00
10	CB#1	654944.13	2984200.34		218.20	222.12	3.92	218.20	0.00	222.12	0.00	0.00
11	CLEANOUT	654853.05	2984329.78		223.54	224.91	1.37	223.54	0.00	224.91	0.00	0.00
12	DS	654859.20	2984319.42		223.70	234.84	11.14	223.70	0.00	234.84	0.00	0.00
13	DS#2	654867.73	2984297.27		230.00	232.76	2.76	230.00	0.00	232.76	0.00	0.00
14	178) (1) (2) (1)	654883.16	2984249.98		219.72	220.72	1.00	219.72	0.00	220.72	0.00	0.00
15	t-1Pipe - (194)	654922.20	2984274.39		221.86	227.86	6.00	221.86	0.00	227.86	0.00	0.00
16	:ANOUT TO FG	654927.44	2984266.30		220.20	224.50	4.30	220.20	0.00	224.50	0.00	0.00
17	ructure - (317)	654865.37	2984296.36		226.50	230.90	4.40	226.50	0.00	230.90	0.00	0.00
18	ructure - (318)	654857.13	2984318.62		229.30	229.90	0.60	229.30	0.00	229.90	0.00	0.00
19	ructure - (319)	654915.18	2984261.67		220.06	222.36	2.30	220.06	0.00	222.36	0.00	0.00
20	ructure - (321)	654920.18	2984286.33		221.10	221.60	0.50	221.10	0.00	221.60	0.00	0.00
21	ructure - (322)	654914.06	2984303.14		222.75	223.26	0.51	222.75	0.00	223.26	0.00	0.00
22	ructure - (323)	654908.64	2984318.02		224.66	225.15	0.49	224.66	0.00	225.15	0.00	0.00
23	ructure - (324)	654901.99	2984336.28		227.00	227.63	0.63	227.00	0.00	227.63	0.00	0.00
24	ructure - (325)	654854.85	2984316.82		229.30	229.90	0.60	229.30	0.00	229.90	0.00	0.00
25	ructure - (326)	654858.58	2984314.60		229.25	229.75	0.50	229.25	0.00	229.75	0.00	0.00
26	ructure - (327)	654917.82	2984262.67		220.09	221.09	1.00	220.09	0.00	221.09	0.00	0.00
27	TD #2	654821.80	2984290.63		227.00	230.52	3.52	227.00	0.00	230.52	0.00	0.00
28	TD#1	654851.48	2984315.64		230.00	235.50	5.50	230.00	0.00	235.50	0.00	0.00
29	TD#3	654892.66	2984230.80		220.27	223.77	3.50	220.27	0.00	223.77	0.00	0.00

