Stormwater & Hydrologic Report

for

Site Regrading

located at

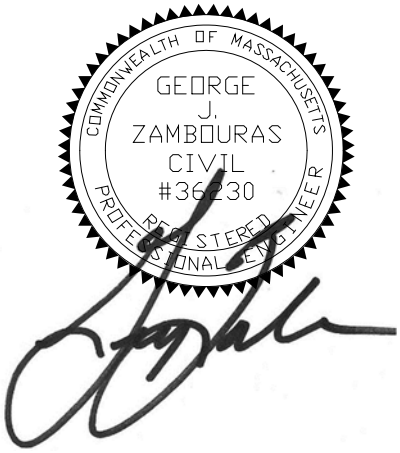
6 Gunnison Road

Boxford, Massachusetts 01921

Prepared For

Michael Cogley & Alissa Stuckey
6 Gunnison Road
Boxford, MA 01921

2, 10, 25, 50 & 100 Year Storm
24 Hour Duration



Date: February 8, 2021

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INTRODUCTION:

This report describes the pre- and post-hydraulic analysis and stormwater management measures necessary to ensure the work at 6 Gunnison Road - Boxford, Massachusetts will not adversely effect stormwater rates or volumes, flooding, sediment transport, groundwater recharge, drinking water, surface waters, public safety or surrounding properties.

In analyzing the impacts of the proposed improvements only the portions of the site's watershed being disturbed by the proposed work is studied. The hydraulic report does not calculate run-off rates or quantities for the areas of the site were no work or alteration is proposed.

The design of the stormwater system's components is based on the hydraulic analysis performed utilizing "HydroCAD Storm water Modeling Software" for storm events of 2, 10, 25, 50 and 100-year storm frequencies.

In accordance with the Town of Boxford's stormwater regulations and guidelines; pre-development watershed is analyzed as "Woods - Good Condition" and rainfall run-off quantities are based on the following: 2-year = 3.10, 10-year = 4.7", 25-year = 5.8", 50-year = 7.1" and 100-year = 8.3".

EXISTING CONDITIONS:

The project site is a developed 2-acre single family residential parcel located on the westerly side of Gunnison Road approximately 400 feet north of the intersection of Gunnison Road and Bare Hill Road. The existing site consists of a single-family residential dwelling, driveway and lawn area which encompasses approximately 1 acre of the site. The remainder of the site is comprised of grassed field, brush and lightly wooded areas.

The site is relatively flat having slopes of less than 3% and the general drainage pattern of the site result in stormwater run-off to flow in a general northwest to southeast direction from the rear of the site to Gunnison Road. The site is serviced via on site sewage disposal and a private well.

Prior to the submission of this application land disturbance did occur within the site, which is explained below. For the purpose of the comparison of pre- and post-development conditions the pre-existing conditions of the site are analyzed based on the above described conditions as regulated by the Town of Boxford's stormwater regulations.

PROPOSED CONDITIONS:

The property owner initially started site re-grading in 2020 at which time, the homeowner was unaware permitting was required based on the area of disturbance to occur within the site. This initial disturbance encompassed an area of approximately 1.2 acres. All work on the project ceased following an enforcement order issued by the Town of Boxford officials on October 15, 2020.

The purpose of the project is to perform site re-grading, to direct run-off away from the existing dwelling, and to clear trees and scrub brush to create an expanded lawn area. No new structures, impervious surfaces, utilities, or stormwater controls are proposed. Upon completion of the project a total of 1.8 acres of land will be disturbed.

The work necessary to complete the project and restore the site consists of additional tree and brush removal and disposal, removal of surplus gravel, removal of brush piles, site grading, loam, and seed. This additional work encompasses approximately 0.6 acres

SITE SOILS:

Existing site soils, as identified by the United States Department of Agriculture Natural Resources Conservation Services (NRCS) Soil Report, located in Appendix "D", are primarily comprised of Hinckley loamy sands.

These soils are excessively drained and belong to the Hydrologic Soil Group (HSG) A. Typical soils profiles are indicated to consist of: loamy sand (0 - 8"); gravelly loamy sand (8" – 19"); and very gravelly sand (19" – 65") having a depth to ground water of more than 80".

There is a small negligible area identified as Ninigret fine sandy loams in the NRCS report. However, these soils encompass only 0.5% of the site; are located on the extreme perimeter of the site and are therefore are classified as Hinckley in the analysis of the site.

No soil testing was performed on the site however, based on an examination of soil in the disturbed areas and spoil piles, site soils are comprised of sands and loamy sands. There is no evidence high ground water in excavated areas.

Based on the NRCS Soil Report and the examination of disturbed soils, throughout this analysis the site is modeled utilizing soils belonging to the Hydrologic Soil Group A to establish a comparison of pre- and post-run-off rates and volumes.

In accordance with DEP stormwater regulations the applicable Rawl's infiltration rate of 2.41 inches per hour for loamy sands is utilized for infiltration calculations within the site.

STORMWATER MANAGEMENT AND PROTECTION OF THE ENVIRONMENT

The proposed project does not create any new impervious surfaces and does not crate any new stormwater conveyances or point discharges. The project is solely to create an expanded lawn area and to perform site regrading. As identified in the hydraulic analysis the proposed site regrading creates natural lawn depressions that assist in amplifying the infiltration of stormwater run-off thereby mitigating the effects of the proposed land disturbance.

As part of this project, a "Construction Period Pollution Prevention, Erosion and Sedimentation Control Plan" (SWPPP) has been created to control sedimentation and to ensure that no disturbance to resource areas or abutting properties occur during construction of the project.

The controls to be implemented during construction and the design of the site regrading ensures that the project will not adversely effect stormwater rates or volumes, flooding, sediment transport, groundwater recharge, drinking water, surface waters, public safety or surrounding properties.

COMPLIANCE WITH DEP STORMWATER MANAGEMENT POLICY

The sites proposed stormwater runoff is managed thought the use of natural grading of the site and does not include any managed stormwater controls.

In review of compliance with DEP Stormwater Management Policy the "site" is limited to the areas to be disturbed, which do not include any impervious surfaces. As such certain standards are incalculable and not applicable to the project. In these cases the Standards will be applied to the greatest extent possible.

Standard 1 – Untreated Stormwater
Standard 1 states that "No new stormwater conveyances (e.g. outfalls) will discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth."

The proposed site improvements do not include any new untreated conveyances that discharge directly to or cause erosion to resource areas. As no new conveyances or direct stormwater discharges are being created, the project meets Standard 1.

Standard 2 – Post Development Peak Discharge Rates
"Stormwater management systems shall be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates."

Summary of Site Discharge Flows

Design Storm	*Pre-Development Peak Discharge (CFS.)*	*Post-Development Peak Discharge (CFS.)*
2 Yr.	***0.00***	***0.00***
10 Yr.	***0.00***	***0.00***
25 Yr.	***0.01***	***0.00***
50 Yr.	***0.06***	***0.05***
100 Yr.	***0.21***	***0.13***

The Post development discharge rates equal or result in a reduction of pre-development rates for the 2, 10, 25, 50 and 100-year storm events therefore the project meets Standard 2.

Standard 3 – Recharge to Groundwater

The target depth factor for Class A soils is 0.6-inch. However, the site does not include any impervious area therefore the required stormwater recharge calculation is not possible. Additionally, due to the class A soils on the site, measurable discharges (at the design point) do not occur until the 25-year storm event.

Storm Water Recharge Calculation:
Required Recharge Volume

The Required Recharge Volume (Rv) is calculated using the following formula:

Rv = F x Impervious Area
Where Target Depth Factor F: F= 0.6 inch (for HSG A Soils)

Site Impervious Area = 0 square feet (0.60 acres)
Rv = ((0.6/12) x 0) = No value

Irrespective the above, the proposed regrading and natural lawn features allows for recharge of stormwater as follows:

(The following values are obtained from the HydroCAD analysis)

Front yard depression total possible capture volume = 106 c.f.
Rear yard depression total possible capture volume = 2,500+/- c.f.

The recharge volume provided 2,606 c.f. > required recharge volume of 0 c.f. therefore the project meets standard 3.

Standard 4 – Water Quality and Removal of 80% Total Suspended Solids (TSS)

As no new stormwater conveyances or controls are proposed for the project; and the project does not include any impervious surfaces the calculation of these values is zero or not possible.

In addition, as there are no stormwater controls to operate, inspect or maintain a long-term pollution prevention plan that establishes practices to control and prevent pollution is not applicable for the site.

Therefore, the project meets Standard 4.

Standard 5 – Land Uses with Higher Potential Pollutant Loads

The project use is not a Land Use with Higher Potential Pollutant Loads. Therefore, Standard 5 is not applicable to this project.

Standard 6 – Critical Areas

The project is not located within a Zone II or Interim Wellhead Protection Area of a public water supply and the project's stormwater discharges do not discharge near or to any critical areas, therefore
The project's is not located in estimated habitat or any critical area therefore Standard 6 does not apply.

Standard 7 - Redevelopment

Standard 7 states that "A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable: Standard 2, Standard 3, and the pretreatment and structural best management practice requirements of Standards 4, 5 and 6.

The project is a redevelopment project, and as regulated by the Town Boxford's regulations stipulating that the project shall meet all thresholds of the Policy.

The project reduces post development rates and volumes, provides for recharge, and meets other applicable thresholds of the Policy there the project meets standard 7.

Standard 8 – Erosion and Sedimentation Controls

A Stormwater Pollution Prevention Plan for the Project has been developed for the site (refer to Appendix ”C”)
Therefore, the Project complies with Standard 8.

Standard 9 – Operation and Maintenance Plans

As there are no stormwater controls to operate, inspect or maintain a long-term pollution prevention plan that establishes practices to control and prevent pollution is not applicable for the site.

