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Stormwater Report

P&G Andover Manufacturing Center Enhancement Project
30 Burtt Road
Andover, MA 01810

Prepared for:

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Nitsch Project #15363

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

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SECTION 1 Introduction

Nitsch Engineering has prepared this Stormwater Report to support the Notice of Intent Application and the Major Non-residential Project Special Permit Application to the Town of Andover for the P&G Andover Manufacturing Center Enhancement Project. The Project site is located at 30 Burtt Road in Andover, MA (subsequently referred to as the "Site"). A 169,744 square foot, building addition facility is proposed, as well as a landscaped area next to it. The landscaped area is reserved as a potential location for a future expansion of the manufacturing facility. The remaining parking area will be reconstructed and redesigned to meet current stormwater treatment requirements. One parking lot is not being improved but will be the reserve location for a possible future parking garage.

The site improvements include the following:

1. Demolition of two of the three existing parking lots;
2. Construction of the building addition;
3. Installation of new utilities to support the proposed building;
4. Construction of new parking facilities including electric vehicle charging stations and pedestrian walkways and;
5. Construction of a new stormwater management system.

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

SECTION 2 Existing Conditions

The Site is located at 30 Burtt Road in Andover, MA. The Site is developed with thirteen wetlandd resource areas around the perimeter of the site. The existing 30 Burtt Road property is approximately 154.5 ± acres and contains a 572,360± square-foot manufacturing building with associated parking, driveway, and utilities. There is an existing access road that runs north of the facility, named Gillette Way, which connects to Lowell Junction Road and another road on the western side of the parking area that connects to Burtt Road.

Existing Drainage Infrastructure

Stormwater runoff from existing parking areas is collected in catch basins and piped to the adjacent wetland resource areas. Stormwater runoff from the access road located along the western side and the access road at the eastern side of the building sheet flows to concrete swales which discharge to the wetland resource areas. The existing stormwater management system was constructed prior to the 2008 MassDEP Stormwater Management Standards and the Site provides minimal peak flow attenuation, water quality treatment, and groundwater recharge.

NRCS Soil Designations

The Soil Classification Summary (Table 1) outlines the Natural Resources Conservation Services (NRCS) designation of the soil series at the Site. The onsite soils are classified as Urban Land with no hydrologic soil group (HSG) rating, because the soils are excavated and filled land (refer to the NRCS Soil Maps and Descriptions in Appendix G).

Table 1. NRCS Soil Classification Summary

Soil Unit	Soil Series	Hydrologic Soil Group
602	Urban Land	NA (Fill)

Onsite Soil Investigations

GEI Consultants Inc., conducted seven borings and thirteen test pits between April 24th and May 8th, 2023. The test pits classified the soils as predominantly A/B soils with a small area east of the building containing silty HSG C type soils. Proposed subsurface systems #1, #2, and #3 are in a soil designation of HSG B, while proposed subsurface system #4 is in a soil designation of HSB A. Additional test pits were conducted by GEI Consultants, Inc in July 2024. The test pits confirmed previous soil designations and estimated season high groundwater for subsurface systems #1, #2 and #4. Test pits in the footprint of subsurface system #3 encountered groundwater.

The Geotechnical Report and test pit logs are provided in Appendix G.

Wetland Resource Areas

Thirteen Wetland Resource Areas are located on the Site. Refer to the Notice of Intent (prepared by others) for additional information.

Total Maximum Daily Load (TMDL)

Stormwater flows from the Site and ultimately discharges to the Shawsheen River, which discharges into the Merrimack River. The Site is located within the Merrimack River Watershed and will potentially be subject to a Draft Pathogen Total Maximum Daily Load (TMDL) if it is finalized by MassDEP. The Project has been designed

to minimize stormwater discharge and associated pathogen pollutants through infiltration practices to meet the intent of the TMDL.

SECTION 3 Proposed Conditions

Project Description

The Project Site is located in Andover, MA. A 169,744 SF building addition comprised of manufacturing space is proposed, as well as a landscaped area next to it. The landscaped area is reserved as a potential location for future expansion of the manufacturing facility. The stormwater systems have been sized to accommodate the future building expansion. The remaining parking area will be largely reconstructed and redesigned to meet current stormwater treatment requirements. One parking lot is not being improved but will be the reserve location for a possible future parking garage.

The site improvements include the following:

1. Construction of parking facilitates and pedestrian walkways;
2. Demolition of two of the three existing parking lots;
3. Construction of a new building addition;
4. Installation of new utilities to support the proposed building addition; and
5. Construction of a new stormwater management system.

The Project is considered a mix of new development and redevelopment and is anticipated to increase the overall impervious area for the Project by approximately 3.03 acres. Refer to Table 2 for a comparison of the existing and proposed land use for the Site.

Table 2. Proposed land use for 30 Burtt Road (in acres)

Land Use	Existing Site (acres)	Proposed Site (acres)	Change
Buildings*	0**	4.55	+4.55
Site Pavement	9.64	8.00	-1.64
Landscaped Areas*	4.72	2.76	-1.96
Undeveloped Areas	0.95	0.00	-0.95
Total	15.31	15.31	---

*Please note that the proposed future building addition and the reduction in landscaped areas are included in the calculations as previously noted in Section 1.
**Existing building area is considered outside the limit of work and is not included in the stormwater calculations

Stormwater Management System

The Site will include the installation of a stormwater management system that is being designed to meet the MassDEP Stormwater Management Standards and the Town of Andover Conservation Commission Wetland Protection Regulations, Stormwater Management and Erosion Control Regulations, and Stormwater Management Program Plan.

The Stormwater design prevents the generation of stormwater and non-point source pollution by disconnecting flow paths, treating and infiltrating stormwater at its source, and protecting natural processes. Stormwater systems have been designed to model natural hydrologic features, including promoting infiltration throughout the site.

The proposed stormwater management system for the Project will include deep sump and hooded catch basins, subsurface infiltration systems, and proprietary water quality structures. Overflow from the proposed BMPs will be discharged to the adjacent wetland using the existing infrastructure to minimize concentrated flow.

Deep Sump and Hooded Catch Basins and Silt Prison Inlets

Deep sump and hooded catch basins are proposed to provide pretreatment in the impervious areas of the parking lot and driveways. Silt Prison inlets are also proposed throughout the site which provide additional treatment. Stormwater captured in the catch basins will be directed to another treatment or infiltration BMP prior to discharge.

Subsurface Infiltration/Detention Systems

Stormwater will be collected and infiltrated using three (3) subsurface infiltration systems and one (1) subsurface detention system. Subsurface Infiltration System #1 is proposed to collect and infiltrate runoff from the proposed building and west parking area. The system consists of Retain-It Concrete Precast chambers enveloped by crushed stone. Overflow from the system discharges to the west via a 30" reinforced concrete pipe. Subsurface System #1 is designed to reduce the peak rate and runoff volumes in the 2-, 10-, 25- and 100-year 24-hour storm events.

Subsurface Infiltration System #2 is proposed to collect and infiltrate runoff from the adjacent parking site area. The system is located in the parking area south of system #1 and north of the proposed building addition. The system consists of Retain-It Concrete Precast chambers enveloped by crushed stone. Overflow from the system discharges to the west via a 30" reinforced concrete pipe. Subsurface Infiltration System 2 is designed to reduce the peak rate and runoff volumes in the 2-, 10, 25- and 100-year 24-hour storm events.

Subsurface Detention System #3 is proposed to collect runoff from the proposed southeast parking area. The system consists of Retain-It Concrete Precast chambers enveloped by crushed stone and will be lined due to high groundwater. Subsurface System #3 is designed to reduce the peak rates in the 2-, 10-, 25- and 100-year 24-hour storm events.

Subsurface Infiltration System #4 is proposed to collect and infiltrate runoff from the proposed drop lots located east of the existing building. The system consists of Retain-It Concrete Precast chambers surrounded by crushed stone. Subsurface System #4 is designed to reduce peak rate and runoff volumes in the 2, 10, 25 and 100-year 24-hour storm events.

Water Quality Structures

Thirteen (13) proprietary water quality structures are proposed for water quality pretreatment in areas of the Site where space is limited, or additional pretreatment is required prior to infiltration. These BMPs have been designed to remove greater than 90% TSS in conjunction with their associated deep sump and hooded catch basins. Sizing calculations are provided in Appendix A.

Rain Guardians

Four (4) Rain Guardian inlets are proposed for water quality pretreatment for the western parking lot. Manufacturer information and third party testing states these structures remove 70% TSS prior to discharging into Wetland areas.

Stormwater Management During Construction

The Site Contractor will be responsible for stormwater management of the active construction site and is required to adhere to the conditions of the 2022 Construction General Permit under the Environmental Protection Agency through the preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP). A draft SWPPP has been prepared in accordance with the MassDEP Stormwater Management Standards and the 2022 Construction General Permit (Appendix E).

SECTION 4 Stormwater Management Analysis

Methodology

Nitsch Engineering completed a hydrologic analysis of the existing project site utilizing Soil Conservation Service (SCS) Runoff Curve Number (CN) methodology. The SCS method calculates the rate at which the runoff reaches the design point considering several factors: the slope and flow lengths of the subcatchment area, the soil type of the subcatchment area, and the type of surface cover in the subcatchment area. HydroCAD Version 10.10-6a computer modeling software was used in conjunction with the SCS method to determine the peak runoff rates and runoff volumes for the 2-, 10-, 25-, and 100-year, 24-hour storm events. The proposed project site is being analyzed with the same methodology.

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

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

HydroCAD Version 10.10-6a

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

HydroCAD Version 10.10-6a uses up to four types of components to analyze the hydrology of a given site: subcatchments, reaches, basins, and links. Subcatchments are areas of land that produce surface runoff. The area, weighted CN, and T_c characterize each individual subcatchment area. Reaches are generally uniform streams, channels, or pipes that convey water from one point to another. A basin is any impoundment that fills with water from one or more sources and empties via an outlet structure. Links are used to introduce hydrographs into a project from another source or to provide a junction for more than one hydrograph within a project. The time span for the model was set for 0-72 hours in order to prevent truncation of the hydrograph.

Existing Hydrologic Conditions

Nitsch Engineering delineated the existing project site into four (4) subcatchment (watershed) areas discharging to two (2) design points utilizing an existing conditions survey and on-site observations (See Figure DR-1). The design points (DP) are defined as the western wetland (DP-1), and the northeast wetland (DP-2). The HydroCAD model for existing conditions is provided in Appendix B and results from the HydroCAD calculations are summarized below in Table 3.

Proposed Hydrologic Conditions

The proposed site was delineated into nine (9) subcatchment (watershed) areas discharging to two (2) design points. The proposed project has been designed to mitigate the change in stormwater runoff at each of the design points as required by the DEP Stormwater Management Standards. The existing watershed areas were modified to reflect the proposed topography, storm drainage structures and BMPs, and roof areas. (See Figure DR-2). The HydroCAD model for proposed conditions is provided in Appendix C and results from the calculations are summarized in Table 3.

Peak Flow Rates

The proposed stormwater management system is expected to reduce the proposed peak runoff rates to at or below the existing rates for Design Points DP-1 and DP-2. Table 3 below summarizes the existing and proposed hydrologic analyses for the site at each design point.

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

	Storm Event	2-year	10-year	25-year	100-year
DP-1	Existing	22.99	44.03	57.25	77.72
	Proposed	10.08	30.33	39.64	55.91
DP-2	Existing	1.77	4.31	6.03	8.81
	Proposed	0.02	0.19	0.33	0.57

The proposed stormwater management system is expected to reduce or maintain the post-development peak rates of runoff to at or below the pre-development rates. Table 4 below demonstrates a reduction in runoff volumes for the required storm events. The proposed stormwater management system will provide a reduction in peak flow rates and volumes at both design points and to any Massachusetts Department of Transportation infrastructure.

Table 4. Volumes of Runoff for Total Site (in acre-feet)

Storm Event	2-year	10-year	25-year	100-year
Existing	2.14	4.22	5.59	7.75
Proposed	1.22	2.84	4.07	6.03

SECTION 5 Andover Stormwater Regulations

Annual Load Reduction of Phosphorus (60%) and TSS (90%)

The Andover Stormwater Management Rules and Regulations require new developments to meet the minimum requirements of the MS4 permit by including removal of 90% of the average annual load of Total Suspended Solids and 60% of the average annual load of Total Phosphorus.

The proposed project is expected to reduce Total Phosphorus loads in the post-construction condition by 72% and TSS loads by 90% by using a combination of deep sump catch basins, water quality structures, and subsurface infiltration. In addition, an Operations and Maintenance plan that calls for catch basin cleaning, sweeping of the vehicular impervious surfaces on-site, and litter removal will allow for additional Phosphorus reductions. (Refer to Appendix E for the Long-Term Pollution Prevent and Stormwater Operation and Maintenance Plan and refer to Appendix A for the Phosphorus and TSS Removal Calculations.)

SECTION 6 MassDEP Stormwater Management Standards

The Project is considered a mix of redevelopment and new development under the MassDEP Stormwater Management Standards. However, this project has been designed to meet the requirements for a ***new development***. The Site will be designed to meet and exceed the MassDEP Stormwater Management Standards as summarized below:

Standard 1: No New Untreated Discharges

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

Standard 2: Peak Rate Attenuation

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

Standard 3: Groundwater Recharge

The Site was designed using environmentally sensitive site design, low impact development techniques, and stormwater BMP treatment trains to minimize the loss of annual recharge to groundwater. The annual recharge from the post-development site will approximate the annual recharge from pre-development conditions based on soil type using the guidelines provided in the MassDEP Stormwater Management Handbook.

Impervious Area in HSG A	= 1.36 acres = 59,241 square feet
Rv (Recharge Volume)	= 59,424 x 0.6 in. / (12 inches/ft)
	= 2,972 cubic feet
Impervious Area in HSG B	= 10.08 acres = 439,243 square feet
Rv (Recharge Volume)	= 439,243 x 0.35 in. / (12 inches/ft)
	= 12,812 cubic feet
Impervious Area in HSG C	= 1.10 acres = 47,952 square feet
Rv (Recharge Volume)	= 47,952 x 0.25 in. / (12 inches/ft)
	= 999 cubic feet
Total Required Recharge Volume	= 2,972 cubic feet + 12,812 cubic feet + 999 cubic feet
	= 16,783 cubic feet

10.81 acres of 12.55 impervious acres, or 86%, are directed to the infiltrations BMPs. An adjustment calculation was performed to ensure the entire recharge requirement can be met by this area.

Adjusted Required Recharge Volume	= [1/ (% to recharge system)] x Required Recharge Volume
	= [1/0.86] x 16,783 cubic feet
	= 1.16 x 16,783 cubic feet
	= 19,515 cubic feet

The infiltration BMPs are sized to exceed the recharge volume required under the MassDEP Stormwater Management Standards (Refer to Table 5 on the following page).

Table 5. Proposed Recharge Volumes for Stormwater BMPs

Infiltration BMP	Recharge Volume (cf)
Subsurface Infiltration System 1	31,012
Subsurface Infiltration System 2	12,357
Subsurface Infiltration System 4	5,439
Total	**48,808**

The HydroCAD reports provided in Appendix C indicate that all proposed infiltration BMPs will drain within 19 hours or less for the 2-, 10-, 25-, and 100-year storm events, meeting the 72-hour MassDEP drawdown requirement. 72-hour draw down calculations have been provided in Appendix A.

Groundwater was not encountered in the test pits by subsurface systems #1, #2, and #4. The test pits at Subsurface Detention System #3 showed high groundwater and therefore the system is lined.

Standard 4: Water Quality Treatment

The proposed stormwater management system will be designed to remove greater than 80% of the average annual post-construction load of Total Suspended Solids (TSS). Structural stormwater BMPs including deep sump and hooded catch basins, Silt Prisons, subsurface infiltration, and Stormceptor® water quality units are sized to capture the required water quality volume (1 inch over the project site) and remove a minimum of 80% of total suspended solids.

TSS removal calculation spreadsheets are provided in Appendix A.

Source control and pollution prevention measures, such as vacuum cleaning, street sweeping, proper snow management, and stabilization of eroded surfaces, are included in the Long-Term Pollution Prevention Plan and Operation and Maintenance Plan (Appendix E).

Standard 5: Land Uses with Higher Potential Pollutant Loads

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

Standard 6: Critical Areas

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

Standard 7: Redevelopments

The Project is considered a mix of redevelopment and new development under the MassDEP Stormwater Management Standards. However, this project has been designed to meet the requirements for a new development.

Standard 8: Construction Period Pollution Prevention and Sedimentation Control

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

Because the Project will disturb more than one (1) acre of land, a Notice of Intent will be submitted to the Environmental Protection Agency (EPA) for coverage under the National Pollution Discharge Elimination System (NPDES) Construction General Permit. As part of this application the Applicant is required to prepare a Stormwater Pollution Prevention Plan (SWPPP) and implement the measures in the SWPPP. The SWPPP, which is to be kept on site, includes erosion and sediment controls (stabilization practices and structural practices), temporary and permanent stormwater management measures, Contractor inspection schedules and reporting of all SWPPP features, materials management, waste disposal, off-site vehicle tracking, spill prevention and response, sanitation, and non-stormwater discharges. A draft SWPPP is provided in Appendix F.

Standard 9: Operation and Maintenance Plan

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

Standard 10: Prohibition of Illicit Discharges

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

SECTION 7 Closed Drainage System Design

The proposed closed drainage system consists of deep sump and hooded catch basins, drainage manholes, and proprietary water quality treatment units connected with corrugated polyethylene pipe. The closed drainage system was designed to convey the 25-year storm event using the Rational method. Refer to Appendix D for more information.

SECTION 8 Conclusion

In conclusion, the Project's stormwater management system will reduce peak runoff rates and volumes through the widespread use of infiltration BMPs and improve the water quality of stormwater being discharged from the Site. The Project is designed to meet and exceed the MassDEP Stormwater Management Standards and the Town of Andover Stormwater Rules and Regulations.

FIGURES

DR-1 Existing Watershed Areas

DR-2 Proposed Watershed Areas

LEGEND

- DP-X — DESIGN POINT-X
- XX — STORMWATER BMP
- EX-X — SUBCATCHMENT-X
- SUBCATCHMENT BOUNDARY
- A — B — TIME OF CONCENTRATION
- GRAVEL COVERAGE
- ROOF COVERAGE
- GRASS/LANDSCAPED AREA COVERAGE
- IMPERVIOUS COVERAGE (PAVEMENT, BIT. CONCRETE)
- TREE/WOODS COVERAGE

DP 1
DP 2
EX-1
EX-2
EX-3
EX-4
EXISTING DEVELOPED AREA
GILLETTE WAY
100 FT BUFFER
50 FT NO BUILD ZONE
25 FT NO DISTURBANCE ZONE
RAILROAD TRACK REMAINS
APPROXIMATE RECORD LOCATION OF FORMER RAILROAD TRACK CENTERLINE (SEE BOSTON AND MAINE VAL. MAP V.7)
EXISTING DEVELOPED AREA
DELINEATION OF H2N2 PRIORITY HABITAT AREA
EXISTING EASEMENT LINE
LOCATION OF RIGHT OF WAY TAKEN BY THE MASS. DPW AS SHOWN ON STATE HIGHWAY LAYOUT #4645 RECORDED IN THE ENROD AS PLAN #3669 KNOWN AS BURTT ROAD.
EXISTING EASEMENT (TO REMAIN)
THE GILLETTE COMPANY PARCEL ID 185-2 BOOK 1093 PAGE 363 L.C.C. 32180 30 BURTT ROAD (PARCEL 4) (FORMER RAILROAD PARCEL)
THE GILLETTE COMPANY PARCEL ID 185-2 BOOK 1093 PAGE 361 L.C.C. 42862A 30 BURTT ROAD
COMMONWEALTH OF MASSACHUSETTS EASEMENT (BOOK 875 PAGE 156)
RECORDED LAND REGISTERED LAND (L.C.C. 42862A)
1-STORY CONCRETE & GLASS
WETLAND 12 (NON-BVW)
NAD83
SCALE: 1" = 40'

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EXISTING DRAINAGE AREAS
30 BURTT ROAD, ANDOVER, MASSACHUSETTS

PREPARED FOR:
FENNICK MCCREDIE ARCHITECTURE
70 FRANKLIN STREET, BOSTON, MA 02110

REV.	COMMENTS	DATE
	REVISIONS	

NITSCH PROJECT #	15363
FILE:	15363-EDA
SCALE:	1"=40'
DATE:	07/26/2024
PROJECT MANAGER:	DC
SURVEYOR:	
DRAFTED BY:	BJB
CHECKED BY:	MV

SHEET:
DR-1
OF REV.

LEGEND

- DP-X — DESIGN POINT-X
- XX — STORMWATER BMP
- PR-X — SUBCATCHMENT-X
- SUBCATCHMENT BOUNDARY
- A — B — TIME OF CONCENTRATION
- GRAVEL COVERAGE
- ROOF COVERAGE
- GRASS/LANDSCAPED AREA COVERAGE
- IMPERVIOUS COVERAGE (PAVEMENT, BIT. CONCRETE)
- TREE/WOODS COVERAGE

PR-1 PR-2 PR-3 PR-4 PR-5 PR-6 PR-7 PR-8 PR-9

DP 1 DP 2

GILLETTE WAY

100 FT BUFFER

50 FT NO BUILD ZONE

25 FT NO DISTURBANCE ZONE

RAILROAD TRACK REMAINS

APPROXIMATE RECORD LOCATION OF FORMER RAILROAD TRACK CENTERLINE (SEE BOSTON AND MAINE VAL MAP V.7-4)

LIMIT OF WORK (TYP.)

DELINEATION OF H2N2 PRIORITY HABITAT AREA

NAD83

SCALE: 1" = 40'

40 20 0 40 80

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PROPOSED DRAINAGE AREAS

30 BURTT ROAD, ANDOVER, MASSACHUSETTS

PREPARED FOR:

FENNICK MCCREDIE ARCHITECTURE

70 FRANKLIN STREET, BOSTON, MA 02110

REV.	COMMENTS	DATE
	REVISIONS	

NITSCH PROJECT #	15363
FILE:	15363-PDA
SCALE:	1"=40'
DATE:	07/26/2024
PROJECT MANAGER:	DC
SURVEYOR:	
DRAFTED BY:	BJB
CHECKED BY:	MV

SHEET:

DR-2

OF REV.

APPENDIX A

Stormwater Management Standards Documentation

MassDEP Checklist for Stormwater Report

Standard 3: 72-HR Drawdown Calculations

Standard 4: TSS Removal Calculations

Standard 4: Proprietary Water Quality Structure Calculations

Standard 10: Illicit Discharge Compliance Statement

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

Checklist for Stormwater Report

A. Introduction

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



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

The Stormwater Report must include:

- The Stormwater Checklist completed and stamped by a Registered Professional Engineer (see page 2) that certifies that the Stormwater Report contains all required submittals.[1] This Checklist is to be used as the cover for the completed Stormwater Report.
- Applicant/Project Name
- Project Address
- Name of Firm and Registered Professional Engineer that prepared the Report
- Long-Term Pollution Prevention Plan required by Standards 4-6
- Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan required by Standard 8[2]
- Operation and Maintenance Plan required by Standard 9

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

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

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

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

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

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

Checklist for Stormwater Report

B. Stormwater Checklist and Certification

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

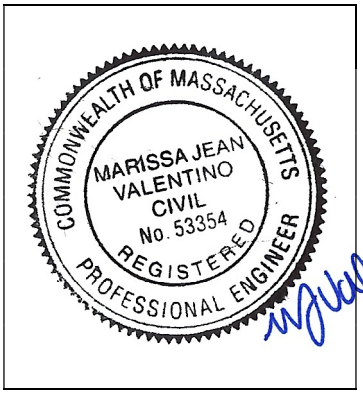
Note: Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the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

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

Registered Professional Engineer's Certification

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

Registered Professional Engineer Block and Signature



M J Valentino 7/30/2024

Signature and Date

Checklist

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

☐ New development

☐ Redevelopment

☒ Mix of New Development and Redevelopment

Checklist for Stormwater Report

Checklist (continued)

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

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

Standard 1: No New Untreated Discharges

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

Checklist for Stormwater Report

Checklist (continued)

Standard 2: Peak Rate Attenuation

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

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

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

Standard 3: Recharge

☒ Soil Analysis provided.

☒ Required Recharge Volume calculation provided.

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

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

☒ Static ☐ Simple Dynamic ☐ Dynamic Field[1]

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 3: Recharge (continued)

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

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

Standard 4: Water Quality

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

Standard 4: Water Quality (continued)

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

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

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

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

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

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

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

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

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

☐ All exposure has been eliminated.

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

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

Standard 6: Critical Areas

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

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

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

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

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

Checklist for Stormwater Report

Checklist (continued)

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

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

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

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

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

Standard 9: Operation and Maintenance Plan

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

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

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

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

Standard 10: Prohibition of Illicit Discharges

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

☒ An Illicit Discharge Compliance Statement is attached;

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

Nitsch Engineering

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

Form S3-G: Standard 3 - Recharge
72-hour Drawdown Calculation

Project Name:	Principio Validation		
Nitsch Job #	15363	Location:	Andover, MA
Calculated by:	BJB	Checked by:	MV
Recharge BMP ID:	SYS 1	Date:	7/26/2024

INSTRUCTIONS:

1. In 'Method' Column, Click on Blue Cell to Activate Drop Down Menu
2. Enter the "Required recharge Volume" (in cubic feet) in Blue Cell for the appropriate chosen Method.
3. Enter the "Bottom Area" (in square feet) in the blue cell as the maximum infiltration surface area. Do not use sidewalls.
4. For "Dynamic: In-Situ Method" ONLY (if other, go to Step #5) Enter Hydraulic Conductivity Rate in Blue Cell
5. In 'Texture Class' Column, Click on Blue Cell to Activate Drop Down Menu

Step #			
1	Method:	**Static**	
2	Provided Recharge Volume:	*31,012*	*Cu. Ft*
3	Bottom Area:	*17,920*	*Sq.Ft.*

Step #			
4	Enter Hydraulic Conductivity Rate ONLY IIf using the Dynamic: In-Situ Method -->	Hydraulic Conductivity Rate:	In-Situ Saturated Hydraulic Conductivity Rate
			0

Step #			
	Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate (Inches/Hour)
5	Sandy Loam	B	1.02

Hours

$Time_{drawdown}$ = 20.36

72-Hour Drawdown Requirement Check: ***OK***

Nitsch Engineering

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

Form S3-G: Standard 3 - Recharge
72-hour Drawdown Calculation

Project Name:	Principio Validation		
Nitsch Job #	15363	Location:	Andover, MA
Calculated by:	BJB	Checked by:	MV
Recharge BMP ID:	SYS 2	Date:	7/26/2024

INSTRUCTIONS:

1. In 'Method' Column, Click on Blue Cell to Activate Drop Down Menu
2. Enter the "Required recharge Volume" (in cubic feet) in Blue Cell for the appropriate chosen Method.
3. Enter the "Bottom Area" (in square feet) in the blue cell as the maximum infiltration surface area. Do not use sidewalls.
4. For "Dynamic: In-Situ Method" ONLY (if other, go to Step #5) Enter Hydraulic Conductivity Rate in Blue Cell
5. In 'Texture Class' Column, Click on Blue Cell to Activate Drop Down Menu

Step #			
1	Method:	**Static**	
2	Provided Recharge Volume:	*12,357*	*Cu. Ft*
3	Bottom Area:	*7,168*	*Sq.Ft.*

Step #			
4	Enter Hydraulic Conductivity Rate ONLY IIf using the Dynamic: In-Situ Method -->	Hydraulic Conductivity Rate:	In-Situ Saturated Hydraulic Conductivity Rate
			0

Step #			
	Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate (Inches/Hour)
5	Sandy Loam	B	1.02

Hours

$Time_{drawdown}$ = 20.28

72-Hour Drawdown Requirement Check: ***OK***

Nitsch Engineering

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

Form S3-G: Standard 3 - Recharge
72-hour Drawdown Calculation

Project Name:	Principio Validation		
Nitsch Job #	15363	Location:	Andover, MA
Calculated by:	BJB	Checked by:	MV
Recharge BMP ID:	SYS 4	Date:	7/26/2024

INSTRUCTIONS:

1. In 'Method' Column, Click on Blue Cell to Activate Drop Down Menu
2. Enter the "Required recharge Volume" (in cubic feet) in Blue Cell for the appropriate chosen Method.
3. Enter the "Bottom Area" (in square feet) in the blue cell as the maximum infiltration surface area. Do not use sidewalls.
4. For "Dynamic: In-Situ Method" ONLY (if other, go to Step #5) Enter Hydraulic Conductivity Rate in Blue Cell
5. In 'Texture Class' Column, Click on Blue Cell to Activate Drop Down Menu

Step #			
1	Method:	**Static**	
2	Provided Recharge Volume:	*5,439*	*Cu. Ft*
3	Bottom Area:	*2,048*	*Sq.Ft.*

Step #			
4	Enter Hydraulic Conductivity Rate ONLY IIf using the Dynamic: In-Situ Method -->	Hydraulic Conductivity Rate:	In-Situ Saturated Hydraulic Conductivity Rate
			0

Step #			
	Texture Class	NRCS Hydrologic Soil Group (HSG)	Infiltration Rate (Inches/Hour)
5	Loamy Sand	A	2.41

Hours

$Time_{drawdown}$ = 13.22

72-Hour Drawdown Requirement Check: ***OK***

Stage-Area-Storage for Pond 6P: UNDERGROUND RECHARGE SYSTEM #1

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
91.50	**17,920**	0	92.02	17,920	3,455
91.51	17,920	63	92.03	17,920	3,614
91.52	17,920	125	92.04	17,920	3,773
91.53	17,920	188	92.05	17,920	3,932
91.54	17,920	251	92.06	17,920	4,092
91.55	17,920	314	92.07	17,920	4,251
91.56	17,920	376	92.08	17,920	4,410
91.57	17,920	439	92.09	17,920	4,570
91.58	17,920	502	92.10	17,920	4,729
91.59	17,920	564	92.11	17,920	4,888
91.60	17,920	627	92.12	17,920	5,047
91.61	17,920	690	92.13	17,920	5,207
91.62	17,920	753	92.14	17,920	5,366
91.63	17,920	815	92.15	17,920	5,525
91.64	17,920	878	92.16	17,920	5,685
91.65	17,920	941	92.17	17,920	5,844
91.66	17,920	1,004	92.18	17,920	6,003
91.67	17,920	1,066	92.19	17,920	6,163
91.68	17,920	1,129	92.20	17,920	6,322
91.69	17,920	1,192	92.21	17,920	6,481
91.70	17,920	1,254	92.22	17,920	6,640
91.71	17,920	1,317	92.23	17,920	6,800
91.72	17,920	1,380	92.24	17,920	6,959
91.73	17,920	1,443	92.25	17,920	7,118
91.74	17,920	1,505	92.26	17,920	7,278
91.75	17,920	1,568	92.27	17,920	7,437
91.76	17,920	1,631	92.28	17,920	7,596
91.77	17,920	1,693	92.29	17,920	7,755
91.78	17,920	1,756	92.30	17,920	7,915
91.79	17,920	1,819	92.31	17,920	8,074
91.80	17,920	1,882	92.32	17,920	8,233
91.81	17,920	1,944	92.33	17,920	8,393
91.82	17,920	2,007	92.34	17,920	8,552
91.83	17,920	2,070	92.35	17,920	8,711
91.84	17,920	2,132	92.36	17,920	8,870
91.85	17,920	2,195	92.37	17,920	9,030
91.86	17,920	2,258	92.38	17,920	9,189
91.87	17,920	2,321	92.39	17,920	9,348
91.88	17,920	2,383	92.40	17,920	9,508
91.89	17,920	2,446	92.41	17,920	9,667
91.90	17,920	2,509	92.42	17,920	9,826
91.91	17,920	2,572	92.43	17,920	9,986
91.92	17,920	2,634	92.44	17,920	10,145
91.93	17,920	2,697	92.45	17,920	10,304
91.94	17,920	2,760	92.46	17,920	10,463
91.95	17,920	2,822	92.47	17,920	10,623
91.96	17,920	2,885	92.48	17,920	10,782
91.97	17,920	2,948	92.49	17,920	10,941
91.98	17,920	3,011	92.50	17,920	11,101
91.99	17,920	3,073	92.51	17,920	11,260
92.00	17,920	3,136	92.52	17,920	11,419
92.01	17,920	3,295	92.53	17,920	11,578