Minimum Pipe Cover (inches)	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Maximum HGL Elevation (ft)	Maximum HGL Depth (ft)	Maximum Surcharge Depth (ft)	Minimum Freeboard Attained (ft)	Average HGL Elevation (ft)	Average HGL Depth (ft)	Time of Maximum HGL (days hh:mm)	Time of Peak Flooding (days hh:mm)	Total Flooded Volume (ac-inches)	Total Time Flooded (minutes)
40.60	0.42	0.00	218.32	0.32	0.00	3.83	218.13	0.13	0 00:06	0 00:00	0.00	0.00
57.12	0.90	0.00	220.66	1.28	0.00	5.08	220.50	1.12	0 00:06	0 00:00	0.00	0.00
56.64	0.63	0.00	219.93	0.35	0.00	5.47	219.71	0.13	0 00:06	0 00:00	0.00	0.00
12.00	1.17	0.00	226.13	7.15	0.00	1.87	226.02	7.04	0 00:06	0 00:00	0.00	0.00
18.00	0.01	0.01	229.54	0.04	0.00	1.96	229.51	0.01	0 00:06	0 00:00	0.00	0.00
44.04	0.12	0.04	219.96	0.11	0.00	4.06	219.87	0.02	0 00:06	0 00:00	0.00	0.00
33.00	0.28	0.28	220.93	0.18	0.00	3.07	220.77	0.02	0 00:06	0 00:00	0.00	0.00
36.00	0.10	0.10	220.41	0.12	0.00	3.38	220.31	0.02	0 00:06	0 00:00	0.00	0.00
28.00	0.13	0.13	218.64	0.14	0.00	2.86	218.52	0.02	0 00:06	0 00:00	0.00	0.00
39.04	0.29	0.29	218.42	0.22	0.00	3.70	218.23	0.03	0 00:06	0 00:00	0.00	0.00
0.00	0.01	0.00	229.49	5.95	0.00	0.46	229.46	5.92	0 00:06	0 00:00	0.00	0.00
10.12	0.08	0.08	233.53	9.83	0.00	1.31	233.50	9.80	0 00:06	0 00:00	0.00	0.00
12.72	0.05	0.05	231.23	1.23	0.00	1.53	231.20	1.20	0 00:06	0 00:00	0.00	0.00
0.00	0.63	0.00	219.97	0.25	0.00	0.75	219.76	0.04	0 00:06	0 00:00	0.00	0.00
54.00	0.00	0.00	221.86	0.00	0.00	6.00	221.86	0.00	0 00:00	0 00:00	0.00	0.00
39.60	0.25	0.00	220.37	0.17	0.00	4.13	220.22	0.02	0 00:06	0 00:00	0.00	0.00
16.80	0.16	0.00	229.14	2.64	0.00	1.76	229.02	2.52	0 00:06	0 00:00	0.00	0.00
1.20	0.09	0.00	229.42	0.12	0.00	0.48	229.32	0.02	0 00:06	0 00:00	0.00	0.00
15.56	0.51	0.00	220.31	0.25	0.00	2.05	220.09	0.03	0 00:06	0 00:00	0.00	0.00
0.00	0.25	0.03	221.32	0.22	0.00	0.38	221.22	0.12	0 00:06	0 00:00	0.00	0.00
0.09	0.22	0.05	222.87	0.12	0.00	0.39	222.77	0.02	0 00:06	0 00:00	0.00	0.00
0.00	0.17	0.03	224.75	0.09	0.00	0.40	224.67	0.01	0 00:06	0 00:00	0.00	0.00
1.54	0.14	0.14	227.09	0.09	0.00	0.54	227.01	0.01	0 00:06	0 00:00	0.00	0.00
3.20	0.02	0.00	229.38	0.08	0.00	0.52	229.31	0.01	0 00:06	0 00:00	0.00	0.00
0.00	0.11	0.00	229.39	0.14	0.00	0.36	229.27	0.02	0 00:06	0 00:00	0.00	0.00
0.00	0.41	0.16	220.31	0.22	0.00	0.78	220.12	0.03	0 00:06	0 00:00	0.00	0.00
36.24	0.11	0.11	227.11	0.11	0.00	3.41	227.01	0.01	0 00:06	0 00:00	0.00	0.00
62.00	0.02	0.02	230.04	0.04	0.00	5.46	230.01	0.01	0 00:05	0 00:00	0.00	0.00
36.00	0.08	0.08	220.37	0.10	0.00	3.40	220.28	0.01	0 00:06	0 00:00	0.00	0.00

