

---

# Stormwater Management Report

for 127 Clark Street Residence  
Newton, Massachusetts

---

Prepared For  
Tim & Lauren Fagerberg

July 2021



**Munden Engineering**

Prepared by: J. Veillette, E.I.T.

Revised by: G. Munden, P.E.

## Table of Contents

<b>Section 1 Introduction &amp; Regulatory Compliance</b>	1
<b>Section 2 Project Summary</b>	1
<b>Section 3 Existing Conditions</b>	2
<b>Section 4 Proposed Site Conditions</b>	3
<b>Section 5 Compliance with Stormwater Management Standards</b>	5
5.1 Standard 1: No New Stormwater Conveyances of Untreated Stormwater or Erosion Offsite	6
5.2 Standard 2: Peak Discharge Rate Attenuation	6
5.3 Standard 3: Groundwater Recharge and Discharge Volume	7
5.4 Standard 4: Water Quality	7
5.5 Standard 5: Land Uses with Higher Potential Pollutant Loads (LUHPPLs)	8
5.6 Standard 6: Critical Areas	8
5.7 Standard 7: Redevelopment Projects	8
5.8 Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control	8
5.9 Standard 9: Long-Term Operation and Maintenance Plan	9
5.10 Standard 10: Prohibition of Illicit Discharges	9

## Appendices

- A Figures
  - Figure 1: Site Location
  - Figure 2: Priority Resources
  - Figure 3: Orthophotograph
  - Figure 4: Existing Conditions Drainage Area Map
  - Figure 5: Proposed Conditions Drainage Area Map
- B NRCS Soils Information
- C Pre-Development Stormwater Calculations
- D Post-Development Stormwater Calculations
- E Construction Period Pollution Prevention Plan
- F Long-Term Operation and Maintenance Plan

## Tables

- 3.1 Existing Conditions Runoff Runoff Curve Numbers
- 3.2 Existing Conditions Drainage Area Summary
- 4.1 Proposed Development Runoff Curve Numbers
- 4.2 Proposed Development Drainage Area Summary
- 5.1 Peak Discharge Rate Comparison

## **Section 1 Introduction & Regulatory Compliance**

On behalf of the project applicant and current property owners, Tim & Lauren Fagerberg, Munden Engineering has prepared the following Stormwater Management Report to support the proposed building addition to a single-family dwelling located at 127 Clark Street in the City of Newton, Massachusetts.

A drainage analysis of the pre-development and post-development site was performed to determine the impacts of the proposed project to peak discharge rates and stormwater runoff volumes. The pre- and post-development drainage calculations were prepared utilizing HydroCAD Release 10.00-26, the U.S. Soil Conservation Service National Engineering Hydrology Handbook, design rainfall data determined by the City of Newton, and accepted engineering design practices. HydroCAD Release 10.00-26 is a hydrology and hydraulics software using Technical Release (TR) 20 and TR-55 methodologies. Applying the regulatory standard to the HydroCAD software, a representative model of the existing and proposed stormwater conditions were generated. The HydroCAD Reports for both the pre- and post-development conditions for the design storm of 8.78 inches for 24-hr Type-III Rainfall are provided in the Appendices of this report.

## **Section 2 Project Summary**

The property is located on the West side of Clark Street and abuts residential properties to the North, West, and South. On the East side of the property, the lot has a 60-foot frontage along Clark Street.

The Site currently consists of a 2-story single family dwelling with a covered porch, driveway, brick walkways, and retaining walls on 0.25 acres of land within the MR1 residential zone. The proposed project includes the construction of a 2-story addition off the rear side of the existing dwelling.

A site location figure, orthophotograph, and priority resources figure of the subject property is provided in Appendix A. Site plans of the proposed work are provided separately.

## Section 3 Existing Conditions

The existing site consists of the 1,123 sq.ft. dwelling, 1,591 sq.ft. driveway, 169 sq.ft. walkways, 163 sq.ft. gravel area, and 91 sq.ft. stone retaining walls. Under existing conditions, the total impervious area is 3,261 sq.ft. The existing driveway pavement within the City limits includes approximately 108 sq.ft. area. The ground cover surrounding the existing house and other impervious areas are maintained as manicured lawn. The existing topography slopes downhill from the front of the lot to the rear, with slopes ranging from approximately 7 to 11 percent.

The NRCS soil data was obtained through the Web Soil Survey portal on the USDA NRCS website. The areas surrounding the property were queried for soil types according to the record soil survey maps maintained by NRCS. Soils within the project area, as published in the USDA Soil Survey Norfolk County, Version 20, dated June 9th, 2020, include Haven-Urban land complex. The NRCS Soils Mapping is provided in Appendix B.

The hydrologic soil group designation (HSG) for the subject property is listed as "A". The HSG rating is based on estimates of runoff potential. The soils in the United States are assigned to one of four groups (A, B, C, and D). HSG A indicates a very high infiltration rate with low runoff potential. A subsurface exploration program of the Site was conducted on December 28th, 2020 by Munden Engineering. The soils observed were made up predominantly of a silt loam. From the test pit explorations, the soils observed are more representative of HSG B, indicating moderate infiltration rates and moderate rates of water transmission. Therefore, HSG B was used in the calculations to depict a more accurate hydrologic model. The test pit locations are shown on the Plans.

Currently, there are no stormwater management practices employed on the property and all the stormwater runoff flows uncontrolled off-site. An Existing Conditions Drainage Area Map is provided as Figure 4 in the Appendix A.

For the purposes of producing a hydrologic model, one design point were analyzed for the pre-development conditions. The sidewalk section of the driveway which is within the street layout has no proposed changes in size or direction, and is sloped towards the roadway pavement, and therefore does not affect the comparison of existing vs proposed. Therefore, that section is not

included in calculations and area calculations represent ground covers within the property limits only. Based on the design storm of 8.78 inches for 24-hr Type-III Rainfall, the peak rate of runoff at Design Point DP-1 is 1.47 cfs.

The runoff curve numbers (CN) used in the calculation of the composite CN for each drainage area is based on the values provided in TR-55, Urban Hydrology for Small Watersheds. CN values vary depending on the type of ground cover and soil HSG. The CN used in the calculation of the composite CN for each drainage area is based on the values provided in Table 3.1.

**Table 3.1 Existing Conditions Runoff Curve Numbers**

Ground Cover Type	Runoff Curve Number
>75% Grass Cover, Good, HSG B	61
Roofs and Covered Porch, HSG B	98
Driveway, HSG B	98
Shed, HSG B	98
Gravel Surface, HSG B	96
Walkways, Conc. Pad and Walls, HSG B	98

The existing conditions drainage area was delineated based on topography and stormwater discharge location. A summary of each existing conditions drainage area, its size and associated composite CN is provided in Table 3.2.

**Table 3.2 Existing Conditions Drainage Area Summary**

Drainage Area Designation	Drainage Area Size (sq. ft.)	Composite Runoff Curve Number (CN)
Drainage Area 1S	10,830	72
<b>Total</b>	<b>10,830</b>	<b>72</b>

## Section 4 Proposed Site Conditions

The proposed site development involves the construction of a building addition attached to the southwestern side of the existing house and reconfiguring the existing driveway. The project will

result in an increase of impervious ground surface. Currently, 3,261 sq.ft. of impervious surfaces exist within the project area. The total proposed impervious area for the project is 4,671 sq.ft., this includes the single-family dwelling, covered porch, the new building addition, raised deck, walkways, concrete pad, retaining walls and driveway. The difference in impervious areas is 1,410 sq. ft. between existing and proposed conditions. This design has been prepared in accordance with recommendations in the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Handbook.

Under proposed conditions, the topography will not be altered, and stormwater runoff will continue to be directed to the back of the lot. A Proposed Conditions Drainage Area Map is provided as Figure 5 in the Appendix A.

Based on the design storm of 8.78 inches for 24-hr Type-III Rainfall, the peak rate of runoff at Design Point DP-1 is 1.38 cfs.

The CN used in the calculation of the composite CN for each drainage area is based on the values provided in Table 4.1.

**Table 4.1 Proposed Conditions Runoff Curve Numbers**

Ground Cover Type	Runoff Curve Number
Roofs and Covered Porch, HSG B	98
Driveway, HSG B	98
>75% Grass Cover, Good, HSG B	61
Walkways, Pad and Ret. Walls, HSG B	98
Gravel surface, HSG B	96
Stone Patio, HSG B	98

A summary of each proposed conditions drainage area, its size and associated composite CN is provided in Table 4.2 on the following page.

**Table 4.2 Proposed Conditions Drainage Area Summary**

Drainage Area Designation	Drainage Area Size (sq. ft.)	Composite Runoff Curve Number (CN)
Drainage Area 1S	9,147	75
Drainage Area 2S	1,683	98
<b>Total</b>	<b>10,830</b>	<b>77</b>

The proposed stormwater management system includes best management practices (BMP's) such as a catch basin, conveyance piping and infiltration chambers.

A brief description of the proposed Best Management Practices incorporated into the stormwater management system are as follows:

Deep-Sump, Hooded Catch Basins: The catch basin located at the driveway is provided to collect stormwater runoff from the driveway and/or parking areas and connect to the project's stormwater collection system. The deep-sump and hooded outlet provide runoff an opportunity to separate from solids and floatable pollutants prior to discharge and are used as a pretreatment device.

Infiltration Chambers: The proposed infiltration chambers are the collection point for the stormwater runoff from the proposed driveway (approximately 1,683 sq. ft.). The open-bottom, plastic chamber system is designed to receive stormwater from impervious areas such as driveways. The captured stormwater slowly infiltrates through the bottom and sides of the system into the surrounding sub-soil. The subsurface infiltration system has been designed in accordance with Massachusetts Stormwater Handbook to provide the required groundwater recharge for the project.

## **Section 5 Compliance with Stormwater Management Standards**

The project is required to comply with the ten MassDEP Massachusetts Stormwater Standards (Standards) under the Massachusetts Wetlands Protection Act and the City of Newton Stormwater Management Regulations.



## 5.1 Standard 1: No New Stormwater Conveyances of Untreated Stormwater or Erosion Offsite

The project will not result in any new stormwater conveyance discharging untreated stormwater directly to the waters of the Commonwealth. Stormwater discharges are limited to the discharges from the subsurface infiltration chambers. Furthermore, it is not anticipated that erosive stormwater velocities will be encountered post-construction. All discharges have been designed to meet the thresholds identified in Volume 3 of the Massachusetts Stormwater Handbook.

## 5.2 Standard 2: Peak Discharge Rate Attenuation

The project will not substantially alter the existing stormwater flow paths at the site through the use of infiltration. Under proposed conditions, all of the driveway area runoff will be conveyed to the infiltration chamber while the roof runoff will continue to flow to the backyard.

A hydrologic analysis of the pre-development and post-development site was performed to determine the impacts of the proposed project to peak discharge rates and stormwater runoff volumes. HydroCAD is a hydrology and hydraulics software using Technical Release (TR) 20 and TR-55 methodologies for the determination of stormwater runoff quantities. The HydroCAD Reports for the pre- and post-development conditions for the City of Newton design storm event is provided in Appendix C and D.

Table 5.1 indicates that post-development peak discharge rates do not exceed pre-development peak discharge rates.

**Table 5.1 Peak Discharge Rate Comparison**

Storm Frequency	Existing Conditions Peak Rate of Runoff (cfs)	Proposed Conditions Peak Rate of Runoff Total (cfs) (Minimum Tc 6 min.)	Proposed Conditions Peak Rate of Runoff Total (cfs) (Minimum Tc 0 min.)
Design Storm 8.78” Type-III Rainfall	1.47	1.38	1.42

Note: Methodologies used in for the purposes of stormwater management calculations recommend that minimum of 6 minutes Time of Concentration is used. Additional Proposed Peak Rate of runoff calculation performed without minimum Tc is presented for comparison in case the minimum 6 min Tc number might be considered to underestimate the difference between existing as proposed conditions.

### 5.3 Standard 3: Groundwater Recharge and Discharge Volume

The proposed project will allow treated stormwater runoff from the proposed project to infiltrate to groundwater. Discharges from the infiltration chambers are properly pretreated to remove at least 80% of the total suspended solids (TSS) load from the stormwater flow. Further documentation pertaining to stormwater treatment is provided in section 5.4.

The driveway runoff is directed towards a catch basin and conveyed through drainage piping to the subsurface infiltration chambers. The stormwater is stored in the Cultec chambers until the runoff exfiltrates through the stormwater system and back into the groundwater. Recharge calculations for compliance with standard 3 are provided below.

$$\text{Required Recharge Volume } (R_v) = (F) * (A_{IMP})$$

$$\text{Increase in impervious area } (A_{IMP}) = 1,969 \text{ sq. ft.}$$

*For Hydrologic Soil Group B = 0.35 in./sq.ft recharge is required.*

$$\text{Recharge required: } 1,969 \text{ sq.ft.} \times 0.35 \text{ in./sq.ft.} \times (1 \text{ ft./} 12 \text{ in.}) = 57.4 \text{ cu. ft.}$$

*Recharge provided: 766.2 cu.ft. for 10 CULTEC 280 HD chambers installed storage*

### 5.4 Standard 4: Water Quality

Standard 4 of the Massachusetts Stormwater Standards addresses stormwater quality requirements. This standard requires that new stormwater management systems be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). MassDEP has published presumed removal rates for each of the BMP's featured in their design guidelines. Additionally, this standard addresses the required volume of stormwater runoff that is to be treated by the BMPs, as well as components of a long-term source control and pollution prevention plan.

The following treatment trains have been incorporated into the design of the stormwater management system:

**Treatment Train 1:** This treatment train consists of a deep-sump hooded catch basin and subsurface infiltration system. The overall TSS removal for this train is 85%.

The project has been designed such that all proposed impervious and gravel surfaces, excluding the building rooftop, pass through the previously described treatment trains, which results in the required TSS removal for the project. The MassDEP TSS Removal Worksheet is provided in Appendix D.