Therefore Standard 9 is not applicable to the site.

Standard 10 – Illicit Discharges to Drainage System

There are no known or suspected illicit discharges to the stormwater management system at the project site. An illicit discharge statement is provided within this document.

Therefore, the Project complies with Standard 10.

SUMMARY:

The project does not result in increases of stormwater; provides for recharge thereby meeting DEP Stormwater policy and the Town of Boxford’s Regulations.

As indicated in the summary below the proposed regrading of the site does not cause any increases of peak run-off rates or volumes for the 2, 10, 25, 50 and 100-year events.

Summary of Total Site Discharge Flows and Volumes

Design Storm	*Pre-Development Max. Discharge (CFS.)*	*Post-Development Max. Discharge (CFS.)*	*Pre-Development Max. Volume (Cubic-FT.)*	*Post-Development Max. Volume (Cubic-FT.)*
2 Yr.	*0.00*	*0.00*	*0*	*0*
10 Yr.	*0.00*	*0.00*	*0*	*0*
25 Yr.	*0.01*	*0.00*	*340*	*0*
50 Yr.	*0.06*	*0.05*	*1,487*	*58*
100 Yr.	*0.21*	*0.13*	*3,168*	*271*

Based on the control to be implemented during construction and the mitigation of stormwater, the project will not adversely effect stormwater rates or volumes, flooding, sediment transport, groundwater recharge, drinking water, surface waters, public safety or surrounding properties.

Assumptions:

The following assumptions are being used for design purposes:

1) ***2, 10, 25, 50 & 100 year storm frequency.***
2) ***24 hour storm duration (min.)***
3) ***Hydro logic soils groups for the run-off areas are classified class as "A" – Sandy Loams.***
4) ***Existing and proposed Cn values are as noted in the report.***
5) ***Exfiltration rate for Loamy Sands is 2.41 inches/hour based on DEP's Table 2.3.3 "1982 Rawls Rates".***

Design Criteria:

1) ***Run-off quantities are calculated using Town of Boxford's stipulated intensity values.***
2) ***Extreme Precipitation rainfall Data***

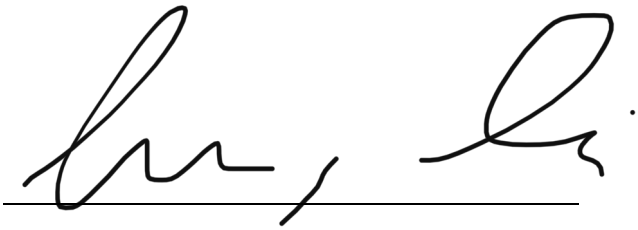
Storm Event in Years	*Inches per 24 Hours*
2	*3.10*
10	*4.70*
25	*5.80*
50	*7.10*
100	*8.30*

3) ***Proposed Cn values are as noted in the report.***
4) ***Hyetograph shape = S.C.S.III (eastern U.S.)***
5) ***The maximum post-development run-off flow rates and volumes for the 2, 10, 25, 50 & 100 yr. design storms shall be equal or less than pre-development rates and volumes.***

Illicit Discharge Compliance Statement

An illicit discharge is a discharge to a municipal separate storm sewer that is not comprised entirely of stormwater, discharges from fire-fighting activities, and certain designated allowable non-stormwater discharges.

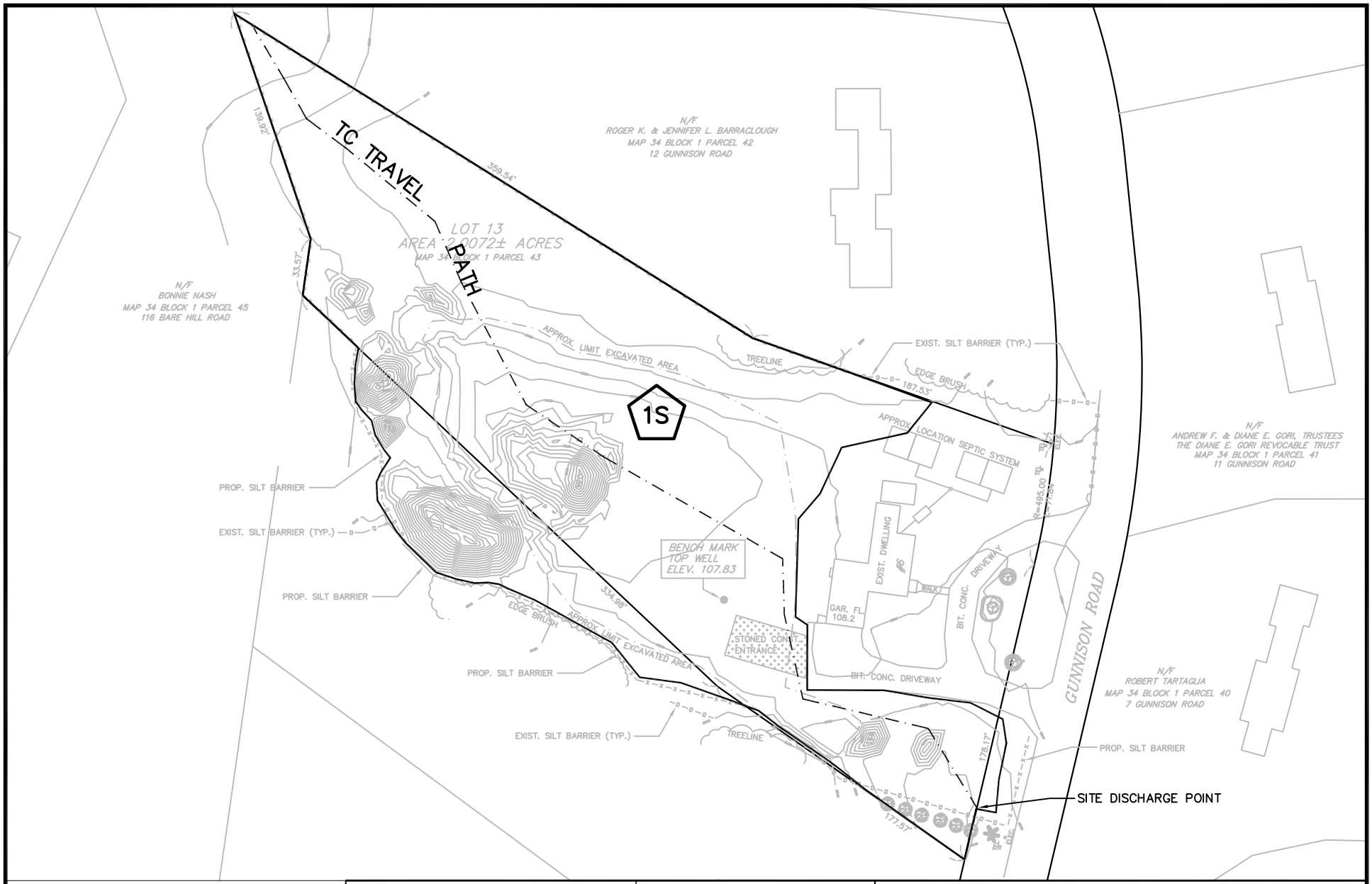
To the best of my knowledge, no detectable illicit discharge exists on site. The site plans included with this report identify the location of the proposed sewerage disposal system and detail the storm sewer that convey stormwater on the site and demonstrates that these systems do not allow the entry of any illicit discharge into the stormwater management system. An Operation and Maintenance Plan and a Long Term Pollution Control Plan have been prepared for the Site that outlines measures to prevent future illicit discharges. As the Site Owner, I will be responsible for implementing the Long Term Pollution Control Plan.

Signature: 

Owner's Name

Appendix A

Pre-Development Calculations



DATE: FEBRUARY 6, 2021	SCALE 1"=80'

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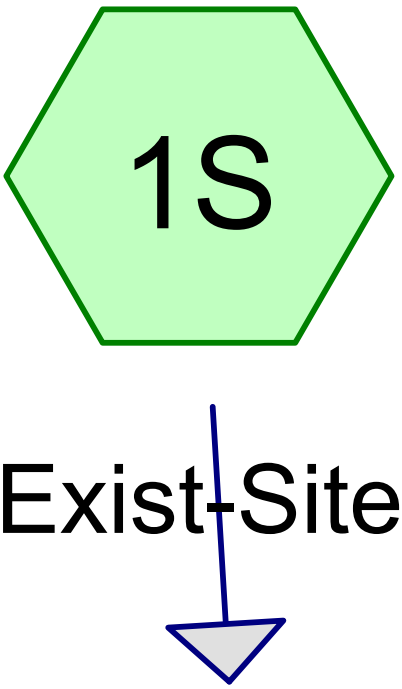
PRE–DEVELOPMENT WATERSHED
6 GUNNISON ROAD
BOXFORD, MASSACHUSETTS



Exist-Site

Subcat Reach Pond Link

Routing Diagram for 6 Gunnison
Prepared by George J. Zambouras, P.E., Printed 2/6/2021

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
77,650	30	Woods, Good, HSG A (1S)
77,650	**30**	**TOTAL AREA**

Time span=5.00-30.00 hrs, dt=0.04 hrs, 626 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: Exist-Site Runoff Area=77,650 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=671' Tc=26.0 min CN=30 Runoff=0.00 cfs 0 cf

Link 1L: Exist-Site Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Total Runoff Area = 77,650 sf Runoff Volume = 0 cf Average Runoff Depth = 0.00"
100.00% Pervious = 77,650 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 1S: Exist-Site

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
77,650	30	Woods, Good, HSG A
77,650		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0350	0.08		**Sheet Flow, Field**
					Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	41	0.0350	1.31		**Shallow Concentrated Flow, Field**
					Short Grass Pasture Kv= 7.0 fps
2.7	108	0.0090	0.66		**Shallow Concentrated Flow, Field**
					Short Grass Pasture Kv= 7.0 fps
9.6	336	0.0070	0.59		**Shallow Concentrated Flow, Field**
					Short Grass Pasture Kv= 7.0 fps
3.2	136	0.0100	0.70		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
26.0	671	Total			