Stage-Area-Storage for Pond 6P: UNDERGROUND RECHARGE SYSTEM #1 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
92.54	17,920	11,738
92.55	17,920	11,897
92.56	17,920	12,056
92.57	17,920	12,216
92.58	17,920	12,375
92.59	17,920	12,534
92.60	17,920	12,693
92.61	17,920	12,853
92.62	17,920	13,012
92.63	17,920	13,171
92.64	17,920	13,331
92.65	17,920	13,490
92.66	17,920	13,649
92.67	17,920	13,809
92.68	17,920	13,968
92.69	17,920	14,127
92.70	17,920	14,286
92.71	17,920	14,446
92.72	17,920	14,605
92.73	17,920	14,764
92.74	17,920	14,924
92.75	17,920	15,083
92.76	17,920	15,242
92.77	17,920	15,401
92.78	17,920	15,561
92.79	17,920	15,720
92.80	17,920	15,879
92.81	17,920	16,039
92.82	17,920	16,198
92.83	17,920	16,357
92.84	17,920	16,516
92.85	17,920	16,676
92.86	17,920	16,835
92.87	17,920	16,994
92.88	17,920	17,154
92.89	17,920	17,313
92.90	17,920	17,472
92.91	17,920	17,631
92.92	17,920	17,791
92.93	17,920	17,950
92.94	17,920	18,109
92.95	17,920	18,269
92.96	17,920	18,428
92.97	17,920	18,587
92.98	17,920	18,747
92.99	17,920	18,906
93.00	17,920	19,065
93.01	17,920	19,224
93.02	17,920	19,384
93.03	17,920	19,543
93.04	17,920	19,702
93.05	17,920	19,862
93.06	17,920	20,021
93.07	17,920	20,180
93.08	17,920	20,339
93.09	17,920	20,499
93.10	17,920	20,658
93.11	17,920	20,817
93.12	17,920	20,977
93.13	17,920	21,136
93.14	17,920	21,295
93.15	17,920	21,454
93.16	17,920	21,614
93.17	17,920	21,773
93.18	17,920	21,932
93.19	17,920	22,092
93.20	17,920	22,251
93.21	17,920	22,410
93.22	17,920	22,570
93.23	17,920	22,729
93.24	17,920	22,888
93.25	17,920	23,047
93.26	17,920	23,207
93.27	17,920	23,366
93.28	17,920	23,525
93.29	17,920	23,685
93.30	17,920	23,844
93.31	17,920	24,003
93.32	17,920	24,162
93.33	17,920	24,322
93.34	17,920	24,481
93.35	17,920	24,640
93.36	17,920	24,800
93.37	17,920	24,959
93.38	17,920	25,118
93.39	17,920	25,277
93.40	17,920	25,437
93.41	17,920	25,596
93.42	17,920	25,755
93.43	17,920	25,915
93.44	17,920	26,074
93.45	17,920	26,233
93.46	17,920	26,393
93.47	17,920	26,552
93.48	17,920	26,711
93.49	17,920	26,870
93.50	17,920	27,030
93.51	17,920	27,189
93.52	17,920	27,348
93.53	17,920	27,508
93.54	17,920	27,667
93.55	17,920	27,826
93.56	17,920	27,985
93.57	17,920	28,145

Stage-Area-Storage for Pond 6P: UNDERGROUND RECHARGE SYSTEM #1 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
93.58	17,920	28,304	94.10	17,920	36,587
93.59	17,920	28,463	94.11	17,920	36,746
93.60	17,920	28,623	94.12	17,920	36,906
93.61	17,920	28,782	94.13	17,920	37,065
93.62	17,920	28,941	94.14	17,920	37,224
93.63	17,920	29,100	94.15	17,920	37,384
93.64	17,920	29,260	94.16	17,920	37,543
93.65	17,920	29,419	94.17	17,920	37,702
93.66	17,920	29,578	94.18	17,920	37,861
93.67	17,920	29,738	94.19	17,920	38,021
93.68	17,920	29,897	94.20	17,920	38,180
93.69	17,920	30,056	94.21	17,920	38,339
93.70	17,920	30,215	94.22	17,920	38,499
93.71	17,920	30,375	94.23	17,920	38,658
93.72	17,920	30,534	94.24	17,920	38,817
93.73	17,920	30,693	94.25	17,920	38,977
93.74	17,920	30,853	94.26	17,920	39,136
93.75	17,920	31,012	94.27	17,920	39,295
93.76	17,920	31,171	94.28	17,920	39,454
93.77	17,920	31,331	94.29	17,920	39,614
93.78	17,920	31,490	94.30	17,920	39,773
93.79	17,920	31,649	94.31	17,920	39,932
93.80	17,920	31,808	94.32	17,920	40,092
93.81	17,920	31,968	94.33	17,920	40,251
93.82	17,920	32,127	94.34	17,920	40,410
93.83	17,920	32,286	94.35	17,920	40,569
93.84	17,920	32,446	94.36	17,920	40,729
93.85	17,920	32,605	94.37	17,920	40,888
93.86	17,920	32,764	94.38	17,920	41,047
93.87	17,920	32,923	94.39	17,920	41,207
93.88	17,920	33,083	94.40	17,920	41,366
93.89	17,920	33,242	94.41	17,920	41,525
93.90	17,920	33,401	94.42	17,920	41,684
93.91	17,920	33,561	94.43	17,920	41,844
93.92	17,920	33,720	94.44	17,920	42,003
93.93	17,920	33,879	94.45	17,920	42,162
93.94	17,920	34,038	94.46	17,920	42,322
93.95	17,920	34,198	94.47	17,920	42,481
93.96	17,920	34,357	94.48	17,920	42,640
93.97	17,920	34,516	94.49	17,920	42,799
93.98	17,920	34,676	94.50	17,920	42,959
93.99	17,920	34,835	94.51	17,920	43,118
94.00	17,920	34,994	94.52	17,920	43,277
94.01	17,920	35,154	94.53	17,920	43,437
94.02	17,920	35,313	94.54	17,920	43,596
94.03	17,920	35,472	94.55	17,920	43,755
94.04	17,920	35,631	94.56	17,920	43,915
94.05	17,920	35,791	94.57	17,920	44,074
94.06	17,920	35,950	94.58	17,920	44,233
94.07	17,920	36,109	94.59	17,920	44,392
94.08	17,920	36,269	94.60	17,920	44,552
94.09	17,920	36,428	94.61	17,920	44,711

Stage-Area-Storage for Pond 6P: UNDERGROUND RECHARGE SYSTEM #1 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
94.62	17,920	44,870
94.63	17,920	45,030
94.64	17,920	45,189
94.65	17,920	45,348
94.66	17,920	45,507
94.67	17,920	45,667
94.68	17,920	45,826
94.69	17,920	45,985
94.70	17,920	46,145
94.71	17,920	46,304
94.72	17,920	46,463
94.73	17,920	46,622
94.74	17,920	46,782
94.75	17,920	46,941
94.76	17,920	47,100
94.77	17,920	47,260
94.78	17,920	47,419
94.79	17,920	47,578
94.80	17,920	47,738
94.81	17,920	47,897
94.82	17,920	48,056
94.83	17,920	48,215
94.84	17,920	48,375
94.85	17,920	48,534
94.86	17,920	48,693
94.87	17,920	48,853
94.88	17,920	49,012
94.89	17,920	49,171
94.90	17,920	49,330
94.91	17,920	49,490
94.92	17,920	49,649
94.93	17,920	49,808
94.94	17,920	49,968
94.95	17,920	50,127
94.96	17,920	50,286
94.97	17,920	50,445
94.98	17,920	50,605
94.99	17,920	50,764
95.00	17,920	50,923
95.01	17,920	51,083
95.02	17,920	51,242
95.03	17,920	51,401
95.04	17,920	51,561
95.05	17,920	51,720
95.06	17,920	51,879
95.07	17,920	52,038
95.08	17,920	52,198
95.09	17,920	52,357
95.10	17,920	52,516
95.11	17,920	52,676
95.12	17,920	52,835
95.13	17,920	52,994
95.14	17,920	53,153
95.15	17,920	53,313
95.16	17,920	53,472
95.17	17,920	53,631
95.18	17,920	53,791
95.19	17,920	53,950
95.20	17,920	54,109
95.21	17,920	54,268
95.22	17,920	54,428
95.23	17,920	54,587
95.24	17,920	54,746
95.25	17,920	54,906
95.26	17,920	55,065
95.27	17,920	55,224
95.28	17,920	55,383
95.29	17,920	55,543
95.30	17,920	55,702
95.31	17,920	55,861
95.32	17,920	56,021
95.33	17,920	56,180
95.34	17,920	56,339
95.35	17,920	56,499
95.36	17,920	56,658
95.37	17,920	56,817
95.38	17,920	56,976
95.39	17,920	57,136
95.40	17,920	57,295
95.41	17,920	57,454
95.42	17,920	57,614
95.43	17,920	57,773
95.44	17,920	57,932
95.45	17,920	58,091
95.46	17,920	58,251
95.47	17,920	58,410
95.48	17,920	58,569
95.49	17,920	58,729
95.50	17,920	58,888
95.51	17,920	58,888
95.52	17,920	58,888
95.53	17,920	58,888
95.54	17,920	58,888
95.55	17,920	58,888
95.56	17,920	58,888
95.57	17,920	58,888
95.58	17,920	58,888
95.59	17,920	58,888
95.60	17,920	58,888
95.61	17,920	58,888
95.62	17,920	58,888
95.63	17,920	58,888
95.64	17,920	58,888
95.65	17,920	58,888

Stage-Area-Storage for Pond 6P: UNDERGROUND RECHARGE SYSTEM #1 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
95.66	17,920	58,888
95.67	17,920	58,888
95.68	17,920	58,888
95.69	17,920	58,888
95.70	17,920	58,888
95.71	17,920	58,888
95.72	17,920	58,888
95.73	17,920	58,888
95.74	17,920	58,888
95.75	17,920	58,888
95.76	17,920	58,888
95.77	17,920	58,888
95.78	17,920	58,888
95.79	17,920	58,888
95.80	17,920	58,888
95.81	17,920	58,888
95.82	17,920	58,888
95.83	17,920	58,888
95.84	17,920	58,888
95.85	17,920	58,888
95.86	17,920	58,888
95.87	17,920	58,888
95.88	17,920	58,888
95.89	17,920	58,888
95.90	17,920	58,888
95.91	17,920	58,888
95.92	17,920	58,888
95.93	17,920	58,888
95.94	17,920	58,888
95.95	17,920	58,888
95.96	17,920	58,888
95.97	17,920	58,888
95.98	17,920	58,888
95.99	17,920	58,888
96.00	17,920	58,888
96.01	17,920	58,888
96.02	17,920	58,888
96.03	17,920	58,888
96.04	17,920	58,888
96.05	17,920	58,888
96.06	17,920	58,888
96.07	17,920	58,888
96.08	17,920	58,888
96.09	17,920	58,888
96.10	17,920	58,888
96.11	17,920	58,888
96.12	17,920	58,888
96.13	17,920	58,888
96.14	17,920	58,888
96.15	17,920	58,888
96.16	17,920	58,888
96.17	17,920	**58,888**

Stage-Area-Storage for Pond 2P: UNDERGROUND RECHARGE SYSTEM #2

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
91.50	**7,168**	0
91.51	7,168	25
91.52	7,168	50
91.53	7,168	75
91.54	7,168	100
91.55	7,168	125
91.56	7,168	151
91.57	7,168	176
91.58	7,168	201
91.59	7,168	226
91.60	7,168	251
91.61	7,168	276
91.62	7,168	301
91.63	7,168	326
91.64	7,168	351
91.65	7,168	376
91.66	7,168	401
91.67	7,168	426
91.68	7,168	452
91.69	7,168	477
91.70	7,168	502
91.71	7,168	527
91.72	7,168	552
91.73	7,168	577
91.74	7,168	602
91.75	7,168	627
91.76	7,168	652
91.77	7,168	677
91.78	7,168	702
91.79	7,168	728
91.80	7,168	753
91.81	7,168	778
91.82	7,168	803
91.83	7,168	828
91.84	7,168	853
91.85	7,168	878
91.86	7,168	903
91.87	7,168	928
91.88	7,168	953
91.89	7,168	978
91.90	7,168	1,004
91.91	7,168	1,029
91.92	7,168	1,054
91.93	7,168	1,079
91.94	7,168	1,104
91.95	7,168	1,129
91.96	7,168	1,154
91.97	7,168	1,179
91.98	7,168	1,204
91.99	7,168	1,229
92.00	7,168	1,254
92.01	7,168	1,318
92.02	7,168	1,381
92.03	7,168	1,445
92.04	7,168	1,508
92.05	7,168	1,572
92.06	7,168	1,635
92.07	7,168	1,698
92.08	7,168	1,762
92.09	7,168	1,825
92.10	7,168	1,889
92.11	7,168	1,952
92.12	7,168	2,016
92.13	7,168	2,079
92.14	7,168	2,143
92.15	7,168	2,206
92.16	7,168	2,269
92.17	7,168	2,333
92.18	7,168	2,396
92.19	7,168	2,460
92.20	7,168	2,523
92.21	7,168	2,587
92.22	7,168	2,650
92.23	7,168	2,714
92.24	7,168	2,777
92.25	7,168	2,840
92.26	7,168	2,904
92.27	7,168	2,967
92.28	7,168	3,031
92.29	7,168	3,094
92.30	7,168	3,158
92.31	7,168	3,221
92.32	7,168	3,285
92.33	7,168	3,348
92.34	7,168	3,411
92.35	7,168	3,475
92.36	7,168	3,538
92.37	7,168	3,602
92.38	7,168	3,665
92.39	7,168	3,729
92.40	7,168	3,792
92.41	7,168	3,856
92.42	7,168	3,919
92.43	7,168	3,982
92.44	7,168	4,046
92.45	7,168	4,109
92.46	7,168	4,173
92.47	7,168	4,236
92.48	7,168	4,300
92.49	7,168	4,363
92.50	7,168	4,427
92.51	7,168	4,490
92.52	7,168	4,553
92.53	7,168	4,617

Stage-Area-Storage for Pond 2P: UNDERGROUND RECHARGE SYSTEM #2 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
92.54	7,168	4,680
92.55	7,168	4,744
92.56	7,168	4,807
92.57	7,168	4,871
92.58	7,168	4,934
92.59	7,168	4,998
92.60	7,168	5,061
92.61	7,168	5,124
92.62	7,168	5,188
92.63	7,168	5,251
92.64	7,168	5,315
92.65	7,168	5,378
92.66	7,168	5,442
92.67	7,168	5,505
92.68	7,168	5,569
92.69	7,168	5,632
92.70	7,168	5,695
92.71	7,168	5,759
92.72	7,168	5,822
92.73	7,168	5,886
92.74	7,168	5,949
92.75	7,168	6,013
92.76	7,168	6,076
92.77	7,168	6,139
92.78	7,168	6,203
92.79	7,168	6,266
92.80	7,168	6,330
92.81	7,168	6,393
92.82	7,168	6,457
92.83	7,168	6,520
92.84	7,168	6,584
92.85	7,168	6,647
92.86	7,168	6,710
92.87	7,168	6,774
92.88	7,168	6,837
92.89	7,168	6,901
92.90	7,168	6,964
92.91	7,168	7,028
92.92	7,168	7,091
92.93	7,168	7,155
92.94	7,168	7,218
92.95	7,168	7,281
92.96	7,168	7,345
92.97	7,168	7,408
92.98	7,168	7,472
92.99	7,168	7,535
93.00	7,168	7,599
93.01	7,168	7,662
93.02	7,168	7,726
93.03	7,168	7,789
93.04	7,168	7,852
93.05	7,168	7,916
93.06	7,168	7,979
93.07	7,168	8,043
93.08	7,168	8,106
93.09	7,168	8,170
93.10	7,168	8,233
93.11	7,168	8,297
93.12	7,168	8,360
93.13	7,168	8,423
93.14	7,168	8,487
93.15	7,168	8,550
93.16	7,168	8,614
93.17	7,168	8,677
93.18	7,168	8,741
93.19	7,168	8,804
93.20	7,168	8,868
93.21	7,168	8,931
93.22	7,168	8,994
93.23	7,168	9,058
93.24	7,168	9,121
93.25	7,168	9,185
93.26	7,168	9,248
93.27	7,168	9,312
93.28	7,168	9,375
93.29	7,168	9,439
93.30	7,168	9,502
93.31	7,168	9,565
93.32	7,168	9,629
93.33	7,168	9,692
93.34	7,168	9,756
93.35	7,168	9,819
93.36	7,168	9,883
93.37	7,168	9,946
93.38	7,168	10,010
93.39	7,168	10,073
93.40	7,168	10,136
93.41	7,168	10,200
93.42	7,168	10,263
93.43	7,168	10,327
93.44	7,168	10,390
93.45	7,168	10,454
93.46	7,168	10,517
93.47	7,168	10,580
93.48	7,168	10,644
93.49	7,168	10,707
93.50	7,168	10,771
93.51	7,168	10,834
93.52	7,168	10,898
93.53	7,168	10,961
93.54	7,168	11,025
93.55	7,168	11,088
93.56	7,168	11,151
93.57	7,168	11,215

Stage-Area-Storage for Pond 2P: UNDERGROUND RECHARGE SYSTEM #2 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
93.58	7,168	11,278
93.59	7,168	11,342
93.60	7,168	11,405
93.61	7,168	11,469
93.62	7,168	11,532
93.63	7,168	11,596
93.64	7,168	11,659
93.65	7,168	11,722
93.66	7,168	11,786
93.67	7,168	11,849
93.68	7,168	11,913
93.69	7,168	11,976
93.70	7,168	12,040
93.71	7,168	12,103
93.72	7,168	12,167
93.73	7,168	12,230
93.74	7,168	12,293
93.75	7,168	12,357
93.76	7,168	12,420
93.77	7,168	12,484
93.78	7,168	12,547
93.79	7,168	12,611
93.80	7,168	12,674
93.81	7,168	12,738
93.82	7,168	12,801
93.83	7,168	12,864
93.84	7,168	12,928
93.85	7,168	12,991
93.86	7,168	13,055
93.87	7,168	13,118
93.88	7,168	13,182
93.89	7,168	13,245
93.90	7,168	13,309
93.91	7,168	13,372
93.92	7,168	13,435
93.93	7,168	13,499
93.94	7,168	13,562
93.95	7,168	13,626
93.96	7,168	13,689
93.97	7,168	13,753
93.98	7,168	13,816
93.99	7,168	13,880
94.00	7,168	13,943
94.01	7,168	14,006
94.02	7,168	14,070
94.03	7,168	14,133
94.04	7,168	14,197
94.05	7,168	14,260
94.06	7,168	14,324
94.07	7,168	14,387
94.08	7,168	14,450
94.09	7,168	14,514
94.10	7,168	14,577
94.11	7,168	14,641
94.12	7,168	14,704
94.13	7,168	14,768
94.14	7,168	14,831
94.15	7,168	14,895
94.16	7,168	14,958
94.17	7,168	15,021
94.18	7,168	15,085
94.19	7,168	15,148
94.20	7,168	15,212
94.21	7,168	15,275
94.22	7,168	15,339
94.23	7,168	15,402
94.24	7,168	15,466
94.25	7,168	15,529
94.26	7,168	15,592
94.27	7,168	15,656
94.28	7,168	15,719
94.29	7,168	15,783
94.30	7,168	15,846
94.31	7,168	15,910
94.32	7,168	15,973
94.33	7,168	16,037
94.34	7,168	16,100
94.35	7,168	16,163
94.36	7,168	16,227
94.37	7,168	16,290
94.38	7,168	16,354
94.39	7,168	16,417
94.40	7,168	16,481
94.41	7,168	16,544
94.42	7,168	16,608
94.43	7,168	16,671
94.44	7,168	16,734
94.45	7,168	16,798
94.46	7,168	16,861
94.47	7,168	16,925
94.48	7,168	16,988
94.49	7,168	17,052
94.50	7,168	17,115
94.51	7,168	17,179
94.52	7,168	17,242
94.53	7,168	17,305
94.54	7,168	17,369
94.55	7,168	17,432
94.56	7,168	17,496
94.57	7,168	17,559
94.58	7,168	17,623
94.59	7,168	17,686
94.60	7,168	17,750
94.61	7,168	17,813

Stage-Area-Storage for Pond 2P: UNDERGROUND RECHARGE SYSTEM #2 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)	Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
94.62	7,168	17,876	95.14	7,168	21,175
94.63	7,168	17,940	95.15	7,168	21,239
94.64	7,168	18,003	95.16	7,168	21,302
94.65	7,168	18,067	95.17	7,168	21,366
94.66	7,168	18,130	95.18	7,168	21,429
94.67	7,168	18,194	95.19	7,168	21,493
94.68	7,168	18,257	95.20	7,168	21,556
94.69	7,168	18,321	95.21	7,168	21,620
94.70	7,168	18,384	95.22	7,168	21,683
94.71	7,168	18,447	95.23	7,168	21,746
94.72	7,168	18,511	95.24	7,168	21,810
94.73	7,168	18,574	95.25	7,168	21,873
94.74	7,168	18,638	95.26	7,168	21,937
94.75	7,168	18,701	95.27	7,168	22,000
94.76	7,168	18,765	95.28	7,168	22,064
94.77	7,168	18,828	95.29	7,168	22,127
94.78	7,168	18,891	95.30	7,168	22,191
94.79	7,168	18,955	95.31	7,168	22,254
94.80	7,168	19,018	95.32	7,168	22,317
94.81	7,168	19,082	95.33	7,168	22,381
94.82	7,168	19,145	95.34	7,168	22,444
94.83	7,168	19,209	95.35	7,168	22,508
94.84	7,168	19,272	95.36	7,168	22,571
94.85	7,168	19,336	95.37	7,168	22,635
94.86	7,168	19,399	95.38	7,168	22,698
94.87	7,168	19,462	95.39	7,168	22,762
94.88	7,168	19,526	95.40	7,168	22,825
94.89	7,168	19,589	95.41	7,168	22,888
94.90	7,168	19,653	95.42	7,168	22,952
94.91	7,168	19,716	95.43	7,168	23,015
94.92	7,168	19,780	95.44	7,168	23,079
94.93	7,168	19,843	95.45	7,168	23,142
94.94	7,168	19,907	95.46	7,168	23,206
94.95	7,168	19,970	95.47	7,168	23,269
94.96	7,168	20,033	95.48	7,168	23,332
94.97	7,168	20,097	95.49	7,168	23,396
94.98	7,168	20,160	95.50	7,168	23,459
94.99	7,168	20,224	95.51	7,168	23,459
95.00	7,168	20,287	95.52	7,168	23,459
95.01	7,168	20,351	95.53	7,168	23,459
95.02	7,168	20,414	95.54	7,168	23,459
95.03	7,168	20,478	95.55	7,168	23,459
95.04	7,168	20,541	95.56	7,168	23,459
95.05	7,168	20,604	95.57	7,168	23,459
95.06	7,168	20,668	95.58	7,168	23,459
95.07	7,168	20,731	95.59	7,168	23,459
95.08	7,168	20,795	95.60	7,168	23,459
95.09	7,168	20,858	95.61	7,168	23,459
95.10	7,168	20,922	95.62	7,168	23,459
95.11	7,168	20,985	95.63	7,168	23,459
95.12	7,168	21,049	95.64	7,168	23,459
95.13	7,168	21,112	95.65	7,168	23,459

Stage-Area-Storage for Pond 2P: UNDERGROUND RECHARGE SYSTEM #2 (continued)

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
95.66	7,168	23,459
95.67	7,168	23,459
95.68	7,168	23,459
95.69	7,168	23,459
95.70	7,168	23,459
95.71	7,168	23,459
95.72	7,168	23,459
95.73	7,168	23,459
95.74	7,168	23,459
95.75	7,168	23,459
95.76	7,168	23,459
95.77	7,168	23,459
95.78	7,168	23,459
95.79	7,168	23,459
95.80	7,168	23,459
95.81	7,168	23,459
95.82	7,168	23,459
95.83	7,168	23,459
95.84	7,168	23,459
95.85	7,168	23,459
95.86	7,168	23,459
95.87	7,168	23,459
95.88	7,168	23,459
95.89	7,168	23,459
95.90	7,168	23,459
95.91	7,168	23,459
95.92	7,168	23,459
95.93	7,168	23,459
95.94	7,168	23,459
95.95	7,168	23,459
95.96	7,168	23,459
95.97	7,168	23,459
95.98	7,168	23,459
95.99	7,168	23,459
96.00	7,168	23,459
96.01	7,168	23,459
96.02	7,168	23,459
96.03	7,168	23,459
96.04	7,168	23,459
96.05	7,168	23,459
96.06	7,168	23,459
96.07	7,168	23,459
96.08	7,168	23,459
96.09	7,168	23,459
96.10	7,168	23,459
96.11	7,168	23,459
96.12	7,168	23,459
96.13	7,168	23,459
96.14	7,168	23,459
96.15	7,168	23,459
96.16	7,168	23,459
96.17	7,168	**23,459**

Stage-Area-Storage for Pond 4P: UNDERGROUND RECHARGE SYSTEM #4

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
90.25	0	90.77	373	91.29	788
90.26	7	90.78	380	91.30	806
90.27	14	90.79	387	91.31	824
90.28	22	90.80	394	91.32	842
90.29	29	90.81	401	91.33	859
90.30	36	90.82	409	91.34	877
90.31	43	90.83	416	91.35	895
90.32	50	90.84	423	91.36	913
90.33	57	90.85	430	91.37	931
90.34	65	90.86	437	91.38	948
90.35	72	90.87	444	91.39	966
90.36	79	90.88	452	91.40	984
90.37	86	90.89	459	91.41	1,002
90.38	93	90.90	466	91.42	1,020
90.39	100	90.91	473	91.43	1,038
90.40	108	90.92	480	91.44	1,055
90.41	115	90.93	487	91.45	1,073
90.42	122	90.94	495	91.46	1,091
90.43	129	90.95	502	91.47	1,109
90.44	136	90.96	509	91.48	1,127
90.45	143	90.97	516	91.49	1,144
90.46	151	90.98	523	91.50	1,162
90.47	158	90.99	530	91.51	1,180
90.48	165	91.00	538	91.52	1,198
90.49	172	91.01	545	91.53	1,216
90.50	179	91.02	552	91.54	1,234
90.51	186	91.03	559	91.55	1,251
90.52	194	91.04	566	91.56	1,269
90.53	201	91.05	573	91.57	1,287
90.54	208	91.06	581	91.58	1,305
90.55	215	91.07	588	91.59	1,323
90.56	222	91.08	595	91.60	1,341
90.57	229	91.09	602	91.61	1,358
90.58	237	91.10	609	91.62	1,376
90.59	244	91.11	616	91.63	1,394
90.60	251	91.12	624	91.64	1,412
90.61	258	91.13	631	91.65	1,430
90.62	265	91.14	638	91.66	1,447
90.63	272	91.15	645	91.67	1,465
90.64	280	91.16	652	91.68	1,483
90.65	287	91.17	659	91.69	1,501
90.66	294	91.18	667	91.70	1,519
90.67	301	91.19	674	91.71	1,537
90.68	308	91.20	681	91.72	1,554
90.69	315	91.21	688	91.73	1,572
90.70	323	91.22	695	91.74	1,590
90.71	330	91.23	702	91.75	1,608
90.72	337	91.24	710	91.76	1,626
90.73	344	91.25	717	91.77	1,643
90.74	351	91.26	735	91.78	1,661
90.75	358	91.27	752	91.79	1,679
90.76	366	91.28	770	91.80	1,697

Stage-Area-Storage for Pond 4P: UNDERGROUND RECHARGE SYSTEM #4 (continued)

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
91.81	1,715	92.33	2,641	92.85	3,568
91.82	1,733	92.34	2,659	92.86	3,586
91.83	1,750	92.35	2,677	92.87	3,604
91.84	1,768	92.36	2,695	92.88	3,622
91.85	1,786	92.37	2,713	92.89	3,639
91.86	1,804	92.38	2,731	92.90	3,657
91.87	1,822	92.39	2,748	92.91	3,675
91.88	1,840	92.40	2,766	92.92	3,693
91.89	1,857	92.41	2,784	92.93	3,711
91.90	1,875	92.42	2,802	92.94	3,729
91.91	1,893	92.43	2,820	92.95	3,746
91.92	1,911	92.44	2,837	92.96	3,764
91.93	1,929	92.45	2,855	92.97	3,782
91.94	1,946	92.46	2,873	92.98	3,800
91.95	1,964	92.47	2,891	92.99	3,818
91.96	1,982	92.48	2,909	93.00	3,835
91.97	2,000	92.49	2,927	93.01	3,853
91.98	2,018	92.50	2,944	93.02	3,871
91.99	2,036	92.51	2,962	93.03	3,889
92.00	2,053	92.52	2,980	93.04	3,907
92.01	2,071	92.53	2,998	93.05	3,925
92.02	2,089	92.54	3,016	93.06	3,942
92.03	2,107	92.55	3,034	93.07	3,960
92.04	2,125	92.56	3,051	93.08	3,978
92.05	2,142	92.57	3,069	93.09	3,996
92.06	2,160	92.58	3,087	93.10	4,014
92.07	2,178	92.59	3,105	93.11	4,031
92.08	2,196	92.60	3,123	93.12	4,049
92.09	2,214	92.61	3,140	93.13	4,067
92.10	2,232	92.62	3,158	93.14	4,085
92.11	2,249	92.63	3,176	93.15	4,103
92.12	2,267	92.64	3,194	93.16	4,121
92.13	2,285	92.65	3,212	93.17	4,138
92.14	2,303	92.66	3,230	93.18	4,156
92.15	2,321	92.67	3,247	93.19	4,174
92.16	2,338	92.68	3,265	93.20	4,192
92.17	2,356	92.69	3,283	93.21	4,210
92.18	2,374	92.70	3,301	93.22	4,228
92.19	2,392	92.71	3,319	93.23	4,245
92.20	2,410	92.72	3,336	93.24	4,263
92.21	2,428	92.73	3,354	93.25	4,281
92.22	2,445	92.74	3,372	93.26	4,299
92.23	2,463	92.75	3,390	93.27	4,317
92.24	2,481	92.76	3,408	93.28	4,334
92.25	2,499	92.77	3,426	93.29	4,352
92.26	2,517	92.78	3,443	93.30	4,370
92.27	2,535	92.79	3,461	93.31	4,388
92.28	2,552	92.80	3,479	93.32	4,406
92.29	2,570	92.81	3,497	93.33	4,424
92.30	2,588	92.82	3,515	93.34	4,441
92.31	2,606	92.83	3,532	93.35	4,459
92.32	2,624	92.84	3,550	93.36	4,477