Stormwater quality calculations for compliance with standard 4 are provided below.

$$V_{WQ} = (D_{WQ}/12 \text{ inches/foot}) * (A_{IMP})$$
$$V_{WQ} = (1/2\text{-inch}/12 \text{ inches/foot}) * (1,969 \text{ sq.ft.})$$
$$V_{WQ} = \mathbf{82 \text{ cubic feet}}$$

### **5.5 Standard 5: Land Uses with Higher Potential Pollutant Loads (LUHPPLs)**

The proposed use is not considered a LUHPPL. Therefore, compliance with the additional requirements of Standard 5 is not required.

### **5.6 Standard 6: Critical Areas**

The project will not result in any new discharges to wetlands, or surface waters. The project site is not located in critical areas based on the MassGIS Priority Resource Map in Appendix A.

### **5.7 Standard 7: Redevelopment Projects**

This site is considered a redevelopment project. The project has been designed to fully comply with all Standards.

### **5.8 Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control**

A construction period Stormwater Management and Erosion Control Plan (SMECP) is included in the Site Plans. The SMECP presents the minimum soil erosion and sediment control practices to be used during construction. A Construction Site Inspection Log is included in Appendix E.

Additionally, there will be less than one acre of land disturbed as a result of this project; therefore, the construction will not be required to submit a Construction general permit (CGP).



## **5.9 Standard 9: Long-Term Operation and Maintenance Plan**

A Long-Term Stormwater Operations and Maintenance Plan is included in Appendix F of this report. The O&M plan indicates the responsible parties for the project, routine and non-routine maintenance tasks and inspection criteria.

## **5.10 Standard 10: Prohibition of Illicit Discharges**

Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater. Illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning, condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing, and water used to clean residential buildings without detergents. The Owner is not aware of any existing illicit discharges to the Site and is not proposing any illicit discharges as part of the project. A signed Illicit Discharge Statement is provided on the following page of this report.

### **Illicit Discharge Statement**

At no time will the owner or any: other individual utilize the stormwater management system for any purpose other than its intended use. The stormwater management system as shown on the attached site plan at no time shall receive discharges other than stormwater, this includes "wastewater discharges and discharges of stormwater contaminated by contact with process wastes, raw materials, raw materials, toxic pollutants, hazardous substances, oil or grease."



\_\_\_\_\_ (signature)

Tim Fagerberg (Property Owner)



\_\_\_\_\_ (signature)

Lauren Fagerberg (Property Owner)

<b>TITLE</b>	Illicit Discharge Statement for signature
<b>FILE NAME</b>	Illicit Discharge Statement_unsigned.pdf
<b>DOCUMENT ID</b>	09cf8e440f1bcedbe0241f377deed643b77a58bb
<b>AUDIT TRAIL DATE FORMAT</b>	MM / DD / YYYY
<b>STATUS</b>	● Completed

## Document History



SENT

**04 / 05 / 2021**  
 12:37:07 UTC

Sent for signature to Tim Fagerberg (tjfagerberg@hotmail.com) and Lauren Fagerberg (lkpenna9@hotmail.com) from jamie@mundenengineering.com  
 IP: 71.234.190.246



VIEWED

**04 / 05 / 2021**  
 13:47:56 UTC

Viewed by Tim Fagerberg (tjfagerberg@hotmail.com)  
 IP: 174.242.68.145



SIGNED

**04 / 05 / 2021**  
 13:50:00 UTC

Signed by Tim Fagerberg (tjfagerberg@hotmail.com)  
 IP: 174.242.68.145



VIEWED

**04 / 05 / 2021**  
 15:41:50 UTC

Viewed by Lauren Fagerberg (lkpenna9@hotmail.com)  
 IP: 108.26.214.221



SIGNED

**04 / 06 / 2021**  
 00:59:40 UTC

Signed by Lauren Fagerberg (lkpenna9@hotmail.com)  
 IP: 108.26.214.221



COMPLETED

**04 / 06 / 2021**  
 00:59:40 UTC

The document has been completed.

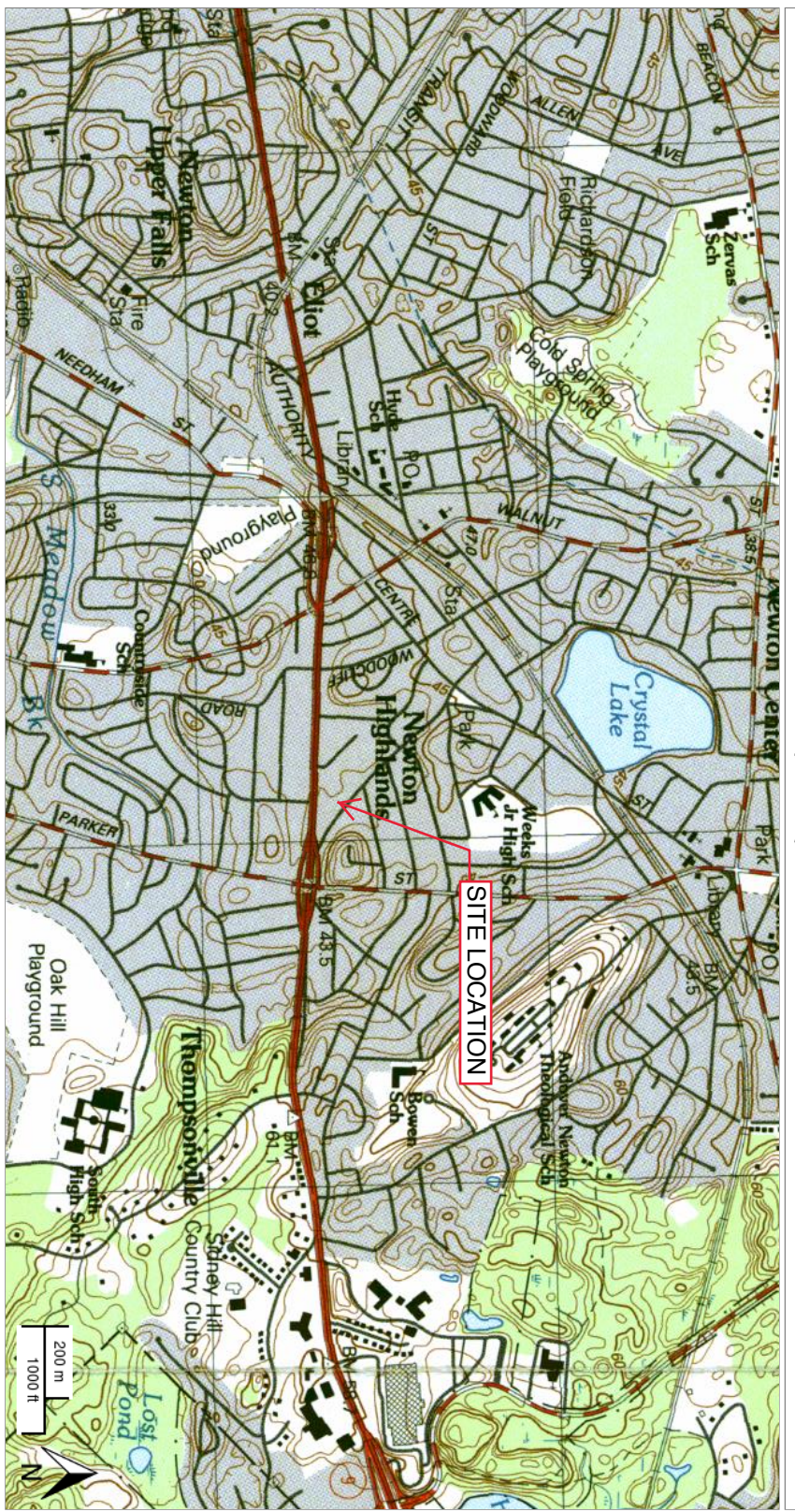


Munden Engineering

mundenengineering.com  
[info@mundenengineering.com](mailto:info@mundenengineering.com)  
781-302-6099