Summary for Link 1L: Exist-Site

Inflow Area = 77,650 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs

Time span=5.00-30.00 hrs, dt=0.04 hrs, 626 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: Exist-Site Runoff Area=77,650 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=671' Tc=26.0 min CN=30 Runoff=0.00 cfs 0 cf

Link 1L: Exist-Site Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Total Runoff Area = 77,650 sf Runoff Volume = 0 cf Average Runoff Depth = 0.00"
100.00% Pervious = 77,650 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 1S: Exist-Site

Runoff = 0.00 cfs @ 24.16 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
77,650	30	Woods, Good, HSG A
77,650		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0350	0.08		**Sheet Flow, Field**
					Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	41	0.0350	1.31		**Shallow Concentrated Flow, Field**
					Short Grass Pasture Kv= 7.0 fps
2.7	108	0.0090	0.66		**Shallow Concentrated Flow, Field**
					Short Grass Pasture Kv= 7.0 fps
9.6	336	0.0070	0.59		**Shallow Concentrated Flow, Field**
					Short Grass Pasture Kv= 7.0 fps
3.2	136	0.0100	0.70		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
26.0	671	Total			

Summary for Link 1L: Exist-Site

Inflow Area = 77,650 sf, 0.00% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 24.16 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 24.16 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs

Time span=5.00-30.00 hrs, dt=0.04 hrs, 626 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: Exist-Site Runoff Area=77,650 sf 0.00% Impervious Runoff Depth=0.05"
Flow Length=671' Tc=26.0 min CN=30 Runoff=0.01 cfs 340 cf

Link 1L: Exist-Site Inflow=0.01 cfs 340 cf
Primary=0.01 cfs 340 cf

Total Runoff Area = 77,650 sf Runoff Volume = 340 cf Average Runoff Depth = 0.05"
100.00% Pervious = 77,650 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 1S: Exist-Site

Runoff = 0.01 cfs @ 17.09 hrs, Volume= 340 cf, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-Year Rainfall=5.80"

Area (sf)	CN	Description
77,650	30	Woods, Good, HSG A
77,650		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0350	0.08		**Sheet Flow, Field**
					Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	41	0.0350	1.31		**Shallow Concentrated Flow, Field**
					Short Grass Pasture Kv= 7.0 fps
2.7	108	0.0090	0.66		**Shallow Concentrated Flow, Field**
					Short Grass Pasture Kv= 7.0 fps
9.6	336	0.0070	0.59		**Shallow Concentrated Flow, Field**
					Short Grass Pasture Kv= 7.0 fps
3.2	136	0.0100	0.70		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
26.0	671	Total			

Summary for Link 1L: Exist-Site

Inflow Area = 77,650 sf, 0.00% Impervious, Inflow Depth = 0.05" for 25-Year event
Inflow = 0.01 cfs @ 17.09 hrs, Volume= 340 cf
Primary = 0.01 cfs @ 17.09 hrs, Volume= 340 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs

Time span=5.00-30.00 hrs, dt=0.04 hrs, 626 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: Exist-Site Runoff Area=77,650 sf 0.00% Impervious Runoff Depth=0.23"
Flow Length=671' Tc=26.0 min CN=30 Runoff=0.06 cfs 1,487 cf

Link 1L: Exist-Site Inflow=0.06 cfs 1,487 cf
Primary=0.06 cfs 1,487 cf

Total Runoff Area = 77,650 sf Runoff Volume = 1,487 cf Average Runoff Depth = 0.23"
100.00% Pervious = 77,650 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 1S: Exist-Site

Runoff = 0.06 cfs @ 14.00 hrs, Volume= 1,487 cf, Depth= 0.23"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs
Type III 24-hr 50-Year Rainfall=7.10"

Area (sf)	CN	Description
77,650	30	Woods, Good, HSG A
77,650		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0350	0.08		**Sheet Flow, Field**
					Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	41	0.0350	1.31		**Shallow Concentrated Flow, Field**
					Short Grass Pasture Kv= 7.0 fps
2.7	108	0.0090	0.66		**Shallow Concentrated Flow, Field**
					Short Grass Pasture Kv= 7.0 fps
9.6	336	0.0070	0.59		**Shallow Concentrated Flow, Field**
					Short Grass Pasture Kv= 7.0 fps
3.2	136	0.0100	0.70		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
26.0	671	Total			

Summary for Link 1L: Exist-Site

Inflow Area = 77,650 sf, 0.00% Impervious, Inflow Depth = 0.23" for 50-Year event
Inflow = 0.06 cfs @ 14.00 hrs, Volume= 1,487 cf
Primary = 0.06 cfs @ 14.00 hrs, Volume= 1,487 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs

Time span=5.00-30.00 hrs, dt=0.04 hrs, 626 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: Exist-Site Runoff Area=77,650 sf 0.00% Impervious Runoff Depth=0.49"
Flow Length=671' Tc=26.0 min CN=30 Runoff=0.21 cfs 3,168 cf

Link 1L: Exist-Site Inflow=0.21 cfs 3,168 cf
Primary=0.21 cfs 3,168 cf

Total Runoff Area = 77,650 sf Runoff Volume = 3,168 cf Average Runoff Depth = 0.49"
100.00% Pervious = 77,650 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 1S: Exist-Site

Runoff = 0.21 cfs @ 12.70 hrs, Volume= 3,168 cf, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-Year Rainfall=8.30"

Area (sf)	CN	Description
77,650	30	Woods, Good, HSG A
77,650		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.0	50	0.0350	0.08		**Sheet Flow, Field**
					Woods: Light underbrush n= 0.400 P2= 3.10"
0.5	41	0.0350	1.31		**Shallow Concentrated Flow, Field**
					Short Grass Pasture Kv= 7.0 fps
2.7	108	0.0090	0.66		**Shallow Concentrated Flow, Field**
					Short Grass Pasture Kv= 7.0 fps
9.6	336	0.0070	0.59		**Shallow Concentrated Flow, Field**
					Short Grass Pasture Kv= 7.0 fps
3.2	136	0.0100	0.70		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
26.0	671	Total			

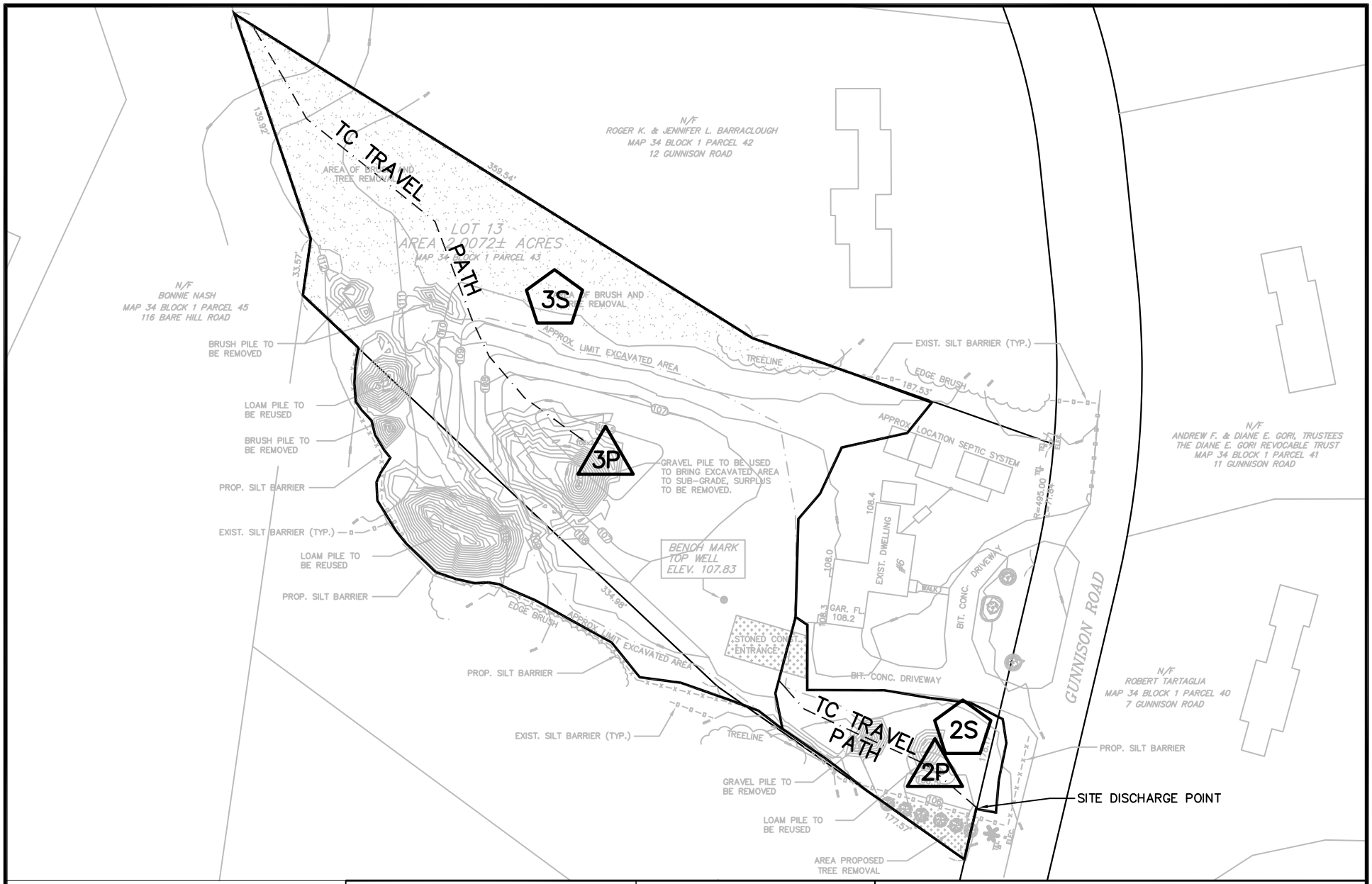
Summary for Link 1L: Exist-Site

Inflow Area = 77,650 sf, 0.00% Impervious, Inflow Depth = 0.49" for 100-Year event
Inflow = 0.21 cfs @ 12.70 hrs, Volume= 3,168 cf
Primary = 0.21 cfs @ 12.70 hrs, Volume= 3,168 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs

Appendix B

Post-Development Calculations



DATE: FEBRUARY 6, 2021 | SCALE 1"=80'

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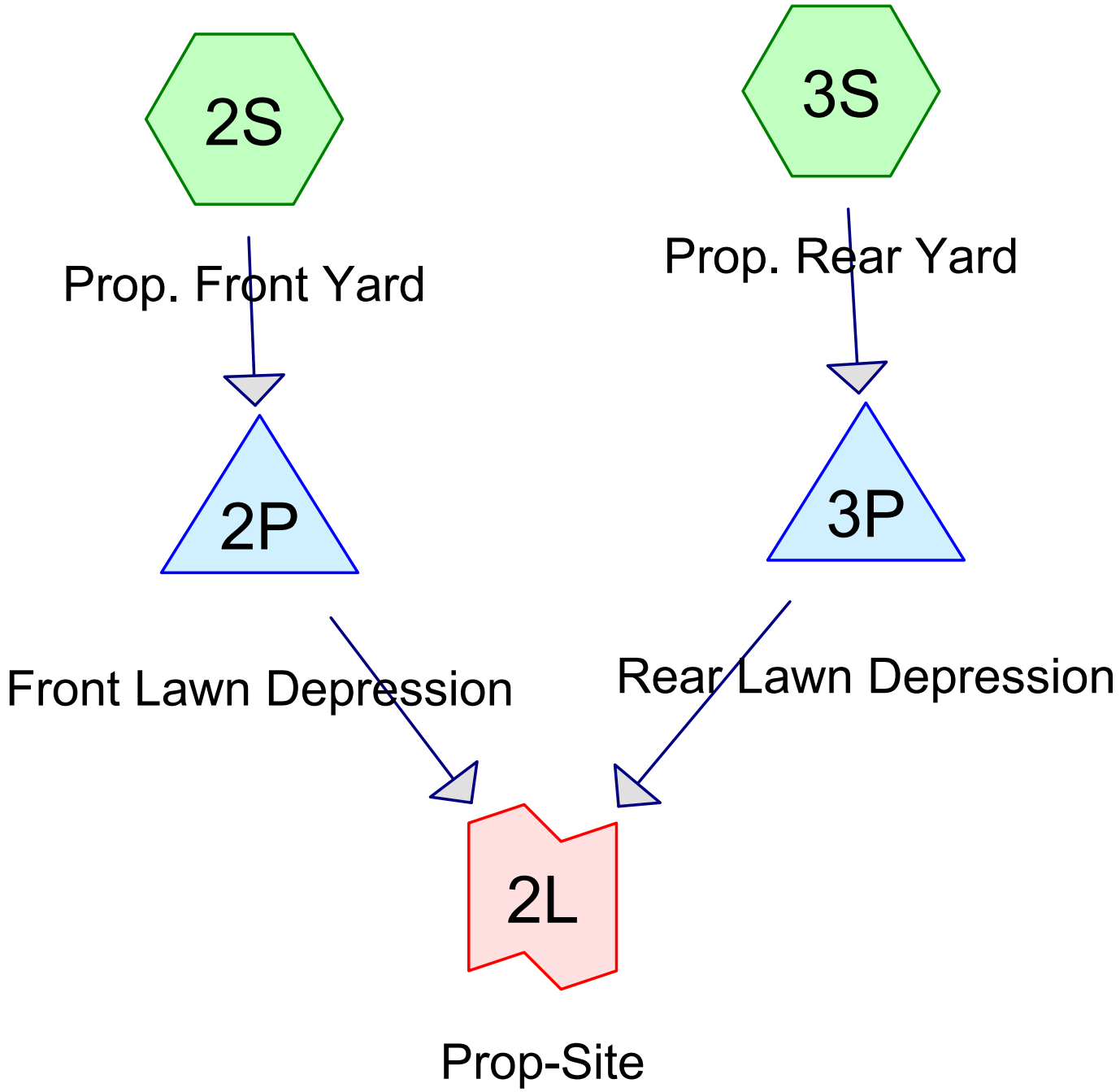
POST-DEVELOPMENT WATERSHED
6 GUNNISON ROAD
BOXFORD, MASSACHUSETTS



Subcat Reach Pond Link

Routing Diagram for 6 Gunnison
Prepared by George J. Zambouras, P.E., Printed 2/6/2021

Area Listing (selected nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
77,650	39	>75% Grass cover, Good, HSG A (2S, 3S)
77,650	**39**	**TOTAL AREA**

Time span=5.00-30.00 hrs, dt=0.04 hrs, 626 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 2S: Prop. Front Yard Runoff Area=8,244 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=103' Tc=9.9 min CN=39 Runoff=0.00 cfs 0 cf

Subcatchment 3S: Prop. Rear Yard Runoff Area=69,406 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=322' Tc=9.7 min CN=39 Runoff=0.00 cfs 0 cf

Pond 2P: Front Lawn Depression Peak Elev=106.00' Storage=0 cf Inflow=0.00 cfs 0 cf
Discarded=0.00 cfs 0 cf Primary=0.00 cfs 0 cf Outflow=0.00 cfs 0 cf

Pond 3P: Rear Lawn Depression Peak Elev=106.25' Storage=0 cf Inflow=0.00 cfs 0 cf
Discarded=0.00 cfs 0 cf Primary=0.00 cfs 0 cf Outflow=0.00 cfs 0 cf

Link 2L: Prop-Site Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Total Runoff Area = 77,650 sf Runoff Volume = 0 cf Average Runoff Depth = 0.00"
100.00% Pervious = 77,650 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 2S: Prop. Front Yard

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
8,244	39	>75% Grass cover, Good, HSG A
8,244		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	50	0.0160	0.09		**Sheet Flow, Lawn**
					Grass: Dense n= 0.240 P2= 3.10"
0.8	53	0.0250	1.11		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
9.9	103	Total			

Summary for Subcatchment 3S: Prop. Rear Yard

Runoff = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs
Type III 24-hr 2-Year Rainfall=3.10"

Area (sf)	CN	Description
69,406	39	>75% Grass cover, Good, HSG A
69,406		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0350	0.18		**Sheet Flow, Field**
					Grass: Short n= 0.150 P2= 3.10"
0.5	41	0.0350	1.31		**Shallow Concentrated Flow, Field**
					Short Grass Pasture Kv= 7.0 fps
2.7	108	0.0090	0.66		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
0.7	62	0.0450	1.48		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
1.2	61	0.0150	0.86		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
9.7	322	Total			

Summary for Pond 2P: Front Lawn Depression

Inflow Area = 8,244 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 5.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 106.00' @ 5.00 hrs Surf.Area= 70 sf Storage= 0 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	106.00'	106 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
106.00	70	35.0	0	0	70
106.50	400	75.0	106	106	421

Device	Routing	Invert	Outlet Devices
#1	Discarded	106.00'	**2.410 in/hr Exfiltration over Wetted area**
#2	Primary	106.40'	**8.0' long x 0.5' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.00 cfs @ 5.00 hrs HW=106.00' (Free Discharge)
↑—**1=Exfiltration** (Passes 0.00 cfs of 0.00 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=106.00' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 3P: Rear Lawn Depression

Inflow Area = 69,406 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 5.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs
Peak Elev= 106.25' @ 5.00 hrs Surf.Area= 67 sf Storage= 0 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	106.25'	2,768 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
106.25	67	40.0	0	0	67
106.50	1,880	192.0	192	192	2,873
107.00	9,380	393.0	2,577	2,768	12,232

Device	Routing	Invert	Outlet Devices
#1	Discarded	106.25'	**2.410 in/hr Exfiltration over Wetted area**
#2	Primary	106.90'	**10.0' long x 0.5' breadth Simulation-Broad-Weir-For-Calculations**
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.00 cfs @ 5.00 hrs HW=106.25' (Free Discharge)
↑—**1=Exfiltration** (Passes 0.00 cfs of 0.00 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=106.25' (Free Discharge)
↑—**2=Simulation-Broad-Weir-For-Calculations** (Controls 0.00 cfs)

Summary for Link 2L: Prop-Site

Inflow Area = 77,650 sf, 0.00% Impervious, Inflow Depth = 0.00" for 2-Year event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs

Time span=5.00-30.00 hrs, dt=0.04 hrs, 626 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 2S: Prop. Front Yard Runoff Area=8,244 sf 0.00% Impervious Runoff Depth=0.14"
Flow Length=103' Tc=9.9 min CN=39 Runoff=0.00 cfs 99 cf

Subcatchment 3S: Prop. Rear Yard Runoff Area=69,406 sf 0.00% Impervious Runoff Depth=0.14"
Flow Length=322' Tc=9.7 min CN=39 Runoff=0.03 cfs 830 cf

Pond 2P: Front Lawn Depression Peak Elev=106.00' Storage=0 cf Inflow=0.00 cfs 99 cf
Discarded=0.00 cfs 99 cf Primary=0.00 cfs 0 cf Outflow=0.00 cfs 99 cf