Stage-Area-Storage for Pond 4P: UNDERGROUND RECHARGE SYSTEM #4 (continued)

Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)	Elevation (feet)	Storage (cubic-feet)
93.37	4,495	93.89	5,421	94.41	6,063
93.38	4,513	93.90	5,439	94.42	6,063
93.39	4,530	93.91	5,457	94.43	6,063
93.40	4,548	93.92	5,475	94.44	6,063
93.41	4,566	93.93	5,493	94.45	6,063
93.42	4,584	93.94	5,511	94.46	6,063
93.43	4,602	93.95	5,528	94.47	6,063
93.44	4,620	93.96	5,546	94.48	6,063
93.45	4,637	93.97	5,564	94.49	6,063
93.46	4,655	93.98	5,582	94.50	6,063
93.47	4,673	93.99	5,600	94.51	6,063
93.48	4,691	94.00	5,618	94.52	6,063
93.49	4,709	94.01	5,635	94.53	6,063
93.50	4,726	94.02	5,653	94.54	6,063
93.51	4,744	94.03	5,671	94.55	6,063
93.52	4,762	94.04	5,689	94.56	6,063
93.53	4,780	94.05	5,707	94.57	6,063
93.54	4,798	94.06	5,724	94.58	6,063
93.55	4,816	94.07	5,742	94.59	6,063
93.56	4,833	94.08	5,760	94.60	6,063
93.57	4,851	94.09	5,778	94.61	6,063
93.58	4,869	94.10	5,796	94.62	6,063
93.59	4,887	94.11	5,814	94.63	6,063
93.60	4,905	94.12	5,831	94.64	6,063
93.61	4,923	94.13	5,849	94.65	6,063
93.62	4,940	94.14	5,867	94.66	6,063
93.63	4,958	94.15	5,885	94.67	6,063
93.64	4,976	94.16	5,903	94.68	6,063
93.65	4,994	94.17	5,920	94.69	6,063
93.66	5,012	94.18	5,938	94.70	6,063
93.67	5,029	94.19	5,956	94.71	6,063
93.68	5,047	94.20	5,974	94.72	6,063
93.69	5,065	94.21	5,992	94.73	6,063
93.70	5,083	94.22	6,010	94.74	6,063
93.71	5,101	94.23	6,027	94.75	6,063
93.72	5,119	94.24	6,045	94.76	6,063
93.73	5,136	94.25	6,063	94.77	6,063
93.74	5,154	94.26	6,063	94.78	6,063
93.75	5,172	94.27	6,063	94.79	6,063
93.76	5,190	94.28	6,063	94.80	6,063
93.77	5,208	94.29	6,063	94.81	6,063
93.78	5,225	94.30	6,063	94.82	6,063
93.79	5,243	94.31	6,063	94.83	6,063
93.80	5,261	94.32	6,063	94.84	6,063
93.81	5,279	94.33	6,063	94.85	6,063
93.82	5,297	94.34	6,063	94.86	6,063
93.83	5,315	94.35	6,063	94.87	6,063
93.84	5,332	94.36	6,063	94.88	6,063
93.85	5,350	94.37	6,063	94.89	6,063
93.86	5,368	94.38	6,063	94.90	6,063
93.87	5,386	94.39	6,063	94.91	6,063
93.88	5,404	94.40	6,063	94.92	**6,063**

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Treatment Spreadsheet

Treatment Train A

B	C	D	E	F
BMP	TSS Removal Rate	Starting TSS Load	Amount Removed (C*D)	Remaining Load (D-E)
Deep Sump & Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Water Quality Structure	**0.77**	**0.75**	**0.58**	**0.17**
Subsurface Infiltration System	**0.80**	**0.17**	**0.14**	**0.03**

Total TSS Removal = 97%

Treatment Train B

B	C	D	E	F
BMP	TSS Removal Rate	Starting TSS Load	Amount Removed (C*D)	Remaining Load (D-E)
Water Quality Structure	**0.77**	**1**	**0.77**	**0.23**
Subsurface Infiltration System	**0.80**	**0.23**	**0.18**	**0.05**

Total TSS Removal = 95%

Treatment Train C

B	C	D	E	F
BMP	TSS Removal Rate	Starting TSS Load	Amount Removed (C*D)	Remaining Load (D-E)
Rain Guardian	**0.70**	**1.00**	**0.70**	**0.30**

Total TSS Removal = 70%

Treatment Train D

B	C	D	E	F
BMP	TSS Removal Rate	Starting TSS Load	Amount Removed (C*D)	Remaining Load (D-E)
Silt Prison	**0.63**	**1.00**	**0.63**	**0.37**
Water Quality Structure	**0.77**	**0.37**	**0.28**	**0.09**

Total TSS Removal = 91%

Treatment Train E

B	C	D	E	F
BMP	TSS Removal Rate	Starting TSS Load	Amount Removed (C*D)	Remaining Load (D-E)
Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**

Total TSS Removal = 25%

Vehicular Impervious

Treatment Train	BMP	sq feet	acres	Treatment Provided	% of Site Vehicular Impervious Area	Weighted Percentage
A	CB to WQS to Subsurface Infiltration	154,995	3.56	97%	46.44%	44.84%
B	WQS to Subsurface Infiltration	3,063	0.07	95%	0.92%	0.88%
C	Rain Gardian	41,527	0.95	70%	12.44%	8.71%
D	Silt Prison to WQS	128,808	2.96	91%	38.60%	35.31%
E	CB	5,335	0.12	25%	1.60%	0.40%
	Total Treated Vehicular Area	**333,728**	**7.66**		**100.00%**	**90.14%**
	Total Vehicular Area	**333,728**	**7.66**			

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1" Calculation Sheet

Nitsch Job # 15363
Calc: bjb
Date: 7/30/2024

This spreadsheet should be used to convert water quality volume to an equivilent water quality peak flow rate as outlined in the new MA DEP guidelines that take effect on October 15, 2013.

Glossary

Water Quality Flow Rate = WQF
Water Quality Volume = WQV*
unit peak discharge (csm/in) = qu**
Impervious Area in watershed (square miles) = Ai

*WQV is expressed in watershed inches (you must use 1.0-inches in all cases with this method and not 0.5-inches)
** calculate the qu based on the time of concentration (see 1" - qu Table)

Compute Water Quality Flow with the following Equation

WQF = (qu)(A)(WQV)

Input Information (in colored cells only)

Site Plan Callout		Enter qu (from 1" - qu Table)	Enter Impervious Area (SF)	Ai (sq/mi)	WQV		WQF	
WQI-113	=	774	3,913.75	0.000140	1	=	0.11	cfs
WQS-203		774	40,055.88	0.001437	1		1.11	
WQS-204	=	774	29,178.45	0.001047	1	=	0.81	cfs
WQS-205	=	774	33,828.28	0.001213	1	=	0.94	cfs
WQS-206	=	774	38,943.87	0.001397	1	=	1.08	cfs
WQS-207	=	774	22,399.51	0.000803	1	=	0.62	cfs
WQS-208	=	774	25,089.83	0.000900	1	=	0.70	cfs
WQS-209	=	774	25,078.83	0.000900	1	=	0.70	cfs
WQS-212	=	774	14,955.40	0.000536	1	=	0.42	cfs
WQS-233	=	774	7,635.49	0.000274	1	=	0.21	cfs
WQS-244	=	774	34,142.54	0.001225	1	=	0.95	cfs
WQS-245	=	774	24,798.56	0.000890	1	=	0.69	cfs
WQS-246	=	774	30,447.93	0.001092	1	=	0.85	cfs
	=							
	=							
	=							
	=							
	=							
	=							

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Sediment Storage Calculation Sheet

Nitsch Job #	15363	Date:	7/30/2024
Project Name:	Principio		
Calculated by:	BJB	Checked by:	
Water Quality ID:	WQI-113		

This spreadsheet should be used to calculate the required amount of sediment storage for proposed water quality units.

Assumptions:	150	mg/L	TSS Loading
*change these as needed	42	inches	Annual Rainfall - Boston Area
	2650	kg/m^3	SG
	90%		TSS Removal
	3	years	Storage Capacity

Input:

Drainage Area:	0.17828	acres	Input Project Specific Values
% Impervious:	50.40%	of area	

Volume of Runoff:	13699.007	cf/year =	387.912	m^3/year		
Loading:	0.150	kg/m^3				
Sediment:	58.187	kg/year =	0.022	m^3/year =	0.775	cf/year
Sediment Removal:	0.698	cf/year				

Sediment Storage Required:	**2 cf**

Notes
1) TSS Loading is a conservative estimate based on a study completed by Maestre and Pitt in 2005
2) Rainfall data is based on NOAA Atlas 14 Volume 10 for Andover.
3) Specific Gravity is based on the NJDEP testing requirements for dynamic separators.
4) TSS removal goal is for storage calculations only.
5) Providing 3 years of storage capacity as a factor of safety assuming yearly cleaning of WQS.

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Sediment Storage Calculation Sheet

Nitsch Job #	15363	Date:	7/30/2024
Project Name:	Principio		
Calculated by:	BJB	Checked by:	
Water Quality ID:	WQS-203		

This spreadsheet should be used to calculate the required amount of sediment storage for proposed water quality units.

Assumptions:	150	mg/L	TSS Loading
*change these as needed	42	inches	Annual Rainfall - Boston Area
	2650	kg/m^3	SG
	90%		TSS Removal
	3	years	Storage Capacity

Input:

Drainage Area:	1.27567	acres	Input Project Specific Values
% Impervious:	72.08%	of area	

Volume of Runoff:	140187.418	cf/year =	3969.659	m^3/year		
Loading:	0.150	kg/m^3				
Sediment:	595.449	kg/year =	0.225	m^3/year =	7.935	cf/year
Sediment Removal:	7.142	cf/year				

Sediment Storage Required:	**21 cf**

Notes

1) TSS Loading is a conservative estimate based on a study completed by Maestre and Pitt in 2005
2) Rainfall data is based on NOAA Atlas 14 Volume 10 for Andover.
3) Specific Gravity is based on the NJDEP testing requirements for dynamic separators.
4) TSS removal goal is for storage calculations only.
5) Providing 3 years of storage capacity as a factor of safety assuming yearly cleaning of WQS.

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Sediment Storage Calculation Sheet

Nitsch Job #	15363	Date:	7/30/2024
Project Name:	Principio		
Calculated by:	BJB	Checked by:	
Water Quality ID:	WQS-204		

This spreadsheet should be used to calculate the required amount of sediment storage for proposed water quality units.

Assumptions:	150	mg/L	TSS Loading
*change these as needed	42	inches	Annual Rainfall - Boston Area
	2650	kg/m^3	SG
	90%		TSS Removal
	3	years	Storage Capacity

Input:

Drainage Area:	0.72326	acres	Input Project Specific Values
% Impervious:	92.61%	of area	

Volume of Runoff:	102119.398	cf/year =	2891.695	m^3/year		
Loading:	0.150	kg/m^3				
Sediment:	433.754	kg/year =	0.164	m^3/year =	5.780	cf/year
Sediment Removal:	5.202	cf/year				

Sediment Storage Required:	**16 cf**

Notes
1) TSS Loading is a conservative estimate based on a study completed by Maestre and Pitt in 2005
2) Rainfall data is based on NOAA Atlas 14 Volume 10 for Andover.
3) Specific Gravity is based on the NJDEP testing requirements for dynamic separators.
4) TSS removal goal is for storage calculations only.
5) Providing 3 years of storage capacity as a factor of safety assuming yearly cleaning of WQS.

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Sediment Storage Calculation Sheet

Nitsch Job #	15363	Date:	7/30/2024
Project Name:	Principio		
Calculated by:	BJB	Checked by:	
Water Quality ID:	WQS-205		

This spreadsheet should be used to calculate the required amount of sediment storage for proposed water quality units.

Assumptions:	150	mg/L	TSS Loading
*change these as needed	42	inches	Annual Rainfall - Boston Area
	2650	kg/m^3	SG
	90%		TSS Removal
	3	years	Storage Capacity

Input:

Drainage Area:	1.2	acres	Input Project Specific Values
% Impervious:	64.74%	of area	

Volume of Runoff:	118443.125	cf/year =	3353.93	m^3/year	
Loading:	0.150	kg/m^3			
Sediment:	503.090	kg/year =	0.190	m^3/year =	6.704 cf/year
Sediment Removal:	6.034	cf/year			

Sediment Storage Required: 18 cf

Notes

1) TSS Loading is a conservative estimate based on a study completed by Maestre and Pitt in 2005
2) Rainfall data is based on NOAA Atlas 14 Volume 10 for Andover.
3) Specific Gravity is based on the NJDEP testing requirements for dynamic separators.
4) TSS removal goal is for storage calculations only.
5) Providing 3 years of storage capacity as a factor of safety assuming yearly cleaning of WQS.

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Sediment Storage Calculation Sheet

Nitsch Job #	15363	Date:	7/30/2024
Project Name:	Principio		
Calculated by:	BJB	Checked by:	
Water Quality ID:	WQS-206		

This spreadsheet should be used to calculate the required amount of sediment storage for proposed water quality units.

Assumptions:	150	mg/L	TSS Loading
*change these as needed	42	inches	Annual Rainfall - Boston Area
	2650	kg/m^3	SG
	90%		TSS Removal
	3	years	Storage Capacity

Input:

Drainage Area:	1.68	acres	Input Project Specific Values
% Impervious:	53.24%	of area	

Volume of Runoff:	136365.103	cf/year =	3861.423	m^3/year	
Loading:	0.150	kg/m^3			
Sediment:	579.214	kg/year =	0.219	m^3/year =	7.719 cf/year
Sediment Removal:	6.947	cf/year			

Sediment Storage Required:	**21 cf**

Notes
1) TSS Loading is a conservative estimate based on a study completed by Maestre and Pitt in 2005
2) Rainfall data is based on NOAA Atlas 14 Volume 10 for Andover.
3) Specific Gravity is based on the NJDEP testing requirements for dynamic separators.
4) TSS removal goal is for storage calculations only.
5) Providing 3 years of storage capacity as a factor of safety assuming yearly cleaning of WQS.

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Sediment Storage Calculation Sheet

Nitsch Job #	15363	Date:	7/30/2024
Project Name:	Principio		
Calculated by:	BJB	Checked by:	
Water Quality ID:	WQS-207		

This spreadsheet should be used to calculate the required amount of sediment storage for proposed water quality units.

Assumptions:	150	mg/L	TSS Loading
*change these as needed	42	inches	Annual Rainfall - Boston Area
	2650	kg/m^3	SG
	90%		TSS Removal
	3	years	Storage Capacity

Input:

Drainage Area:	0.86	acres	Input Project Specific Values
% Impervious:	60.09%	of area	

Volume of Runoff:	78787.364	cf/year =	2231.006	m^3/year		
Loading:	0.150	kg/m^3				
Sediment:	334.651	kg/year =	0.126	m^3/year =	4.460	cf/year
Sediment Removal:	4.014	cf/year				

Sediment Storage Required:	**12 cf**

Notes

1) TSS Loading is a conservative estimate based on a study completed by Maestre and Pitt in 2005
2) Rainfall data is based on NOAA Atlas 14 Volume 10 for Andover.
3) Specific Gravity is based on the NJDEP testing requirements for dynamic separators.
4) TSS removal goal is for storage calculations only.
5) Providing 3 years of storage capacity as a factor of safety assuming yearly cleaning of WQS.

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Sediment Storage Calculation Sheet

Nitsch Job #	15363	Date:	7/30/2024
Project Name:	Principio		
Calculated by:	BJB	Checked by:	
Water Quality ID:	WQS-208		

This spreadsheet should be used to calculate the required amount of sediment storage for proposed water quality units.

Assumptions:	150	mg/L	TSS Loading
*change these as needed	42	inches	Annual Rainfall - Boston Area
	2650	kg/m^3	SG
	90%		TSS Removal
	3	years	Storage Capacity

Input:

Drainage Area:	0.91	acres	Input Project Specific Values
% Impervious:	63.45%	of area	

Volume of Runoff:	88029.642	cf/year =	2492.718	m^3/year		
Loading:	0.150	kg/m^3				
Sediment:	373.908	kg/year =	0.141	m^3/year =	4.983	cf/year
Sediment Removal:	4.485	cf/year				

Sediment Storage Required:	**13 cf**

Notes

1) TSS Loading is a conservative estimate based on a study completed by Maestre and Pitt in 2005
2) Rainfall data is based on NOAA Atlas 14 Volume 10 for Andover.
3) Specific Gravity is based on the NJDEP testing requirements for dynamic separators.
4) TSS removal goal is for storage calculations only.
5) Providing 3 years of storage capacity as a factor of safety assuming yearly cleaning of WQS.

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Sediment Storage Calculation Sheet

Nitsch Job #	15363	Date:	7/30/2024
Project Name:	Principio		
Calculated by:	BJB	Checked by:	
Water Quality ID:	WQS-209		

This spreadsheet should be used to calculate the required amount of sediment storage for proposed water quality units.

Assumptions:	150	mg/L	TSS Loading
*change these as needed	42	inches	Annual Rainfall - Boston Area
	2650	kg/m^3	SG
	90%		TSS Removal
	3	years	Storage Capacity

Input:

Drainage Area:	0.81153	acres	Input Project Specific Values
% Impervious:	70.94%	of area	

Volume of Runoff:	87771.128	cf/year =	2485.397	m^3/year		
Loading:	0.150	kg/m^3				
Sediment:	372.810	kg/year =	0.141	m^3/year =	4.968	cf/year
Sediment Removal:	4.471	cf/year				

Sediment Storage Required:	**13 cf**

Notes

1) TSS Loading is a conservative estimate based on a study completed by Maestre and Pitt in 2005
2) Rainfall data is based on NOAA Atlas 14 Volume 10 for Andover.
3) Specific Gravity is based on the NJDEP testing requirements for dynamic separators.
4) TSS removal goal is for storage calculations only.
5) Providing 3 years of storage capacity as a factor of safety assuming yearly cleaning of WQS.

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Sediment Storage Calculation Sheet

Nitsch Job #	15363	Date:	7/30/2024
Project Name:	Principio		
Calculated by:	BJB	Checked by:	
Water Quality ID:	WQS-212		

This spreadsheet should be used to calculate the required amount of sediment storage for proposed water quality units.

Assumptions:	150	mg/L	TSS Loading
*change these as needed	42	inches	Annual Rainfall - Boston Area
	2650	kg/m^3	SG
	90%		TSS Removal
	3	years	Storage Capacity

Input:

Drainage Area:	0.37856	acres	Input Project Specific Values
% Impervious:	90.69%	of area	

Volume of Runoff:	52341.967	cf/year =	1482.157	m^3/year		
Loading:	0.150	kg/m^3				
Sediment:	222.324	kg/year =	0.084	m^3/year =	2.963	cf/year
Sediment Removal:	2.666	cf/year				

Sediment Storage Required:	**8 cf**

Notes

1) TSS Loading is a conservative estimate based on a study completed by Maestre and Pitt in 2005
2) Rainfall data is based on NOAA Atlas 14 Volume 10 for Andover.
3) Specific Gravity is based on the NJDEP testing requirements for dynamic separators.
4) TSS removal goal is for storage calculations only.
5) Providing 3 years of storage capacity as a factor of safety assuming yearly cleaning of WQS.

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Sediment Storage Calculation Sheet

Nitsch Job #	15363	Date:	7/30/2024
Project Name:	Principio		
Calculated by:	BJB	Checked by:	
Water Quality ID:	WQS-233		

This spreadsheet should be used to calculate the required amount of sediment storage for proposed water quality units.

Assumptions:	150	mg/L	TSS Loading
*change these as needed	42	inches	Annual Rainfall - Boston Area
	2650	kg/m^3	SG
	90%		TSS Removal
	3	years	Storage Capacity

Input:

Drainage Area:	0.69662	acres	Input Project Specific Values
% Impervious:	25.16%	of area	

Volume of Runoff:	26721.602	cf/year =	756.6703	m^3/year		
Loading:	0.150	kg/m^3				
Sediment:	113.501	kg/year =	0.043	m^3/year =	1.513	cf/year
Sediment Removal:	1.361	cf/year				

Sediment Storage Required:	**4 cf**

Notes

1) TSS Loading is a conservative estimate based on a study completed by Maestre and Pitt in 2005
2) Rainfall data is based on NOAA Atlas 14 Volume 10 for Andover.
3) Specific Gravity is based on the NJDEP testing requirements for dynamic separators.
4) TSS removal goal is for storage calculations only.
5) Providing 3 years of storage capacity as a factor of safety assuming yearly cleaning of WQS.

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Sediment Storage Calculation Sheet

Nitsch Job #	15363	Date:	7/30/2024
Project Name:	Principio		
Calculated by:	BJB	Checked by:	
Water Quality ID:	WQS-244		

This spreadsheet should be used to calculate the required amount of sediment storage for proposed water quality units.

Assumptions:	150	mg/L	TSS Loading
*change these as needed	42	inches	Annual Rainfall - Boston Area
	2650	kg/m^3	SG
	90%		TSS Removal
	3	years	Storage Capacity

Input:

Drainage Area:	1.01	acres	Input Project Specific Values
% Impervious:	77.25%	of area	

Volume of Runoff:	118953.104	cf/year =	3368.371	m^3/year		
Loading:	0.150	kg/m^3				
Sediment:	505.256	kg/year =	0.191	m^3/year =	6.733	cf/year
Sediment Removal:	6.060	cf/year				

Sediment Storage Required:	**18 cf**

Notes

1) TSS Loading is a conservative estimate based on a study completed by Maestre and Pitt in 2005
2) Rainfall data is based on NOAA Atlas 14 Volume 10 for Andover.
3) Specific Gravity is based on the NJDEP testing requirements for dynamic separators.
4) TSS removal goal is for storage calculations only.
5) Providing 3 years of storage capacity as a factor of safety assuming yearly cleaning of WQS.

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Sediment Storage Calculation Sheet

Nitsch Job #	15363	Date:	7/30/2024
Project Name:	Principio		
Calculated by:	BJB	Checked by:	
Water Quality ID:	WQS-245		

This spreadsheet should be used to calculate the required amount of sediment storage for proposed water quality units.

Assumptions:	150	mg/L	TSS Loading
*change these as needed	42	inches	Annual Rainfall - Boston Area
	2650	kg/m^3	SG
	90%		TSS Removal
	3	years	Storage Capacity

Input:

Drainage Area:	0.94	acres	Input Project Specific Values
% Impervious:	60.70%	of area	

Volume of Runoff:	86990.627	cf/year =	2463.296	m^3/year	
Loading:	0.150	kg/m^3			
Sediment:	369.494	kg/year =	0.139	m^3/year =	4.924 cf/year
Sediment Removal:	4.432	cf/year			

Sediment Storage Required:	**13 cf**

Notes
1) TSS Loading is a conservative estimate based on a study completed by Maestre and Pitt in 2005
2) Rainfall data is based on NOAA Atlas 14 Volume 10 for Andover.
3) Specific Gravity is based on the NJDEP testing requirements for dynamic separators.
4) TSS removal goal is for storage calculations only.
5) Providing 3 years of storage capacity as a factor of safety assuming yearly cleaning of WQS.

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Sediment Storage Calculation Sheet

Nitsch Job #	15363	Date:	7/30/2024
Project Name:	Principio		
Calculated by:	BJB	Checked by:	
Water Quality ID:	WQS-246		

This spreadsheet should be used to calculate the required amount of sediment storage for proposed water quality units.

Assumptions:	150	mg/L	TSS Loading
*change these as needed	42	inches	Annual Rainfall - Boston Area
	2650	kg/m^3	SG
	90%		TSS Removal
	3	years	Storage Capacity

Input:	Drainage Area:	0.83	acres	Input Project Specific Values
	% Impervious:	84.71%	of area	

Volume of Runoff:	107193.559	cf/year =	3035.379	m^3/year		
Loading:	0.150	kg/m^3				
Sediment:	455.307	kg/year =	0.172	m^3/year =	6.068	cf/year
Sediment Removal:	5.461	cf/year				

Sediment Storage Required:	**16 cf**

Notes
1) TSS Loading is a conservative estimate based on a study completed by Maestre and Pitt in 2005
2) Rainfall data is based on NOAA Atlas 14 Volume 10 for Andover.
3) Specific Gravity is based on the NJDEP testing requirements for dynamic separators.
4) TSS removal goal is for storage calculations only.
5) Providing 3 years of storage capacity as a factor of safety assuming yearly cleaning of WQS.

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STANDARD 10: Illicit Discharge Compliance Statement

Project Name: Principio Validation	Nitsch Project #: 15363
Location: 30 Burtt Road, Andover, MA	Checked by: MV
Prepared by: BJB	Sheet No. 1 of 1
Date: 7/26/2024	

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

This is to verify:

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

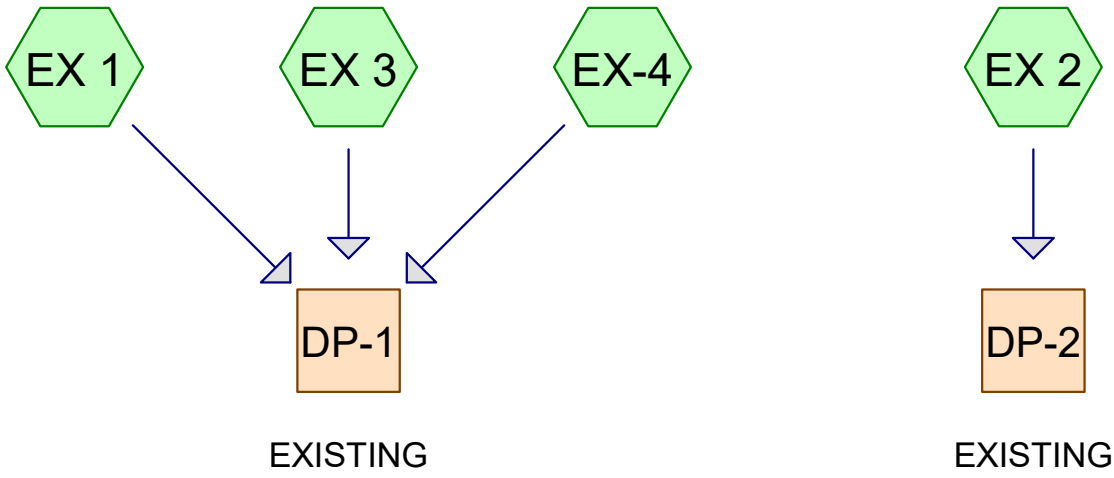
2. The design of the stormwater system includes no proposed illicit discharges.

Marissa Valentino, PE

7/30/2024
Date

APPENDIX B

Existing Conditions – HydroCAD Calculations



Subcat Reach Pond Link

Routing Diagram for 15363-HYDROCAD-revised
Prepared by Nitsch Engineering, Printed 7/30/2024
HydroCAD® 10.10-7c s/n 00546 © 2022 HydroCAD Software Solutions LLC

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	NOAA 24-hr	D	Default	24.00	1	3.22	2
2	10-Year	NOAA 24-hr	D	Default	24.00	1	5.09	2
3	25-Year	NOAA 24-hr	D	Default	24.00	1	6.25	2
4	100-Year	NOAA 24-hr	D	Default	24.00	1	8.05	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.781	39	>75% Grass cover, Good, HSG A (EX 2, EX-4)
2.931	61	>75% Grass cover, Good, HSG B (EX 1)
1.005	74	>75% Grass cover, Good, HSG C (EX 1, EX 3)
0.191	85	Gravel roads, HSG B (EX 1)
0.010	89	Gravel roads, HSG C (EX 1)
0.944	98	Paved parking, HSG A (EX 2, EX-4)
8.159	98	Paved parking, HSG B (EX 1)
0.335	98	Paved parking, HSG C (EX 1, EX 3)
0.831	55	Woods, Good, HSG B (EX 1)
0.122	70	Woods, Good, HSG C (EX 1)
15.309	**84**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
1.725	HSG A	EX 2, EX-4
12.112	HSG B	EX 1
1.472	HSG C	EX 1, EX 3
0.000	HSG D	
0.000	Other	
15.309		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.781	2.931	1.005	0.000	0.000	4.717	>75% Grass cover, Good	EX 1, EX 2, EX 3, EX-4
0.000	0.191	0.010	0.000	0.000	0.201	Gravel roads	EX 1
0.944	8.159	0.335	0.000	0.000	9.438	Paved parking	EX 1, EX 2, EX 3, EX-4
0.000	0.831	0.122	0.000	0.000	0.953	Woods, Good	EX 1
1.725	**12.112**	**1.472**	**0.000**	**0.000**	**15.309**	**TOTAL AREA**	

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	EX 1	0.00	0.00	995.0	0.0037	0.013	0.0	30.0	0.0
2	EX 2	0.00	0.00	334.0	0.0030	0.013	0.0	12.0	0.0

Summary for Subcatchment EX 1:

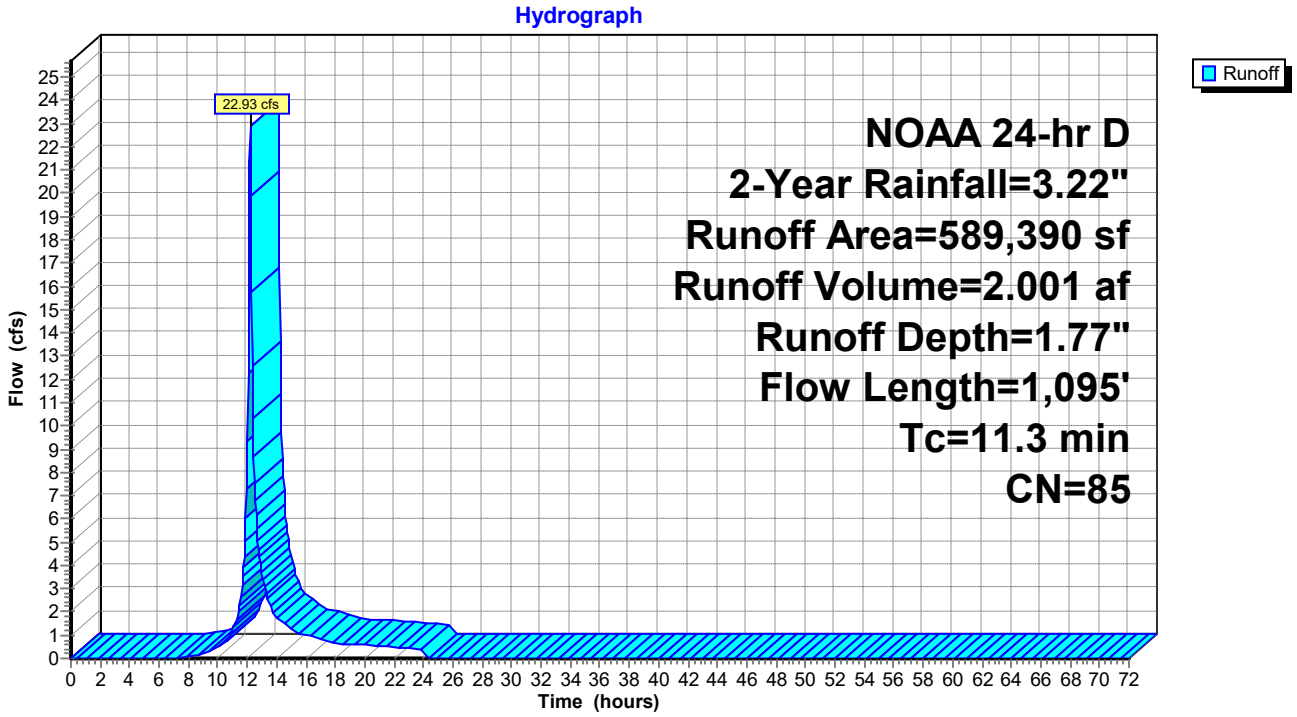
Runoff = 22.93 cfs @ 12.19 hrs, Volume= 2.001 af, Depth= 1.77"
Routed to Reach DP-1 : EXISTING