## Appendix A Figures

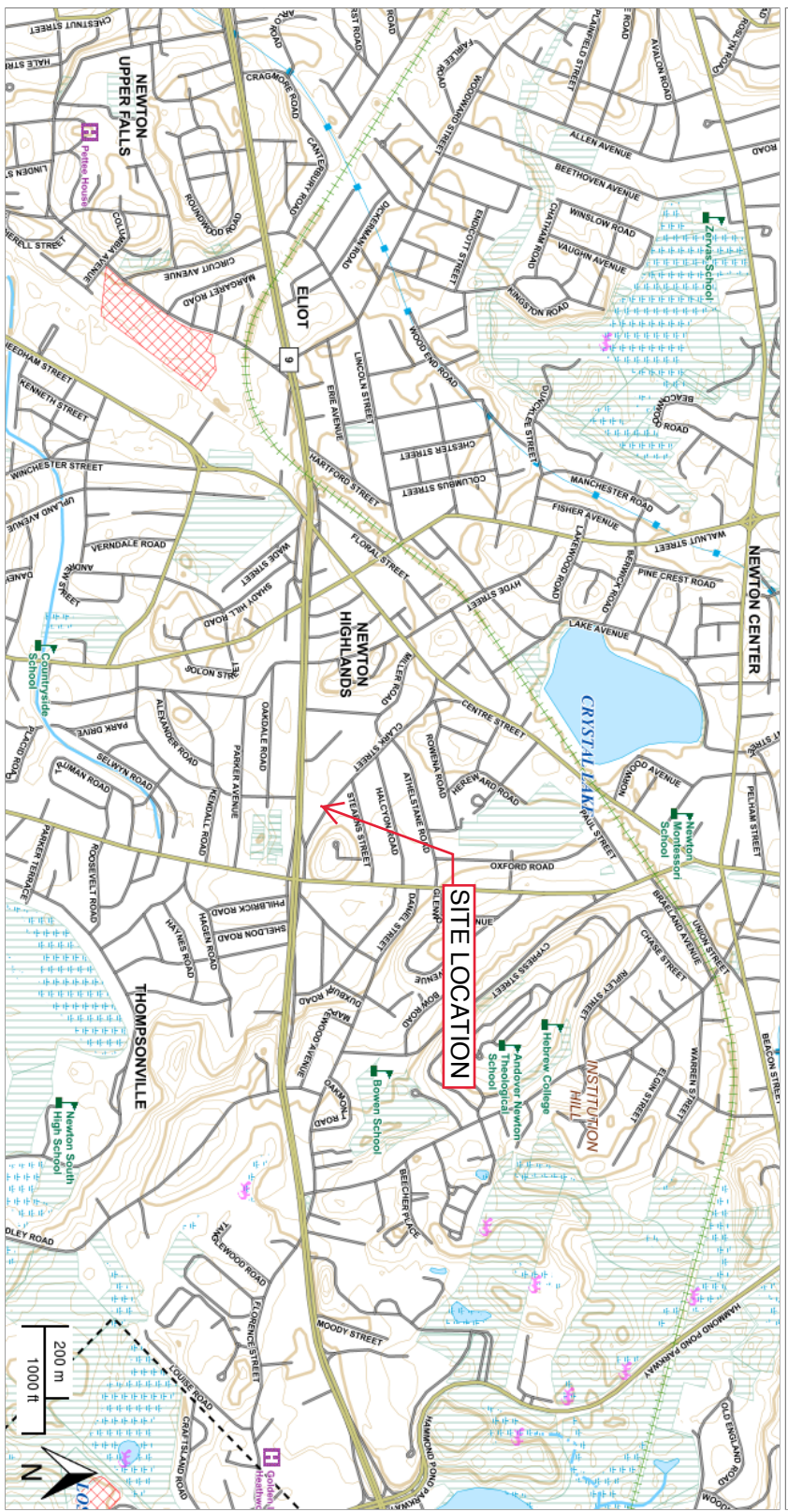
127 Clark St, Newton, MA



USGS Topographic Maps

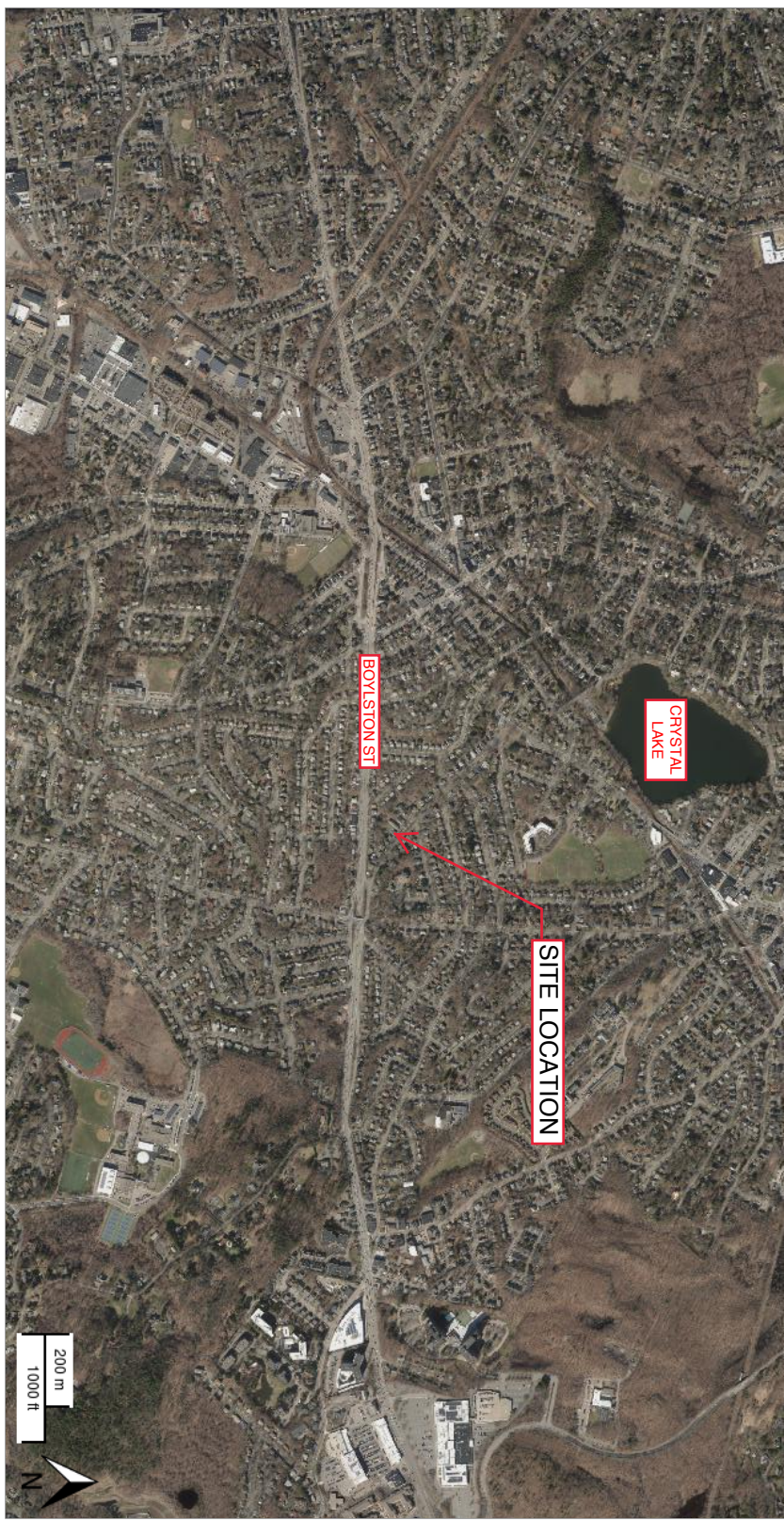


127 Clark St, Newton, MA

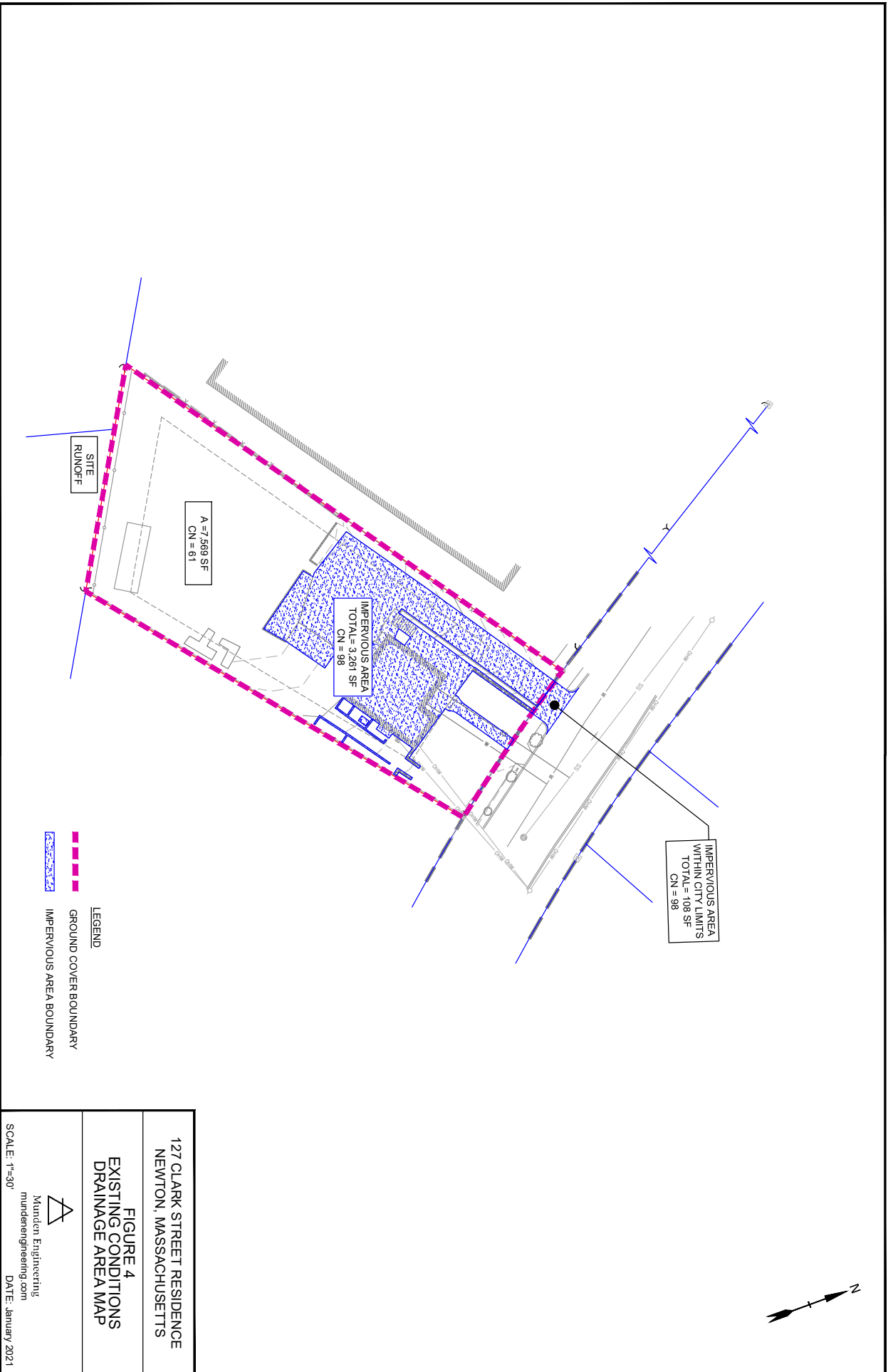


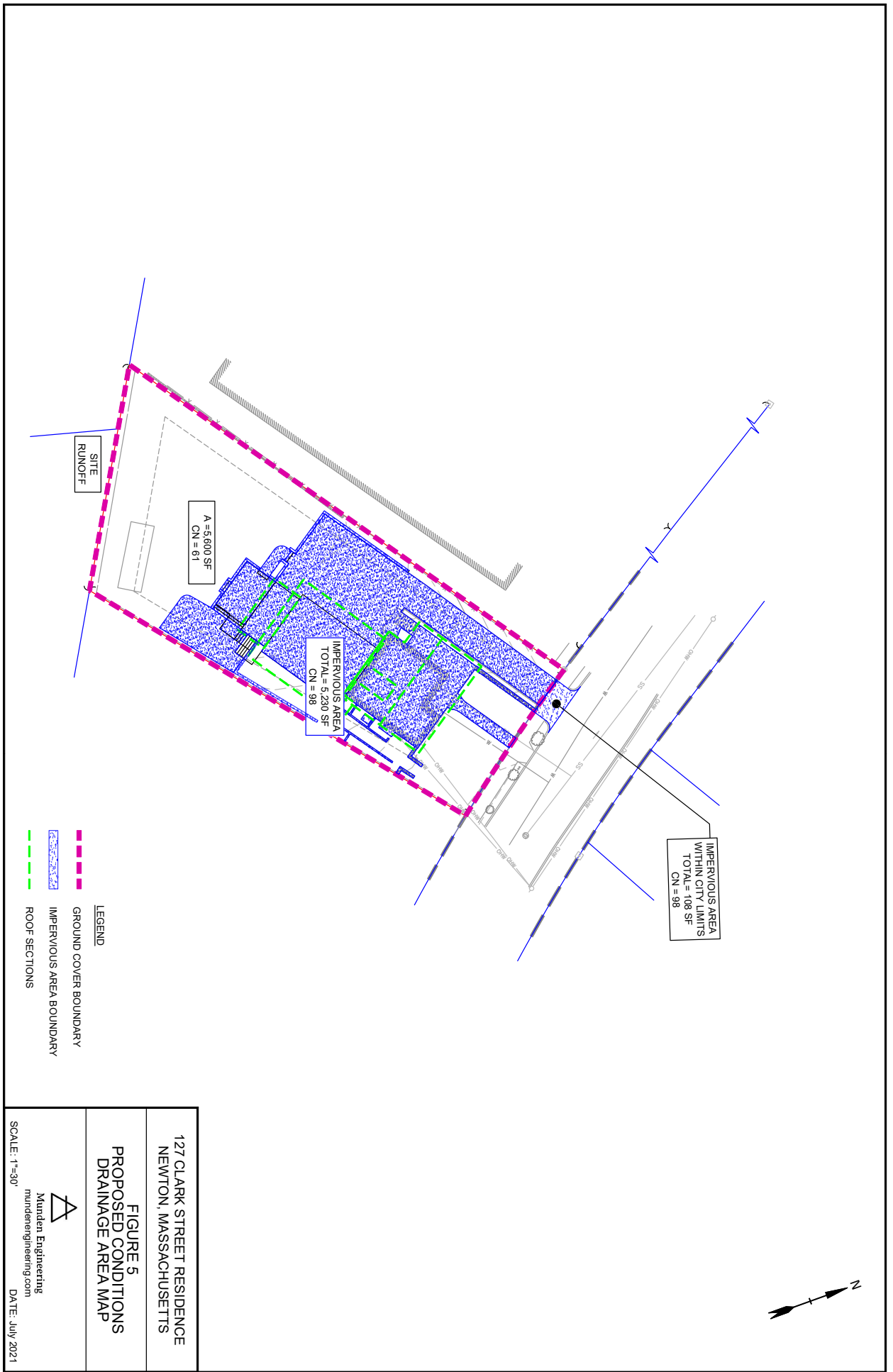
- MassDEP Priority Resource Map
- MassDEP Water Supply Protection Map
- Tax Parcels for Query
- Detailed Features
- Tax Parcels for Display
- MassGIS Statewide Basemap
- MassGIS Topographic Features Basemap

127 Clark St, Newton, MA



2019 Color Orthos (USGS)  
Tax Parcels for Query





- LEGEND**
- - - GROUND COVER BOUNDARY
  - ▨ IMPERVIOUS AREA BOUNDARY
  - - - ROOF SECTIONS

<p><b>127 CLARK STREET RESIDENCE</b>  <b>NEWTON, MASSACHUSETTS</b></p>
<p><b>FIGURE 5</b>  <b>PROPOSED CONDITIONS</b>  <b>DRAINAGE AREA MAP</b></p>
<p>Munden Engineering  mundenengineering.com</p>
<p>SCALE: 1"=30'  DATE: July 2021</p>



Munden Engineering

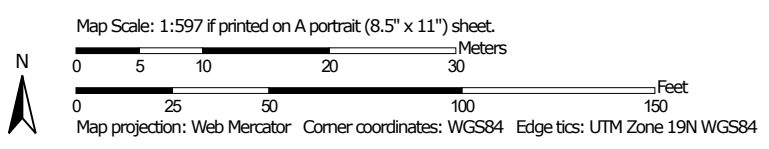
mundenengineering.com  
[info@mundenengineering.com](mailto:info@mundenengineering.com)  
781-302-6099

## Appendix B NRCS Soils Information

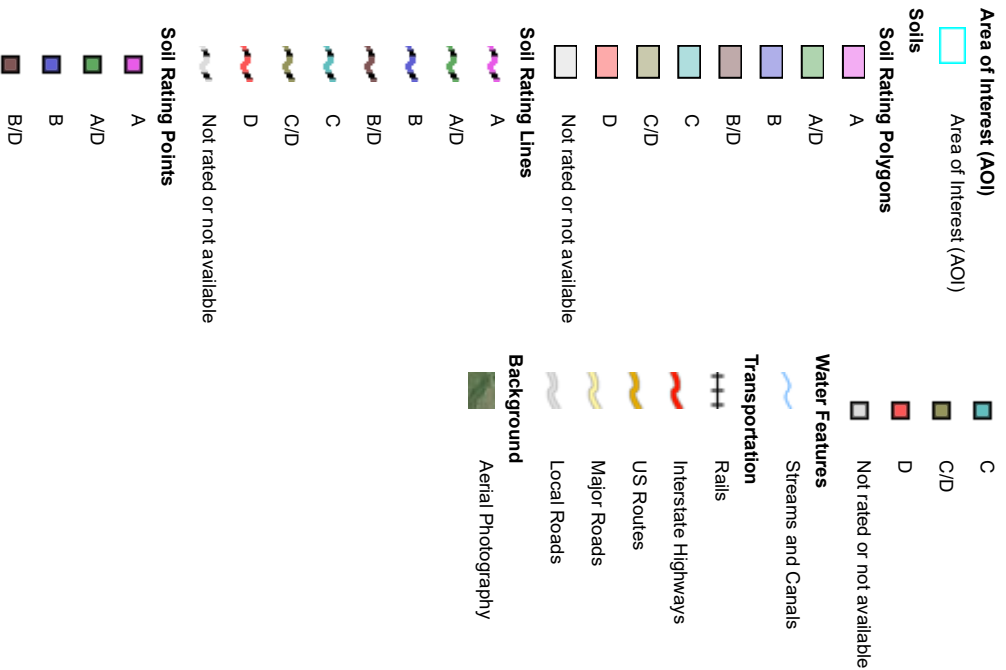
Hydrologic Soil Group—Middlesex County, Massachusetts  
(127 Clark St, Newton, MA)



Soil Map may not be valid at this scale.