Pond 3P: Rear Lawn Depression Peak Elev=106.33' Storage=16 cf Inflow=0.03 cfs 830 cf
Discarded=0.03 cfs 830 cf Primary=0.00 cfs 0 cf Outflow=0.03 cfs 830 cf

Link 2L: Prop-Site Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Total Runoff Area = 77,650 sf Runoff Volume = 929 cf Average Runoff Depth = 0.14"
100.00% Pervious = 77,650 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 2S: Prop. Front Yard

Runoff = 0.00 cfs @ 13.82 hrs, Volume= 99 cf, Depth= 0.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
8,244	39	>75% Grass cover, Good, HSG A
8,244		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	50	0.0160	0.09		**Sheet Flow, Lawn**
					Grass: Dense n= 0.240 P2= 3.10"
0.8	53	0.0250	1.11		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
9.9	103	Total			

Summary for Subcatchment 3S: Prop. Rear Yard

Runoff = 0.03 cfs @ 13.82 hrs, Volume= 830 cf, Depth= 0.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs
Type III 24-hr 10-Year Rainfall=4.70"

Area (sf)	CN	Description
69,406	39	>75% Grass cover, Good, HSG A
69,406		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0350	0.18		**Sheet Flow, Field**
					Grass: Short n= 0.150 P2= 3.10"
0.5	41	0.0350	1.31		**Shallow Concentrated Flow, Field**
					Short Grass Pasture Kv= 7.0 fps
2.7	108	0.0090	0.66		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
0.7	62	0.0450	1.48		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
1.2	61	0.0150	0.86		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
9.7	322	Total			

Summary for Pond 2P: Front Lawn Depression

Inflow Area = 8,244 sf, 0.00% Impervious, Inflow Depth = 0.14" for 10-Year event
Inflow = 0.00 cfs @ 13.82 hrs, Volume= 99 cf
Outflow = 0.00 cfs @ 13.85 hrs, Volume= 99 cf, Atten= 0%, Lag= 1.4 min
Discarded = 0.00 cfs @ 13.85 hrs, Volume= 99 cf
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 106.00' @ 13.85 hrs Surf.Area= 72 sf Storage= 0 cf

Plug-Flow detention time= 1.5 min calculated for 99 cf (100% of inflow)
Center-of-Mass det. time= 1.5 min (1,039.3 - 1,037.8)

Volume	Invert	Avail.Storage	Storage Description
#1	106.00'	106 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
106.00	70	35.0	0	0	70
106.50	400	75.0	106	106	421

Device	Routing	Invert	Outlet Devices
#1	Discarded	106.00'	**2.410 in/hr Exfiltration over Wetted area**
#2	Primary	106.40'	**8.0' long x 0.5' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.00 cfs @ 13.85 hrs HW=106.00' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.00 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=106.00' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond 3P: Rear Lawn Depression

Inflow Area = 69,406 sf, 0.00% Impervious, Inflow Depth = 0.14" for 10-Year event
Inflow = 0.03 cfs @ 13.82 hrs, Volume= 830 cf
Outflow = 0.03 cfs @ 14.03 hrs, Volume= 830 cf, Atten= 1%, Lag= 12.6 min
Discarded = 0.03 cfs @ 14.03 hrs, Volume= 830 cf
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs
Peak Elev= 106.33' @ 14.03 hrs Surf.Area= 370 sf Storage= 16 cf

Plug-Flow detention time= 6.8 min calculated for 829 cf (100% of inflow)
Center-of-Mass det. time= 6.8 min (1,044.4 - 1,037.6)

Volume	Invert	Avail.Storage	Storage Description
#1	106.25'	2,768 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
106.25	67	40.0	0	0	67
106.50	1,880	192.0	192	192	2,873
107.00	9,380	393.0	2,577	2,768	12,232

Device	Routing	Invert	Outlet Devices
#1	Discarded	106.25'	**2.410 in/hr Exfiltration over Wetted area**
#2	Primary	106.90'	**10.0' long x 0.5' breadth Simulation-Broad-Weir-For-Calculations**
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.03 cfs @ 14.03 hrs HW=106.33' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.03 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=106.25' (Free Discharge)
↑**2=Simulation-Broad-Weir-For-Calculations** (Controls 0.00 cfs)

Summary for Link 2L: Prop-Site

Inflow Area = 77,650 sf, 0.00% Impervious, Inflow Depth = 0.00" for 10-Year event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs

Time span=5.00-30.00 hrs, dt=0.04 hrs, 626 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 2S: Prop. Front Yard Runoff Area=8,244 sf 0.00% Impervious Runoff Depth=0.39"
Flow Length=103' Tc=9.9 min CN=39 Runoff=0.03 cfs 268 cf

Subcatchment 3S: Prop. Rear Yard Runoff Area=69,406 sf 0.00% Impervious Runoff Depth=0.39"
Flow Length=322' Tc=9.7 min CN=39 Runoff=0.22 cfs 2,255 cf

Pond 2P: Front Lawn Depression Peak Elev=106.23' Storage=29 cf Inflow=0.03 cfs 268 cf
Discarded=0.01 cfs 268 cf Primary=0.00 cfs 0 cf Outflow=0.01 cfs 268 cf

Pond 3P: Rear Lawn Depression Peak Elev=106.47' Storage=149 cf Inflow=0.22 cfs 2,255 cf
Discarded=0.14 cfs 2,255 cf Primary=0.00 cfs 0 cf Outflow=0.14 cfs 2,255 cf

Link 2L: Prop-Site Inflow=0.00 cfs 0 cf
Primary=0.00 cfs 0 cf

Total Runoff Area = 77,650 sf Runoff Volume = 2,522 cf Average Runoff Depth = 0.39"
100.00% Pervious = 77,650 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 2S: Prop. Front Yard

Runoff = 0.03 cfs @ 12.43 hrs, Volume= 268 cf, Depth= 0.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-Year Rainfall=5.80"

Area (sf)	CN	Description
8,244	39	>75% Grass cover, Good, HSG A
8,244		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	50	0.0160	0.09		**Sheet Flow, Lawn**
					Grass: Dense n= 0.240 P2= 3.10"
0.8	53	0.0250	1.11		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
9.9	103	Total			

Summary for Subcatchment 3S: Prop. Rear Yard

Runoff = 0.22 cfs @ 12.42 hrs, Volume= 2,255 cf, Depth= 0.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs
Type III 24-hr 25-Year Rainfall=5.80"

Area (sf)	CN	Description
69,406	39	>75% Grass cover, Good, HSG A
69,406		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0350	0.18		**Sheet Flow, Field**
					Grass: Short n= 0.150 P2= 3.10"
0.5	41	0.0350	1.31		**Shallow Concentrated Flow, Field**
					Short Grass Pasture Kv= 7.0 fps
2.7	108	0.0090	0.66		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
0.7	62	0.0450	1.48		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
1.2	61	0.0150	0.86		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
9.7	322	Total			

Summary for Pond 2P: Front Lawn Depression

Inflow Area = 8,244 sf, 0.00% Impervious, Inflow Depth = 0.39" for 25-Year event
Inflow = 0.03 cfs @ 12.43 hrs, Volume= 268 cf
Outflow = 0.01 cfs @ 13.38 hrs, Volume= 268 cf, Atten= 57%, Lag= 57.1 min
Discarded = 0.01 cfs @ 13.38 hrs, Volume= 268 cf
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 106.23' @ 13.38 hrs Surf.Area= 188 sf Storage= 29 cf

Plug-Flow detention time= 25.7 min calculated for 267 cf (100% of inflow)
Center-of-Mass det. time= 25.6 min (996.6 - 970.9)

Volume	Invert	Avail.Storage	Storage Description
#1	106.00'	106 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
106.00	70	35.0	0	0	70
106.50	400	75.0	106	106	421

Device	Routing	Invert	Outlet Devices
#1	Discarded	106.00'	**2.410 in/hr Exfiltration over Wetted area**
#2	Primary	106.40'	**8.0' long x 0.5' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.01 cfs @ 13.38 hrs HW=106.23' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.01 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=106.00' (Free Discharge)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond 3P: Rear Lawn Depression

Inflow Area = 69,406 sf, 0.00% Impervious, Inflow Depth = 0.39" for 25-Year event
Inflow = 0.22 cfs @ 12.42 hrs, Volume= 2,255 cf
Outflow = 0.14 cfs @ 12.67 hrs, Volume= 2,255 cf, Atten= 38%, Lag= 15.0 min
Discarded = 0.14 cfs @ 12.67 hrs, Volume= 2,255 cf
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs
Peak Elev= 106.47' @ 12.67 hrs Surf.Area= 1,587 sf Storage= 149 cf

Plug-Flow detention time= 12.5 min calculated for 2,255 cf (100% of inflow)
Center-of-Mass det. time= 12.5 min (983.3 - 970.7)

Volume	Invert	Avail.Storage	Storage Description
#1	106.25'	2,768 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
106.25	67	40.0	0	0	67
106.50	1,880	192.0	192	192	2,873
107.00	9,380	393.0	2,577	2,768	12,232

Device	Routing	Invert	Outlet Devices
#1	Discarded	106.25'	**2.410 in/hr Exfiltration over Wetted area**
#2	Primary	106.90'	**10.0' long x 0.5' breadth Simulation-Broad-Weir-For-Calculations**
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.14 cfs @ 12.67 hrs HW=106.47' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.14 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=106.25' (Free Discharge)
2=Simulation-Broad-Weir-For-Calculations (Controls 0.00 cfs)

Summary for Link 2L: Prop-Site

Inflow Area = 77,650 sf, 0.00% Impervious, Inflow Depth = 0.00" for 25-Year event
Inflow = 0.00 cfs @ 5.00 hrs, Volume= 0 cf
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs

Time span=5.00-30.00 hrs, dt=0.04 hrs, 626 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 2S: Prop. Front Yard Runoff Area=8,244 sf 0.00% Impervious Runoff Depth=0.80"
Flow Length=103' Tc=9.9 min CN=39 Runoff=0.08 cfs 553 cf

Subcatchment 3S: Prop. Rear Yard Runoff Area=69,406 sf 0.00% Impervious Runoff Depth=0.80"
Flow Length=322' Tc=9.7 min CN=39 Runoff=0.66 cfs 4,652 cf

Pond 2P: Front Lawn Depression Peak Elev=106.42' Storage=76 cf Inflow=0.08 cfs 553 cf
Discarded=0.02 cfs 495 cf Primary=0.05 cfs 58 cf Outflow=0.06 cfs 553 cf

Pond 3P: Rear Lawn Depression Peak Elev=106.67' Storage=671 cf Inflow=0.66 cfs 4,652 cf
Discarded=0.30 cfs 4,652 cf Primary=0.00 cfs 0 cf Outflow=0.30 cfs 4,652 cf

Link 2L: Prop-Site Inflow=0.05 cfs 58 cf
Primary=0.05 cfs 58 cf

Total Runoff Area = 77,650 sf Runoff Volume = 5,205 cf Average Runoff Depth = 0.80"
100.00% Pervious = 77,650 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 2S: Prop. Front Yard

Runoff = 0.08 cfs @ 12.25 hrs, Volume= 553 cf, Depth= 0.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs
Type III 24-hr 50-Year Rainfall=7.10"

Area (sf)	CN	Description
8,244	39	>75% Grass cover, Good, HSG A
8,244		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	50	0.0160	0.09		**Sheet Flow, Lawn**
					Grass: Dense n= 0.240 P2= 3.10"
0.8	53	0.0250	1.11		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
9.9	103	Total			

Summary for Subcatchment 3S: Prop. Rear Yard

Runoff = 0.66 cfs @ 12.24 hrs, Volume= 4,652 cf, Depth= 0.80"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs
Type III 24-hr 50-Year Rainfall=7.10"

Area (sf)	CN	Description
69,406	39	>75% Grass cover, Good, HSG A
69,406		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0350	0.18		**Sheet Flow, Field**
					Grass: Short n= 0.150 P2= 3.10"
0.5	41	0.0350	1.31		**Shallow Concentrated Flow, Field**
					Short Grass Pasture Kv= 7.0 fps
2.7	108	0.0090	0.66		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
0.7	62	0.0450	1.48		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
1.2	61	0.0150	0.86		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
9.7	322	Total			

Summary for Pond 2P: Front Lawn Depression

Inflow Area = 8,244 sf, 0.00% Impervious, Inflow Depth = 0.80" for 50-Year event
Inflow = 0.08 cfs @ 12.25 hrs, Volume= 553 cf
Outflow = 0.06 cfs @ 12.49 hrs, Volume= 553 cf, Atten= 18%, Lag= 14.6 min
Discarded = 0.02 cfs @ 12.49 hrs, Volume= 495 cf
Primary = 0.05 cfs @ 12.49 hrs, Volume= 58 cf

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 106.42' @ 12.49 hrs Surf.Area= 326 sf Storage= 76 cf

Plug-Flow detention time= 42.6 min calculated for 552 cf (100% of inflow)
Center-of-Mass det. time= 42.8 min (975.0 - 932.2)

Volume	Invert	Avail.Storage	Storage Description
#1	106.00'	106 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
106.00	70	35.0	0	0	70
106.50	400	75.0	106	106	421

Device	Routing	Invert	Outlet Devices
#1	Discarded	106.00'	**2.410 in/hr Exfiltration over Wetted area**
#2	Primary	106.40'	**8.0' long x 0.5' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.02 cfs @ 12.49 hrs HW=106.42' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.04 cfs @ 12.49 hrs HW=106.42' (Free Discharge)
↑**2=Broad-Crested Rectangular Weir** (Weir Controls 0.04 cfs @ 0.35 fps)

Summary for Pond 3P: Rear Lawn Depression

Inflow Area = 69,406 sf, 0.00% Impervious, Inflow Depth = 0.80" for 50-Year event
Inflow = 0.66 cfs @ 12.24 hrs, Volume= 4,652 cf
Outflow = 0.30 cfs @ 12.68 hrs, Volume= 4,652 cf, Atten= 55%, Lag= 26.2 min
Discarded = 0.30 cfs @ 12.68 hrs, Volume= 4,652 cf
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs
Peak Elev= 106.67' @ 12.68 hrs Surf.Area= 3,812 sf Storage= 671 cf

Plug-Flow detention time= 22.5 min calculated for 4,645 cf (100% of inflow)
Center-of-Mass det. time= 22.4 min (954.4 - 932.0)

Volume	Invert	Avail.Storage	Storage Description
#1	106.25'	2,768 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
106.25	67	40.0	0	0	67
106.50	1,880	192.0	192	192	2,873
107.00	9,380	393.0	2,577	2,768	12,232

Device	Routing	Invert	Outlet Devices
#1	Discarded	106.25'	**2.410 in/hr Exfiltration over Wetted area**
#2	Primary	106.90'	**10.0' long x 0.5' breadth Simulation-Broad-Weir-For-Calculations**
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.30 cfs @ 12.68 hrs HW=106.67' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.30 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=106.25' (Free Discharge)
↑**2=Simulation-Broad-Weir-For-Calculations** (Controls 0.00 cfs)

Summary for Link 2L: Prop-Site

Inflow Area = 77,650 sf, 0.00% Impervious, Inflow Depth = 0.01" for 50-Year event
Inflow = 0.05 cfs @ 12.49 hrs, Volume= 58 cf
Primary = 0.05 cfs @ 12.49 hrs, Volume= 58 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs

Time span=5.00-30.00 hrs, dt=0.04 hrs, 626 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 2S: Prop. Front Yard Runoff Area=8,244 sf 0.00% Impervious Runoff Depth=1.29"
Flow Length=103' Tc=9.9 min CN=39 Runoff=0.17 cfs 883 cf

Subcatchment 3S: Prop. Rear Yard Runoff Area=69,406 sf 0.00% Impervious Runoff Depth=1.29"
Flow Length=322' Tc=9.7 min CN=39 Runoff=1.43 cfs 7,433 cf

Pond 2P: Front Lawn Depression Peak Elev=106.43' Storage=81 cf Inflow=0.17 cfs 883 cf
Discarded=0.02 cfs 610 cf Primary=0.13 cfs 271 cf Outflow=0.15 cfs 881 cf

Pond 3P: Rear Lawn Depression Peak Elev=106.84' Storage=1,494 cf Inflow=1.43 cfs 7,433 cf
Discarded=0.47 cfs 7,433 cf Primary=0.00 cfs 0 cf Outflow=0.47 cfs 7,433 cf

Link 2L: Prop-Site Inflow=0.13 cfs 271 cf
Primary=0.13 cfs 271 cf

Total Runoff Area = 77,650 sf Runoff Volume = 8,316 cf Average Runoff Depth = 1.29"
100.00% Pervious = 77,650 sf 0.00% Impervious = 0 sf

Summary for Subcatchment 2S: Prop. Front Yard

Runoff = 0.17 cfs @ 12.18 hrs, Volume= 883 cf, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-Year Rainfall=8.30"

Area (sf)	CN	Description
8,244	39	>75% Grass cover, Good, HSG A
8,244		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.1	50	0.0160	0.09		**Sheet Flow, Lawn**
					Grass: Dense n= 0.240 P2= 3.10"
0.8	53	0.0250	1.11		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
9.9	103	Total			

Summary for Subcatchment 3S: Prop. Rear Yard

Runoff = 1.43 cfs @ 12.18 hrs, Volume= 7,433 cf, Depth= 1.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs
Type III 24-hr 100-Year Rainfall=8.30"

Area (sf)	CN	Description
69,406	39	>75% Grass cover, Good, HSG A
69,406		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.6	50	0.0350	0.18		**Sheet Flow, Field**
					Grass: Short n= 0.150 P2= 3.10"
0.5	41	0.0350	1.31		**Shallow Concentrated Flow, Field**
					Short Grass Pasture Kv= 7.0 fps
2.7	108	0.0090	0.66		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
0.7	62	0.0450	1.48		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
1.2	61	0.0150	0.86		**Shallow Concentrated Flow, Lawn**
					Short Grass Pasture Kv= 7.0 fps
9.7	322	Total			

Summary for Pond 2P: Front Lawn Depression

Inflow Area = 8,244 sf, 0.00% Impervious, Inflow Depth = 1.29" for 100-Year event
Inflow = 0.17 cfs @ 12.18 hrs, Volume= 883 cf
Outflow = 0.15 cfs @ 12.26 hrs, Volume= 881 cf, Atten= 10%, Lag= 5.0 min
Discarded = 0.02 cfs @ 12.26 hrs, Volume= 610 cf
Primary = 0.13 cfs @ 12.26 hrs, Volume= 271 cf

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs / 2
Peak Elev= 106.43' @ 12.26 hrs Surf.Area= 340 sf Storage= 81 cf

Plug-Flow detention time= 38.1 min calculated for 881 cf (100% of inflow)
Center-of-Mass det. time= 37.2 min (948.4 - 911.2)

Volume	Invert	Avail.Storage	Storage Description
#1	106.00'	106 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
106.00	70	35.0	0	0	70
106.50	400	75.0	106	106	421

Device	Routing	Invert	Outlet Devices
#1	Discarded	106.00'	**2.410 in/hr Exfiltration over Wetted area**
#2	Primary	106.40'	**8.0' long x 0.5' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.02 cfs @ 12.26 hrs HW=106.43' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.02 cfs)

Primary OutFlow Max=0.13 cfs @ 12.26 hrs HW=106.43' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.13 cfs @ 0.50 fps)