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-Year Rainfall=3.22"

Area (sf)	CN	Description
355,407	98	Paved parking, HSG B
127,693	61	>75% Grass cover, Good, HSG B
36,181	55	Woods, Good, HSG B
8,323	85	Gravel roads, HSG B
14,521	98	Paved parking, HSG C
41,515	74	>75% Grass cover, Good, HSG C
5,324	70	Woods, Good, HSG C
426	89	Gravel roads, HSG C
589,390	85	Weighted Average
219,462		37.24% Pervious Area
369,928		62.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	100	0.0300	0.21		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.46"
3.3	995	0.0037	5.08	24.95	**Pipe Channel, B-C** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Concrete pipe, bends & connections
11.3	1,095	Total			

Subcatchment EX 1:



Summary for Subcatchment EX 2:

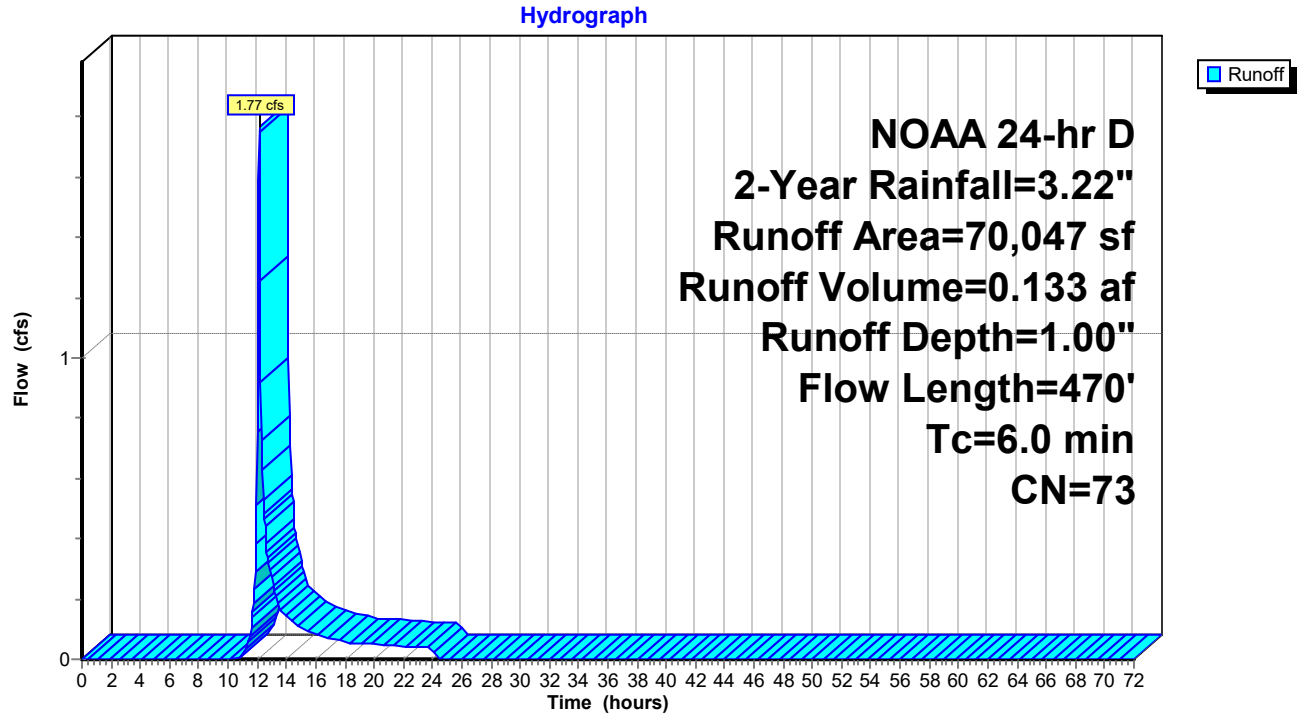
Runoff = 1.77 cfs @ 12.14 hrs, Volume= 0.133 af, Depth= 1.00"
Routed to Reach DP-2 : EXISTING

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-Year Rainfall=3.22"

Area (sf)	CN	Description
40,219	98	Paved parking, HSG A
29,828	39	>75% Grass cover, Good, HSG A
0	30	Woods, Good, HSG A
70,047	73	Weighted Average
29,828		42.58% Pervious Area
40,219		57.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0100	1.08		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.3	36	0.0100	2.03		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
2.2	334	0.0030	2.48	1.95	**Pipe Channel, C-D** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Concrete pipe, bends & connections
4.0	470	Total, Increased to minimum Tc = 6.0 min			

Subcatchment EX 2:



Summary for Subcatchment EX 3:

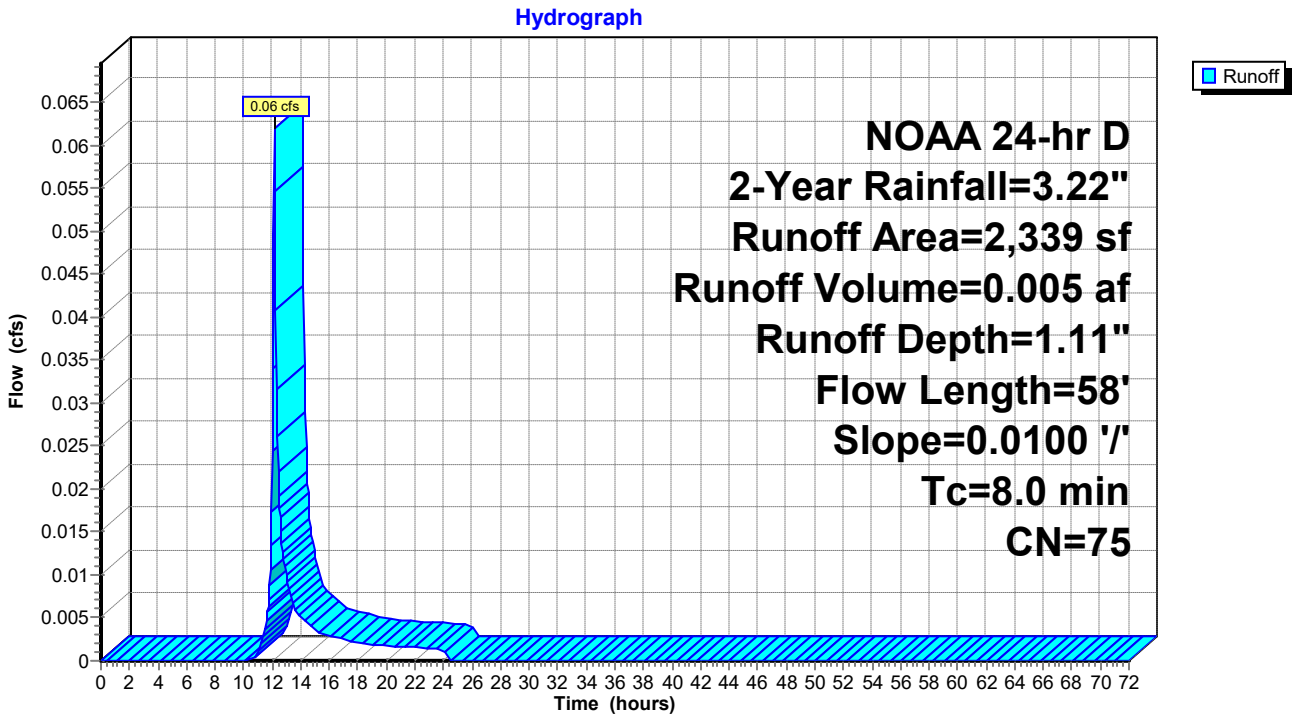
Runoff = 0.06 cfs @ 12.16 hrs, Volume= 0.005 af, Depth= 1.11"
Routed to Reach DP-1 : EXISTING

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-Year Rainfall=3.22"

Area (sf)	CN	Description
89	98	Paved parking, HSG C
2,250	74	>75% Grass cover, Good, HSG C
2,339	75	Weighted Average
2,250		96.19% Pervious Area
89		3.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	58	0.0100	0.12		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.46"

Subcatchment EX 3:



Summary for Subcatchment EX-4:

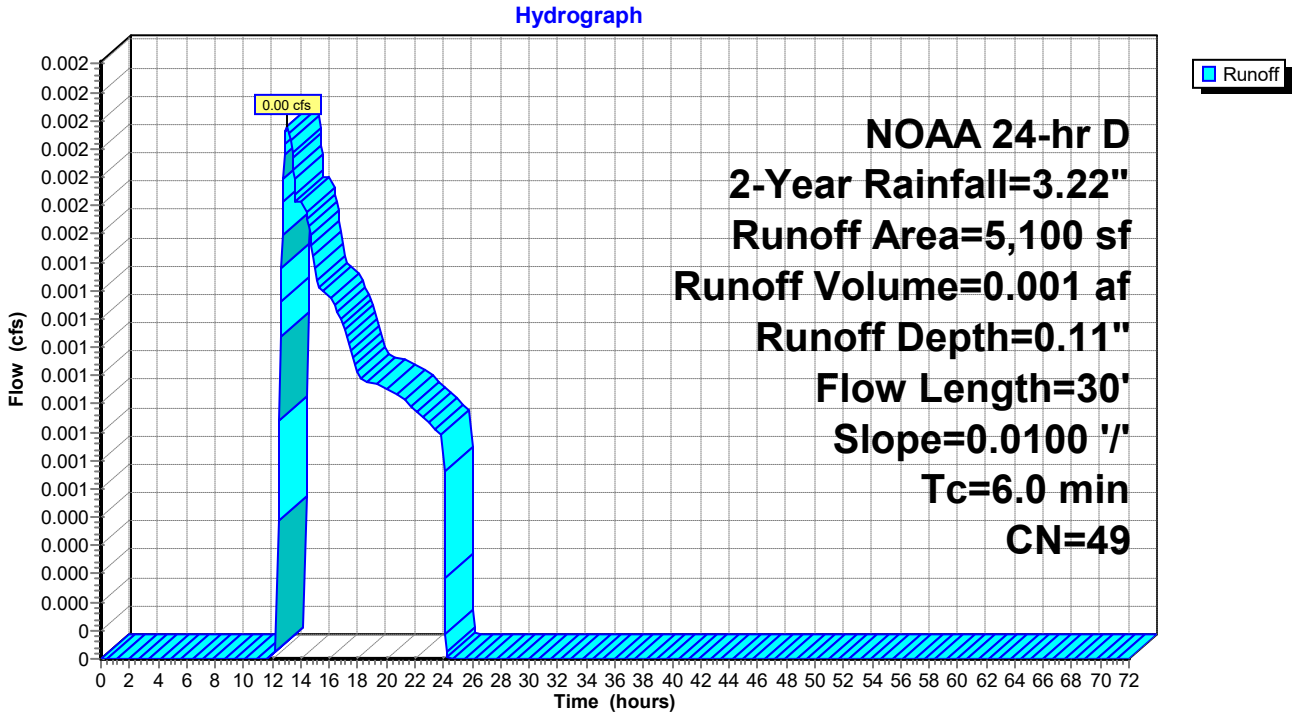
Runoff = 0.00 cfs @ 13.04 hrs, Volume= 0.001 af, Depth= 0.11"
Routed to Reach DP-1 : EXISTING

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-Year Rainfall=3.22"

Area (sf)	CN	Description
903	98	Paved parking, HSG A
4,197	39	>75% Grass cover, Good, HSG A
0	30	Woods, Good, HSG A
5,100	49	Weighted Average
4,197		82.29% Pervious Area
903		17.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	30	0.0100	0.11		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.46"
4.7	30	Total, Increased to minimum Tc = 6.0 min			

Subcatchment EX-4:



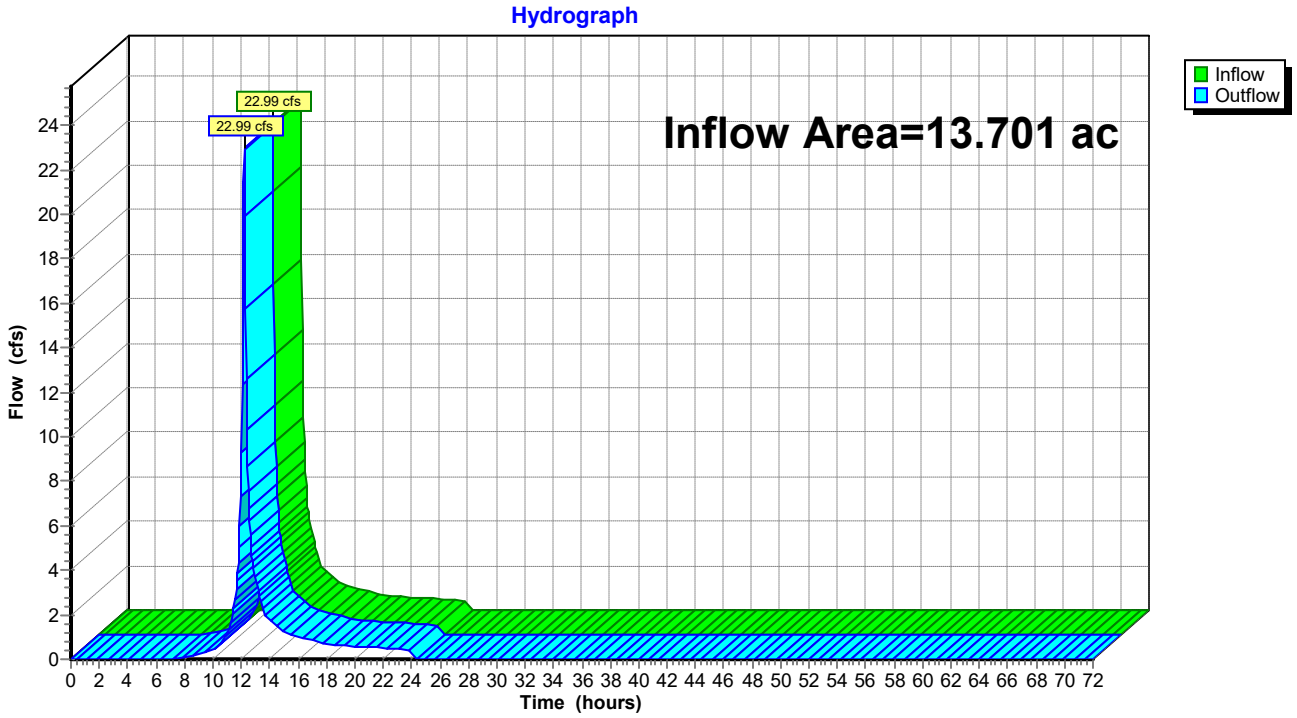
Summary for Reach DP-1: EXISTING

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

Inflow Area = 13.701 ac, 62.15% Impervious, Inflow Depth = 1.76" for 2-Year event
Inflow = 22.99 cfs @ 12.19 hrs, Volume= 2.007 af
Outflow = 22.99 cfs @ 12.19 hrs, Volume= 2.007 af, 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



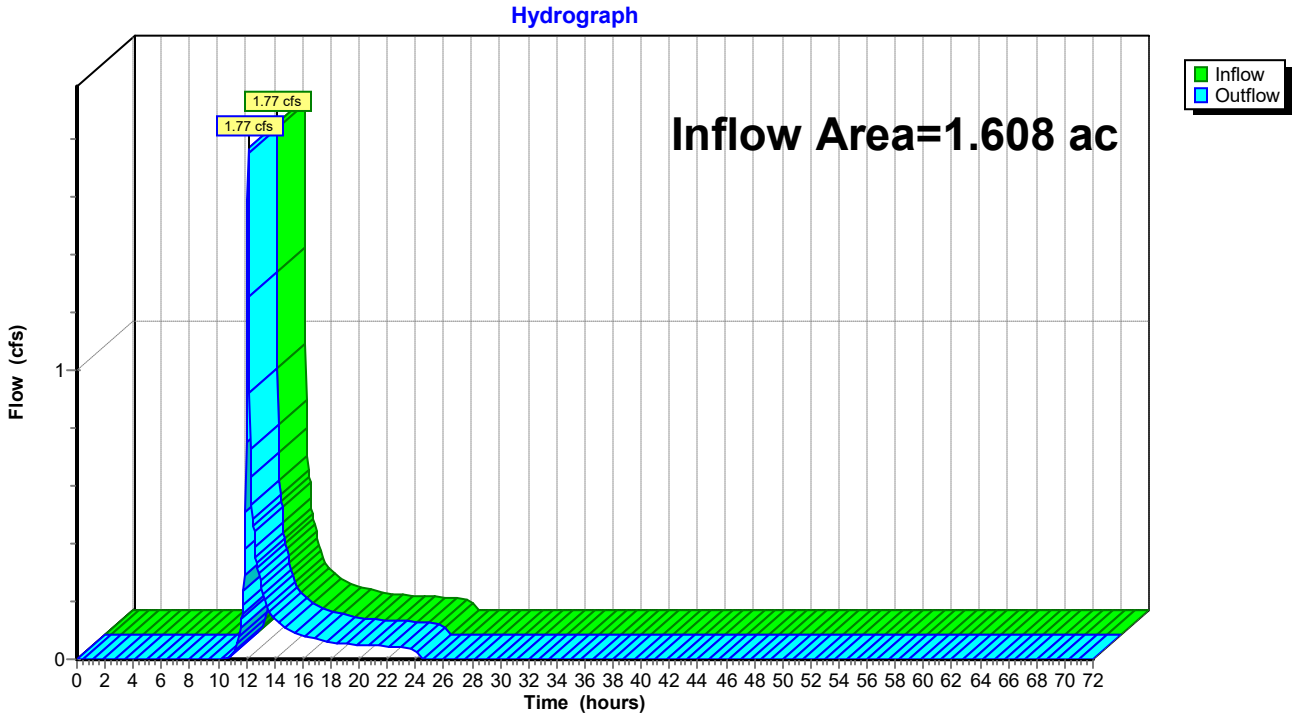
Summary for Reach DP-2: EXISTING

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

Inflow Area = 1.608 ac, 57.42% Impervious, Inflow Depth = 1.00" for 2-Year event
Inflow = 1.77 cfs @ 12.14 hrs, Volume= 0.133 af
Outflow = 1.77 cfs @ 12.14 hrs, Volume= 0.133 af, 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-2: EXISTING



Summary for Subcatchment EX 1:

[47] Hint: Peak is 176% of capacity of segment #2

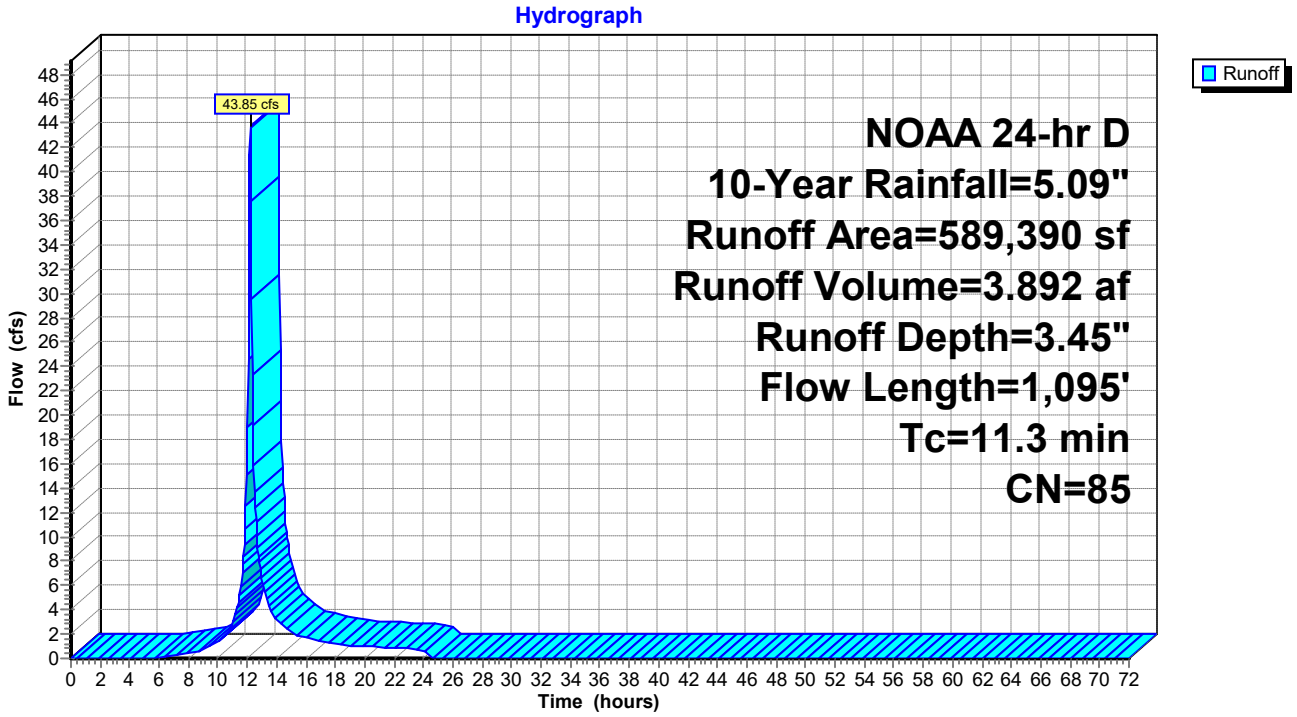
Runoff = 43.85 cfs @ 12.19 hrs, Volume= 3.892 af, Depth= 3.45"
Routed to Reach DP-1 : EXISTING

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-Year Rainfall=5.09"

Area (sf)	CN	Description
355,407	98	Paved parking, HSG B
127,693	61	>75% Grass cover, Good, HSG B
36,181	55	Woods, Good, HSG B
8,323	85	Gravel roads, HSG B
14,521	98	Paved parking, HSG C
41,515	74	>75% Grass cover, Good, HSG C
5,324	70	Woods, Good, HSG C
426	89	Gravel roads, HSG C
589,390	85	Weighted Average
219,462		37.24% Pervious Area
369,928		62.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	100	0.0300	0.21		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.46"
3.3	995	0.0037	5.08	24.95	**Pipe Channel, B-C** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Concrete pipe, bends & connections
11.3	1,095	Total			

Subcatchment EX 1:



Summary for Subcatchment EX 2:

[47] Hint: Peak is 221% of capacity of segment #3

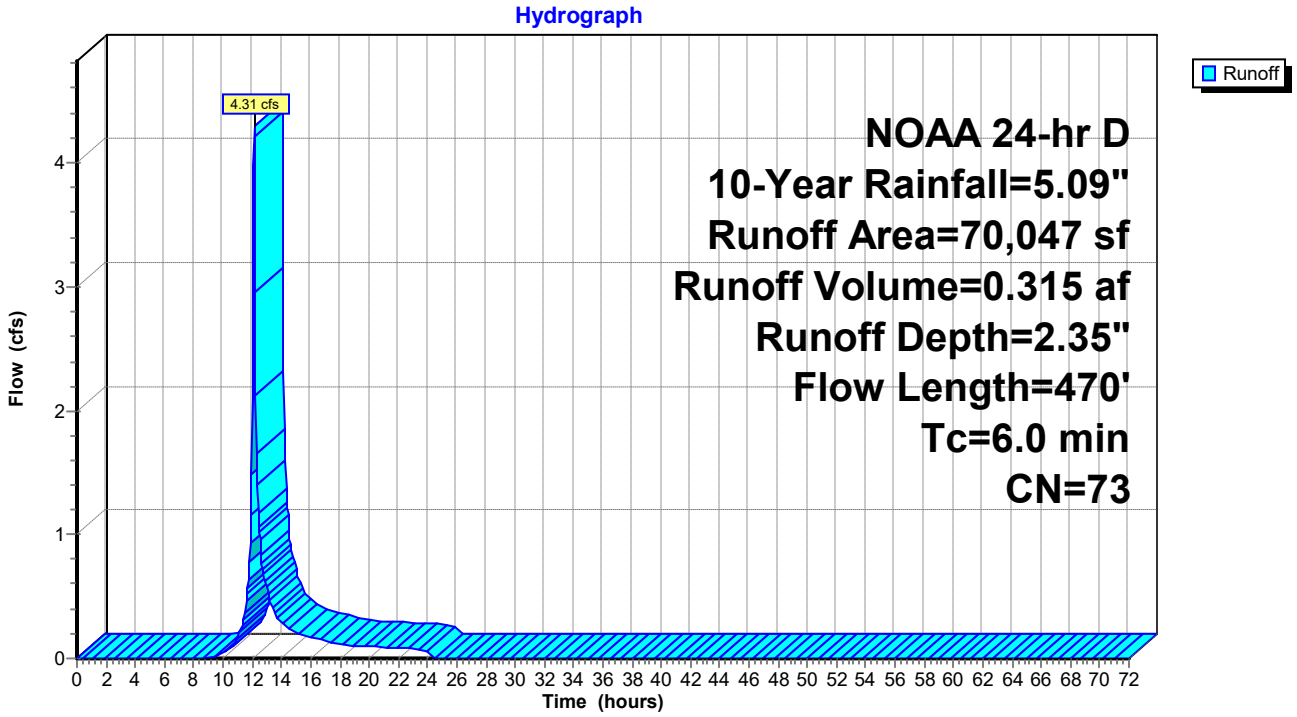
Runoff = 4.31 cfs @ 12.13 hrs, Volume= 0.315 af, Depth= 2.35"
Routed to Reach DP-2 : EXISTING

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-Year Rainfall=5.09"

Area (sf)	CN	Description
40,219	98	Paved parking, HSG A
29,828	39	>75% Grass cover, Good, HSG A
0	30	Woods, Good, HSG A
70,047	73	Weighted Average
29,828		42.58% Pervious Area
40,219		57.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0100	1.08		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.3	36	0.0100	2.03		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
2.2	334	0.0030	2.48	1.95	**Pipe Channel, C-D** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Concrete pipe, bends & connections
4.0	470	Total, Increased to minimum Tc = 6.0 min			

Subcatchment EX 2:



Summary for Subcatchment EX 3:

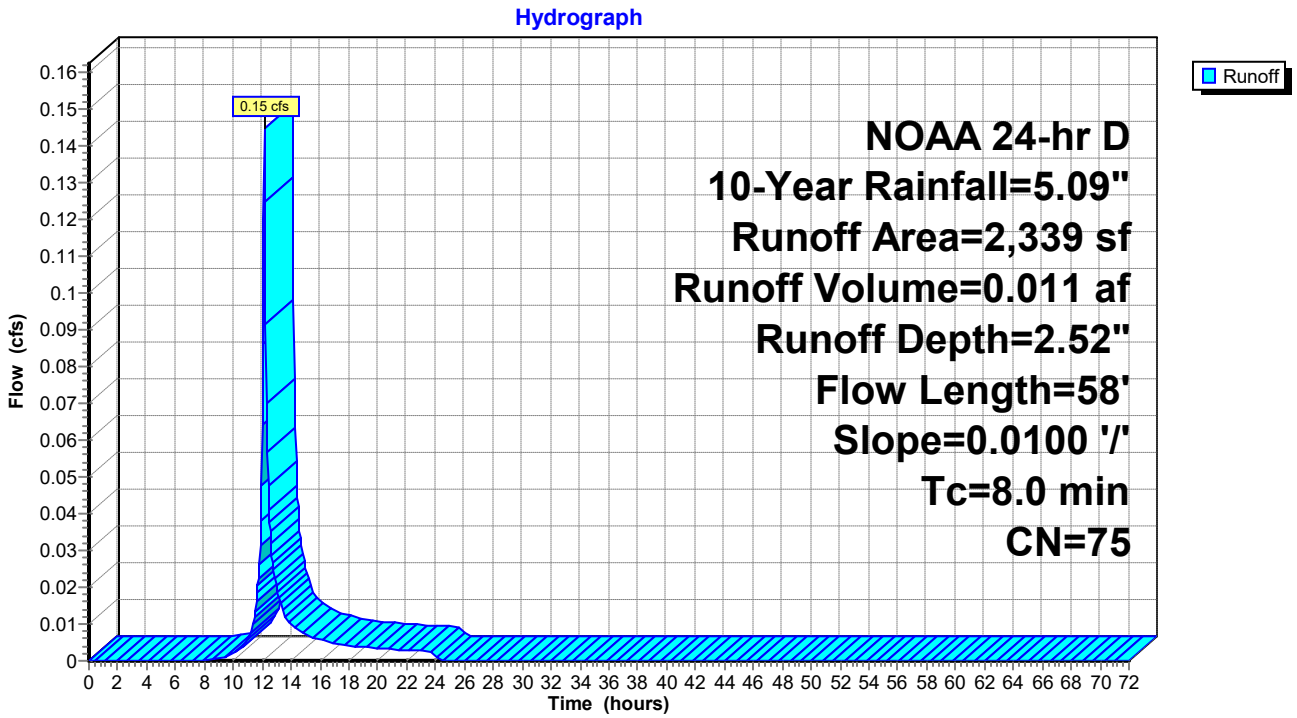
Runoff = 0.15 cfs @ 12.15 hrs, Volume= 0.011 af, Depth= 2.52"
Routed to Reach DP-1 : EXISTING

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-Year Rainfall=5.09"

Area (sf)	CN	Description
89	98	Paved parking, HSG C
2,250	74	>75% Grass cover, Good, HSG C
2,339	75	Weighted Average
2,250		96.19% Pervious Area
89		3.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	58	0.0100	0.12		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.46"

Subcatchment EX 3:



Summary for Subcatchment EX-4:

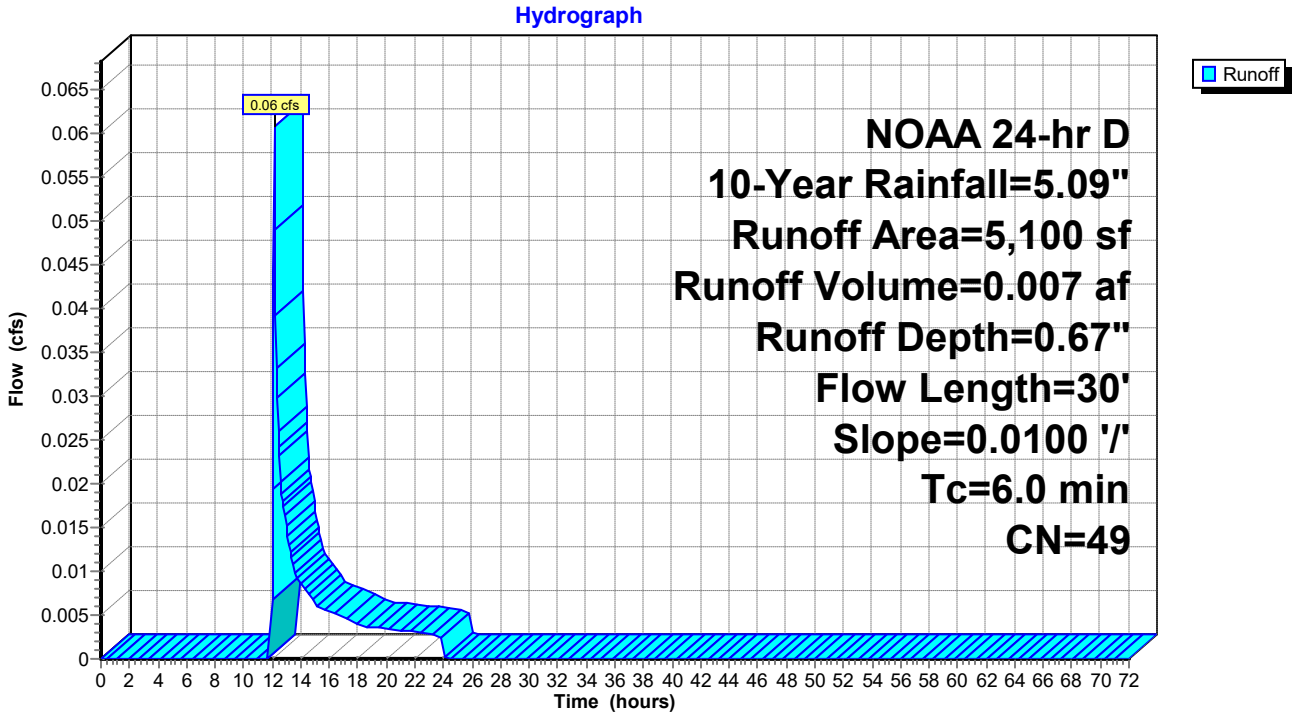
Runoff = 0.06 cfs @ 12.15 hrs, Volume= 0.007 af, Depth= 0.67"
Routed to Reach DP-1 : EXISTING

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-Year Rainfall=5.09"

Area (sf)	CN	Description
903	98	Paved parking, HSG A
4,197	39	>75% Grass cover, Good, HSG A
0	30	Woods, Good, HSG A
5,100	49	Weighted Average
4,197		82.29% Pervious Area
903		17.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	30	0.0100	0.11		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.46"
4.7	30	Total, Increased to minimum Tc = 6.0 min			

Subcatchment EX-4:



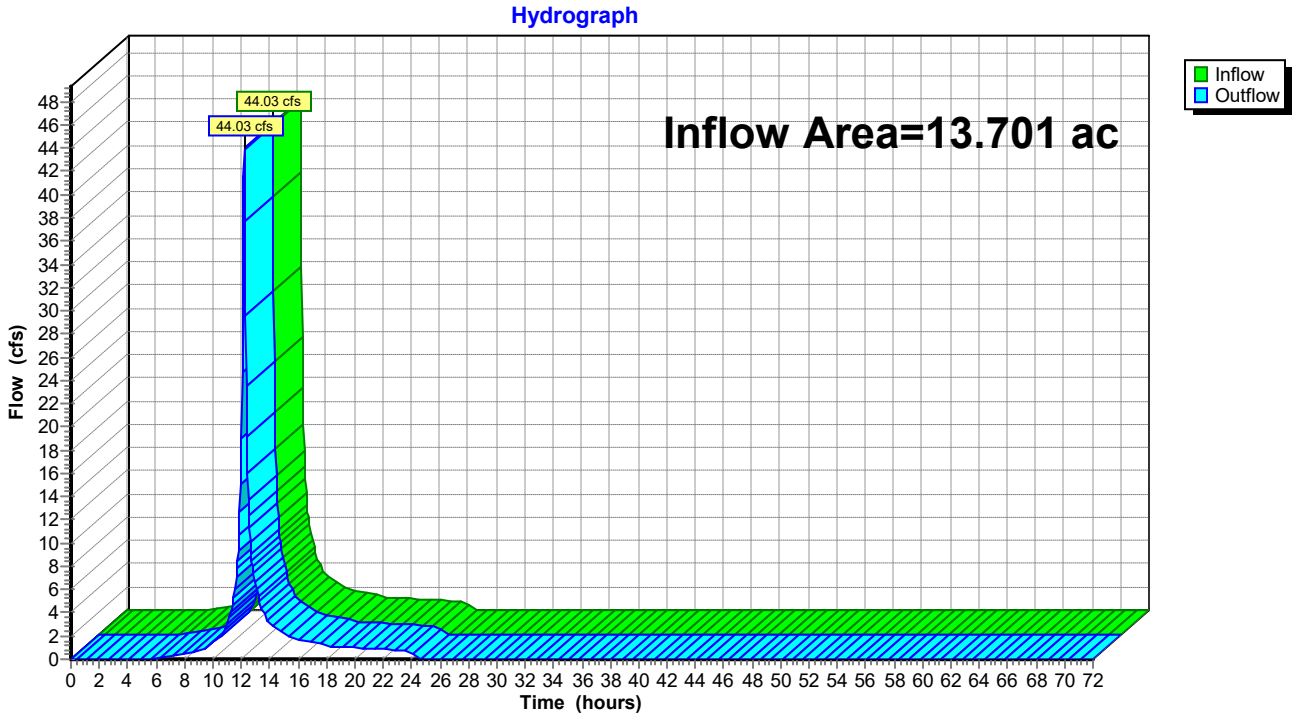
Summary for Reach DP-1: EXISTING

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

Inflow Area = 13.701 ac, 62.15% Impervious, Inflow Depth = 3.42" for 10-Year event
Inflow = 44.03 cfs @ 12.19 hrs, Volume= 3.909 af
Outflow = 44.03 cfs @ 12.19 hrs, Volume= 3.909 af, 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



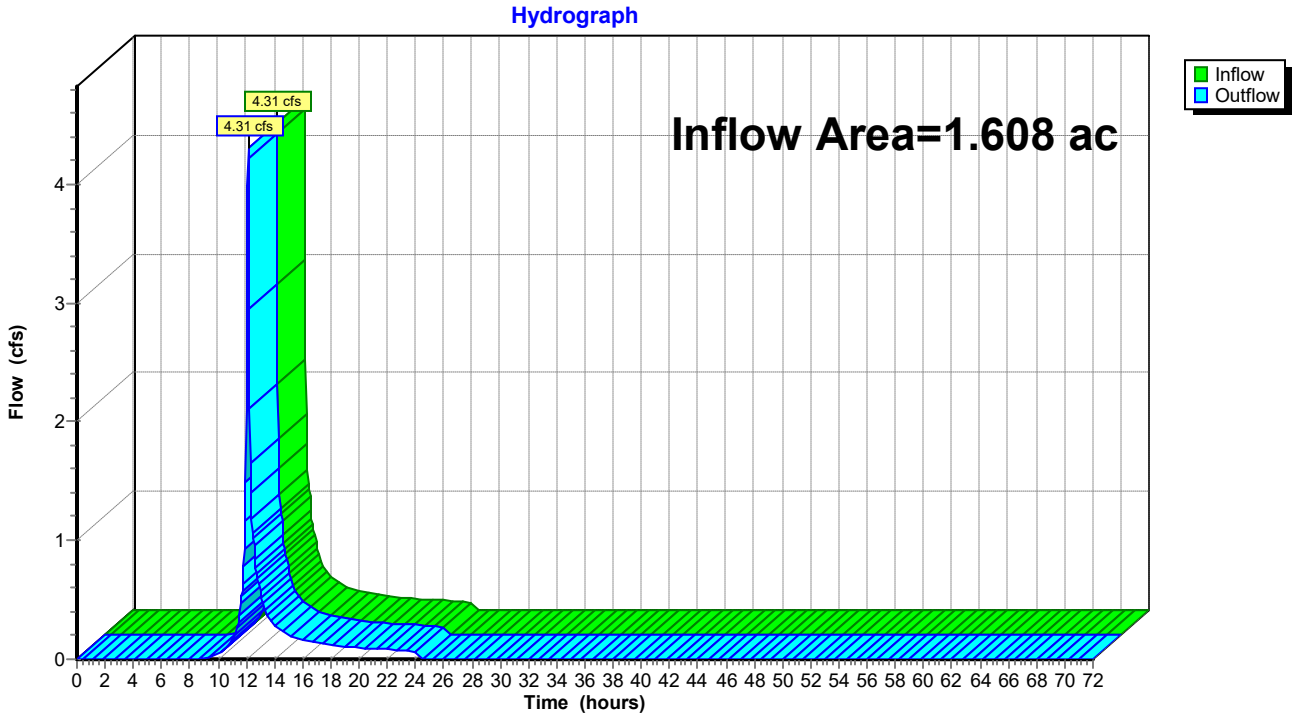
Summary for Reach DP-2: EXISTING

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

Inflow Area = 1.608 ac, 57.42% Impervious, Inflow Depth = 2.35" for 10-Year event
Inflow = 4.31 cfs @ 12.13 hrs, Volume= 0.315 af
Outflow = 4.31 cfs @ 12.13 hrs, Volume= 0.315 af, 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-2: EXISTING



Summary for Subcatchment EX 1:

[47] Hint: Peak is 228% of capacity of segment #2

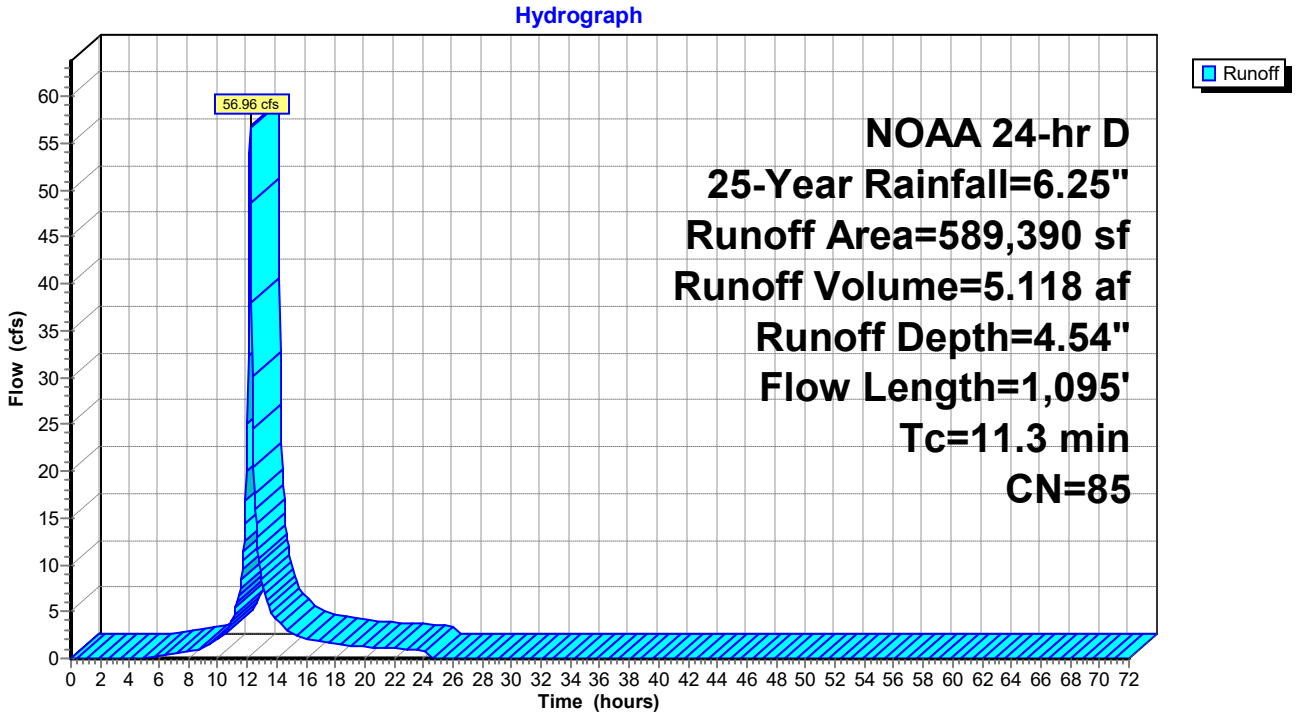
Runoff = 56.96 cfs @ 12.19 hrs, Volume= 5.118 af, Depth= 4.54"
Routed to Reach DP-1 : EXISTING

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-Year Rainfall=6.25"

Area (sf)	CN	Description
355,407	98	Paved parking, HSG B
127,693	61	>75% Grass cover, Good, HSG B
36,181	55	Woods, Good, HSG B
8,323	85	Gravel roads, HSG B
14,521	98	Paved parking, HSG C
41,515	74	>75% Grass cover, Good, HSG C
5,324	70	Woods, Good, HSG C
426	89	Gravel roads, HSG C
589,390	85	Weighted Average
219,462		37.24% Pervious Area
369,928		62.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	100	0.0300	0.21		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.46"
3.3	995	0.0037	5.08	24.95	**Pipe Channel, B-C** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Concrete pipe, bends & connections
11.3	1,095	Total			

Subcatchment EX 1:



Summary for Subcatchment EX 2:

[47] Hint: Peak is 309% of capacity of segment #3

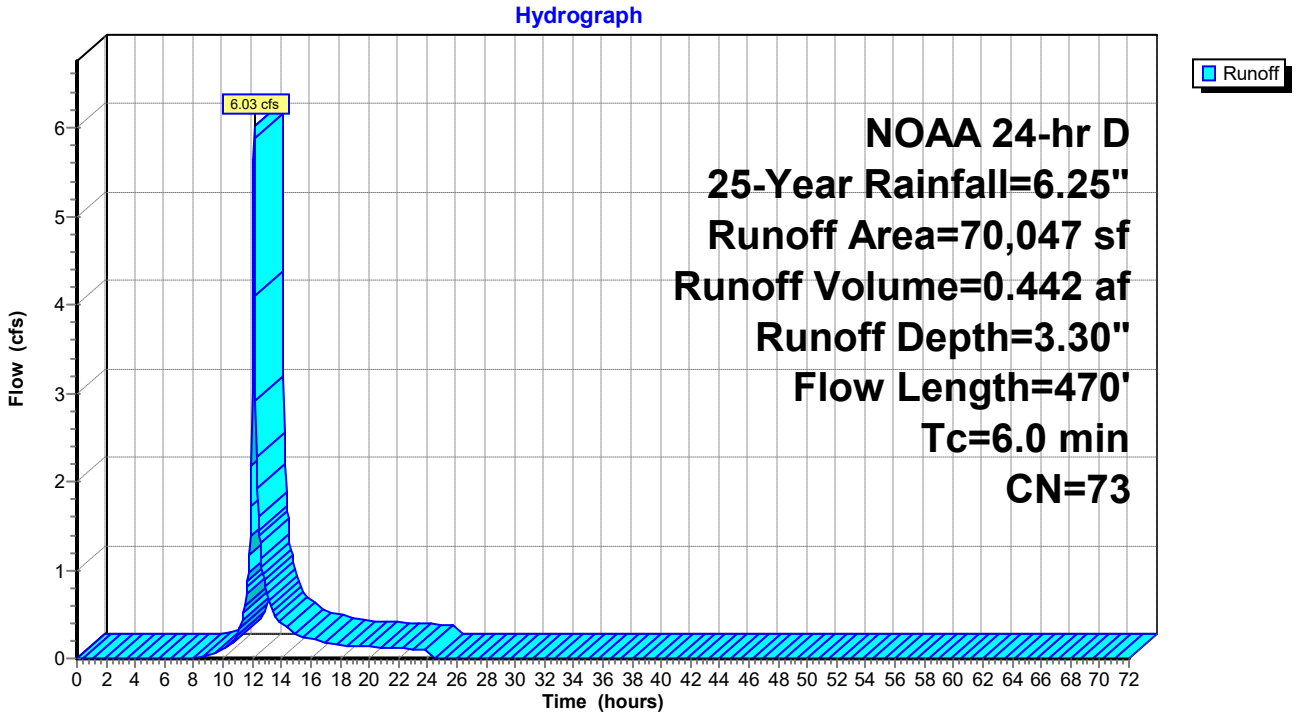
Runoff = 6.03 cfs @ 12.13 hrs, Volume= 0.442 af, Depth= 3.30"
Routed to Reach DP-2 : EXISTING

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-Year Rainfall=6.25"

Area (sf)	CN	Description
40,219	98	Paved parking, HSG A
29,828	39	>75% Grass cover, Good, HSG A
0	30	Woods, Good, HSG A
70,047	73	Weighted Average
29,828		42.58% Pervious Area
40,219		57.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0100	1.08		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.3	36	0.0100	2.03		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
2.2	334	0.0030	2.48	1.95	**Pipe Channel, C-D** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Concrete pipe, bends & connections
4.0	470	Total, Increased to minimum Tc = 6.0 min			

Subcatchment EX 2:



Summary for Subcatchment EX 3:

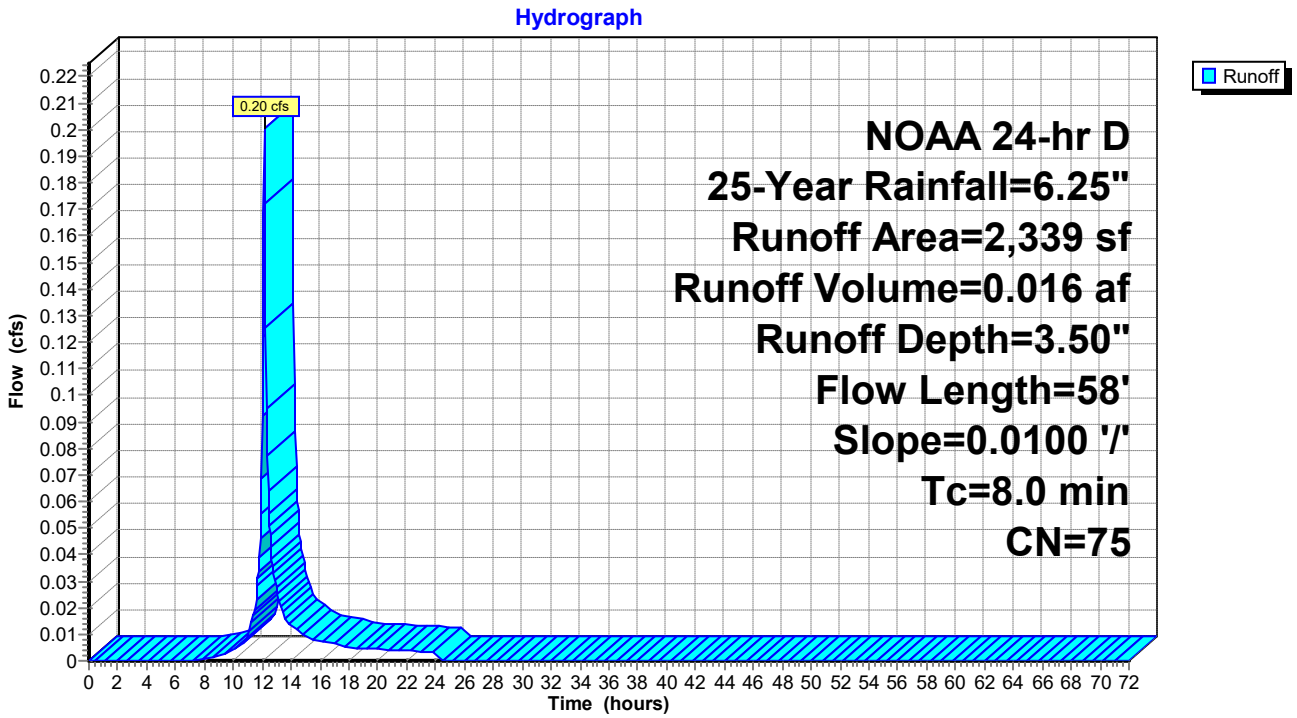
Runoff = 0.20 cfs @ 12.15 hrs, Volume= 0.016 af, Depth= 3.50"
Routed to Reach DP-1 : EXISTING

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-Year Rainfall=6.25"

Area (sf)	CN	Description
89	98	Paved parking, HSG C
2,250	74	>75% Grass cover, Good, HSG C
2,339	75	Weighted Average
2,250		96.19% Pervious Area
89		3.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	58	0.0100	0.12		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.46"

Subcatchment EX 3:



Summary for Subcatchment EX-4:

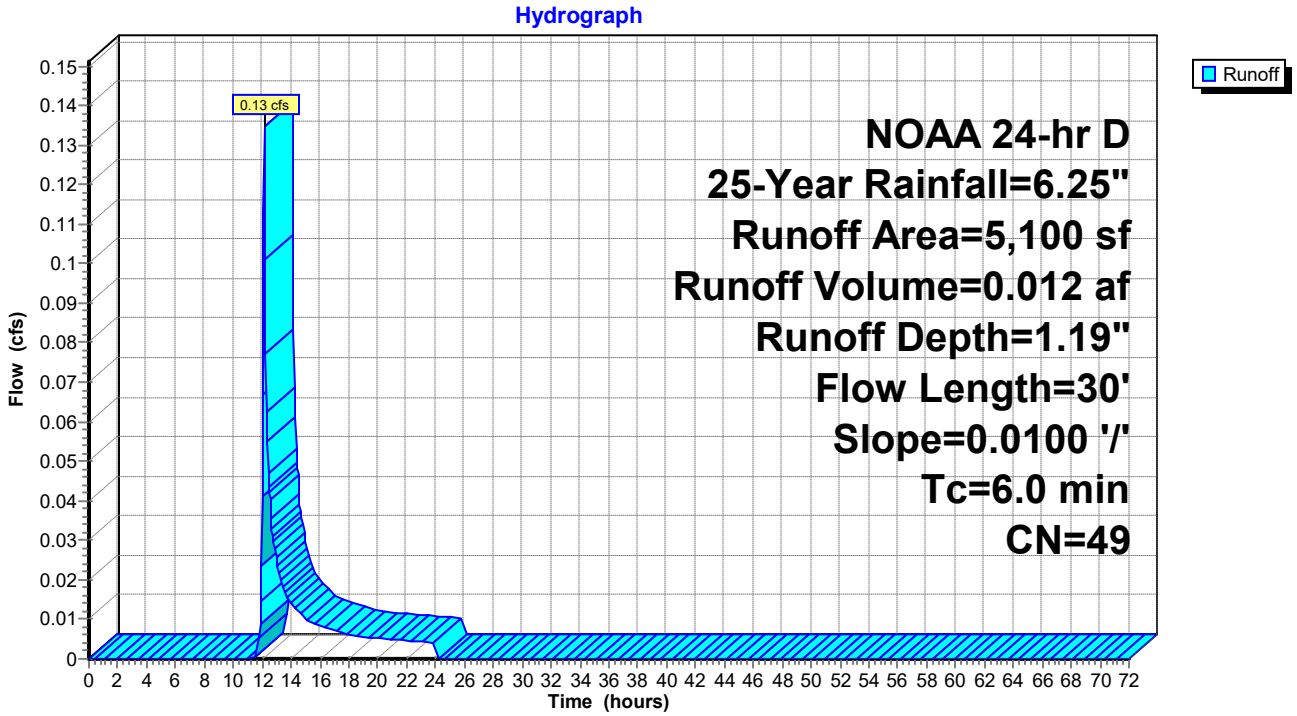
Runoff = 0.13 cfs @ 12.14 hrs, Volume= 0.012 af, Depth= 1.19"
Routed to Reach DP-1 : EXISTING

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-Year Rainfall=6.25"

Area (sf)	CN	Description
903	98	Paved parking, HSG A
4,197	39	>75% Grass cover, Good, HSG A
0	30	Woods, Good, HSG A
5,100	49	Weighted Average
4,197		82.29% Pervious Area
903		17.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	30	0.0100	0.11		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.46"
4.7	30	Total, Increased to minimum Tc = 6.0 min			

Subcatchment EX-4:



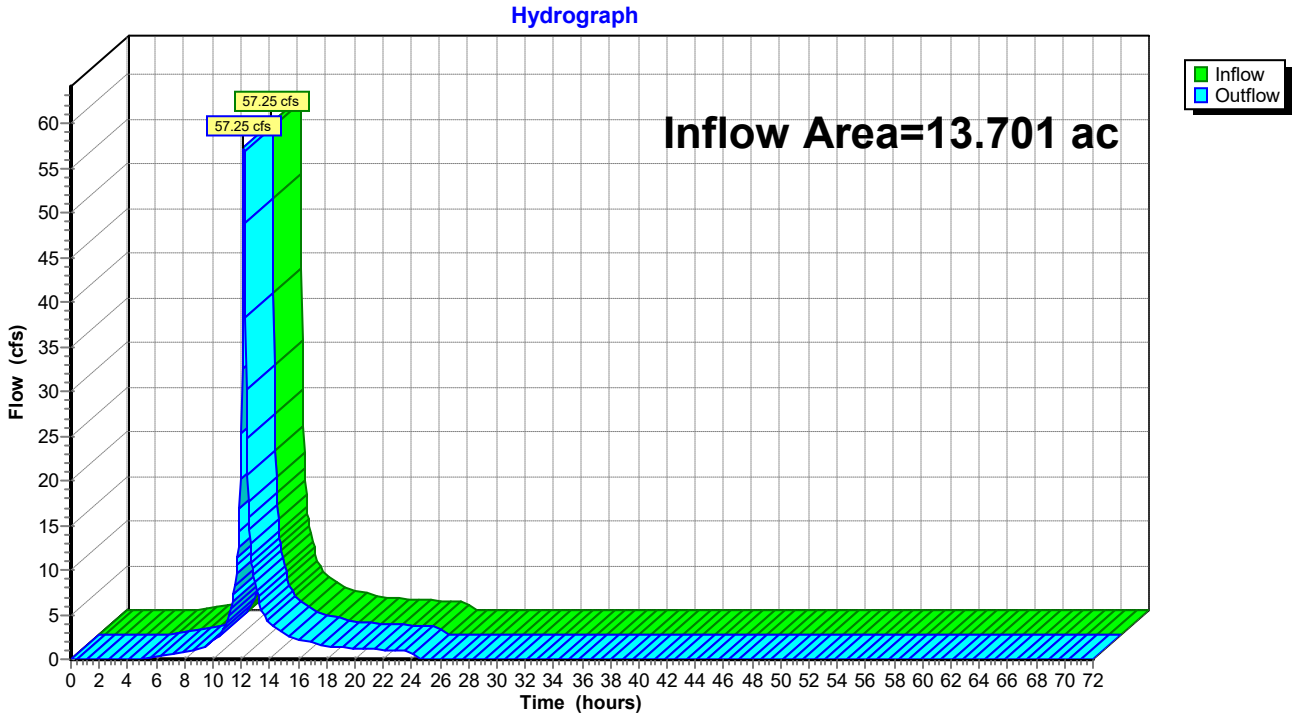
Summary for Reach DP-1: EXISTING

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

Inflow Area = 13.701 ac, 62.15% Impervious, Inflow Depth = 4.51" for 25-Year event
Inflow = 57.25 cfs @ 12.19 hrs, Volume= 5.145 af
Outflow = 57.25 cfs @ 12.19 hrs, Volume= 5.145 af, 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



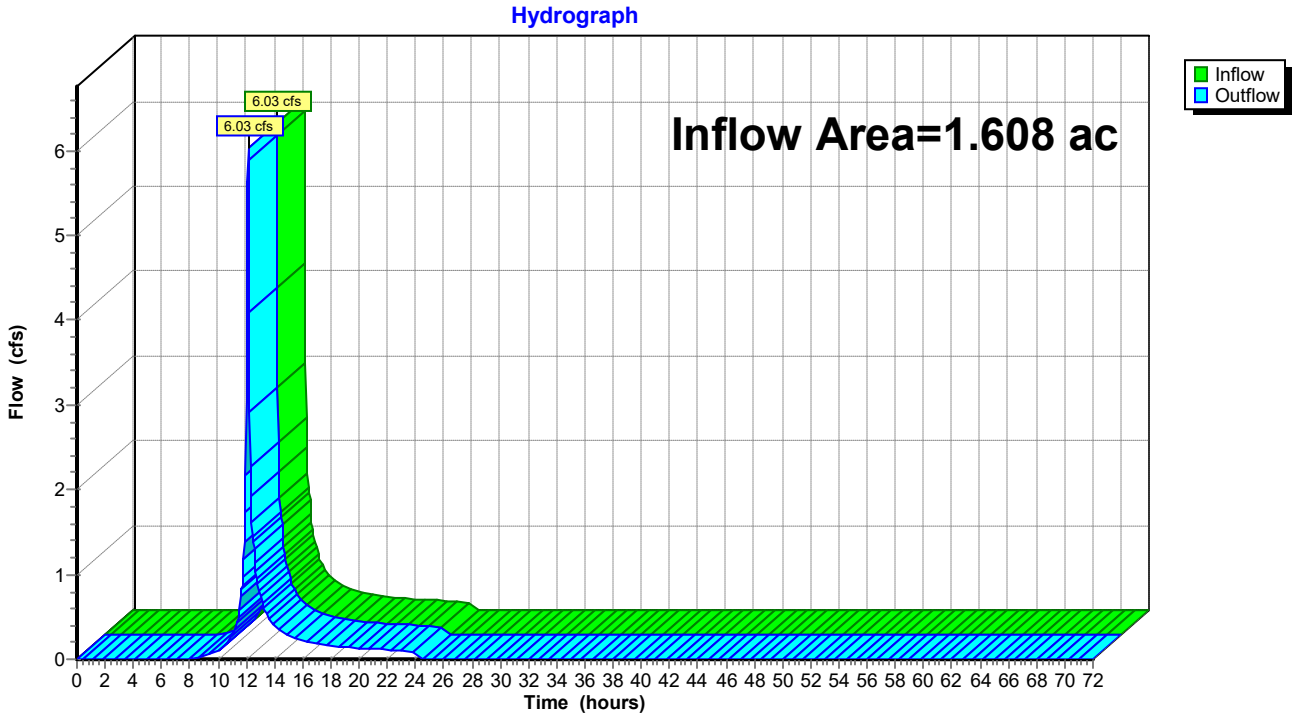
Summary for Reach DP-2: EXISTING

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

Inflow Area = 1.608 ac, 57.42% Impervious, Inflow Depth = 3.30" for 25-Year event
Inflow = 6.03 cfs @ 12.13 hrs, Volume= 0.442 af
Outflow = 6.03 cfs @ 12.13 hrs, Volume= 0.442 af, 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-2: EXISTING



Summary for Subcatchment EX 1:

[47] Hint: Peak is 310% of capacity of segment #2

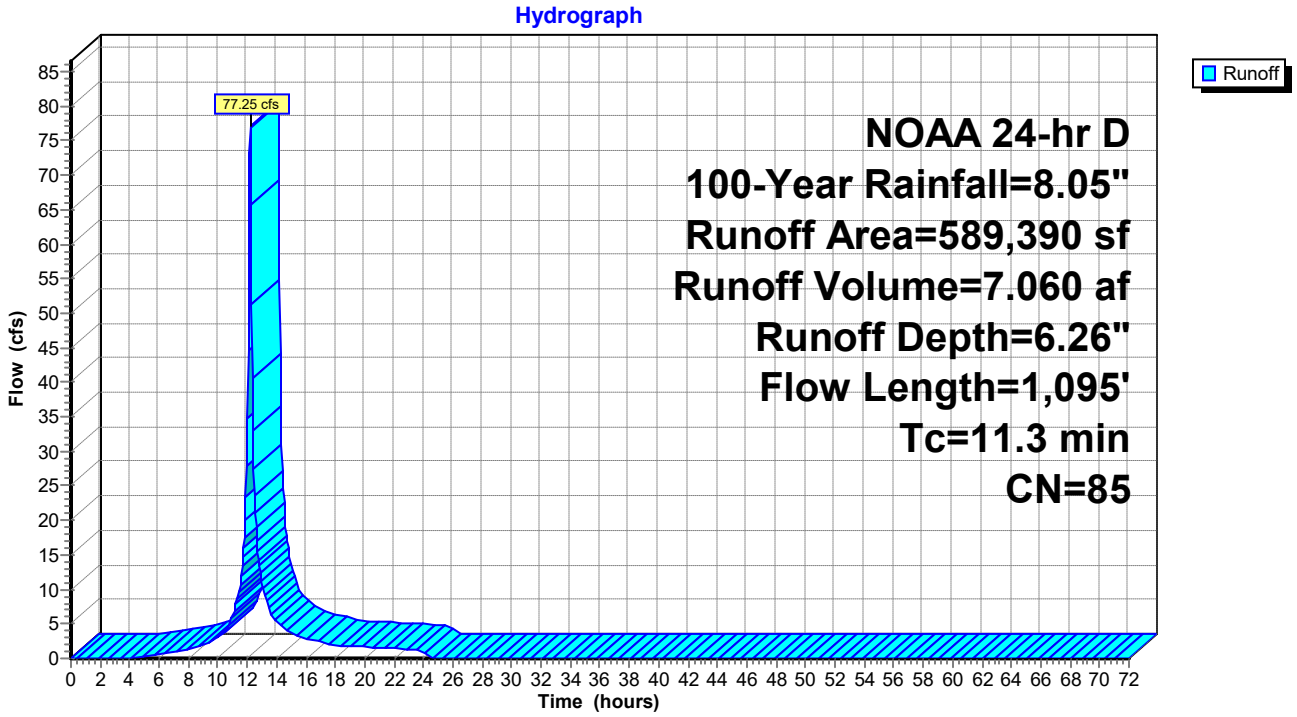
Runoff = 77.25 cfs @ 12.19 hrs, Volume= 7.060 af, Depth= 6.26"
Routed to Reach DP-1 : EXISTING

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-Year Rainfall=8.05"

Area (sf)	CN	Description
355,407	98	Paved parking, HSG B
127,693	61	>75% Grass cover, Good, HSG B
36,181	55	Woods, Good, HSG B
8,323	85	Gravel roads, HSG B
14,521	98	Paved parking, HSG C
41,515	74	>75% Grass cover, Good, HSG C
5,324	70	Woods, Good, HSG C
426	89	Gravel roads, HSG C
589,390	85	Weighted Average
219,462		37.24% Pervious Area
369,928		62.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	100	0.0300	0.21		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.46"
3.3	995	0.0037	5.08	24.95	**Pipe Channel, B-C** 30.0" Round Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.013 Concrete pipe, bends & connections
11.3	1,095	Total			

Subcatchment EX 1:



Summary for Subcatchment EX 2:

[47] Hint: Peak is 451% of capacity of segment #3

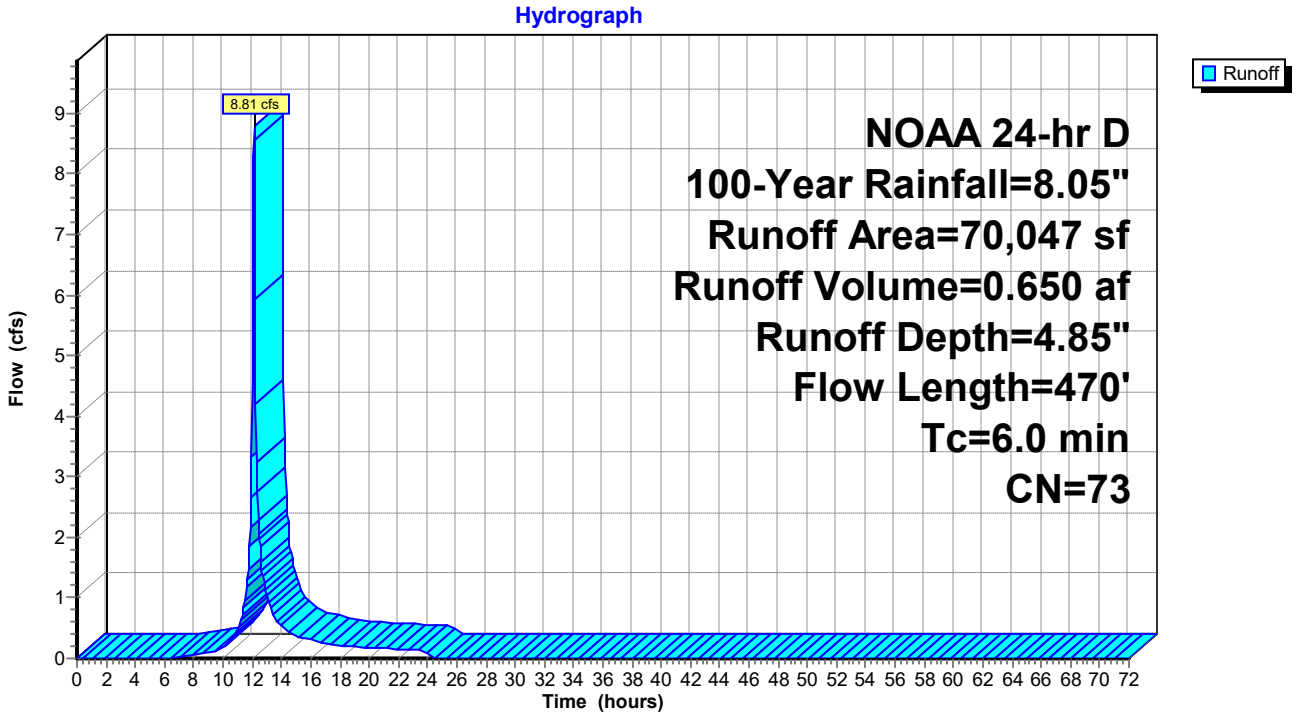
Runoff = 8.81 cfs @ 12.13 hrs, Volume= 0.650 af, Depth= 4.85"
Routed to Reach DP-2 : EXISTING

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-Year Rainfall=8.05"

Area (sf)	CN	Description
40,219	98	Paved parking, HSG A
29,828	39	>75% Grass cover, Good, HSG A
0	30	Woods, Good, HSG A
70,047	73	Weighted Average
29,828		42.58% Pervious Area
40,219		57.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.5	100	0.0100	1.08		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.3	36	0.0100	2.03		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
2.2	334	0.0030	2.48	1.95	**Pipe Channel, C-D** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Concrete pipe, bends & connections
4.0	470	Total, Increased to minimum Tc = 6.0 min			

Subcatchment EX 2:



Summary for Subcatchment EX 3:

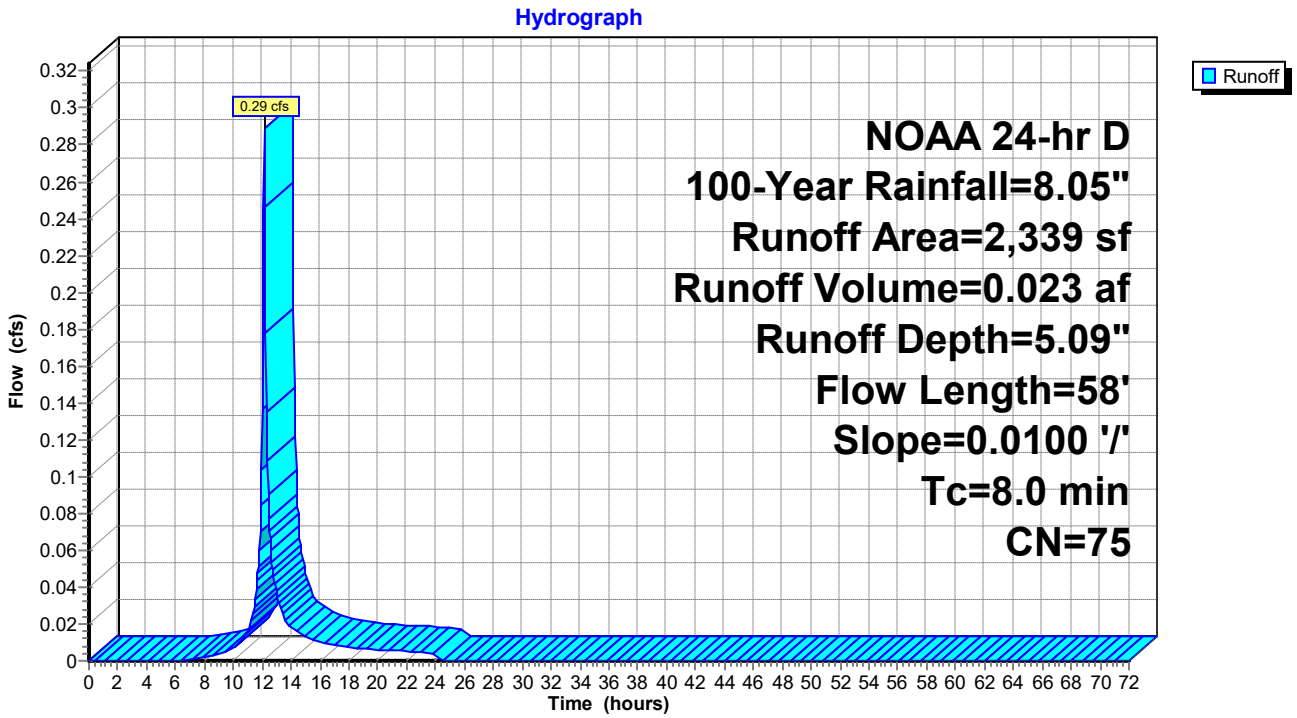
Runoff = 0.29 cfs @ 12.15 hrs, Volume= 0.023 af, Depth= 5.09"
Routed to Reach DP-1 : EXISTING

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-Year Rainfall=8.05"

Area (sf)	CN	Description
89	98	Paved parking, HSG C
2,250	74	>75% Grass cover, Good, HSG C
2,339	75	Weighted Average
2,250		96.19% Pervious Area
89		3.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.0	58	0.0100	0.12		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.46"

Subcatchment EX 3:



Summary for Subcatchment EX-4:

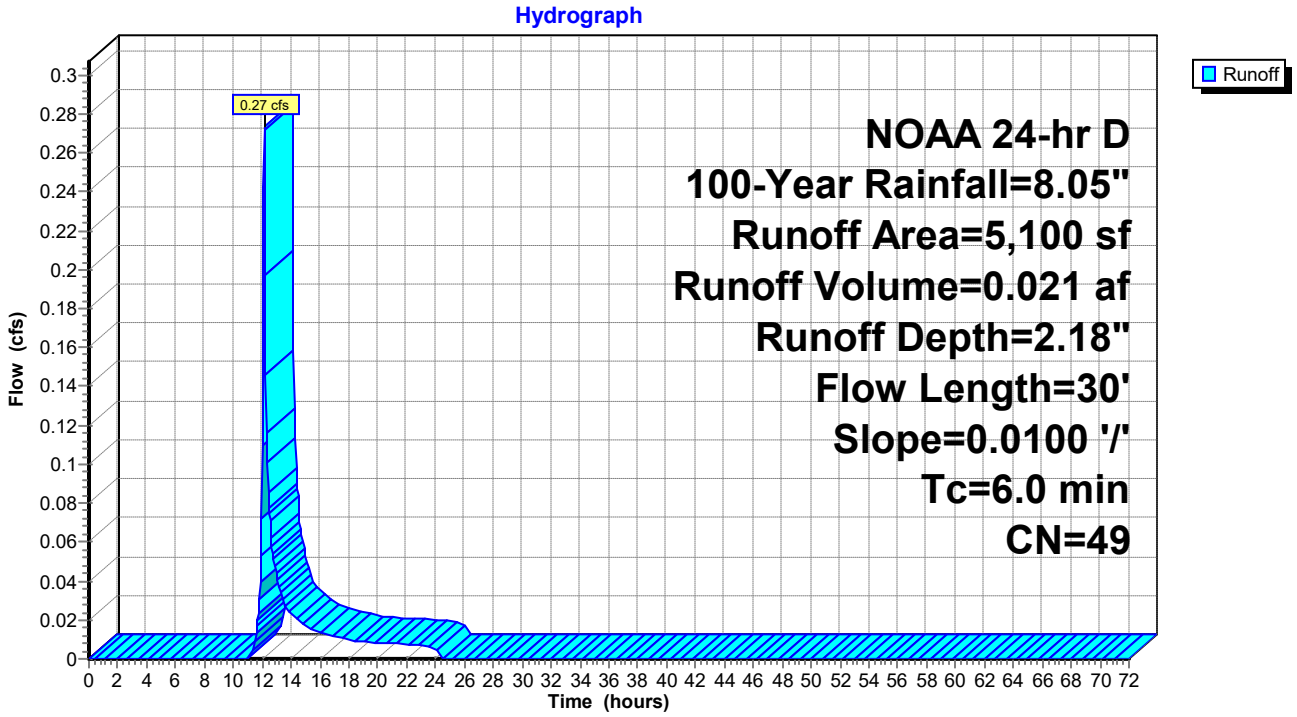
Runoff = 0.27 cfs @ 12.14 hrs, Volume= 0.021 af, Depth= 2.18"
Routed to Reach DP-1 : EXISTING

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-Year Rainfall=8.05"

Area (sf)	CN	Description
903	98	Paved parking, HSG A
4,197	39	>75% Grass cover, Good, HSG A
0	30	Woods, Good, HSG A
5,100	49	Weighted Average
4,197		82.29% Pervious Area
903		17.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
4.7	30	0.0100	0.11		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.46"
4.7	30	Total, Increased to minimum Tc = 6.0 min			

Subcatchment EX-4:



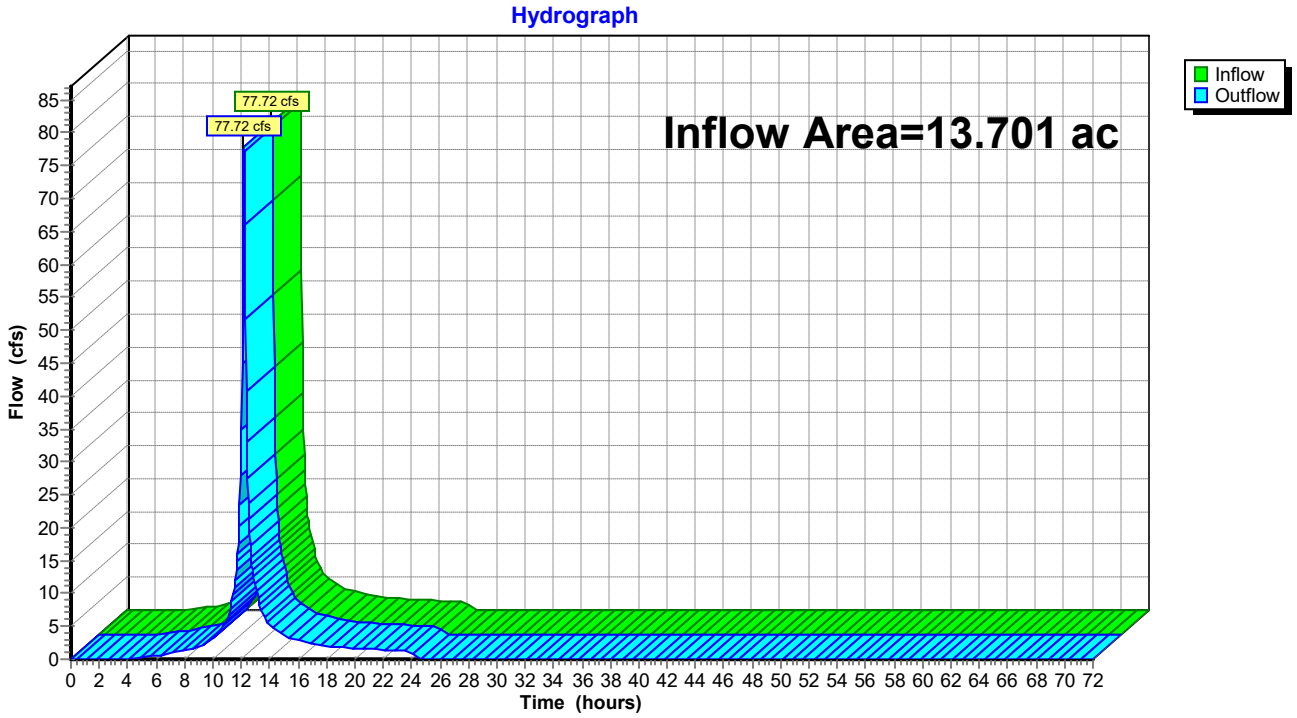
Summary for Reach DP-1: EXISTING

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

Inflow Area = 13.701 ac, 62.15% Impervious, Inflow Depth = 6.22" for 100-Year event
Inflow = 77.72 cfs @ 12.19 hrs, Volume= 7.104 af
Outflow = 77.72 cfs @ 12.19 hrs, Volume= 7.104 af, 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



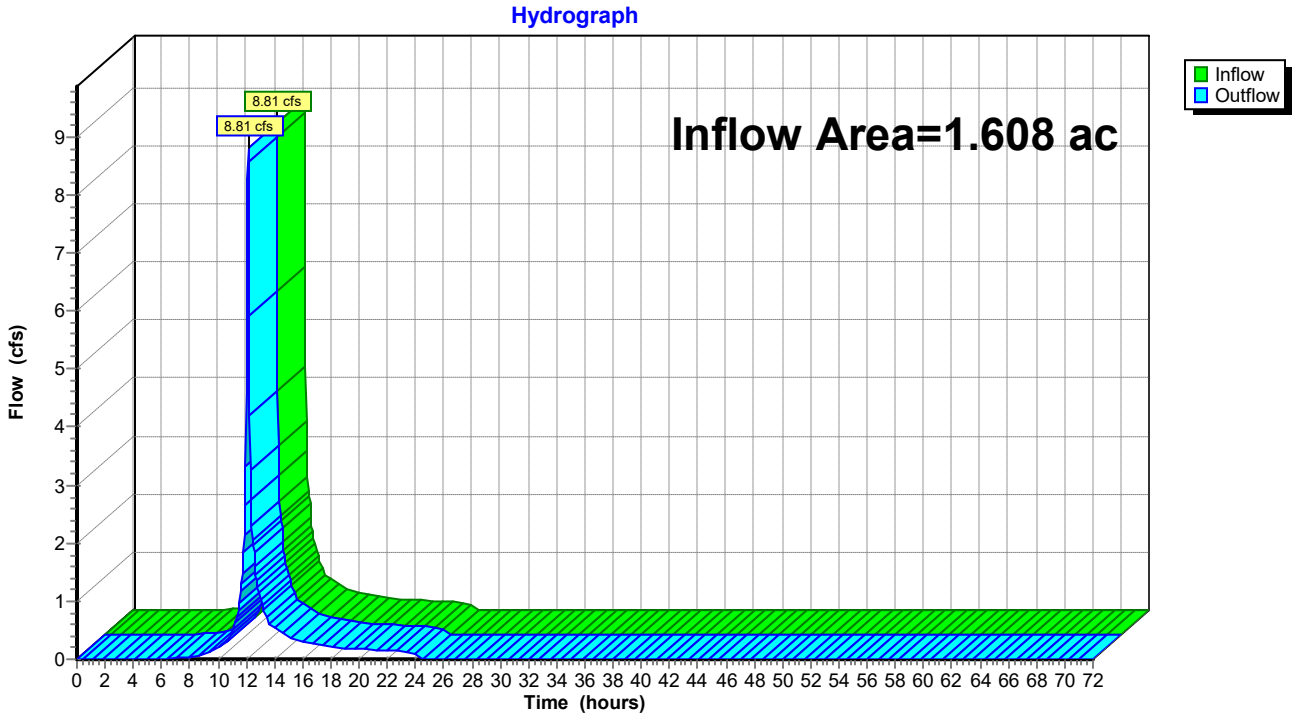
Summary for Reach DP-2: EXISTING

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

Inflow Area = 1.608 ac, 57.42% Impervious, Inflow Depth = 4.85" for 100-Year event
Inflow = 8.81 cfs @ 12.13 hrs, Volume= 0.650 af
Outflow = 8.81 cfs @ 12.13 hrs, Volume= 0.650 af, Atten= 0%, Lag= 0.0 min

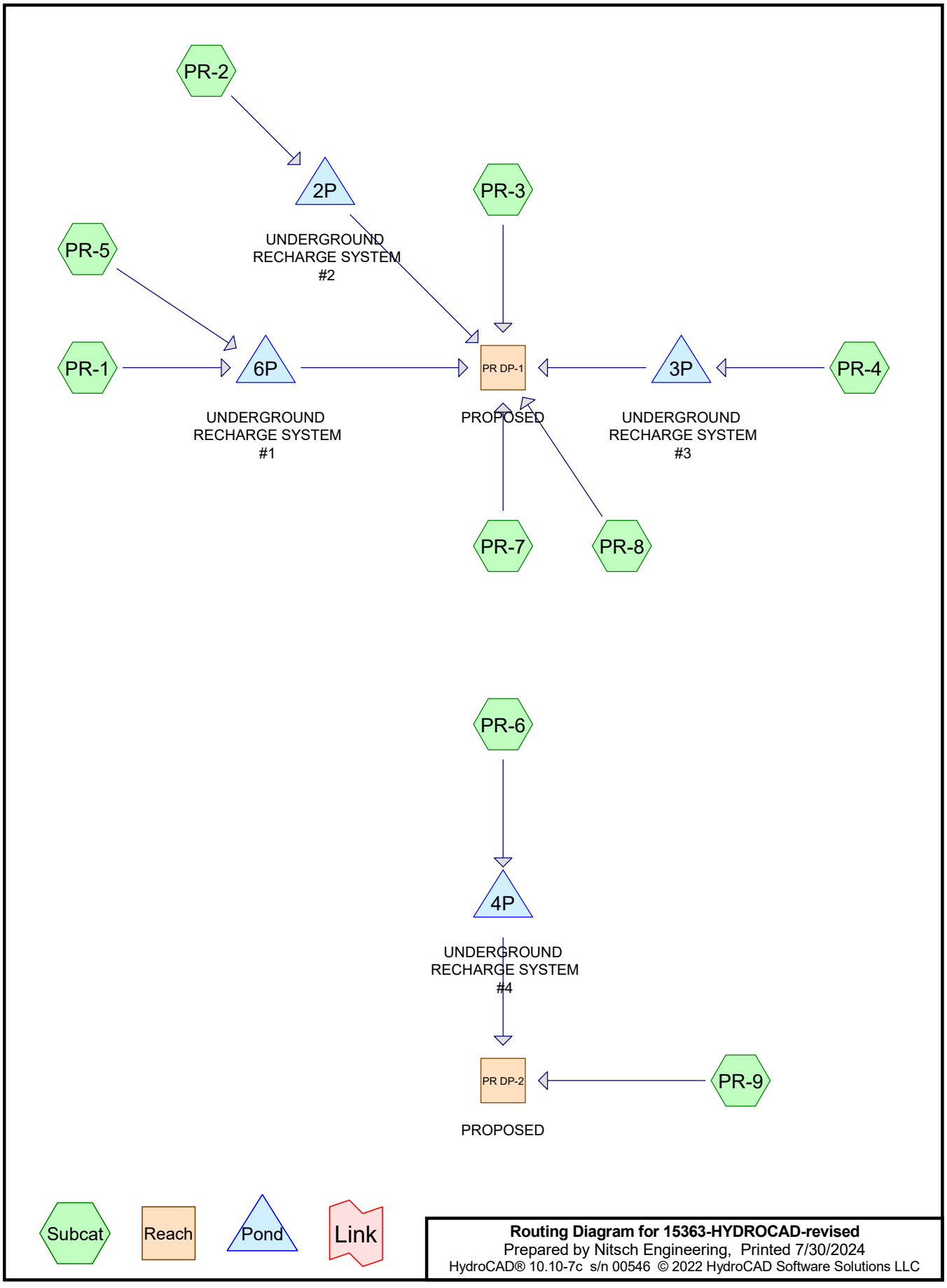
Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP-2: EXISTING



APPENDIX C

Proposed Conditions – HydroCAD Calculations



Routing Diagram for 15363-HYDROCAD-revised
Prepared by Nitsch Engineering, Printed 7/30/2024
HydroCAD® 10.10-7c s/n 00546 © 2022 HydroCAD Software Solutions LLC

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	2-Year	NOAA 24-hr	D	Default	24.00	1	3.22	2
2	10-Year	NOAA 24-hr	D	Default	24.00	1	5.09	2
3	25-Year	NOAA 24-hr	D	Default	24.00	1	6.25	2
4	100-Year	NOAA 24-hr	D	Default	24.00	1	8.05	2

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.486	39	>75% Grass cover, Good, HSG A (PR-6, PR-9)
2.026	61	>75% Grass cover, Good, HSG B (PR-1, PR-2, PR-3, PR-4)
0.249	74	>75% Grass cover, Good, HSG C (PR-4, PR-7, PR-8)
1.364	98	Paved parking, HSG A (PR-6, PR-8, PR-9)
5.535	98	Paved parking, HSG B (PR-1, PR-2, PR-3, PR-4)
1.101	98	Paved parking, HSG C (PR-4, PR-7)
4.548	98	Roofs, HSG B (PR-2, PR-5)
15.309	**91**	**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Group	Subcatchment Numbers
1.850	HSG A	PR-6, PR-8, PR-9
12.109	HSG B	PR-1, PR-2, PR-3, PR-4, PR-5
1.350	HSG C	PR-4, PR-7, PR-8
0.000	HSG D	
0.000	Other	
15.309		**TOTAL AREA**

Ground Covers (selected nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.486	2.026	0.249	0.000	0.000	2.761	>75% Grass cover, Good	PR-1, PR-2, PR-3, PR-4, PR-6, PR-7, PR-8, PR-9
1.364	5.535	1.101	0.000	0.000	8.000	Paved parking	PR-1, PR-2, PR-3, PR-4, PR-6, PR-7, PR-8, PR-9
0.000	4.548	0.000	0.000	0.000	4.548	Roofs	PR-2, PR-5
1.850	**12.109**	**1.350**	**0.000**	**0.000**	**15.309**	**TOTAL AREA**	

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	2P	92.00	91.90	10.0	0.0100	0.012	0.0	30.0	0.0
2	3P	93.00	92.95	10.0	0.0050	0.012	0.0	48.0	0.0
3	4P	93.90	93.85	10.0	0.0050	0.013	0.0	12.0	0.0
4	6P	93.00	92.90	10.0	0.0100	0.012	0.0	18.0	0.0

Summary for Subcatchment PR-1:

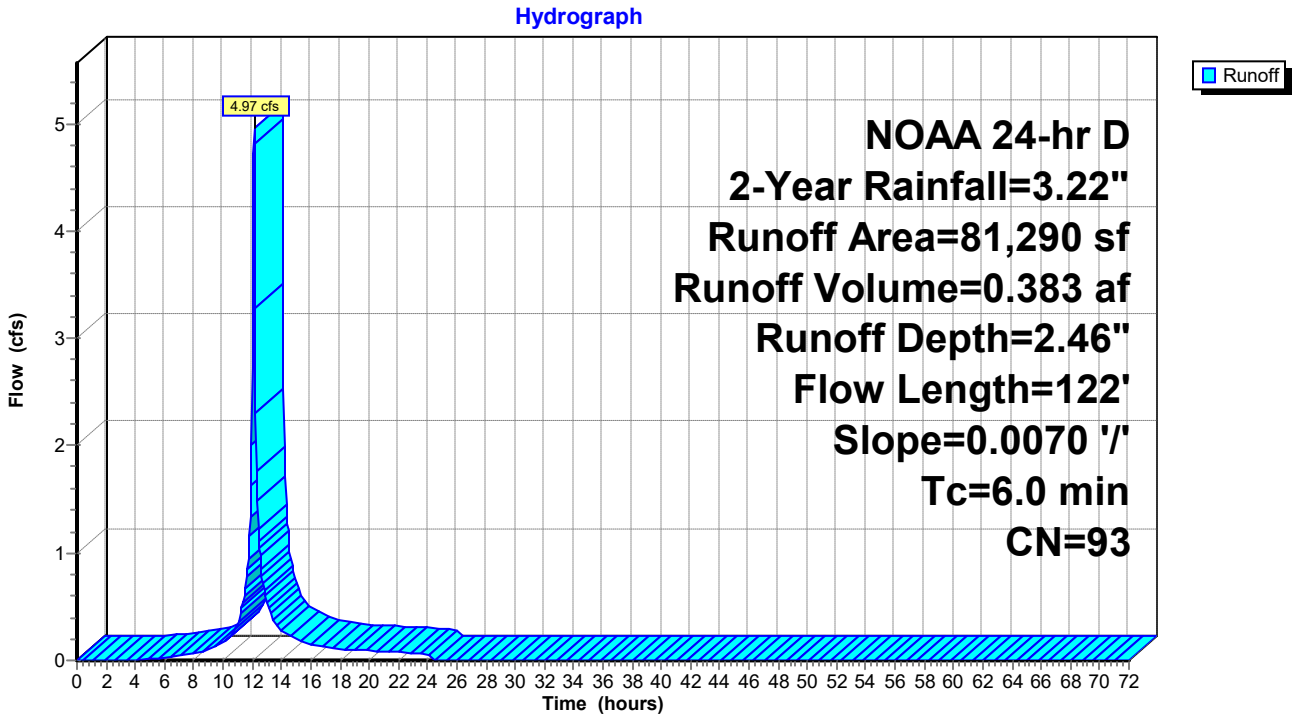
Runoff = 4.97 cfs @ 12.13 hrs, Volume= 0.383 af, Depth= 2.46"
Routed to Pond 6P : UNDERGROUND RECHARGE SYSTEM #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-Year Rainfall=3.22"

Area (sf)	CN	Description
70,874	98	Paved parking, HSG B
10,416	61	>75% Grass cover, Good, HSG B
81,290	93	Weighted Average
10,416		12.81% Pervious Area
70,874		87.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	100	0.0070	0.94		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.2	22	0.0070	1.70		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
2.0	122	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-1:



Summary for Subcatchment PR-2:

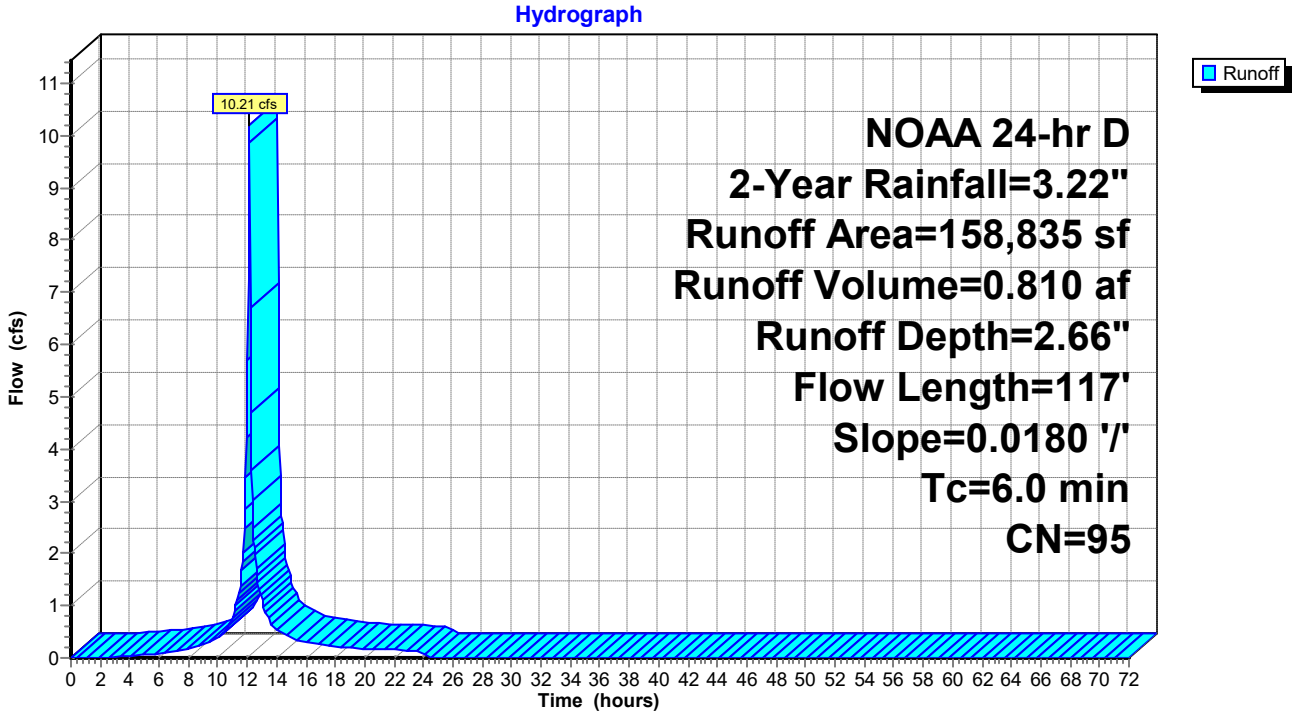
Runoff = 10.21 cfs @ 12.13 hrs, Volume= 0.810 af, Depth= 2.66"
Routed to Pond 2P : UNDERGROUND RECHARGE SYSTEM #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-Year Rainfall=3.22"

Area (sf)	CN	Description
44,527	98	Paved parking, HSG B
13,004	61	>75% Grass cover, Good, HSG B
101,304	98	Roofs, HSG B
158,835	95	Weighted Average
13,004		8.19% Pervious Area
145,831		91.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0180	1.37		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.1	17	0.0180	2.72		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
1.3	117	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-2:



Summary for Subcatchment PR-3:

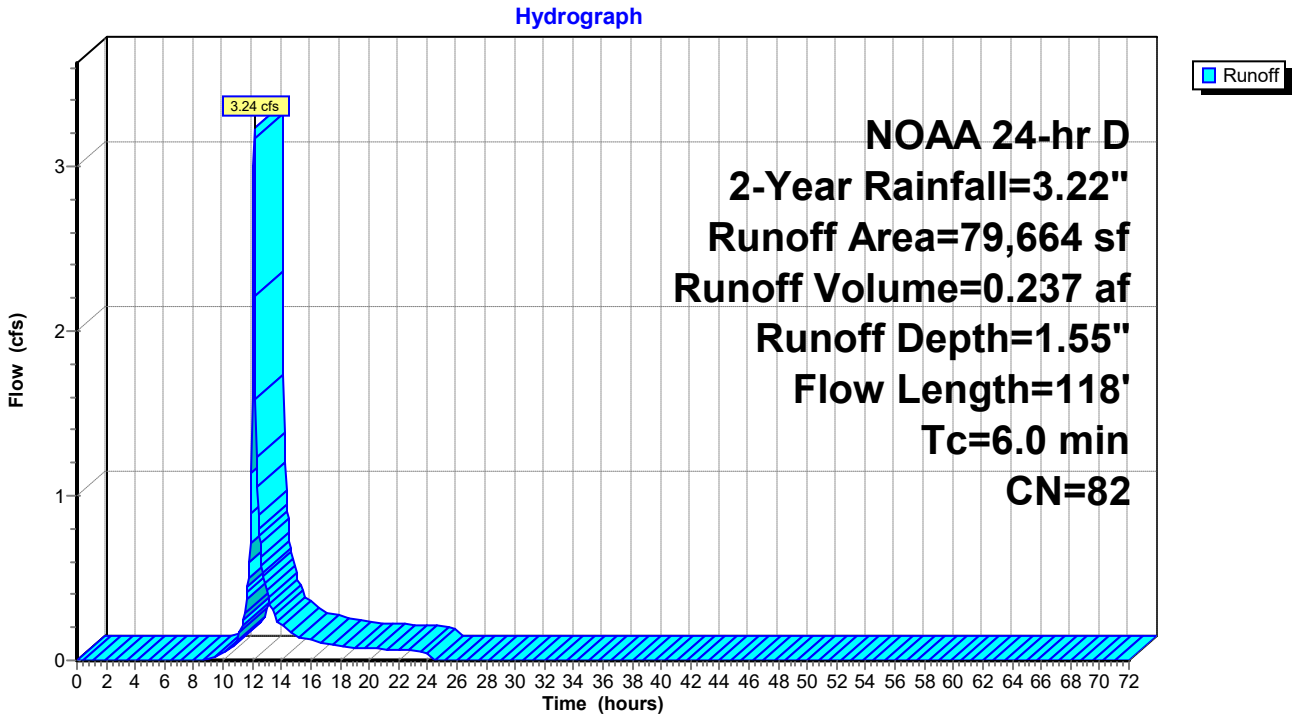
Runoff = 3.24 cfs @ 12.13 hrs, Volume= 0.237 af, Depth= 1.55"
Routed to Reach PR DP-1 : PROPOSED

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-Year Rainfall=3.22"

Area (sf)	CN	Description
45,650	98	Paved parking, HSG B
34,014	61	>75% Grass cover, Good, HSG B
79,664	82	Weighted Average
34,014		42.70% Pervious Area
45,650		57.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0170	1.34		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.1	18	0.0110	2.13		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
1.3	118	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-3:



Summary for Subcatchment PR-4:

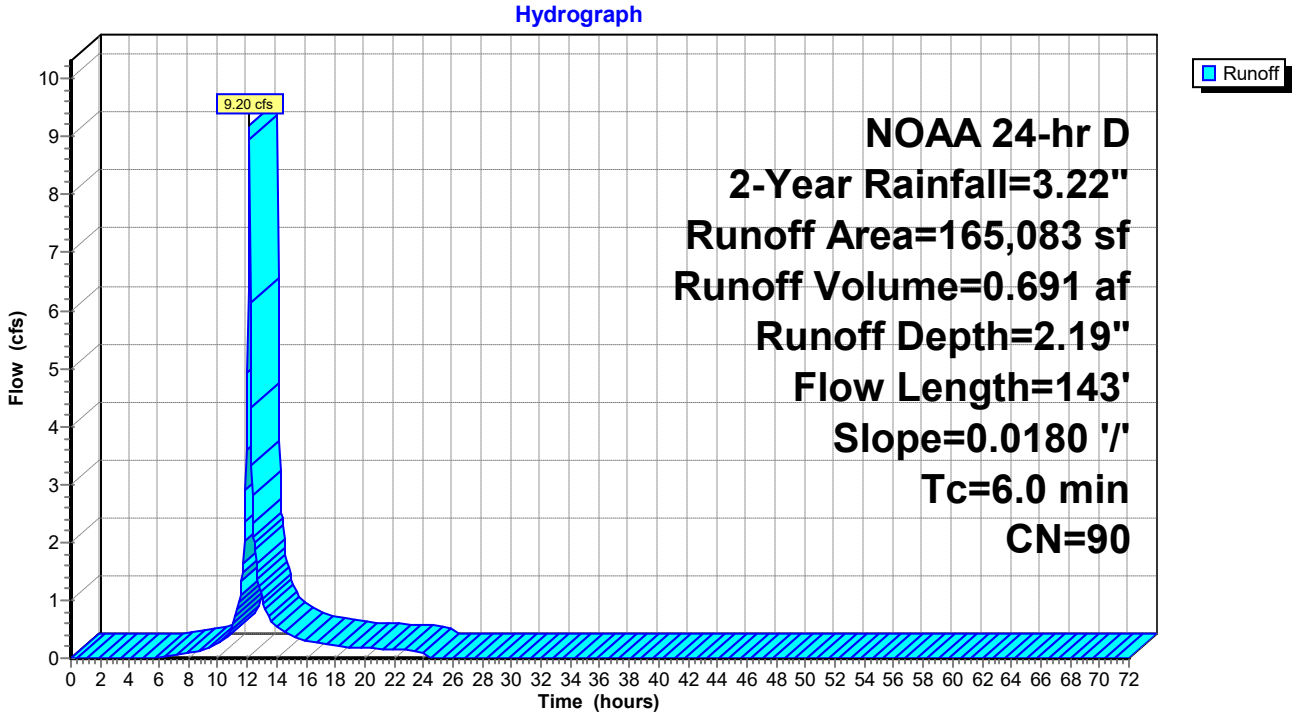
Runoff = 9.20 cfs @ 12.13 hrs, Volume= 0.691 af, Depth= 2.19"
Routed to Pond 3P : UNDERGROUND RECHARGE SYSTEM #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-Year Rainfall=3.22"

Area (sf)	CN	Description
30,812	61	>75% Grass cover, Good, HSG B
80,071	98	Paved parking, HSG B
47,328	98	Paved parking, HSG C
6,872	74	>75% Grass cover, Good, HSG C
165,083	90	Weighted Average
37,684		22.83% Pervious Area
127,399		77.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0180	1.37		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.3	43	0.0180	2.72		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
1.5	143	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-4:



Summary for Subcatchment PR-5:

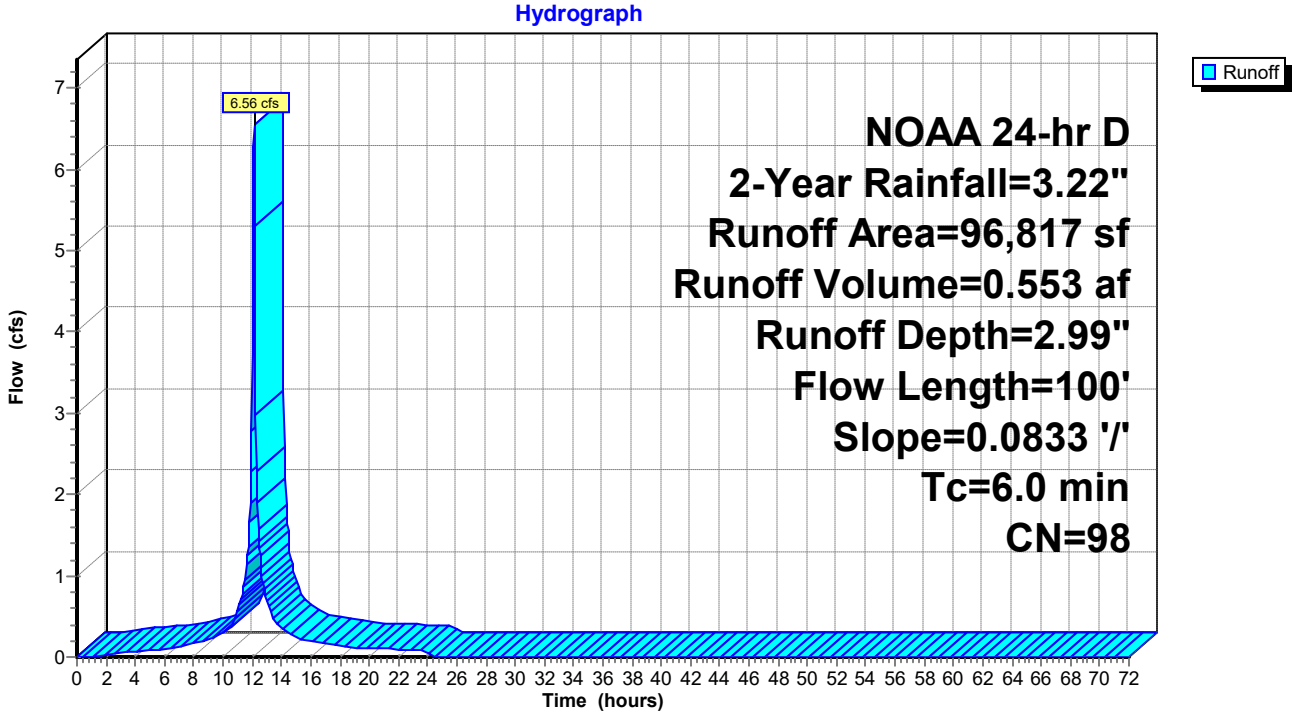
Runoff = 6.56 cfs @ 12.13 hrs, Volume= 0.553 af, Depth= 2.99"
Routed to Pond 6P : UNDERGROUND RECHARGE SYSTEM #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-Year Rainfall=3.22"

Area (sf)	CN	Description
96,817	98	Roofs, HSG B
96,817		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	100	0.0833	2.53		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.7	100	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-5:



Summary for Subcatchment PR-6:

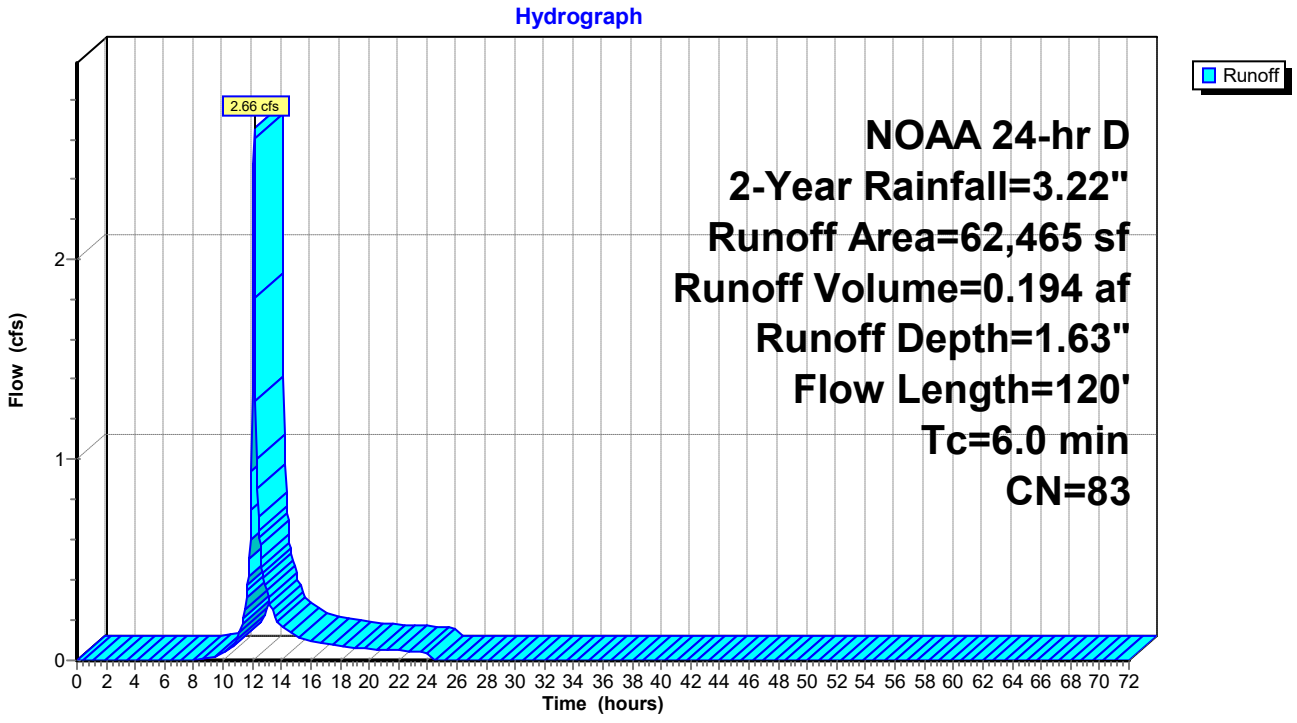
Runoff = 2.66 cfs @ 12.13 hrs, Volume= 0.194 af, Depth= 1.63"
Routed to Pond 4P : UNDERGROUND RECHARGE SYSTEM #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-Year Rainfall=3.22"

Area (sf)	CN	Description
46,670	98	Paved parking, HSG A
15,795	39	>75% Grass cover, Good, HSG A
62,465	83	Weighted Average
15,795		25.29% Pervious Area
46,670		74.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	100	0.0060	0.88		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.3	20	0.0030	1.11		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
2.2	120	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-6:



Summary for Subcatchment PR-7:

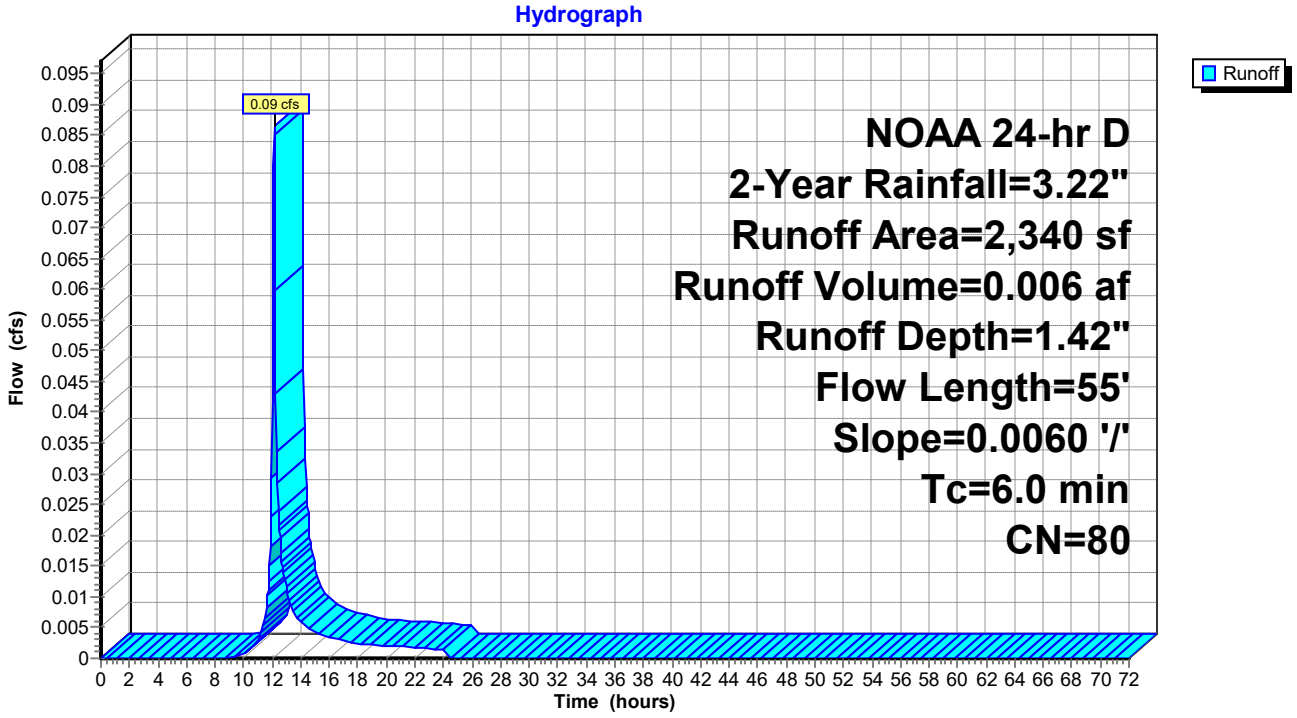
Runoff = 0.09 cfs @ 12.13 hrs, Volume= 0.006 af, Depth= 1.42"
Routed to Reach PR DP-1 : PROPOSED

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-Year Rainfall=3.22"

Area (sf)	CN	Description
624	98	Paved parking, HSG C
1,716	74	>75% Grass cover, Good, HSG C
2,340	80	Weighted Average
1,716		73.33% Pervious Area
624		26.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	55	0.0060	0.78		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
1.2	55	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-7:



Summary for Subcatchment PR-8:

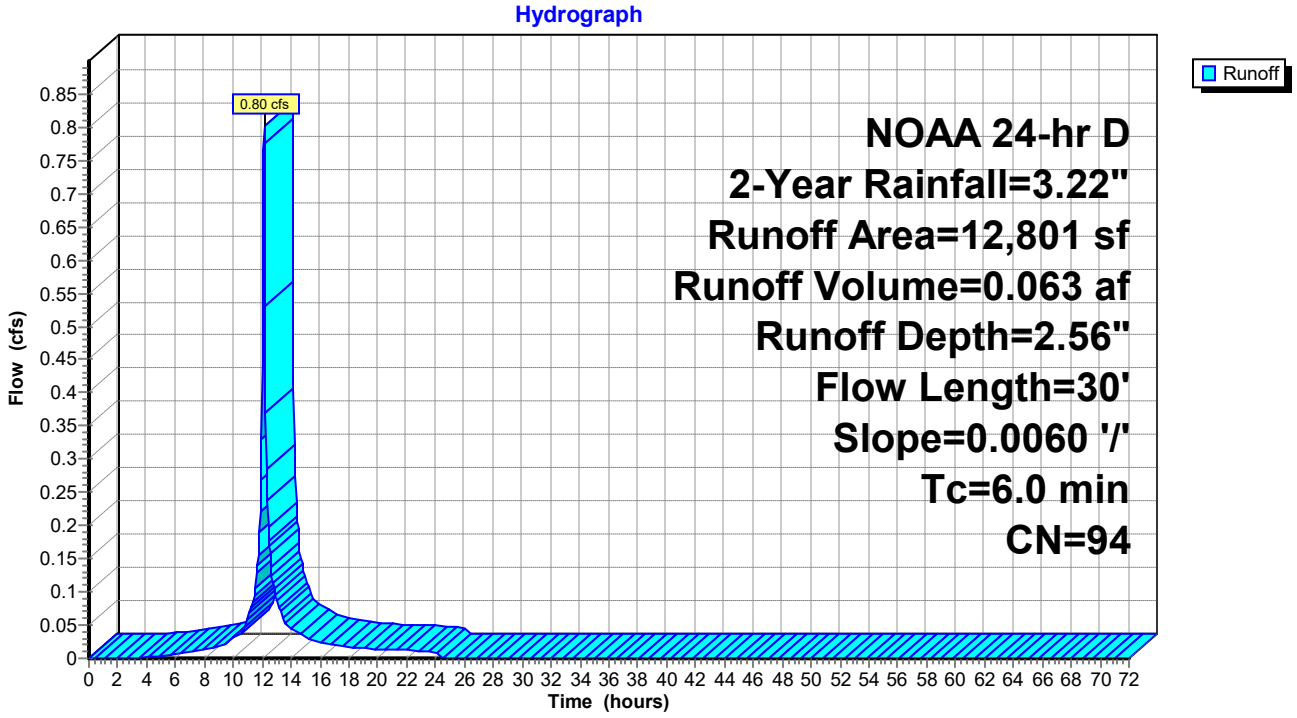
Runoff = 0.80 cfs @ 12.13 hrs, Volume= 0.063 af, Depth= 2.56"
Routed to Reach PR DP-1 : PROPOSED

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-Year Rainfall=3.22"

Area (sf)	CN	Description
10,551	98	Paved parking, HSG A
2,250	74	>75% Grass cover, Good, HSG C
12,801	94	Weighted Average
2,250		17.58% Pervious Area
10,551		82.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	30	0.0060	0.69		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.7	30	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-8:



Summary for Subcatchment PR-9:

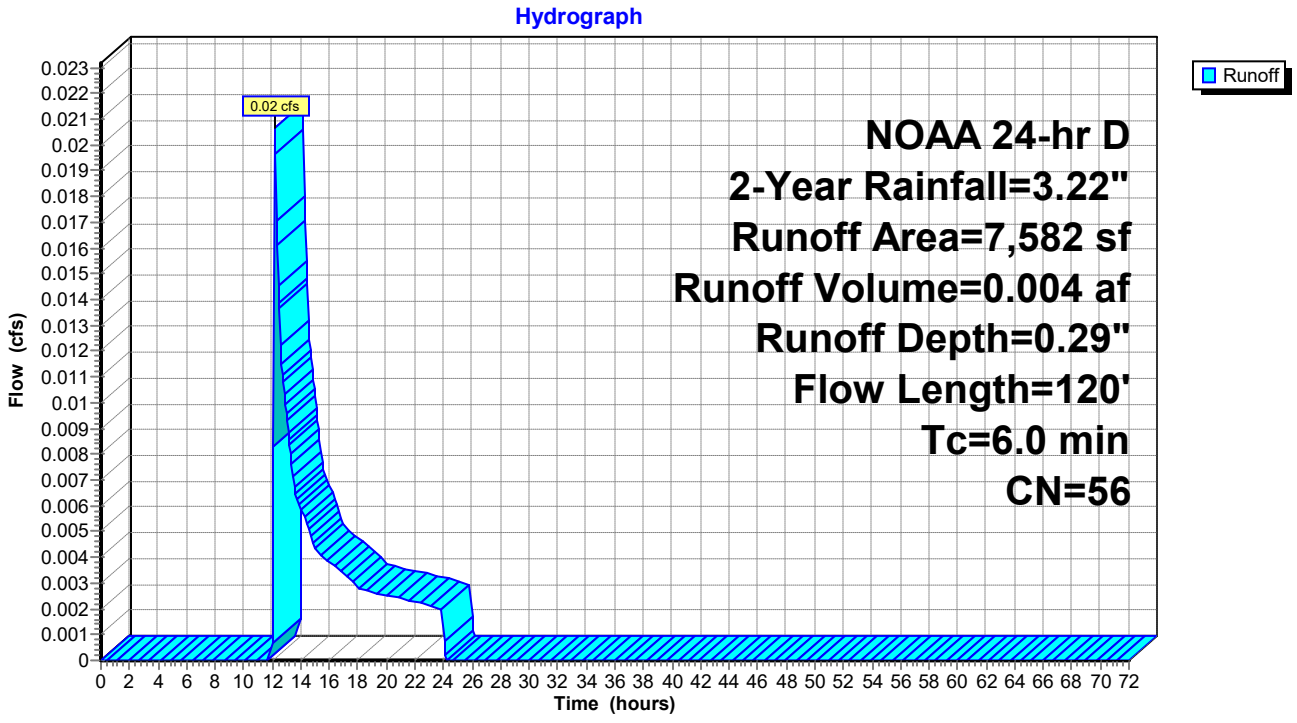
Runoff = 0.02 cfs @ 12.18 hrs, Volume= 0.004 af, Depth= 0.29"
Routed to Reach PR DP-2 : PROPOSED

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 2-Year Rainfall=3.22"

Area (sf)	CN	Description
2,203	98	Paved parking, HSG A
5,379	39	>75% Grass cover, Good, HSG A
7,582	56	Weighted Average
5,379		70.94% Pervious Area
2,203		29.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	100	0.0060	0.88		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.3	20	0.0030	1.11		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
2.2	120	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-9:



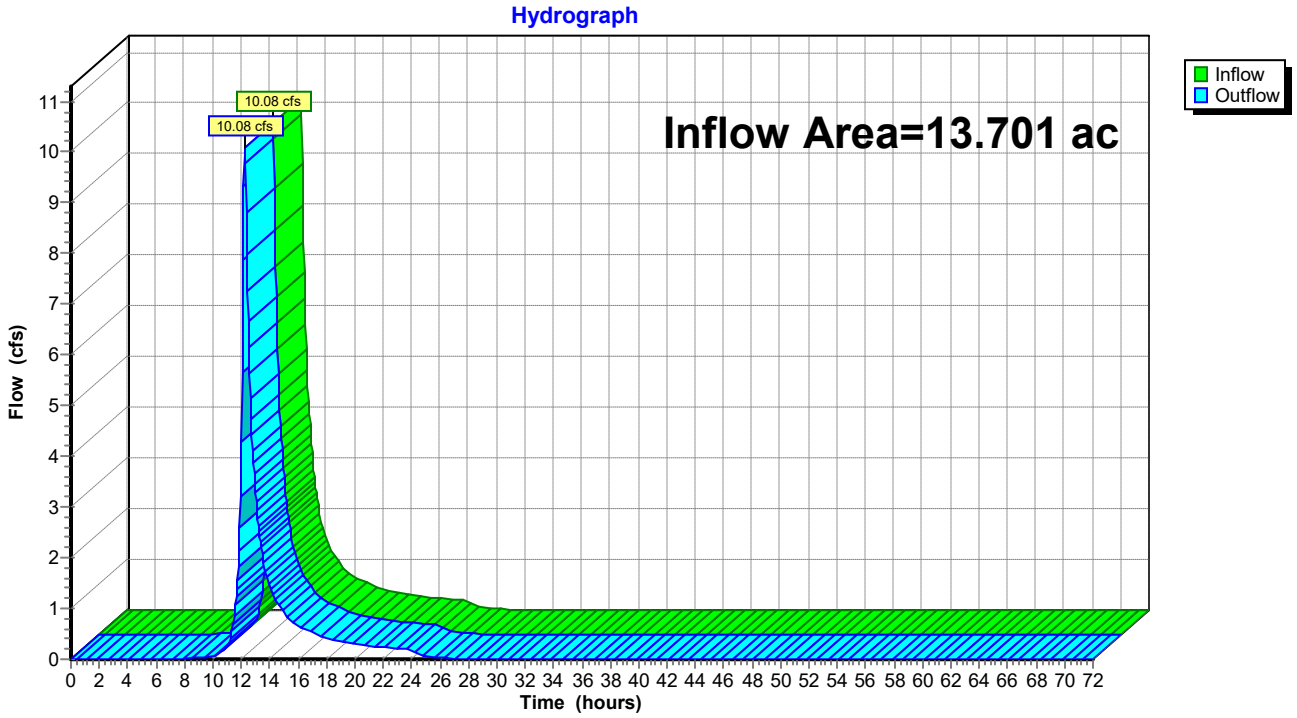
Summary for Reach PR DP-1: PROPOSED

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

Inflow Area = 13.701 ac, 83.40% Impervious, Inflow Depth = 1.07" for 2-Year event
Inflow = 10.08 cfs @ 12.23 hrs, Volume= 1.217 af
Outflow = 10.08 cfs @ 12.23 hrs, Volume= 1.217 af, Atten= 0%, Lag= 0.0 min