## MAP LEGEND



## 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 20, Jun 9, 2020

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

Date(s) aerial images were photographed: Sep 11, 2019—Oct 5, 2019

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

## Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
624B	Haven-Urban land complex, 0 to 8 percent slopes	A	1.6	100.0%
<b>Totals for Area of Interest</b>			<b>1.6</b>	<b>100.0%</b>

### Description

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

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

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

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

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

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

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

### Rating Options

*Aggregation Method:* Dominant Condition



*Component Percent Cutoff: None Specified*

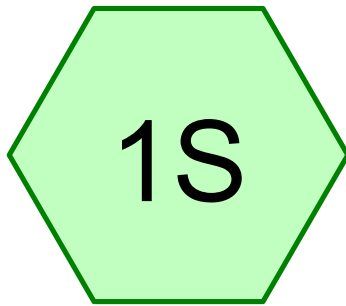
*Tie-break Rule: Higher*



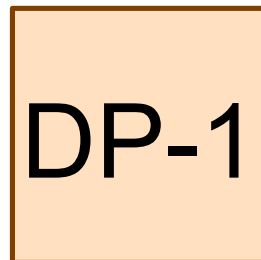
Munden Engineering

mundenengineering.com  
[info@mundenengineering.com](mailto:info@mundenengineering.com)  
781-302-6099

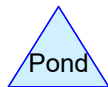
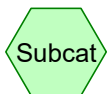
## Appendix C Pre-Development Stormwater Calculations



Existing Uncaptured  
Area



Existing Site Runoff



**127 Clark Street - Existing08032021**

Prepared by Munden Engineering LLC

HydroCAD® 10.00-25 s/n 11058 © 2019 HydroCAD Software Solutions LLC

Page 2

**Area Listing (all nodes)**

Area (sq-ft)	CN	Description (subcatchment-numbers)
7,569	61	>75% Grass cover, Good, HSG B (1S)
168	98	Conc. Pad and Walkways, HSG B (1S)
1,591	98	Driveway, HSG B (1S)
163	96	Gravel surface, HSG B (1S)
1,123	98	Roofs and Covered Porch, HSG B (1S)
125	98	Shed, HSG B (1S)
91	98	Stone Ret. Walls, HSG B (1S)
<b>10,830</b>	<b>72</b>	<b>TOTAL AREA</b>

**127 Clark Street - Existing08032021**

Prepared by Munden Engineering LLC

HydroCAD® 10.00-25 s/n 11058 © 2019 HydroCAD Software Solutions LLC

**Soil Listing (all nodes)**

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
10,830	HSG B	1S
0	HSG C	
0	HSG D	
0	Other	
<b>10,830</b>		<b>TOTAL AREA</b>

**127 Clark Street - Existing08032021**

Prepared by Munden Engineering LLC

HydroCAD® 10.00-25 s/n 11058 © 2019 HydroCAD Software Solutions LLC

Page 4

**Ground Covers (all nodes)**

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
0	7,569	0	0	0	7,569	>75% Grass cover, Good
0	168	0	0	0	168	Conc. Pad and Walkways
0	1,591	0	0	0	1,591	Driveway
0	163	0	0	0	163	Gravel surface
0	1,123	0	0	0	1,123	Roofs and Covered Porch
0	125	0	0	0	125	Shed
0	91	0	0	0	91	Stone Ret. Walls
<b>0</b>	<b>10,830</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>10,830</b>	<b>TOTAL AREA</b>

**127 Clark Street - Existing08032021**

127 Clark Street - Existing  
*Type III 24-hr Design Storm Newton Rainfall=8.78"*

Prepared by Munden Engineering LLC

HydroCAD® 10.00-25 s/n 11058 © 2019 HydroCAD Software Solutions LLC

Page 5

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points  
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 1S: Existing Uncaptured**

Runoff Area=10,830 sf 28.61% Impervious Runoff Depth=5.39"  
Flow Length=174' Tc=7.5 min CN=72 Runoff=1.47 cfs 4,860 cf

**Reach DP-1: Existing Site Runoff**

Inflow=1.47 cfs 4,860 cf  
Outflow=1.47 cfs 4,860 cf

**Total Runoff Area = 10,830 sf Runoff Volume = 4,860 cf Average Runoff Depth = 5.39"**  
**71.39% Pervious = 7,732 sf 28.61% Impervious = 3,098 sf**

**Summary for Subcatchment 1S: Existing Uncaptured Area**

Runoff = 1.47 cfs @ 12.11 hrs, Volume= 4,860 cf, Depth= 5.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
 Type III 24-hr Design Storm Newton Rainfall=8.78"

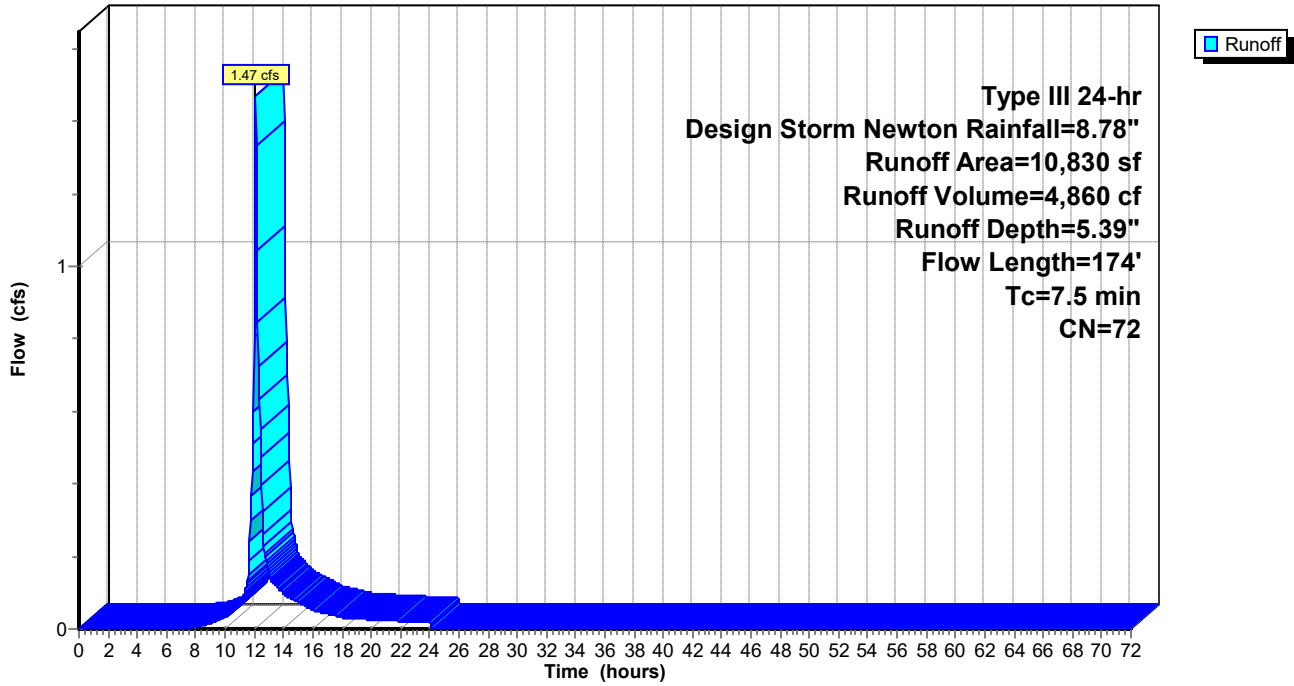
Area (sf)	CN	Description
* 125	98	Shed, HSG B
* 1,123	98	Roofs and Covered Porch, HSG B
* 1,591	98	Driveway, HSG B
* 168	98	Conc. Pad and Walkways, HSG B
* 7,569	61	>75% Grass cover, Good, HSG B
* 91	98	Stone Ret. Walls, HSG B
163	96	Gravel surface, HSG B
10,830	72	Weighted Average
7,732		71.39% Pervious Area
3,098		28.61% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	65	0.0769	3.58		<b>Sheet Flow, Driveway</b> Smooth surfaces n= 0.011 P2= 8.78"
0.2	24	0.0423	2.31		<b>Sheet Flow, Driveway</b> Smooth surfaces n= 0.011 P2= 8.78"
0.1					<b>Direct Entry, Existing Roof</b>
6.9	85	0.0100	0.21		<b>Sheet Flow, Backyard</b> Grass: Short n= 0.150 P2= 8.78"
7.5	174	Total			



### Subcatchment 1S: Existing Uncaptured Area

Hydrograph



### Summary for Reach DP-1: Existing Site Runoff

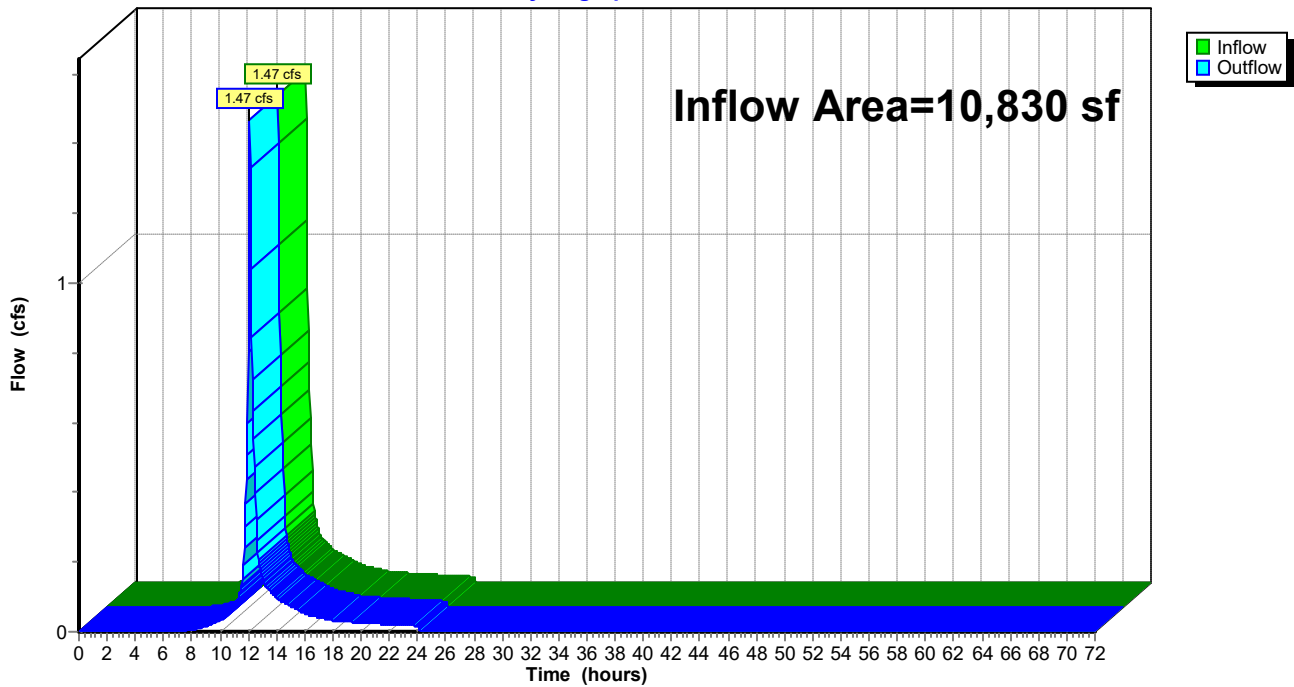
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 10,830 sf, 28.61% Impervious, Inflow Depth = 5.39" for Design Storm Newton event  
Inflow = 1.47 cfs @ 12.11 hrs, Volume= 4,860 cf  
Outflow = 1.47 cfs @ 12.11 hrs, Volume= 4,860 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

### Reach DP-1: Existing Site Runoff

Hydrograph

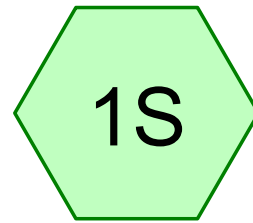
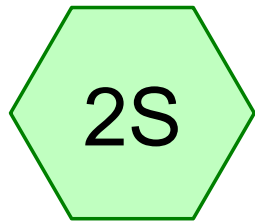




Munden Engineering

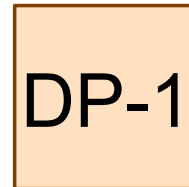
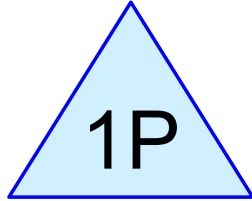
mundenengineering.com  
[info@mundenengineering.com](mailto:info@mundenengineering.com)  
781-302-6099

## Appendix D Post-Development Drainage Calculations



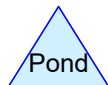
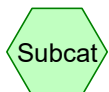
Driveway (captured)

Uncaptured Area



Driveway Infiltration Chambers

Proposed Site Runoff



**127 Clark Street - Proposed rev08032021**

Prepared by Munden Engineering LLC

HydroCAD® 10.00-25 s/n 11058 © 2019 HydroCAD Software Solutions LLC

Page 2

**Area Listing (all nodes)**

Area (sq-ft)	CN	Description (subcatchment-numbers)
5,600	61	>75% Grass cover, Good, HSG B (1S)
147	98	Conc. Pad and Walkways, HSG B (1S)
1,683	98	Driveway, HSG B (2S)
108	98	New RW, HSG B (1S)
400	98	New patio hardscape area, HSG B (1S)
18	98	New stone steps, HSG B (1S)
45	98	New walkway, HSG B (1S)
2,510	98	Roofs and Covered Porch (new roof overlaps exist. by 81 sf), HSG B (1S)
79	98	Stone Ret. Walls, HSG B (1S)
240	98	Stone patio under raised deck, HSG B (1S)
<b>10,830</b>	<b>79</b>	<b>TOTAL AREA</b>

**127 Clark Street - Proposed rev08032021**

Prepared by Munden Engineering LLC

HydroCAD® 10.00-25 s/n 11058 © 2019 HydroCAD Software Solutions LLC

**Soil Listing (all nodes)**

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
10,830	HSG B	1S, 2S
0	HSG C	
0	HSG D	
0	Other	
<b>10,830</b>		<b>TOTAL AREA</b>

**127 Clark Street - Proposed rev08032021**

Prepared by Munden Engineering LLC

HydroCAD® 10.00-25 s/n 11058 © 2019 HydroCAD Software Solutions LLC

Page 4

**Ground Covers (all nodes)**

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
0	5,600	0	0	0	5,600	>75% Grass cover, Good
0	147	0	0	0	147	Conc. Pad and Walkways
0	1,683	0	0	0	1,683	Driveway
0	108	0	0	0	108	New RW
0	400	0	0	0	400	New patio hardscape area
0	18	0	0	0	18	New stone steps
0	45	0	0	0	45	New walkway
0	2,510	0	0	0	2,510	Roofs and Covered Porch (new roof overlaps exist. by 81 sf)
0	79	0	0	0	79	Stone Ret. Walls
0	240	0	0	0	240	Stone patio under raised deck
<b>0</b>	<b>10,830</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>10,830</b>	<b>TOTAL AREA</b>