SN	Element Des ID	Area	Drainage Node ID	Weighted Runoff Coefficient	Accumulated Precipitation	Total Runoff	Peak Runoff	Rainfall Intensity	Time of Concentration
		(acres)			(inches)	(inches)	(cfs)	(inches/hr)	(days hh:mm:ss)
1	Sub-01	0.02	Structure - (324)	0.9000	0.77	0.69	0.14	7.692	0 00:06:00
2	Sub-02	0.01	DS	0.9000	0.77	0.69	0.08	7.692	0 00:06:00
3	Sub-03	0.01	Structure - (323)	0.9000	0.77	0.69	0.04	7.692	0 00:06:00
4	Sub-04	0.01	Structure - (322)	0.9000	0.77	0.69	0.05	7.692	0 00:06:00
5	Sub-05	0.00	Structure - (321)	0.9000	0.77	0.69	0.03	7.692	0 00:06:00
6	Sub-06	0.01	DS#2	0.7200	0.77	0.55	0.05	7.692	0 00:06:00
7	Sub-07	0.02	Structure - (327)	0.9000	0.77	0.69	0.17	7.692	0 00:06:00
8	Sub-08	0.00	AD#1	0.6200	0.77	0.48	0.01	7.692	0 00:06:00
9	Sub-09	0.00	TD#1	0.7200	0.77	0.55	0.03	7.692	0 00:06:00
10	Sub-10	0.02	TD #2	0.7400	0.77	0.57	0.11	7.692	0 00:06:00
11	Sub-11	0.06	AD#3	0.6200	0.77	0.48	0.28	7.692	0 00:06:00
12	Sub-12	0.01	AD#2	0.7200	0.77	0.55	0.04	7.692	0 00:06:00
13	Sub-13	0.01	TD#3	0.8800	0.77	0.68	0.08	7.692	0 00:06:00
14	Sub-14	0.02	AD#4	0.7800	0.77	0.60	0.10	7.692	0 00:06:00
15	Sub-15	0.03	AD#5	0.6300	0.77	0.49	0.13	7.692	0 00:06:00
16	Sub-16	0.05	CB#1	0.8300	0.77	0.64	0.29	7.692	0 00:06:00

APPENDIX E

Long-Term Pollution Prevention Plan and Stormwater Operation and Maintenance Plan

Nitsch Engineering

Building better communities with you

August 2, 2023
Revised April 16, 2024

Long-Term Pollution Prevention Plan and Stormwater Operation and Maintenance Plan

Randall Library Renovation and Addition
19 Crescent Street
Stow, MA 01775

Prepared for:

designLAB Architects
35 Channel Street, Suite 103
Boston, MA 02210

Prepared by:

Nitsch Engineering
2 Center Plaza, Suite 430
Boston, MA 02108

Nitsch Project #14631

Civil Engineering | Transportation Engineering | Structural Engineering | Resilience & Green Infrastructure | Planning | Land Surveying

TABLE OF CONTENTS

SECTION 1 Introduction

The purpose of this document is to specify the pollution prevention measures and stormwater management system operation and maintenance for the Randall Library site. The Responsible Party indicated below shall implement the management practices outlined in this document and proactively conduct operations at the project site in an environmentally responsible manner. Compliance with this Manual does not in any way dismiss the responsible party, owner, property manager, or occupants from compliance with other applicable federal, state or local laws.

Responsible Party: Town of Stow Randall Library
19 Crescent Street,
Stow, MA 01775

This Document has been prepared in compliance with Standards 4 and 9 of the 2008 Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Standards, which state:

Standard 4

The Long-Term Pollution Prevention Plan shall include the proper procedures for the following:

1. Good housekeeping;
2. Storing materials and waste products inside or under cover;
3. Vehicle washing;
4. Routine inspections of stormwater best management practices;
5. Spill prevention and response;
6. Maintenance of lawns, gardens, and other landscaped areas;
7. Storage and use of fertilizers, herbicides, and pesticides;
8. Pet waste management;
9. Operation and management of septic systems; and
10. Proper management of deicing chemicals and snow.

Standard 9

The Long-Term Operation and Maintenance Plan shall at a minimum include:

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

SECTION 2 Long-Term Pollution Prevention Plan

The Responsible Party shall implement the following good housekeeping procedures at the project site to reduce the possibility of accidental releases and to reduce safety hazards.

Storage of Hazardous Materials

To prevent leaks and spills, keep hazardous materials and waste products under cover or inside. Use drip pans or spill containment systems to prevent chemicals from entering the drainage system. Inspect storage areas for materials and waste products at least once per year to determine amount and type of the material on site, and if the material requires disposal.