Summary for Pond 3P: Rear Lawn Depression

Inflow Area = 69,406 sf, 0.00% Impervious, Inflow Depth = 1.29" for 100-Year event
Inflow = 1.43 cfs @ 12.18 hrs, Volume= 7,433 cf
Outflow = 0.47 cfs @ 12.68 hrs, Volume= 7,433 cf, Atten= 67%, Lag= 30.3 min
Discarded = 0.47 cfs @ 12.68 hrs, Volume= 7,433 cf
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs
Peak Elev= 106.84' @ 12.68 hrs Surf.Area= 6,296 sf Storage= 1,494 cf

Plug-Flow detention time= 33.2 min calculated for 7,421 cf (100% of inflow)
Center-of-Mass det. time= 33.2 min (944.2 - 911.0)

Volume	Invert	Avail.Storage	Storage Description
#1	106.25'	2,768 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
106.25	67	40.0	0	0	67
106.50	1,880	192.0	192	192	2,873
107.00	9,380	393.0	2,577	2,768	12,232

Device	Routing	Invert	Outlet Devices
#1	Discarded	106.25'	**2.410 in/hr Exfiltration over Wetted area**
#2	Primary	106.90'	**10.0' long x 0.5' breadth Simulation-Broad-Weir-For-Calculations**
			Head (feet) 0.20 0.40 0.60 0.80 1.00
			Coef. (English) 2.80 2.92 3.08 3.30 3.32

Discarded OutFlow Max=0.47 cfs @ 12.68 hrs HW=106.84' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 0.47 cfs)

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=106.25' (Free Discharge)
↑—**2=Simulation-Broad-Weir-For-Calculations** (Controls 0.00 cfs)

Summary for Link 2L: Prop-Site

Inflow Area = 77,650 sf, 0.00% Impervious, Inflow Depth = 0.04" for 100-Year event
Inflow = 0.13 cfs @ 12.26 hrs, Volume= 271 cf
Primary = 0.13 cfs @ 12.26 hrs, Volume= 271 cf, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-30.00 hrs, dt= 0.04 hrs

Appendix C

Construction - Stormwater Pollution Prevention Plan

Construction - Stormwater

Pollution Prevention, Erosion and Sedimentation Control Plan

for

Site Regrading

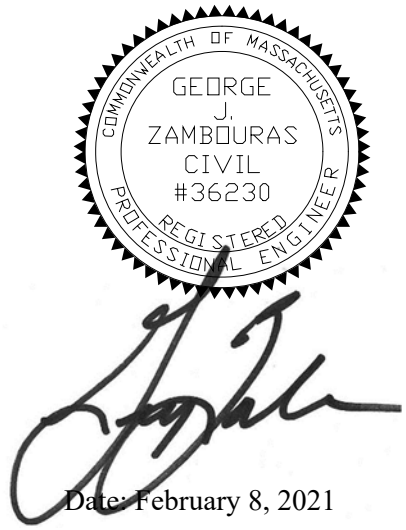
located at

6 Gunnison Road

Boxford, Massachusetts 01921

Prepared For

Michael Cogley & Alissa Stuckey
6 Gunnison Road
Boxford, MA 01921



Date: February 8, 2021

Atlantic Engineering & Survey Consultants Inc.
97 Tenney Street, Georgetown, Massachusetts 01833
(978) 352-7870

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Stormwater Pollution Prevention Plan

Site: Site Regrading
6 Gunnison Road
Boxford, MA 01921

Owner: Michael Cogley & Alissa Stuckey
6 Gunnison Road
Boxford, MA 01921
Tel. No.
Email: cogleymike@yahoo.com

Operator - To Be Determined
Name:
Tel. No.
Email:

Preparation Date:

February 8, 2021

CONSTRUCTION PERIOD STORMWATER POLLUTION PREVENTION, EROSION AND SEDIMENTATION CONTROL PLAN

SECTION 1 – INTRODUCTION

The project consists of the completion of site grading and site restoration at 6 Gunnison Road in Boxford MA. The site is a 2-acre parcel located on the westerly side of Gunnison Road approximately 400 feet north of the intersection of Gunnison Road and Bare Hill Road. The project is to complete the land clearing and site regrading project initially started during 2020 at which time the owner was unaware permitting was required based on the area of disturbance to occur within the site.

The remaining work proposed to complete the project and restore the site includes additional tree and brush removal and disposal, site grading, removal of surplus gravel, removal of brush piles, loam, and seed.

As part of this project, this "Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan" has been created to ensure that the project will prevent sediment transport; protect resource areas, drinking water and surface waters; and ensure that no disturbance to public safety or surrounding properties occurs during the construction of the project.

SECTION 2 – CONSTRUCTION PERIOD POLLUTION PREVENTION MEASURES

Best Management Practices (BMPs) will be utilized as Construction Period Pollution Prevention Measures to reduce potential pollutants and prevent any off-site discharge. The objectives of the BMPs for construction activity are to minimize the disturbed areas, stabilize any disturbed areas, control the site perimeter, and retain sediment. Both erosion and sedimentation controls and non-stormwater best management measures will be used to minimize site disturbance and ensure compliance with the Town of Boxford's stormwater regulations. Measures will be taken to minimize the area disturbed by construction activities to reduce the potential for soil erosion and stormwater pollution problems. In addition, good housekeeping measures will be followed for the day-to-day operation of the construction site under the control of the contractor to minimize the impact of construction. This section describes the control practices that will be in place during construction activities. All recommended control practices will comply with the standards set in the MassDEP Stormwater Handbook.

2.1 Minimize Disturbed Area and Protect Natural Features and Soil

To minimize disturbed areas, all work will be completed within defined work limits. These work limits are shown on the site plans included with this submission. The Contractor will be responsible to make sure that all workers know the proper work limits and do not extend their work outside the limits of work or into abutting properties. The protective measures to ensure this protection are described in more detail in the following sections.

2.2 Control Stormwater Flowing onto and through the project

The Contractor will be required to install compost mulch filter tubes along the perimeter of the work area as shown on the plans.

2.3 Stabilize Soils

The Contractor shall limit the area of land which is exposed and free from vegetation during the project. Disturbed soils outside of active work areas that will be exposed for longer than two weeks shall be stabilized to prevent erosion and the transport of sedimentation to off-site areas.

Stabilization of surfaces shall be an ongoing process. Stabilization of surfaces includes the placement of hay, mulch and the establishment of vegetated surfaces. Upon the completion of construction, all surfaces shall be stabilized.

2.4 Proper storage and cover of material stockpiles

The location of the Contractor's storage areas for equipment and/or materials shall be upon cleared portions of the job site. Earth product stockpiles shall be consolidated and placed within the rear of the site at locations where sediments will not be transported off-site when possible.

Adequate measures for erosion and sediment control, such as the placement of compost mulch filter tubes around the downstream perimeter of stockpiles, shall be employed to protect any downstream off-site areas from sediments, as necessary.

2.5 Perimeter Controls and Sediment Barriers

Erosion control lines as described in Section 5 will be utilized to ensure that no sedimentation occurs outside the perimeter of the work area.

2.6 Storm Drain Inlet Protection

Storm drain inlet protection is not required as no catch basin or drainage system is proposed or located within or adjacent to the site.

2.7 Retain Sediment On-Site

The Contractor will be responsible to monitor all erosion control measures. Whenever necessary, the Contractor will clear all sediment from the compost mulch filter tubes. Daily monitoring should be conducted using the attached Inspection Form.

2.8 Tree Cutting and Brush Clearing

Erosion control devices shall be in place as shown on the plans before tree cutting and brush clearing commences. As the clearing process continues, the movement of vehicles shall be limited, as much as possible, to the area of work

All timber and cord wood shall be used for its value; consideration shall be given to chipping of brush and branches that generate wood chip mulch for the use in stabilization of disturbed surfaces. No spoil (e.g., tree stumps or brush) shall be disposed of by burying.
It is planned that excess brush is to be burned on site under an existing burning permit issued by the Boxford Fire Department. All brush burned on site shall be in accordance with the applicable regulations of the permit.

2.10 Dust Control and Mud Control

The contractor shall provide positive controls to minimize raising dust from construction activities on this site. Dust should be held at a minimum by sprinkling exposed soil with an appropriate amount of water. The contractor shall provide daily positive controls to prevent mud and dirt from leaving the site on equipment tires. The stone construction apron shall be used by all vehicles and shall be maintained or replaced in kind to prevent mud accumulation and the transport of sediments off the site.

2.11 Waste Management

Designated waste collection areas shall be established at locations convenient to site workers. Receptacles shall be of adequate capacity to hold waste accumulated between collection times. Receptacles shall be covered or otherwise protected from precipitation.

2.12 Fertilizers

Application of fertilizer shall be limited to minimum required area and amount. More frequent, lower applications are preferable to infrequent high application rates. After application, fertilizer shall be worked into the soil where feasible.

2.13 Proper Equipment/Vehicle Fueling and Maintenance Practices

On-site vehicles will be monitored for leaks and receive regular preventative maintenance to reduce the risk of leakage. Regular fueling and service of the equipment may be performed using approved methods and with care taken to minimize chance of spills. Any petroleum products will be stored in tightly sealed containers that are clearly labeled. Repair of equipment, except for necessary emergency repairs shall not be permitted on-site.

2.14 Equipment/Vehicle Washing

The Contractor will be responsible to ensure that no equipment is washed on-site except to remove sediments prior to transport from the site.

SECTION 3 – SPILL PREVENTION AND CONTROL PLAN

The Contractor will be responsible for preventing spills in accordance with the project specifications and applicable federal, state, and local regulations. The Contractor will identify a properly trained site employee, involved with the day-to-day site operations to be the spill prevention and cleanup coordinator.
The name(s) of the responsible spill personnel will be posted on-site. Each employee will be instructed that all spills are to be reported to the spill prevention and cleanup coordinator.