**127 Clark Street - Proposed rev08032021** Type III 24-hr Design Storm Newton Rainfall=8.78"

Prepared by Munden Engineering LLC

HydroCAD® 10.00-25 s/n 11058 © 2019 HydroCAD Software Solutions LLC

Page 5

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 1S: Uncaptured Area** Runoff Area=9,147 sf 38.78% Impervious Runoff Depth=5.75"  
 Flow Length=55' Slope=0.0100 '/' Tc=6.0 min CN=75 Runoff=1.38 cfs 4,383 cf

**Subcatchment 2S: Driveway (captured)** Runoff Area=1,683 sf 100.00% Impervious Runoff Depth=8.54"  
 Flow Length=100' Tc=6.0 min CN=98 Runoff=0.33 cfs 1,198 cf

**Reach DP-1: Proposed Site Runoff** Inflow=1.38 cfs 4,383 cf  
 Outflow=1.38 cfs 4,383 cf

**Pond 1P: Driveway Infiltration Chambers** Peak Elev=126.69' Storage=0.016 af Inflow=0.33 cfs 1,198 cf  
 Outflow=0.01 cfs 1,198 cf

**Total Runoff Area = 10,830 sf Runoff Volume = 5,581 cf Average Runoff Depth = 6.18"**  
**51.71% Pervious = 5,600 sf 48.29% Impervious = 5,230 sf**



**127 Clark Street - Proposed rev08032021** Type III 24-hr Design Storm Newton Rainfall=8.78"

Prepared by Munden Engineering LLC

HydroCAD® 10.00-25 s/n 11058 © 2019 HydroCAD Software Solutions LLC

Page 6

**Summary for Subcatchment 1S: Uncaptured Area**

Runoff = 1.38 cfs @ 12.09 hrs, Volume= 4,383 cf, Depth= 5.75"

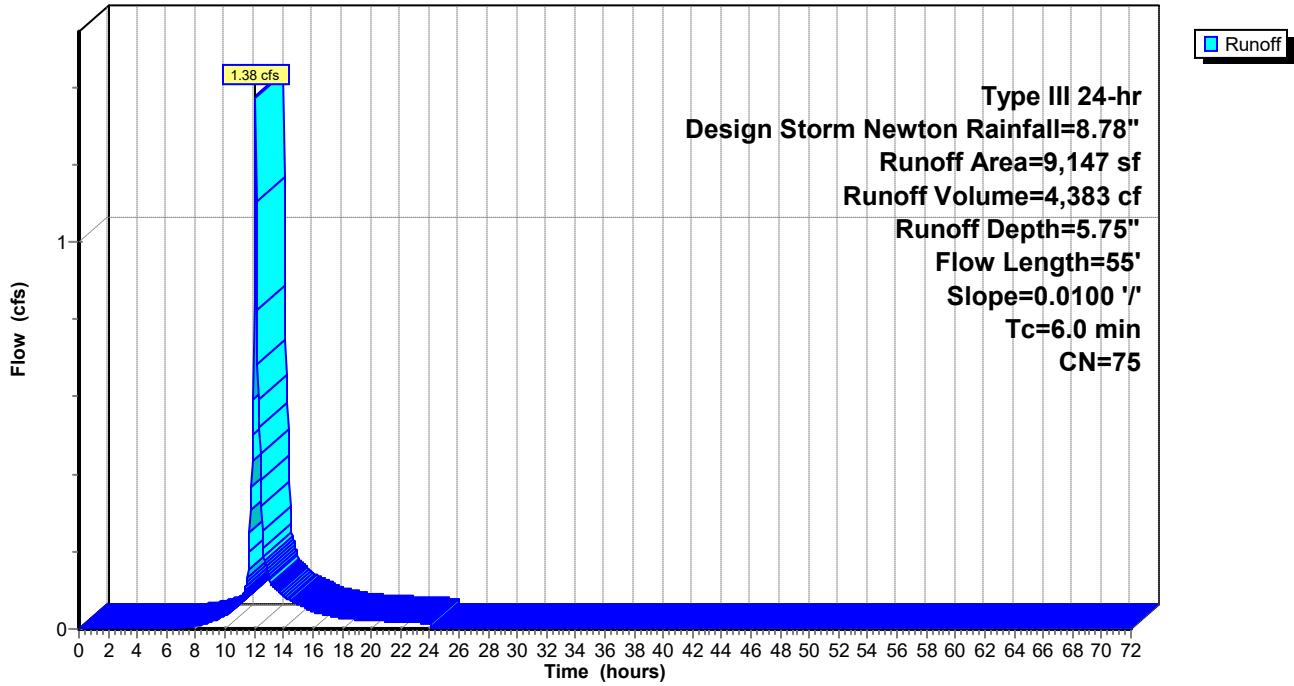
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
Type III 24-hr Design Storm Newton Rainfall=8.78"

Area (sf)	CN	Description
* 2,510	98	Roofs and Covered Porch (new roof overlaps exist. by 81 sf), HSG B
* 147	98	Conc. Pad and Walkways, HSG B
* 5,600	61	>75% Grass cover, Good, HSG B
* 79	98	Stone Ret. Walls, HSG B
* 240	98	Stone patio under raised deck, HSG B
* 18	98	New stone steps, HSG B
* 45	98	New walkway, HSG B
* 400	98	New patio hardscape area, HSG B
* 108	98	New RW, HSG B
9,147	75	Weighted Average
5,600		61.22% Pervious Area
3,547		38.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1					<b>Direct Entry, Roofs</b>
4.8	55	0.0100	0.19		<b>Sheet Flow, Backyard</b>
					Grass: Short n= 0.150 P2= 8.78"
4.9	55	Total, Increased to minimum Tc = 6.0 min			

### Subcatchment 1S: Uncaptured Area

Hydrograph



**127 Clark Street - Proposed rev08032021** Type III 24-hr Design Storm Newton Rainfall=8.78"

Prepared by Munden Engineering LLC

HydroCAD® 10.00-25 s/n 11058 © 2019 HydroCAD Software Solutions LLC

**Summary for Subcatchment 2S: Driveway (captured)**

Runoff = 0.33 cfs @ 12.09 hrs, Volume= 1,198 cf, Depth= 8.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
Type III 24-hr Design Storm Newton Rainfall=8.78"

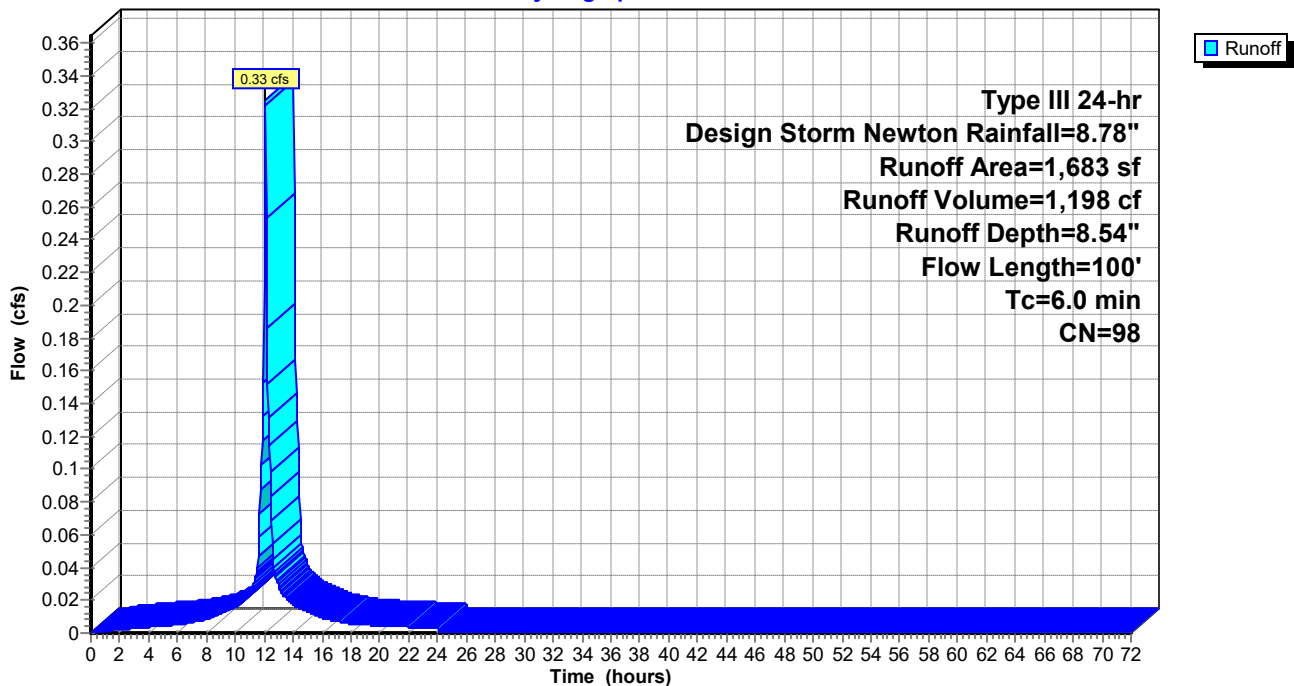
Area (sf)	CN	Description
* 1,683	98	Driveway, HSG B
1,683		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	65	0.0900	3.82		<b>Sheet Flow, Driveway</b> Smooth surfaces n= 0.011 P2= 8.78"
0.3	35	0.0200	1.85		<b>Sheet Flow, Driveway</b> Smooth surfaces n= 0.011 P2= 8.78"
0.6	100	Total, Increased to minimum Tc = 6.0 min			

**Subcatchment 2S: Driveway (captured)**

Hydrograph



### Summary for Reach DP-1: Proposed Site Runoff

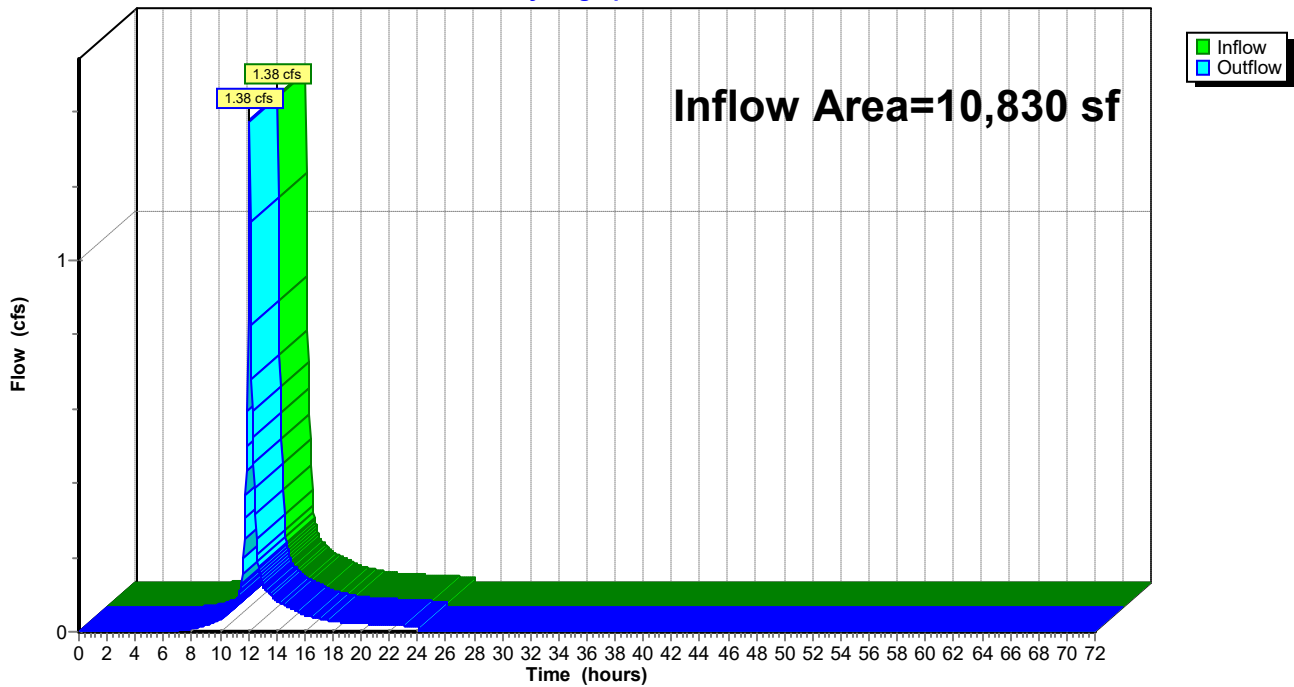
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 10,830 sf, 48.29% Impervious, Inflow Depth = 4.86" for Design Storm Newton event  
Inflow = 1.38 cfs @ 12.09 hrs, Volume= 4,383 cf  
Outflow = 1.38 cfs @ 12.09 hrs, Volume= 4,383 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

### Reach DP-1: Proposed Site Runoff

Hydrograph



**127 Clark Street - Proposed rev08032021** Type III 24-hr Design Storm Newton Rainfall=8.78"

Prepared by Munden Engineering LLC

HydroCAD® 10.00-25 s/n 11058 © 2019 HydroCAD Software Solutions LLC

Page 10

**Summary for Pond 1P: Driveway Infiltration Chambers**

Inflow Area = 1,683 sf, 100.00% Impervious, Inflow Depth = 8.54" for Design Storm Newton event  
 Inflow = 0.33 cfs @ 12.09 hrs, Volume= 1,198 cf  
 Outflow = 0.01 cfs @ 8.40 hrs, Volume= 1,198 cf, Atten= 97%, Lag= 0.0 min  
 Discarded = 0.01 cfs @ 8.40 hrs, Volume= 1,198 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
 Peak Elev= 126.69' @ 16.00 hrs Surf.Area= 0.009 ac Storage= 0.016 af

Plug-Flow detention time= 625.9 min calculated for 1,198 cf (100% of inflow)  
 Center-of-Mass det. time= 625.9 min ( 1,365.9 - 740.1 )