Securely store liquid petroleum products and other liquid chemicals in federally- and state-approved containers. Restrict access to maintenance personnel and administrators.

Storage of Waste Products

Collect and store all waste materials in securely lidded dumpster(s) or other secure containers as applicable to the material. Keep dumpster lids closed and the areas around them clean. Do not fill the dumpsters with liquid waste or hose them out. Sweep areas around the dumpster regularly and put the debris in the garbage, instead of sweeping or hosing it into the parking lot. Legally dispose of collected waste on a regular basis.

Segregate liquid wastes from solid waste and recycle through hazardous waste disposal companies, whenever possible. Contact a hazardous waste hauler for proper disposal to a hazardous waste collection center.

Spill Prevention and Response

Implement spill response procedures for releases of significant materials such as fuels, oils, or chemical materials onto the ground or other area that could reasonably be expected to discharge to surface or groundwater.

1. For minor spills, keep fifty (50) gallon spill control kits and Speedy Dry at all shop and work areas.
2. Immediately contact applicable Federal, State, and local agencies for reportable quantities as required by law.
3. Immediately perform applicable containment and cleanup procedures following a spill release.
4. Promptly remove and dispose of all material collected during the response in accordance with Federal, State, and local requirements. A licensed emergency response contractor may be required to assist in cleanup of releases depending on the amount of the release, and the ability of the Contractor to perform the required response.
5. Reportable quantities of chemicals, fuels, or oils are established under the Clean Water Act and enforced through MassDEP.

Minimize Soil Erosion

Soil erosion facilitates mechanical transport of nutrients, pathogens, and organic matter to surface water bodies. Repair all areas where erosion is occurring throughout the project site. Stabilize bare soil with riprap, seed, mulch, or vegetation.

Maintenance of Lawns, Gardens, and other Landscaped Areas

Fertilizer usage shall be minimized and avoided if unnecessary. Minimize use of ammonia-based fertilizers, biosolid-based fertilizers (for continuous application), synthetic quick-release fertilizers, or "weed and feed" formulations. Dumping of lawn wastes, brush or leaves or other materials or debris is not permitted in the Riverfront Area. Grass clippings, pruned branches and any other landscaped waste should be disposed of or composted in an appropriate location.

Management of Deicing Chemicals and Snow

The qualified contractor selected for snow plowing and deicing shall be made fully aware of the requirements of this section.

Prior to purchasing deicer products, check the Material Safety Data Sheets (MSDS) to confirm the product ingredients. If the product contains sodium chloride or calcium chloride, reduce the total sodium chloride or calcium chloride treatment area to 50% of the total paved area, by square feet, that would normally be treated by converting remaining areas to calcium magnesium acetate treatment or a suitable alternative.

During typical snow plowing operations, snow shall be pushed to adjacent landscape areas. In severe conditions where snow cannot be stockpiled on site, the snow shall be removed from the site and properly disposed of in accordance with DEP Guideline BRP601-01.

Before winter begins, the property owner and the contractor shall review snow plowing, deicing, and stockpiling procedures. Areas designated for stockpiling should be cleaned of any debris. Street and parking lot sweeping should be followed in accordance with the Operation and Maintenance Plan.

Use of sand is permitted only for impervious roadways and parking areas.

Before winter begins, the property owner and the contractor shall review snow plowing, deicing, and stockpiling procedures. Areas designated for stockpiling should be cleaned of any debris. Street and parking lot sweeping should be followed in accordance with the Operation and Maintenance Plan.

Coordination with other Permits and Requirements

Certain conditions of other approvals affecting the long-term management of the property shall be considered part of this Long-Term Pollution Prevention Plan. The Owner shall become familiar with those documents and comply with the guidelines set forth in those documents.

SECTION 3 Stormwater Management System Operation and Maintenance Plan

Introduction

This Operation and Maintenance Plan (O&M Plan) for the Randall Library site is required under Standard 9 of the 2008 MassDEP Stormwater Handbook to provide best management practices for implementing maintenance activities for the stormwater management system in a manner that minimizes impacts to wetland resource areas.