3.1 Spill Control Equipment

Spill control/containment equipment will be kept in the Work Area. Materials and equipment necessary for spill cleanup will be kept either in the Work Area or in an otherwise accessible on-site location. Equipment and materials will include, but not be limited to, absorbent booms/mats, brooms, dust pans, mops, rags, gloves, goggles, sand, plastic, and metal containers specifically for this purpose. It is the responsibility of the Contractor to ensure the inventory will be readily accessible and maintained.

3.2 Notification

All workers will be directed to inform the on-site supervisor of a spill event. The supervisor will assess the incident and initiate proper containment and response procedures immediately upon notification. Workers should avoid direct contact with spilled materials during the containment procedures. Primary notification of a spill should be made to the local Fire Department and Police Departments. Secondary Notification will be to the certified cleanup contractor if deemed necessary by Fire and/or Police personnel. The third level of notification is to the DEP. The specific cleanup contractor to be used will be identified by the Contractor prior to commencement of construction activities.

3.3 Spill Containment and Clean-Up Measures

Spills will be contained with granular sorbent material, sand, sorbent pads, booms, or all of the above to prevent spreading. Certified cleanup contractors should complete spill cleanup. The material manufacturer’s recommended methods for spill cleanup will be clearly posted and on-site personnel will be made aware of the procedures and the location of the information and cleanup supplies.

3.4 Hazardous Materials Spill Report

The Contractor will report and record any spill. The spill report will present a description of the release, including the quantity and type of material, date of the spill, circumstances leading to the release, location of spill, response actions and personnel, documentation of notifications and corrective measures implemented to prevent reoccurrence.

This document does not relieve the Contractor of the Federal reporting requirements of 40 CFR Part 110, 40 CFR Part 117, 40 CFR Part 302 and the State requirements specified under the Massachusetts Contingency Plan (M.C.P) relating to spills or other releases of oils or hazardous substances.

Where a release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity established under either 40 CFR Part 110, 40 CFR Part 117 or 40 CFR Part 302, occurs during a twenty-four (24) hour period, the Contractor is required to comply with the response requirements of the above-mentioned regulations. Spills of oil or hazardous material in excess of the reportable quantity will be reported to the National Response Center (NRC).

SECTION 4 – CONTACT INFORMATION / RESPONSIBLE PARTIES

Owner: Michael Cogley & Alissa Stuckey
6 Gunnison Road
Boxford, MA 01921
Tel. No.
Email: cogleymike@yahoo.com

Operator: TBD

Contractor: TBD

SECTION 5 – EROSION AND SEDIMENTATION CONTROL

The following Erosion and Sedimentation Control are required for the project. The details and layout of each control can be found in the attached plan set. Additional erosion and sedimentation controls shall be utilized, as necessary, to prevent the generation of erosion products based on site conditions.

5.1 Perimeter Controls

An erosion control barrier consisting of a staked silt sock shall be installed about the perimeter of project disturbance limits. An 8” silt sock will be installed in all areas identified to be furnished with a silt sock perimeter control.

5.2 Sediment Anti-Track Out Entrance

A stone anti-tracking area will be installed at the end of the existing driveway and serve as the sole access/egress of the site to Gunnison Road. The area shall be constructed of 2-inch crushed stone at depth of 6 inches, have a minimum length of fifty (50) feet and a width of fifteen (15) feet. The crushed stone will be placed over a layer of geotextile filter fabric to reduce the mitigation of sediment from the underlying soil.

5.3 Stockpiled Material Sediment Control

A sediment control barrier consisting of a staked silt sock or silt fence shall be installed along the down gradient perimeter of stockpiled materials, when stockpiled materials are upgradient of abutting properties.

SECTION 6 – SITE DEVELOPMENT PLAN

6.1 The Site Development Plan is included in the attached plan set.

6.2 Construction Schedule

The anticipated construction schedule and approximate timetable is as follows:

Install perimeter erosion controls and construction entrance	3 days
Tree and brush clearing	2 days
Tree and brush removal and disposal	3 days
Site grading	5 days
Removal of surplus material	2 days
Loam and seed	5 days

SECTION 7 – OPERATION AND MAINTENANCE OF EROSION CONTROL

The erosion control measures will be installed as detailed on the attached plan set. If there is a failure to the controls, the Contractor will be required to stop work until the failure is repaired. Periodically throughout the work sediments that has been deposited against the controls will be removed to ensure that the controls are working properly.

7.1 Silt Sock

Silt sock will be inspected weekly and after any major storm event. Damaged and/or deteriorated areas shall be repaired or replaced immediately. Accumulated sediment behind the silt sock shall be removed when the depth of the sediments has reached 3.25 inches for the 8" silt sock. Silt socks shall remain in place until all disturbed earth has been vegetated and the surrounding soil stabilized.

7.2 Sediment Anti-Track Out Entrance

The anti-tracking pad will be inspected weekly and after storm events or heavy use. All sediment tracked, spilled, or dropped onto the driveway or road will be removed by the end of the same business day. Removal of the rack-out sediments shall be by shoveling or sweeping.

7.3 Stockpiled Material Sediment Control

Silt sock or Silt fence will be inspected weekly and after any major storm event. Damaged and/or deteriorated areas shall be repaired or replaced immediately. The silt sock or silt fence shall remain in place until the stockpiled material has been used or removed.

SECTION 8 – INSPECTION MAINTENANCE AND CORRECTIVE ACTION OF EROSION CONTROL

During construction, the erosion and sedimentation controls will be inspected weekly and after major storm events. An Inspection Form is appended to this document.

Once the contractor is selected, an on-site inspector will be selected to ensure that all erosion and sedimentation controls are in place, working properly and repaired, as necessary.

The on-site individual conducting inspections must be considered a "qualified person." CGP Part 4.1 clarifies that a "qualified person" is a person knowledgeable in the principles and practices of erosion and sediment controls and pollution prevention, who possesses the appropriate skills and training to assess conditions at the construction site that could impact stormwater quality, and the appropriate skills and training to assess the effectiveness of any stormwater controls selected and installed to meet the requirements of this permit.

Inspection Form

Inspected By: _____ Date:_____ Time:_____

ITEM	YES	NO	DOES NOT APPLY
Do any erosion/siltation control measures require repair or clean out to maintain adequate function?			
Are any temporary soil stockpiles or construction materials located in non-approved areas?			
Are on-site construction traffic routes, parking, and storage of equipment and supplies located in areas not specifically designed for them?			
Is there any evidence that sediment is leaving the site and / or entering resource areas?			

Specific location, current weather conditions, and action to be taken:

_____

_____

_____

_____

_____

Other Comments:

_____

_____

Pending the actions noted above I certify that the site is in compliance with the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan.

Signature:_____ Date:_____

Appendix D

NRCS Soils Resource 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 Essex County, Massachusetts, Northern Part

6 Gunnison Road, Boxford MA

January 20, 2021

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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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: 1:1,150 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 Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
253A	Hinckley loamy sand, 0 to 3 percent slopes	2.1	99.5%
276A	Ninigret fine sandy loam, 0 to 3 percent slopes	0.0	0.5%
Totals for Area of Interest		**2.1**	**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.

Essex County, Massachusetts, Northern Part

253A—Hinckley loamy sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2svm7
Elevation: 0 to 1,420 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Hinckley and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hinckley

Setting

Landform: Outwash terraces, outwash deltas, kame terraces, outwash plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear, convex, concave
Across-slope shape: Concave, linear, convex
Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

Oe - 0 to 1 inches: moderately decomposed plant material
A - 1 to 8 inches: loamy sand
Bw1 - 8 to 11 inches: gravelly loamy sand
Bw2 - 11 to 16 inches: gravelly loamy sand
BC - 16 to 19 inches: very gravelly loamy sand
C - 19 to 65 inches: very gravelly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Negligible
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
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 5 percent
Landform: Kame terraces, outwash terraces, outwash deltas
Landform position (three-dimensional): Tread
Down-slope shape: Convex, concave, linear
Across-slope shape: Linear, convex, concave
Hydric soil rating: No

Windsor

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

Sudbury

Percent of map unit: 5 percent
Landform: Kame terraces, outwash terraces, outwash deltas
Landform position (three-dimensional): Tread
Down-slope shape: Convex, concave, linear
Across-slope shape: Linear, convex, concave
Hydric soil rating: No

276A—Ninigret fine sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2tyr6
Elevation: 0 to 1,250 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: All areas are prime farmland

Map Unit Composition

Ninigret and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ninigret

Setting

Landform: Drainageways, outwash terraces, kames, moraines, outwash plains, kame terraces, depressions
Landform position (two-dimensional): Backslope, shoulder, footslope, summit
Landform position (three-dimensional): Side slope, crest, tread, dip, rise
Down-slope shape: Concave, linear, convex
Across-slope shape: Concave, convex

Parent material: Coarse-loamy eolian deposits over sandy and gravelly glaciofluvial deposits derived from gneiss, granite, schist, and/or phyllite

Typical profile

Ap - 0 to 8 inches: fine sandy loam
Bw1 - 8 to 16 inches: fine sandy loam
Bw2 - 16 to 26 inches: fine sandy loam
2C - 26 to 65 inches: stratified loamy sand to loamy fine sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 18 to 38 inches to strongly contrasting textural stratification
Drainage class: Moderately well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 17 to 39 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water capacity: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Ecological site: F144AY026CT - Moist Silty Outwash
Hydric soil rating: No

Minor Components

Agawam

Percent of map unit: 5 percent
Landform: Kames, outwash terraces, outwash plains, moraines, kame terraces
Landform position (two-dimensional): Backslope, shoulder, footslope, summit
Landform position (three-dimensional): Side slope, crest, tread, riser, rise
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Deerfield

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

Windsor

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