Volume	Invert	Avail.Storage	Storage Description
#1A	124.00'	0.008 af	<b>10.33'W x 38.00'L x 3.21'H Field A</b> 0.029 af Overall - 0.010 af Embedded = 0.019 af x 40.0% Voids
#2A	124.50'	0.010 af	<b>Cultec R-280HD</b> x 10 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		0.018 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	124.00'	<b>1.020 in/hr Exfiltration over Surface area</b>

**Discarded OutFlow** Max=0.01 cfs @ 8.40 hrs HW=124.03' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.01 cfs)

### Pond 1P: Driveway Infiltration Chambers - Chamber Wizard Field A

**Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)**

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf

Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap

Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

5 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 36.00' Row Length +12.0" End Stone x 2 = 38.00' Base Length

2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width

6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

10 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 437.2 cf Chamber Storage

1,259.8 cf Field - 437.2 cf Chambers = 822.6 cf Stone x 40.0% Voids = 329.1 cf Stone Storage

Chamber Storage + Stone Storage = 766.2 cf = 0.018 af

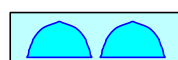
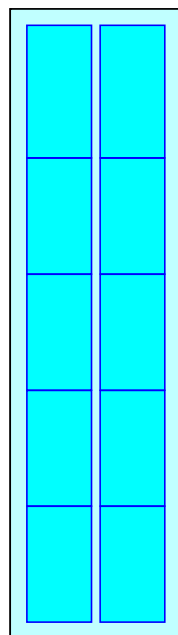
Overall Storage Efficiency = 60.8%

Overall System Size = 38.00' x 10.33' x 3.21'

10 Chambers

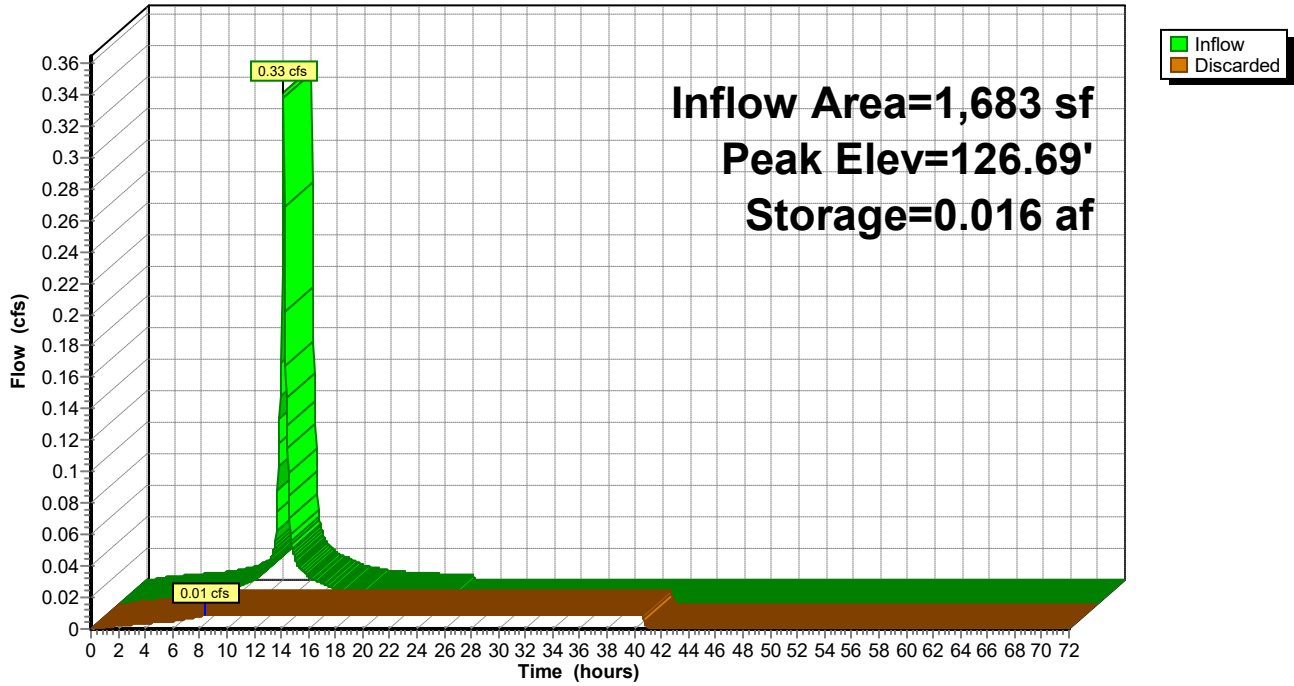
46.7 cy Field

30.5 cy Stone



### Pond 1P: Driveway Infiltration Chambers

Hydrograph



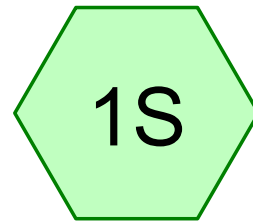
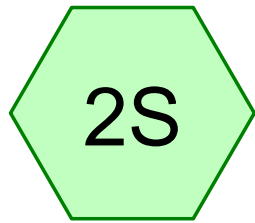


Munden Engineering

mundenengineering.com  
[info@mundenengineering.com](mailto:info@mundenengineering.com)  
781-302-6099

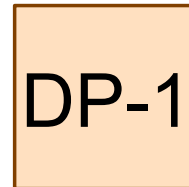
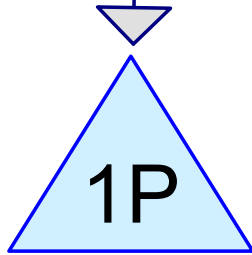
## Post-Construction Calculations with No Minimum Tc





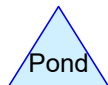
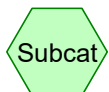
Driveway (captured)

Uncaptured Area



Driveway Infiltration Chambers

Proposed Site Runoff



**127 Clark Street - Proposed rev08032021**

Prepared by Munden Engineering LLC

HydroCAD® 10.00-25 s/n 11058 © 2019 HydroCAD Software Solutions LLC

Page 2

**Area Listing (all nodes)**

Area (sq-ft)	CN	Description (subcatchment-numbers)
5,600	61	>75% Grass cover, Good, HSG B (1S)
147	98	Conc. Pad and Walkways, HSG B (1S)
1,683	98	Driveway, HSG B (2S)
108	98	New RW, HSG B (1S)
400	98	New patio hardscape area, HSG B (1S)
18	98	New stone steps, HSG B (1S)
45	98	New walkway, HSG B (1S)
2,510	98	Roofs and Covered Porch (new roof overlaps exist. by 81 sf), HSG B (1S)
79	98	Stone Ret. Walls, HSG B (1S)
240	98	Stone patio under raised deck, HSG B (1S)
<b>10,830</b>	<b>79</b>	<b>TOTAL AREA</b>

**127 Clark Street - Proposed rev08032021**

Prepared by Munden Engineering LLC

HydroCAD® 10.00-25 s/n 11058 © 2019 HydroCAD Software Solutions LLC

Page 3

**Soil Listing (all nodes)**

Area (sq-ft)	Soil Group	Subcatchment Numbers
0	HSG A	
10,830	HSG B	1S, 2S
0	HSG C	
0	HSG D	
0	Other	
<b>10,830</b>		<b>TOTAL AREA</b>

**127 Clark Street - Proposed rev08032021**

Prepared by Munden Engineering LLC

HydroCAD® 10.00-25 s/n 11058 © 2019 HydroCAD Software Solutions LLC

Page 4

**Ground Covers (all nodes)**

HSG-A (sq-ft)	HSG-B (sq-ft)	HSG-C (sq-ft)	HSG-D (sq-ft)	Other (sq-ft)	Total (sq-ft)	Ground Cover
0	5,600	0	0	0	5,600	>75% Grass cover, Good
0	147	0	0	0	147	Conc. Pad and Walkways
0	1,683	0	0	0	1,683	Driveway
0	108	0	0	0	108	New RW
0	400	0	0	0	400	New patio hardscape area
0	18	0	0	0	18	New stone steps
0	45	0	0	0	45	New walkway
0	2,510	0	0	0	2,510	Roofs and Covered Porch (new roof overlaps exist. by 81 sf)
0	79	0	0	0	79	Stone Ret. Walls
0	240	0	0	0	240	Stone patio under raised deck
<b>0</b>	<b>10,830</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>10,830</b>	<b>TOTAL AREA</b>

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points  
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN  
 Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

**Subcatchment 1S: Uncaptured Area** Runoff Area=9,147 sf 38.78% Impervious Runoff Depth=5.75"  
 Flow Length=55' Slope=0.0100 '/' Tc=4.9 min CN=75 Runoff=1.42 cfs 4,383 cf

**Subcatchment 2S: Driveway (captured)** Runoff Area=1,683 sf 100.00% Impervious Runoff Depth=8.54"  
 Flow Length=100' Tc=0.6 min CN=98 Runoff=0.38 cfs 1,198 cf

**Reach DP-1: Proposed Site Runoff** Inflow=1.42 cfs 4,383 cf  
 Outflow=1.42 cfs 4,383 cf

**Pond 1P: Driveway Infiltration Chambers** Peak Elev=126.69' Storage=0.016 af Inflow=0.38 cfs 1,198 cf  
 Outflow=0.01 cfs 1,198 cf

**Total Runoff Area = 10,830 sf Runoff Volume = 5,581 cf Average Runoff Depth = 6.18"**  
**51.71% Pervious = 5,600 sf 48.29% Impervious = 5,230 sf**

**127 Clark Street - Proposed rev08032021** Type III 24-hr Design Storm Newton Rainfall=8.78"

Prepared by Munden Engineering LLC

HydroCAD® 10.00-25 s/n 11058 © 2019 HydroCAD Software Solutions LLC

**Summary for Subcatchment 1S: Uncaptured Area**

[49] Hint: Tc<2dt may require smaller dt

Runoff = 1.42 cfs @ 12.07 hrs, Volume= 4,383 cf, Depth= 5.75"

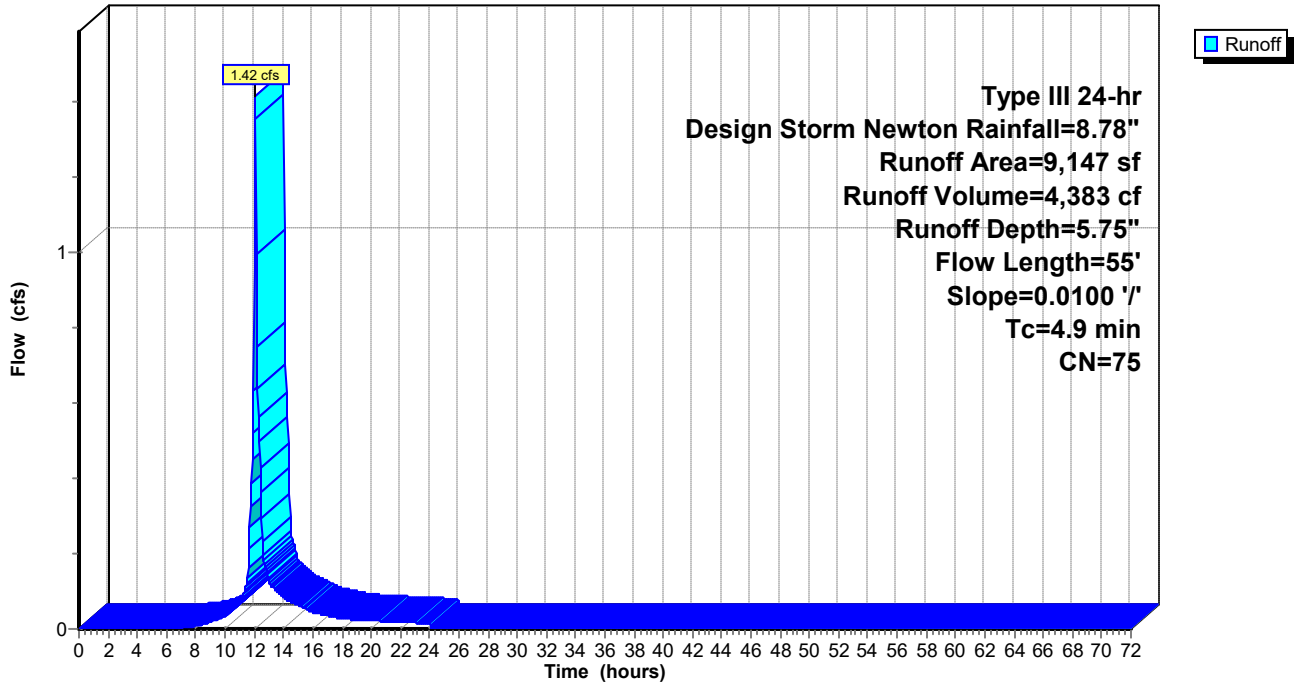
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
Type III 24-hr Design Storm Newton Rainfall=8.78"

Area (sf)	CN	Description
* 2,510	98	Roofs and Covered Porch (new roof overlaps exist. by 81 sf), HSG B
* 147	98	Conc. Pad and Walkways, HSG B
* 5,600	61	>75% Grass cover, Good, HSG B
* 79	98	Stone Ret. Walls, HSG B
* 240	98	Stone patio under raised deck, HSG B
* 18	98	New stone steps, HSG B
* 45	98	New walkway, HSG B
* 400	98	New patio hardscape area, HSG B
* 108	98	New RW, HSG B
9,147	75	Weighted Average
5,600		61.22% Pervious Area
3,547		38.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.1					<b>Direct Entry, Roofs</b>
4.8	55	0.0100	0.19		<b>Sheet Flow, Backyard</b>
					Grass: Short n= 0.150 P2= 8.78"
4.9	55	Total			

### Subcatchment 1S: Uncaptured Area

Hydrograph



**127 Clark Street - Proposed rev08032021** Type III 24-hr Design Storm Newton Rainfall=8.78"

Prepared by Munden Engineering LLC

HydroCAD® 10.00-25 s/n 11058 © 2019 HydroCAD Software Solutions LLC

**Summary for Subcatchment 2S: Driveway (captured)**

[49] Hint: Tc<2dt may require smaller dt

Runoff = 0.38 cfs @ 12.01 hrs, Volume= 1,198 cf, Depth= 8.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
Type III 24-hr Design Storm Newton Rainfall=8.78"