The Owner shall implement this O&M Plan and proactively conduct operations at the site in an environmentally responsible manner. Compliance with this O&M Plan does not in any way dismiss the Owner from compliance with other applicable Federal, State or local laws.

Routine maintenance during construction and post-development phases of the project, as defined in the Operation and Maintenance Plan, shall be permitted without amendment to the Order of Conditions. A continuing condition in the Certificate of Compliance shall ensure that maintenance can be performed without triggering further filings under the Wetlands Protection Act.

All stormwater best management practices (BMPs) shall be operated and maintained in accordance with the design plans and the Operation and Maintenance Plan approved by the issuing authority. The Owner shall:

1. Maintain an operation and maintenance log for the last three years, including inspections, repairs, replacement, and disposal (for disposal the log shall indicate the type of material and the disposal location). This is a rolling log in which the responsible party records all operation and maintenance activities for the past three years.
2. Make this log available to MassDEP and the Conservation Commission upon request; and
3. Allow members and agents of the MassDEP and the Conservation Commission to enter and inspect the premises to evaluate and ensure that the Owner complies with the Operation and Maintenance requirements for each BMP.

Stormwater Operation and Maintenance Requirements

Inspect and maintain the stormwater management system as directed below. Refer to the Stormwater Management System Location Map (Figure 1) for the location of each component of the system. Repairs to any component of the system shall be made as soon as possible to prevent any potential pollutants (including silt) from entering the resource areas.

Area Drains and Trench Drains

Inspect or clean area drains and trench drains four times per year and at the end of foliage and snow-removal seasons. Inspection and maintenance requirements include:

1. Remove organic material, sediment and hydrocarbons four times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin.
2. Transport and disposal of accumulated sediment off-site shall be in accordance with applicable local, state and federal guidelines and regulations.

Water Quality Units (Proprietary Separators)

Maintain water quality units according the recommendations set forth by the manufacturer. General inspection and maintenance procedures for proprietary devices are provided below:

1. Inspect units following completion of construction, prior to being put into service.
2. Inspect units at least twice per year following installation and no less than once per year thereafter.
3. Inspect units immediately after any oil, fuel or chemical spill.
4. All inspections shall include checking the oil level and sediment depth in the unit. Removal of sediments/oils shall occur per manufacturer recommendations.
5. A licensed waste management company shall remove captured petroleum waste products from any oil, chemical or fuel spills and dispose.
6. OSHA confined space entry protocols shall be followed if entry into the unit is required.

Street Sweeping

Perform mechanical broom street sweeping at least twice per year, whenever there is significant debris present on roads and parking lots. Street sweeping shall occur in the spring and fall. Sweepings must be handled and disposed of properly according to the Stow Conservation Commission.

Repair of the Stormwater Management System

The stormwater management system shall be maintained. The repair of any component of the system shall be made as soon as possible to prevent any potential pollutants including silt from entering the resource areas or the existing closed drainage system.

Estimated Operations and Maintenance Budget

An Operations and Maintenance Budget was prepared in compliance with the MassDEP Stormwater Standards.

Table 2. Operations and Maintenance Budget

BMP Type	# of BMPs	Annual O & M Cost (per BMP)	Total Cost
Area Drains and Trench Drains	8	$60-$120	$480-$960
Water Quality Units	1	$120-$360	$120-$360
		Total:	$600-$1,320

Reporting

The Owner shall maintain a record of drainage system inspections and maintenance (per this Plan) and submit a yearly report upon request of Town management.

STORMWATER MANAGEMENT SYSTEM INSPECTION FORM

Randall Library **Stow, MA**		**Inspected by:_____** **Date:_____**
Component	**Status/Inspection**	**Action Taken**
Area Drains and Trench Drains		
Access Basins		
Water Quality Units		
General site conditions – evidence of erosion, etc.		