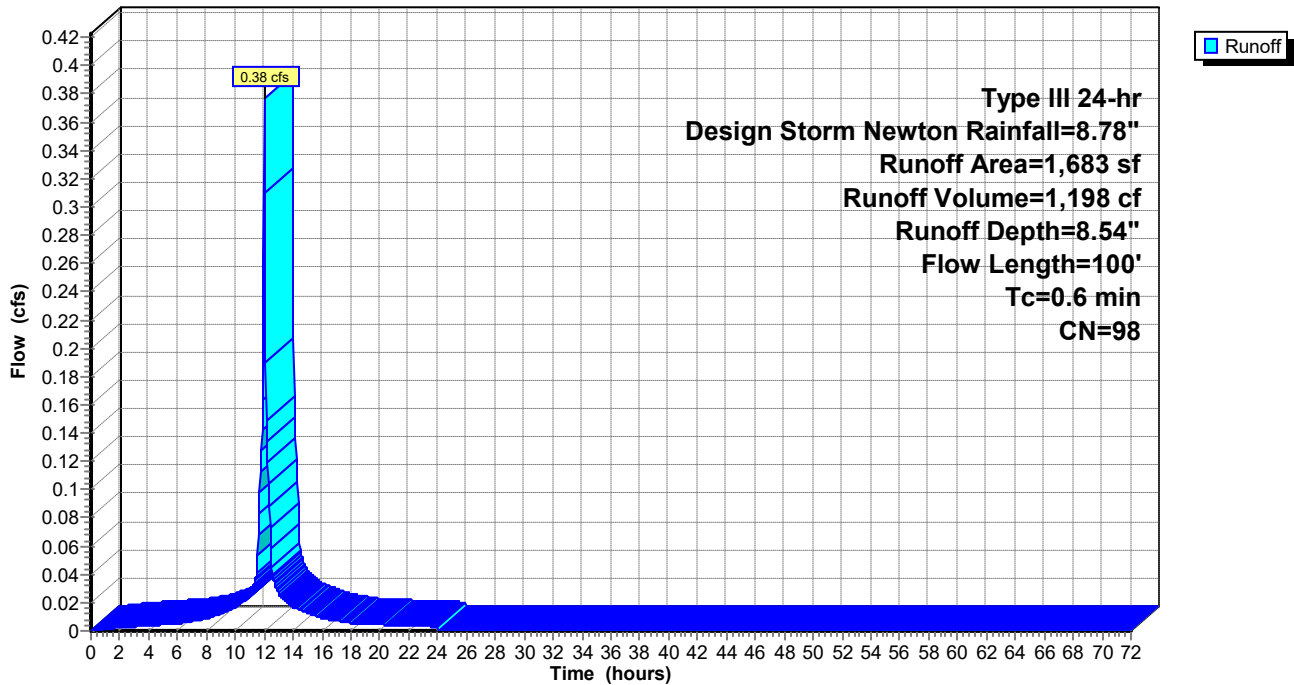
Area (sf)	CN	Description
* 1,683	98	Driveway, HSG B
1,683		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.3	65	0.0900	3.82		<b>Sheet Flow, Driveway</b> Smooth surfaces n= 0.011 P2= 8.78"
0.3	35	0.0200	1.85		<b>Sheet Flow, Driveway</b> Smooth surfaces n= 0.011 P2= 8.78"
0.6	100	Total			

**Subcatchment 2S: Driveway (captured)**

Hydrograph





### Summary for Reach DP-1: Proposed Site Runoff

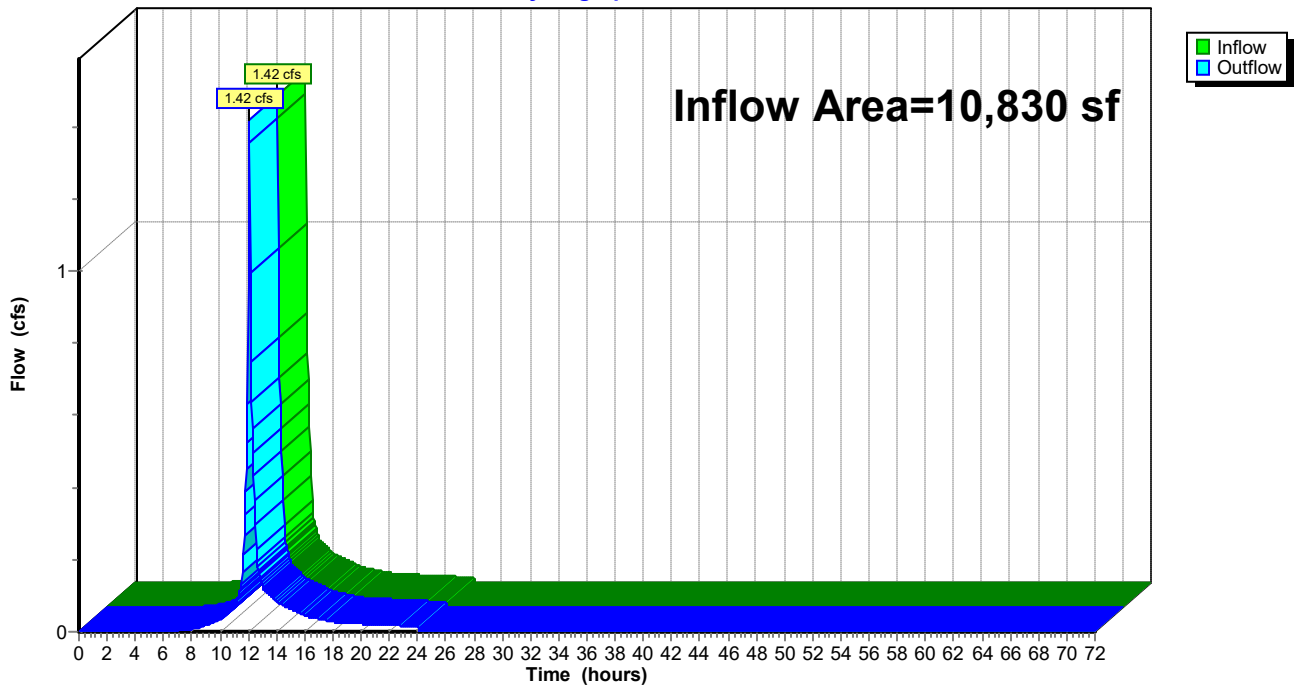
[40] Hint: Not Described (Outflow=Inflow)

Inflow Area = 10,830 sf, 48.29% Impervious, Inflow Depth = 4.86" for Design Storm Newton event  
Inflow = 1.42 cfs @ 12.07 hrs, Volume= 4,383 cf  
Outflow = 1.42 cfs @ 12.07 hrs, Volume= 4,383 cf, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

### Reach DP-1: Proposed Site Runoff

Hydrograph



**127 Clark Street - Proposed rev08032021** Type III 24-hr Design Storm Newton Rainfall=8.78"

Prepared by Munden Engineering LLC

HydroCAD® 10.00-25 s/n 11058 © 2019 HydroCAD Software Solutions LLC

**Summary for Pond 1P: Driveway Infiltration Chambers**

Inflow Area = 1,683 sf, 100.00% Impervious, Inflow Depth = 8.54" for Design Storm Newton event  
 Inflow = 0.38 cfs @ 12.01 hrs, Volume= 1,198 cf  
 Outflow = 0.01 cfs @ 8.35 hrs, Volume= 1,198 cf, Atten= 98%, Lag= 0.0 min  
 Discarded = 0.01 cfs @ 8.35 hrs, Volume= 1,198 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs  
 Peak Elev= 126.69' @ 15.91 hrs Surf.Area= 0.009 ac Storage= 0.016 af

Plug-Flow detention time= 625.6 min calculated for 1,197 cf (100% of inflow)  
 Center-of-Mass det. time= 625.9 min ( 1,361.0 - 735.1 )

Volume	Invert	Avail.Storage	Storage Description
#1A	124.00'	0.008 af	<b>10.33'W x 38.00'L x 3.21'H Field A</b> 0.029 af Overall - 0.010 af Embedded = 0.019 af x 40.0% Voids
#2A	124.50'	0.010 af	<b>Cultec R-280HD</b> x 10 Inside #1 Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap Row Length Adjustment= +1.00' x 6.07 sf x 2 rows
		0.018 af	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	124.00'	<b>1.020 in/hr Exfiltration over Surface area</b>

**Discarded OutFlow** Max=0.01 cfs @ 8.35 hrs HW=124.03' (Free Discharge)

↑ **1=Exfiltration** (Exfiltration Controls 0.01 cfs)

### Pond 1P: Driveway Infiltration Chambers - Chamber Wizard Field A

**Chamber Model = Cultec R-280HD (Cultec Recharger® 280HD)**

Effective Size= 46.9"W x 26.0"H => 6.07 sf x 7.00'L = 42.5 cf

Overall Size= 47.0"W x 26.5"H x 8.00'L with 1.00' Overlap

Row Length Adjustment= +1.00' x 6.07 sf x 2 rows

47.0" Wide + 6.0" Spacing = 53.0" C-C Row Spacing

5 Chambers/Row x 7.00' Long +1.00' Row Adjustment = 36.00' Row Length +12.0" End Stone x 2 = 38.00' Base Length

2 Rows x 47.0" Wide + 6.0" Spacing x 1 + 12.0" Side Stone x 2 = 10.33' Base Width

6.0" Base + 26.5" Chamber Height + 6.0" Cover = 3.21' Field Height

10 Chambers x 42.5 cf +1.00' Row Adjustment x 6.07 sf x 2 Rows = 437.2 cf Chamber Storage

1,259.8 cf Field - 437.2 cf Chambers = 822.6 cf Stone x 40.0% Voids = 329.1 cf Stone Storage

Chamber Storage + Stone Storage = 766.2 cf = 0.018 af

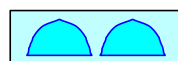
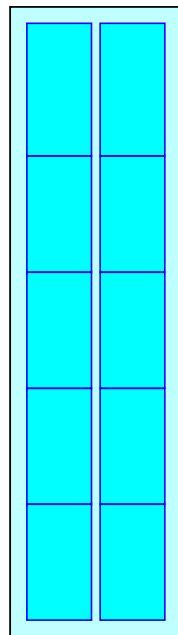
Overall Storage Efficiency = 60.8%

Overall System Size = 38.00' x 10.33' x 3.21'

10 Chambers

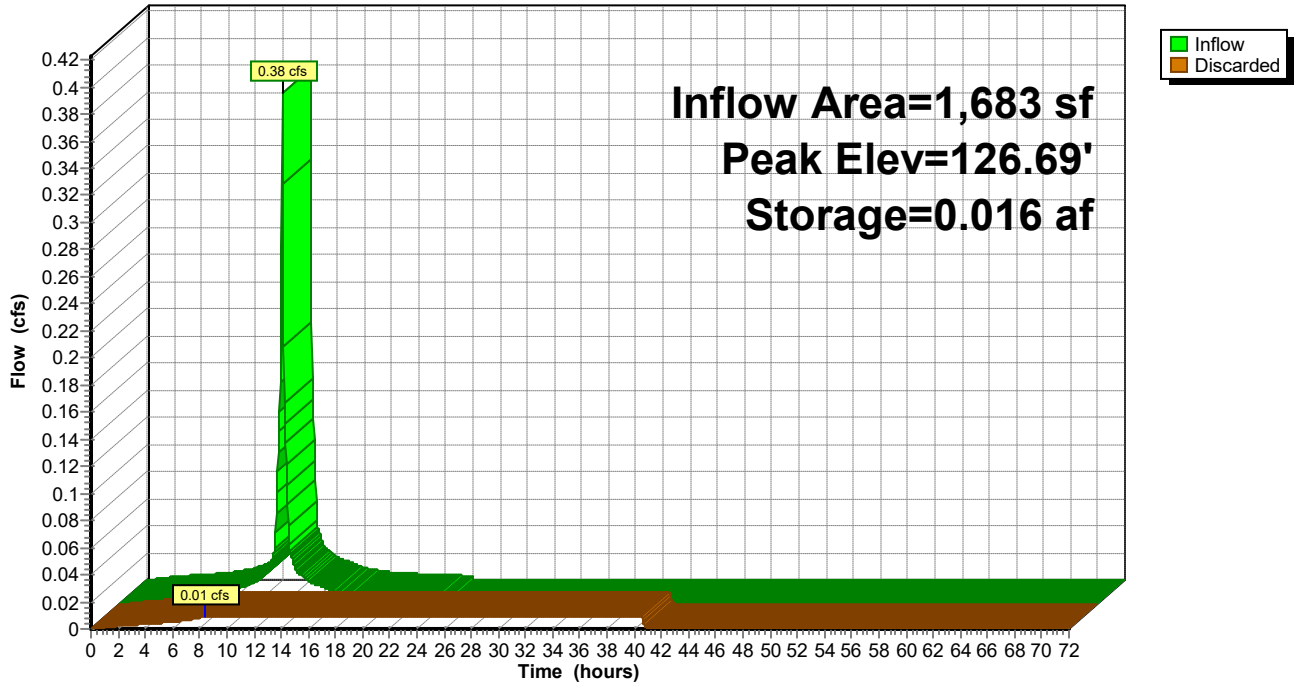
46.7 cy Field

30.5 cy Stone



### Pond 1P: Driveway Infiltration Chambers

Hydrograph





Munden Engineering

mundenengineering.com  
[info@mundenengineering.com](mailto:info@mundenengineering.com)  
781-302-6099

## TSS Removal Worksheet

**INSTRUCTIONS:**

1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: Treatment Train 1

BMP <sup>1</sup>	B TSS Removal Rate <sup>1</sup>	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	0.25	1.00	0.25	0.75
Subsurface Infiltration Structure	0.80	0.75	0.60	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15
	0.00	0.15	0.00	0.15

Separate Form Needs to be Completed for Each Outlet or BMP Train

**Total TSS Removal =** 85%

Project: 127 Clark St Residence  
 Prepared By: JLV  
 Date: 1/12/2021

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

## TSS Removal Calculation Worksheet

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed  
 1. From MassDEP Stormwater Handbook Vol. 1



Munden Engineering

mundenengineering.com  
[info@mundenengineering.com](mailto:info@mundenengineering.com)  
781-302-6099

## Appendix E Construction Period Pollution Prevention Plan



Munden Engineering

mundenengineering.com  
[info@mundenengineering.com](mailto:info@mundenengineering.com)  
781-302-6099

## **CONSTRUCTION PERIOD POLLUTION PREVENTION PLAN**

**127 CLARK ST  
NEWTON MA**

**April 2021**



**Munden Engineering**



## Table of Contents

Section 1 Introduction	1
Section 2 Project Information	1
2.1 Responsible Parties	1
2.2 General Description of Project	1
2.3 Stormwater Management and Erosion Control Plan	2
Section 3 Erosion and Sediment Controls	2
3.1 Perimeter Controls	2
3.2 Inlet Protection	3
Section 4 Pollution Prevention	3
4.1 Waste Management	3
4.1.2 Hazardous or Toxic Waste	4

## Appendices

A Stormwater Construction Site Inspection Log	
---	--

## **Section 1 Introduction**

Standard 8 of the Massachusetts Standards requires:

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

The following Construction Period Pollution Prevention Plan (CPPPP) outlines the requirements to comply with Standard 8.

## **Section 2 Project Information**

### **2.1 Responsible Parties**

This Construction Period Pollution Prevention Plan has been prepared for the construction phase activity for the redevelopment of a single-family dwelling located at 127 Clark St in Newton, Massachusetts. The property is owned by Tim and Lauren Fagerberg. During construction, the contractor will be responsible for pollution prevention and erosion and sediments controls as follows below.

### **2.2 General Description of Project**

The project site activities include the redevelopment of a single-family dwelling located at 127 Clark St in the City of Newton, Massachusetts. The Site currently consists of a 2-story single family dwelling with a covered porch, driveway, brick walkways, and retaining walls. The proposed project includes the construction of a 2-story addition off the rear side of the existing dwelling and extending the existing driveway. Under proposed conditions, the total impervious surface will result in a net increase of 1,410 sq. ft.

The property is located on the West side of Clark Street and abuts residential properties to the North, West, and South. On the East side of the property, the lot has a 60-foot frontage along Clark Street.

## 2.3 Stormwater Management and Erosion Control Plan

A Stormwater Management and Erosion Control Plan (SMECP) is provided on sheet 5 of the Site Plans. The SMECP outlines the minimum requirements for the prevention of erosion and sedimentation due to construction impacts. The SMECP provides locations of the perimeter controls, anti-tracking pads, and inlet protection.

## Section 3 Erosion and Sediment Controls

The Contractor shall comply with the following temporary erosion and sediment controls to minimize the discharge of pollutants in stormwater from construction activities.

### 3.1 Perimeter Controls

Description: The erosion control barriers will consist of silt socks placed in a manner that restricts the contractor to the areas necessary to perform the work. The perimeter controls will generally define the limits of work.

Installation: The temporary erosion control measures shall be installed before construction begins at the site and around soil stockpiles once they have been established. Silt socks will be installed per the details shown on the plans and per manufacturer requirements. Perform work in accordance with the ESCP.

Maintenance Requirements: Perimeter controls will be inspected weekly and immediately after storm events to ensure it is intact and that there are no gaps where the fence meets the ground or tears along the length of the fence. If gaps or tears are found during the inspection, the fabric will be repaired or replaced immediately. Accumulated sediment will be removed from the base if it reaches one-third the height of the silt sock and properly disposed off-site. If accumulated sediment is creating noticeable strain on the fabric and might fail from a sudden storm event, the sediment will be removed more frequently. Before the silt socks are removed from the project area, the sediment will be removed. The erosion control barriers will be removed and properly disposed off-site following the stabilization of disturbed areas. The silt socks will likely need to be replaced if the construction extends over 6 months.

## 3.2 Inlet Protection

Description: Storm drain inlets will be protected from sediment by commercially available catch basin inserts as shown on the plan set for the proposed development. The catch basin inserts will be removed once the construction site has been permanently stabilized.

Installation: Inserts should be installed at all catch basins prior to construction or immediately after catch basins have been constructed until project completion.

Maintenance Requirements: The catch basin inserts will be inspected weekly and immediately after storm events. If the basin insert becomes clogged with sediment, the insert will be removed and cleaned or replaced per the manufacturer's recommendations.

## Section 4 Pollution Prevention

A typical construction site generates pollutants through construction activities. The following identifies preventative measures to reduce the opportunity for pollutants to enter the stormwater runoff stream.

### 4.1 Waste Management

Description: All waste materials will be collected and disposed of into one metal trash dumpster on site. Only trash and construction debris from the site will be deposited in the dumpster. No construction materials will be buried on-site. All personnel will be instructed, during tailgate training sessions, regarding the correct disposal of trash and construction debris. Notices that state these practices will be posted on site and the individual who manages day-to-day site operations will be responsible for seeing that these practices are followed.

Installation: Trash dumpsters will be installed prior to construction.

Maintenance Requirements: The dumpsters will be inspected weekly and immediately after storm events. The dumpster will be emptied weekly and taken to a landfill. If trash and construction debris are exceeding the dumpster's capacity, the dumpsters will be emptied more frequently.



#### **4.1.2 Hazardous or Toxic Waste**

Hazardous waste materials such as oil filters, petroleum products, paint, and equipment maintenance fluids shall not be placed in the dumpster and disposed of daily accordingly with local, state and federal regulations.



Munden Engineering

mundenengineering.com  
[info@mundenengineering.com](mailto:info@mundenengineering.com)  
781-302-6099

## Appendix A Stormwater Construction Site Inspection Log

# Stormwater Construction Site Inspection Form

General Information			
<b>Project Name</b>			
<b>Project Location</b>			
<b>Date of Inspection</b>		<b>Start/End Time</b>	
<b>Inspector's Name(s)</b>			
<b>Inspector's Title(s)</b>			
<b>Inspector's Contact Information</b>			
<b>Describe present phase of construction</b>			
<b>Type of Inspection:</b>			
<input type="checkbox"/> Regular <input type="checkbox"/> Pre-storm event <input type="checkbox"/> During storm event <input type="checkbox"/> Post-storm event			
Weather Information			
<b>Amount of rainfall since last inspection (inches):</b>			
<b>Weather at time of this inspection?</b>			
<input type="checkbox"/> Clear <input type="checkbox"/> Cloudy <input type="checkbox"/> Rain <input type="checkbox"/> Sleet <input type="checkbox"/> Fog <input type="checkbox"/> Snowing <input type="checkbox"/> High Winds <input type="checkbox"/> Other: _____                         Temperature: _____			
<b>Have any discharges occurred since the last inspection?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No			
<b>If yes, describe:</b>			
<b>Are there any discharges at the time of inspection?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No			
<b>If yes, describe:</b>			
Field Observations			
<b>Description of Work Accomplished:</b>			

### Site-specific BMPs

	BMP	BMP Installed or Required	BMP Maintenance Required?	Corrective Action Needed and Notes
1	Perimeter Controls	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
2	Sediment track out	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
3	Inlet protection	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

# Stormwater Construction Site Inspection Form

## Overall Site Issues

	<b>BMP/activity</b>	<b>Implemented?</b>	<b>Maintenance Required?</b>	<b>Corrective Action Needed and Notes</b>
1	Are all slopes and disturbed areas not actively being worked properly stabilized?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
2	Are natural resource areas (e.g., streams, wetlands, mature trees, etc.) protected with barriers or similar BMPs?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
3	Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
4	Are discharge points and receiving waters free of any sediment deposits?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
5	Is the construction sediment track out procedures preventing sediment from being tracked into the street?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
6	Are temporary stockpiles on site which will remain or have remained for more than 7 days have erosion controls?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
7	Are dust control measures being utilized as to prevent the migration of dust from the site and are the effective?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
8	Have areas adjacent to the site work been disturbed, which has resulted in disruption of topsoil outside of the limits of work?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
9	Is trash/litter from work areas	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	



## Stormwater Construction Site Inspection Form

	collected and placed in covered dumpsters?			
10	Are washout facilities (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
11	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
12	Are materials that are potential stormwater contaminants stored inside or under cover?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
13	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

### Non-Compliance

Describe any incidents of non-compliance not described above:

### CERTIFICATION STATEMENT

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

**Print name and title:** \_\_\_\_\_

**Signature:** \_\_\_\_\_

**Date:** \_\_\_\_\_



Munden Engineering

mundenengineering.com  
[info@mundenengineering.com](mailto:info@mundenengineering.com)  
781-302-6099

## Appendix F Long-Term Operation and Maintenance Plan



Munden Engineering

mundenengineering.com  
[info@mundenengineering.com](mailto:info@mundenengineering.com)  
781-302-6099

## **LONG-TERM OPERATION AND MAINTENANCE PLAN**

**127 CLARK ST  
NEWTON MA**

**April 2021**



**Munden Engineering**



## Table of Contents

Section 1 Introduction and Purpose	1
Section 2 Responsible Parties	1
Section 3 Stormwater Management System	1
3.1 Permanent Erosion Control Measures	1
3.2 Inspections	2
3.2.1 Vegetated Surfaces	2
3.2.2 Stormwater Infiltration Chambers	2
3.2.3 Deep Sump Catch Basin	3
Section 4 Operation and Maintenance Log Form	4

## **Section 1 Introduction and Purpose**

The following Long-Term Operation and Maintenance Plan (O&M) Plan has been prepared for the stormwater management system for the proposed redevelopment project located at 127 Clark St in the City of Newton, Massachusetts. The purpose of this plan is to provide guidance and procedures for the maintenance of the stormwater management system following construction.

The proposed project has been designed in compliance with the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Standard and the City of Newton Stormwater Regulations to maintain or improve stormwater runoff quality and quantity. The stormwater management system components shall be maintained as recommended in the Massachusetts Stormwater Handbook.

## **Section 2 Responsible Parties**

The property owners, Tim and Lauren Fagerberg, are responsible for maintaining and servicing the proposed design and stormwater management system post construction. During construction, the contractor will be responsible for stormwater management maintenance.

## **Section 3 Stormwater Management System**

The on-site stormwater management system is comprised of a deep-sump hooded catch basin, conveyance piping and a series of eight underground infiltration chambers. In general, the majority of runoff from the proposed project area, including rooftops, paved driveway and unpaved areas, is conveyed to the backyard either by sheet flow or through the stormwater management system. A minimal amount of discharge from the paved driveway is conveyed to the public road by sheet flow.

### **3.1 Permanent Erosion Control Measures**

Permanent stabilization will be done immediately after the final design grades are achieved, but no later than 14 days after construction ceases. All disturbed areas within the limit of work will be reseeded with grass.

Portions of the site where construction activities have permanently ceased will be stabilized, as soon as possible but no later than 14 days after construction ceases.

All seeded areas will be inspected weekly during construction activities for failure and after storm events until a dense cover of vegetation has been established. If failure is noticed at the seeded area, the area will be reseeded, fertilized, and mulched immediately. After construction is completed at the site, permanently stabilized areas will be monitored until final stabilization is reached.

## **3.2 Inspections**

Inspections will be performed in accordance with the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Handbook. The Site Plans identify the location of each BMP to be inspected and maintained as described in this Section.

The following stormwater management system features will be evaluated during each inspection:

### **3.2.1 Vegetated Surfaces**

**Inspection Frequency:** Bi-annually in Summer and Winter

**Special Inspection Event(s):** Spring Snow Melt

All vegetative surfaces will be observed to identify locations of settlement, erosion and other impacts from the proposed redevelopment.

### **3.2.2 Stormwater Infiltration Chambers**

**Inspection Frequency:** Every 3 months

**Special Inspection Event(s):** After every major storm event

Subsurface infiltration management systems should be inspected quarterly for sediment accumulation, blockages, structural deficiencies, and any other defects that may impair their intended function. The systems should be inspected via the inspection ports provided and should include the inlet and outlet to the system. Quarterly inspections should include one inspection following each the foliage and snow removal seasons.



In addition, Cultec Stormwater Chambers should be inspected 2 years after commissioning, and every 9 years following per manufacturers recommendations. Inspect the interior of the stormwater management chambers through the inspection port for deficiencies using CCTV or comparable technique. If any debris is present, clean stormwater management chambers and feed connectors. Maintenance of the stormwater management system shall be performed by qualified workers and shall follow applicable occupational health and safety requirements. Debris removed from the stormwater management system shall be disposed of in accordance with applicable laws and regulations.

The stormwater infiltration chambers must be inspected 48-hours after every major storm for signs of blockage and excess sedimentation.

### **3.2.3 Deep Sump Catch Basin**

**Inspection Frequency:** Every 3 months

**Special Inspection Event(s):** After every major storm event

Deep sump catch basins must be cleaned out and sediment must be removed every 6 months or as required. Typically, a catch basin should be cleaned if the depth of the deposits is equal to or greater than 3 ft. (one-half of the sump depth) from the invert.



## Section 4 Operation and Maintenance Log Form

Date:

---

---

---

---

---

Person conducting Inspection:

---

---

---

---

---

---

---

---

---

---

Reason for Inspection (Routine / Significant Rainfall):

---

---

---

---

---

### Stormwater Management System Components:

#### **Vegetated Surface**

Component inspected during this inspection

Any Repair Necessary

---

---

---

---

---

---





---

---

Other Comments \_\_\_\_\_

---

---

**Stormwater Infiltration Chambers**

Component inspected during this inspection

Any Repair Necessary \_\_\_\_\_

---

---

---

---

---

---

---

---

---

---

Other Comments \_\_\_\_\_

---

---

---

**Deep Sump Catch Basin**

Component inspected during this inspection

Any Repair Necessary \_\_\_\_\_

---

---

---

---

---

---

---

---

---

---



Other Comments \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_