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

Reach PR DP-1: PROPOSED



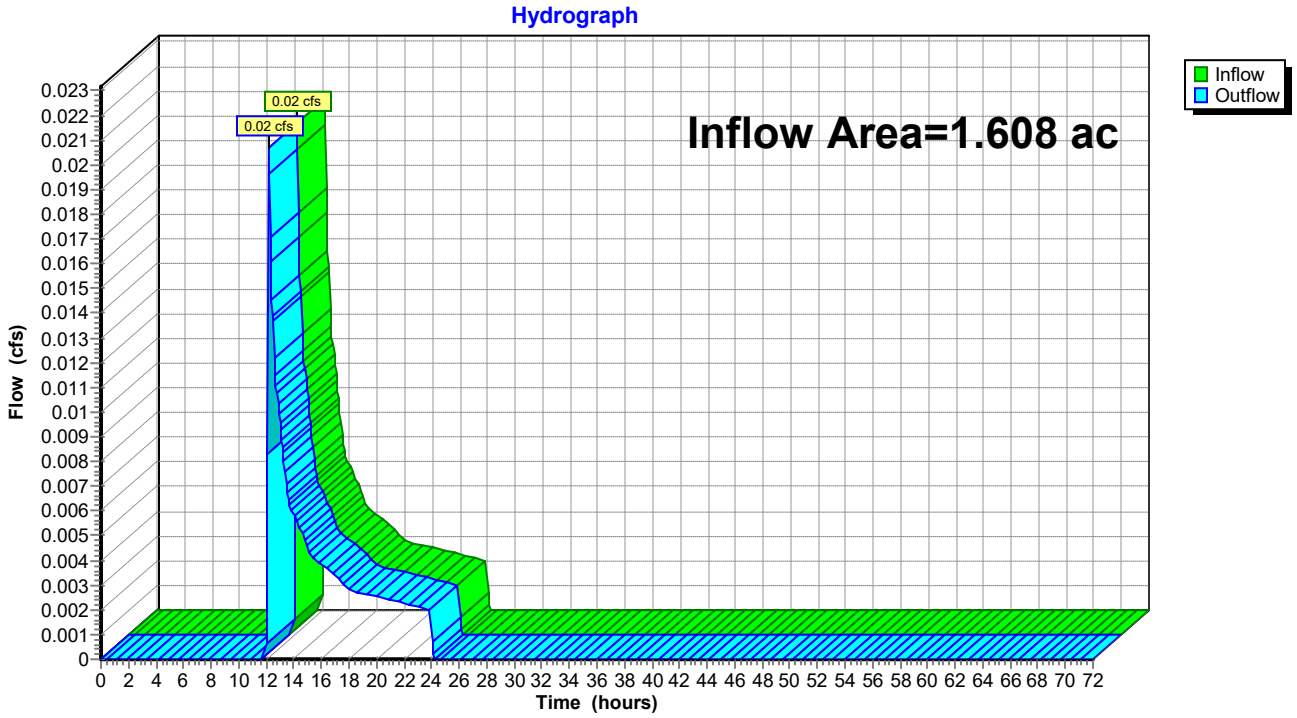
Summary for Reach PR DP-2: PROPOSED

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

Inflow Area = 1.608 ac, 69.77% Impervious, Inflow Depth = 0.03" for 2-Year event
Inflow = 0.02 cfs @ 12.18 hrs, Volume= 0.004 af
Outflow = 0.02 cfs @ 12.18 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min

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

Reach PR DP-2: PROPOSED



Summary for Pond 2P: UNDERGROUND RECHARGE SYSTEM #2

Inflow Area = 3.646 ac, 91.81% Impervious, Inflow Depth = 2.66" for 2-Year event
Inflow = 10.21 cfs @ 12.13 hrs, Volume= 0.810 af
Outflow = 3.05 cfs @ 12.35 hrs, Volume= 0.809 af, Atten= 70%, Lag= 13.4 min
Discarded = 0.17 cfs @ 7.90 hrs, Volume= 0.534 af
Primary = 2.88 cfs @ 12.35 hrs, Volume= 0.275 af
Routed to Reach PR DP-1 : PROPOSED

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 94.12' @ 12.35 hrs Surf.Area= 7,168 sf Storage= 14,699 cf

Plug-Flow detention time= 475.9 min calculated for 0.809 af (100% of inflow)
Center-of-Mass det. time= 476.3 min (1,261.4 - 785.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	91.50'	1,254 cf	**56.00'W x 128.00'L x 4.67'H Field A** 33,451 cf Overall - 29,867 cf Embedded = 3,584 cf x 35.0% Voids
#2A	92.00'	22,205 cf	**retain_it retain_it 3.5'** x 112 Inside #1 Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf 7 Rows adjusted for 282.4 cf perimeter wall
		23,459 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	91.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Device 4	94.25'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 4	93.75'	**48.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	92.00'	**30.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 92.00' / 91.90' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf

Discarded OutFlow Max=0.17 cfs @ 7.90 hrs HW=91.55' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=2.88 cfs @ 12.35 hrs HW=94.12' (Free Discharge)
└**4=Culvert** (Passes 2.88 cfs of 16.75 cfs potential flow)
  ├**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**3=Orifice/Grate** (Orifice Controls 2.88 cfs @ 1.95 fps)

Pond 2P: UNDERGROUND RECHARGE SYSTEM #2 - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.5' (retain-it®)
Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf
Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf
7 Rows adjusted for 282.4 cf perimeter wall

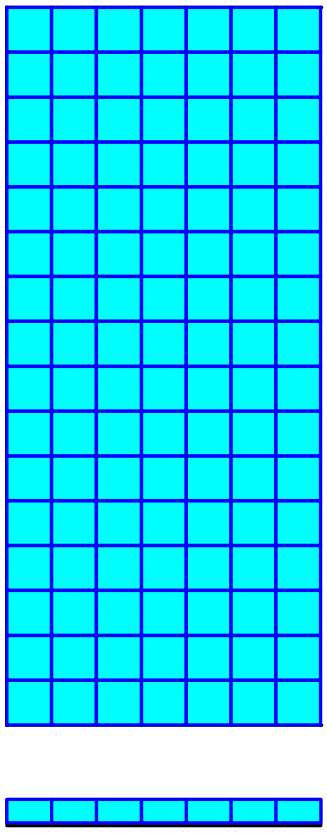
16 Chambers/Row x 8.00' Long = 128.00' Row Length
7 Rows x 96.0" Wide = 56.00' Base Width
6.0" Stone Base + 50.0" Chamber Height = 4.67' Field Height

6.1 cf Sidewall x 16 x 2 + 6.1 cf Endwall x 7 x 2 = 282.4 cf Perimeter Wall
112 Chambers x 200.8 cf - 282.4 cf Perimeter wall = 22,205.0 cf Chamber Storage
112 Chambers x 266.7 cf = 29,866.7 cf Displacement

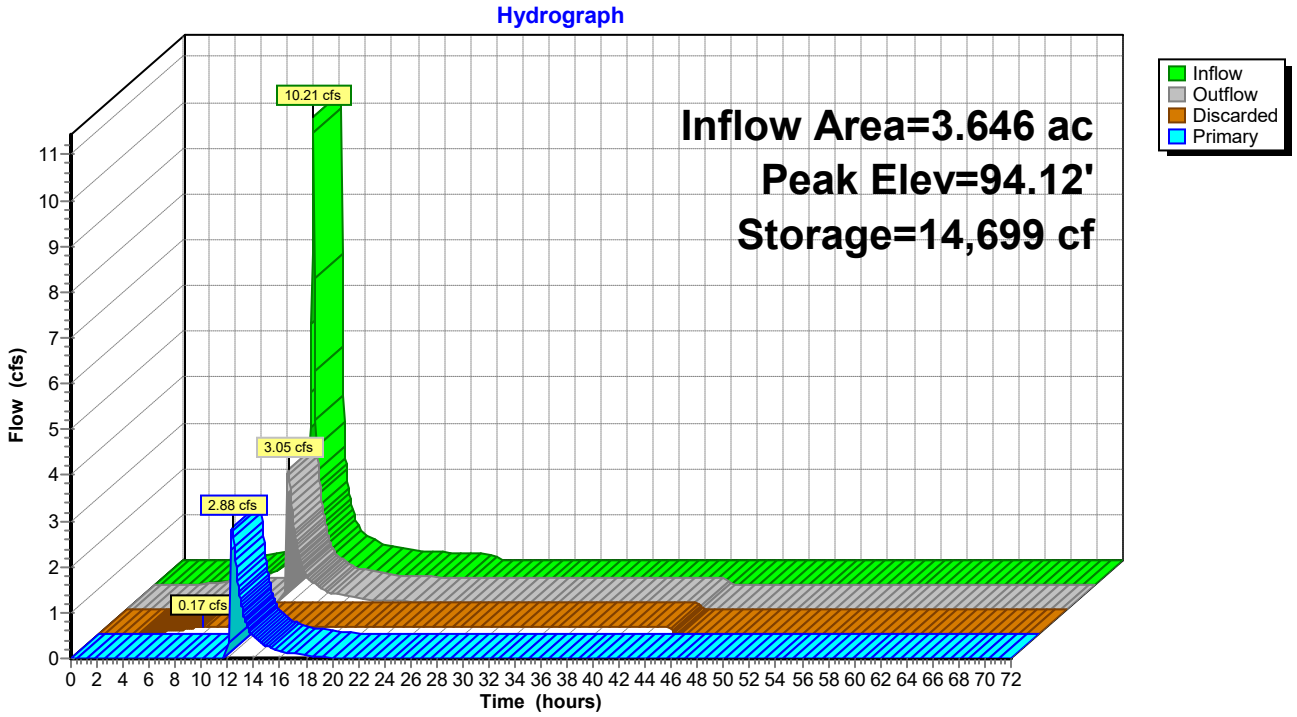
33,450.7 cf Field - 29,866.7 cf Chambers = 3,584.0 cf Stone x 35.0% Voids = 1,254.4 cf Stone Storage

Chamber Storage + Stone Storage = 23,459.4 cf = 0.539 af
Overall Storage Efficiency = 70.1%
Overall System Size = 128.00' x 56.00' x 4.67'

112 Chambers
1,238.9 cy Field
132.7 cy Stone



Pond 2P: UNDERGROUND RECHARGE SYSTEM #2



Summary for Pond 3P: UNDERGROUND RECHARGE SYSTEM #3

Inflow Area = 3.790 ac, 77.17% Impervious, Inflow Depth = 2.19" for 2-Year event
Inflow = 9.20 cfs @ 12.13 hrs, Volume= 0.691 af
Outflow = 5.87 cfs @ 12.21 hrs, Volume= 0.636 af, Atten= 36%, Lag= 5.1 min
Primary = 5.87 cfs @ 12.21 hrs, Volume= 0.636 af
Routed to Reach PR DP-1 : PROPOSED

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 94.03' @ 12.21 hrs Surf.Area= 6,800 sf Storage= 8,280 cf

Plug-Flow detention time= 112.1 min calculated for 0.636 af (92% of inflow)
Center-of-Mass det. time= 71.0 min (885.0 - 814.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	92.00'	2,893 cf	**34.00'W x 200.00'L x 4.67'H Field A** 31,733 cf Overall - 23,467 cf Embedded = 8,267 cf x 35.0% Voids
#2A	93.00'	16,787 cf	**retain_it retain_it 3.0'** x 100 Inside #1 Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf 4 Rows adjusted for 273.8 cf perimeter wall
		19,681 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 4	95.25'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Device 4	94.25'	**48.0" W x 4.0" H Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 4	93.00'	**48.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	93.00'	**48.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.00' / 92.95' S= 0.0050 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 12.57 sf

Primary OutFlow Max=5.85 cfs @ 12.21 hrs HW=94.02' (Free Discharge)
└**4=Culvert** (Barrel Controls 5.85 cfs @ 3.49 fps)
  ├**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  ├**2=Orifice** (Controls 0.00 cfs)
  └**3=Orifice/Grate** (Passes 5.85 cfs of 5.92 cfs potential flow)

Pond 3P: UNDERGROUND RECHARGE SYSTEM #3 - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.0' (retain-it®)
Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf
Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf
4 Rows adjusted for 273.8 cf perimeter wall

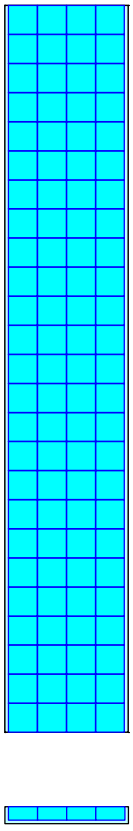
25 Chambers/Row x 8.00' Long = 200.00' Row Length
4 Rows x 96.0" Wide + 12.0" Side Stone x 2 = 34.00' Base Width
12.0" Stone Base + 44.0" Chamber Height = 4.67' Field Height

4.7 cf Sidewall x 25 x 2 + 4.7 cf Endwall x 4 x 2 = 273.8 cf Perimeter Wall
100 Chambers x 170.6 cf - 273.8 cf Perimeter wall = 16,787.3 cf Chamber Storage
100 Chambers x 234.7 cf = 23,466.7 cf Displacement

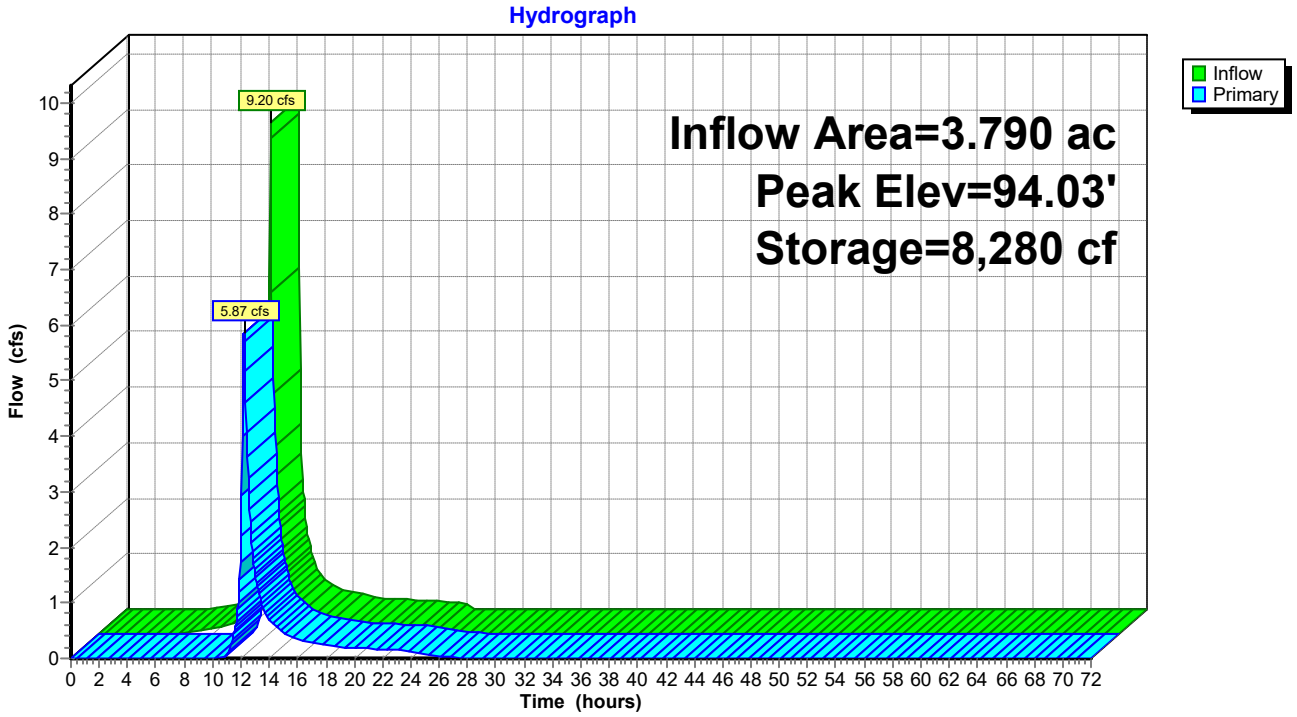
31,733.3 cf Field - 23,466.7 cf Chambers = 8,266.7 cf Stone x 35.0% Voids = 2,893.3 cf Stone Storage

Chamber Storage + Stone Storage = 19,680.6 cf = 0.452 af
Overall Storage Efficiency = 62.0%
Overall System Size = 200.00' x 34.00' x 4.67'

100 Chambers
1,175.3 cy Field
306.2 cy Stone



Pond 3P: UNDERGROUND RECHARGE SYSTEM #3



Summary for Pond 4P: UNDERGROUND RECHARGE SYSTEM #4

Inflow Area = 1.434 ac, 74.71% Impervious, Inflow Depth = 1.63" for 2-Year event
Inflow = 2.66 cfs @ 12.13 hrs, Volume= 0.194 af
Outflow = 2.50 cfs @ 12.13 hrs, Volume= 0.195 af, Atten= 6%, Lag= 0.0 min
Discarded = 2.50 cfs @ 12.13 hrs, Volume= 0.195 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach PR DP-2 : PROPOSED

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 90.33' @ 12.15 hrs Surf.Area= 2,048 sf Storage= 56 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1A	90.25'	717 cf	**32.00'W x 64.00'L x 4.67'H Field A** 9,557 cf Overall - 7,509 cf Embedded = 2,048 cf x 35.0% Voids
#2A	91.25'	5,346 cf	**retain_it retain_it 3.0'** x 32 Inside #1 Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf 4 Rows adjusted for 113.3 cf perimeter wall
		6,063 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	90.25'	**2.41 cfs Exfiltration at all elevations**
#2	Primary	93.90'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 93.90' / 93.85' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=2.41 cfs @ 12.13 hrs HW=90.31' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 2.41 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=90.25' (Free Discharge)
↑**2=Culvert** (Controls 0.00 cfs)

Pond 4P: UNDERGROUND RECHARGE SYSTEM #4 - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.0' (retain-it®)
Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf
Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf
4 Rows adjusted for 113.3 cf perimeter wall

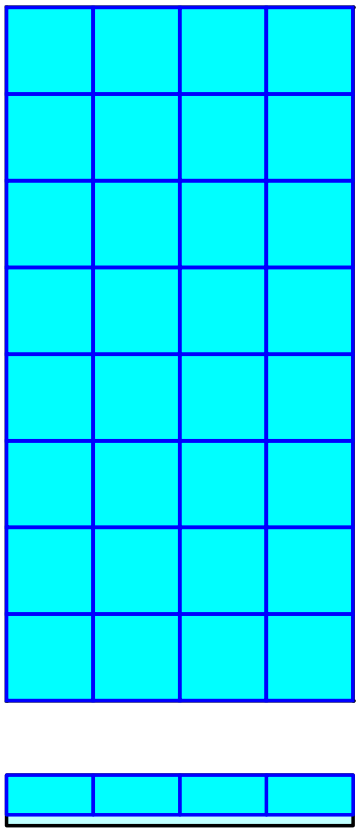
8 Chambers/Row x 8.00' Long = 64.00' Row Length
4 Rows x 96.0" Wide = 32.00' Base Width
12.0" Stone Base + 44.0" Chamber Height = 4.67' Field Height

4.7 cf Sidewall x 8 x 2 + 4.7 cf Endwall x 4 x 2 = 113.3 cf Perimeter Wall
32 Chambers x 170.6 cf - 113.3 cf Perimeter wall = 5,346.2 cf Chamber Storage
32 Chambers x 234.7 cf = 7,509.3 cf Displacement

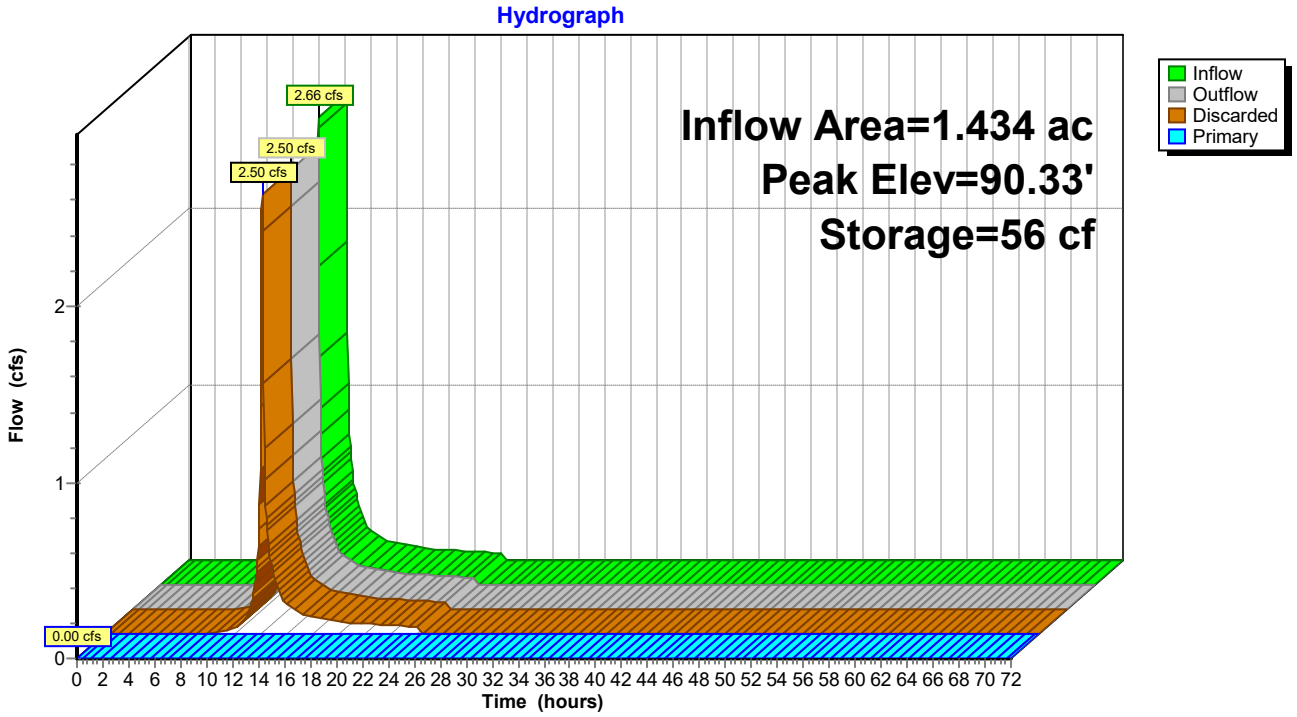
9,557.3 cf Field - 7,509.3 cf Chambers = 2,048.0 cf Stone x 35.0% Voids = 716.8 cf Stone Storage

Chamber Storage + Stone Storage = 6,063.0 cf = 0.139 af
Overall Storage Efficiency = 63.4%
Overall System Size = 64.00' x 32.00' x 4.67'

32 Chambers
354.0 cy Field
75.9 cy Stone



Pond 4P: UNDERGROUND RECHARGE SYSTEM #4



Summary for Pond 6P: UNDERGROUND RECHARGE SYSTEM #1

Inflow Area = 4.089 ac, 94.15% Impervious, Inflow Depth = 2.75" for 2-Year event
Inflow = 11.53 cfs @ 12.13 hrs, Volume= 0.937 af
Outflow = 0.42 cfs @ 9.90 hrs, Volume= 0.937 af, Atten= 96%, Lag= 0.0 min
Discarded = 0.42 cfs @ 9.90 hrs, Volume= 0.937 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach PR DP-1 : PROPOSED

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 93.14' @ 15.03 hrs Surf.Area= 17,920 sf Storage= 21,218 cf

Plug-Flow detention time= 448.2 min calculated for 0.936 af (100% of inflow)
Center-of-Mass det. time= 448.3 min (1,222.9 - 774.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	91.50'	3,136 cf	**80.00'W x 224.00'L x 4.67'H Field A** 83,627 cf Overall - 74,667 cf Embedded = 8,960 cf x 35.0% Voids
#2A	92.00'	55,752 cf	**retain_it retain_it 3.5'** x 280 Inside #1 Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf 10 Rows adjusted for 466.6 cf perimeter wall
		58,888 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	91.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Device 4	94.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 4	93.75'	**24.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	93.00'	**18.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.00' / 92.90' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.42 cfs @ 9.90 hrs HW=91.55' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.42 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=91.50' (Free Discharge)
└**4=Culvert** (Controls 0.00 cfs)
  ├**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**3=Orifice/Grate** (Controls 0.00 cfs)

Pond 6P: UNDERGROUND RECHARGE SYSTEM #1 - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.5' (retain-it®)
Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf
Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf
10 Rows adjusted for 466.6 cf perimeter wall

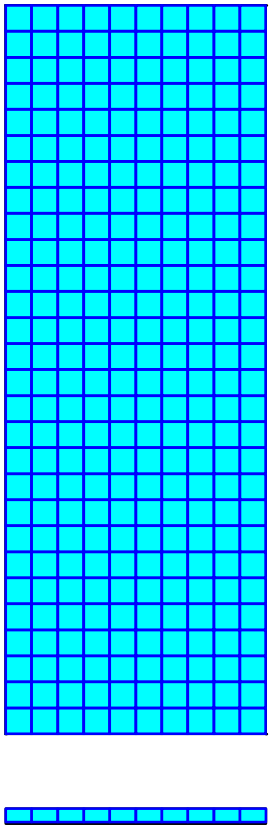
28 Chambers/Row x 8.00' Long = 224.00' Row Length
10 Rows x 96.0" Wide = 80.00' Base Width
6.0" Stone Base + 50.0" Chamber Height = 4.67' Field Height

6.1 cf Sidewall x 28 x 2 + 6.1 cf Endwall x 10 x 2 = 466.6 cf Perimeter Wall
280 Chambers x 200.8 cf - 466.6 cf Perimeter wall = 55,751.9 cf Chamber Storage
280 Chambers x 266.7 cf = 74,666.7 cf Displacement

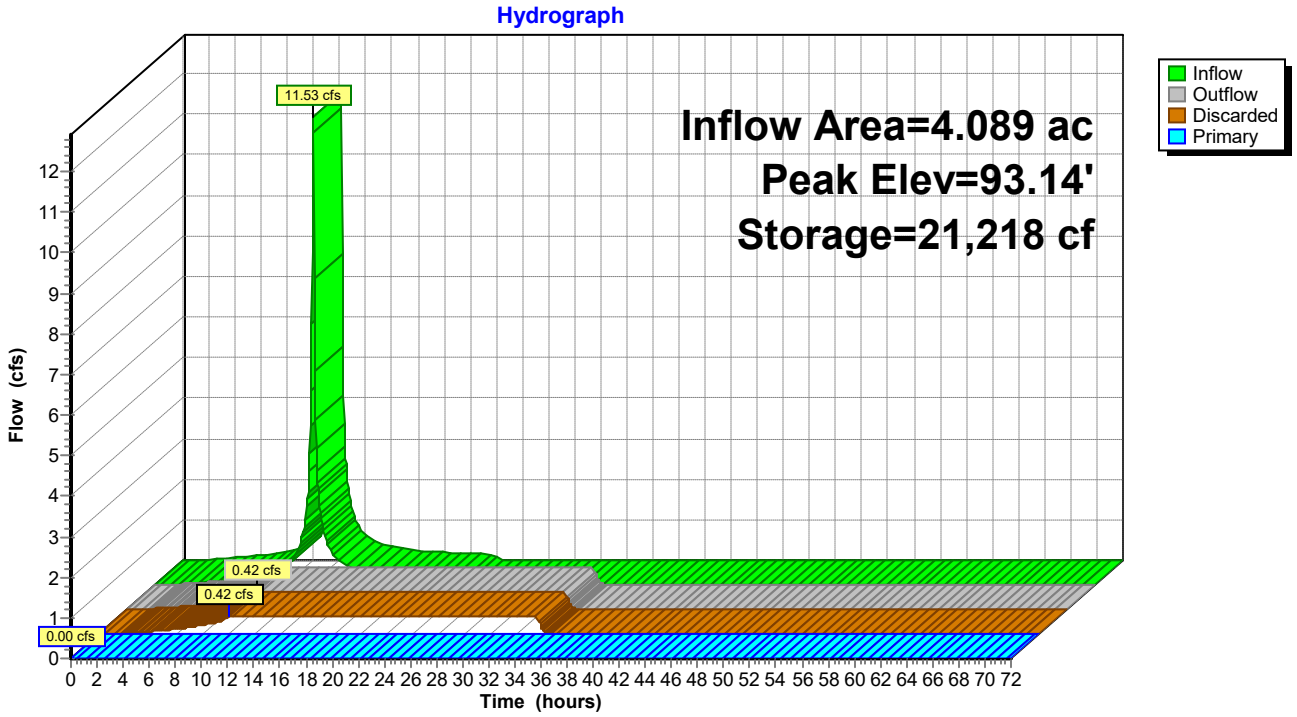
83,626.7 cf Field - 74,666.7 cf Chambers = 8,960.0 cf Stone x 35.0% Voids = 3,136.0 cf Stone Storage

Chamber Storage + Stone Storage = 58,887.9 cf = 1.352 af
Overall Storage Efficiency = 70.4%
Overall System Size = 224.00' x 80.00' x 4.67'

280 Chambers
3,097.3 cy Field
331.9 cy Stone



Pond 6P: UNDERGROUND RECHARGE SYSTEM #1



Summary for Subcatchment PR-1:

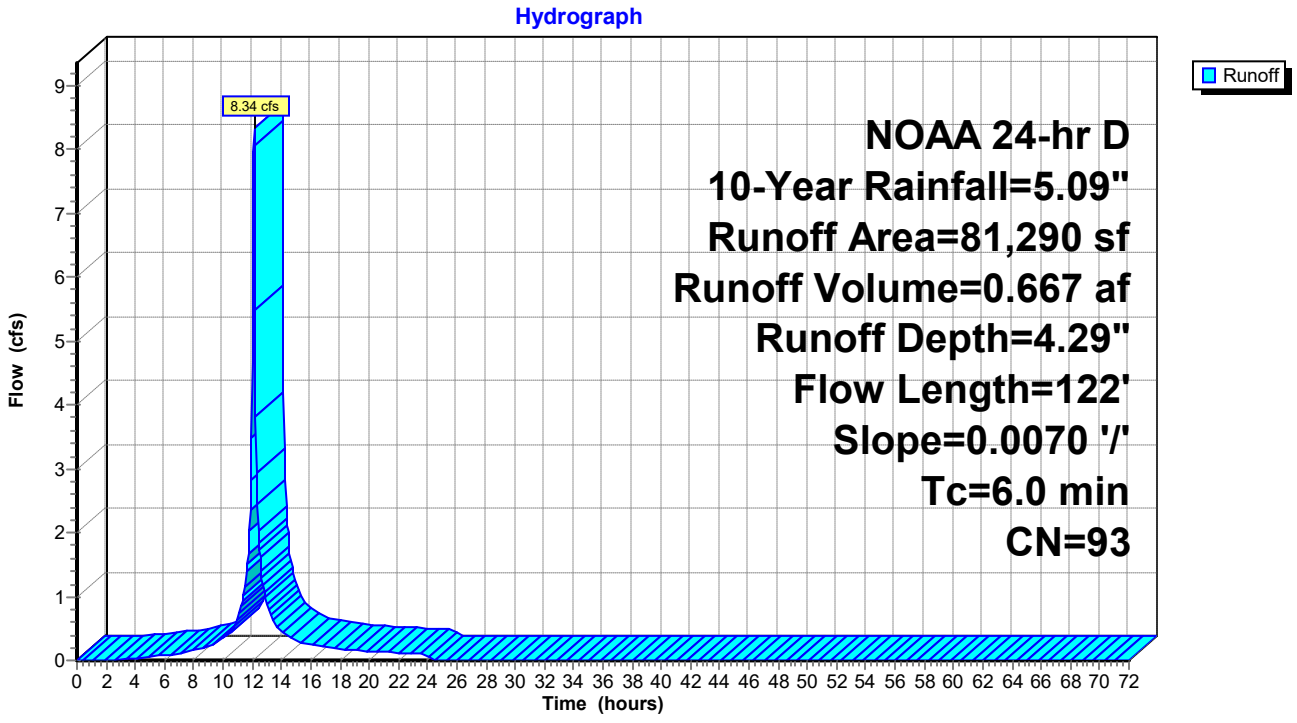
Runoff = 8.34 cfs @ 12.13 hrs, Volume= 0.667 af, Depth= 4.29"
Routed to Pond 6P : UNDERGROUND RECHARGE SYSTEM #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-Year Rainfall=5.09"

Area (sf)	CN	Description
70,874	98	Paved parking, HSG B
10,416	61	>75% Grass cover, Good, HSG B
81,290	93	Weighted Average
10,416		12.81% Pervious Area
70,874		87.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	100	0.0070	0.94		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.2	22	0.0070	1.70		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
2.0	122	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-1:



Summary for Subcatchment PR-2:

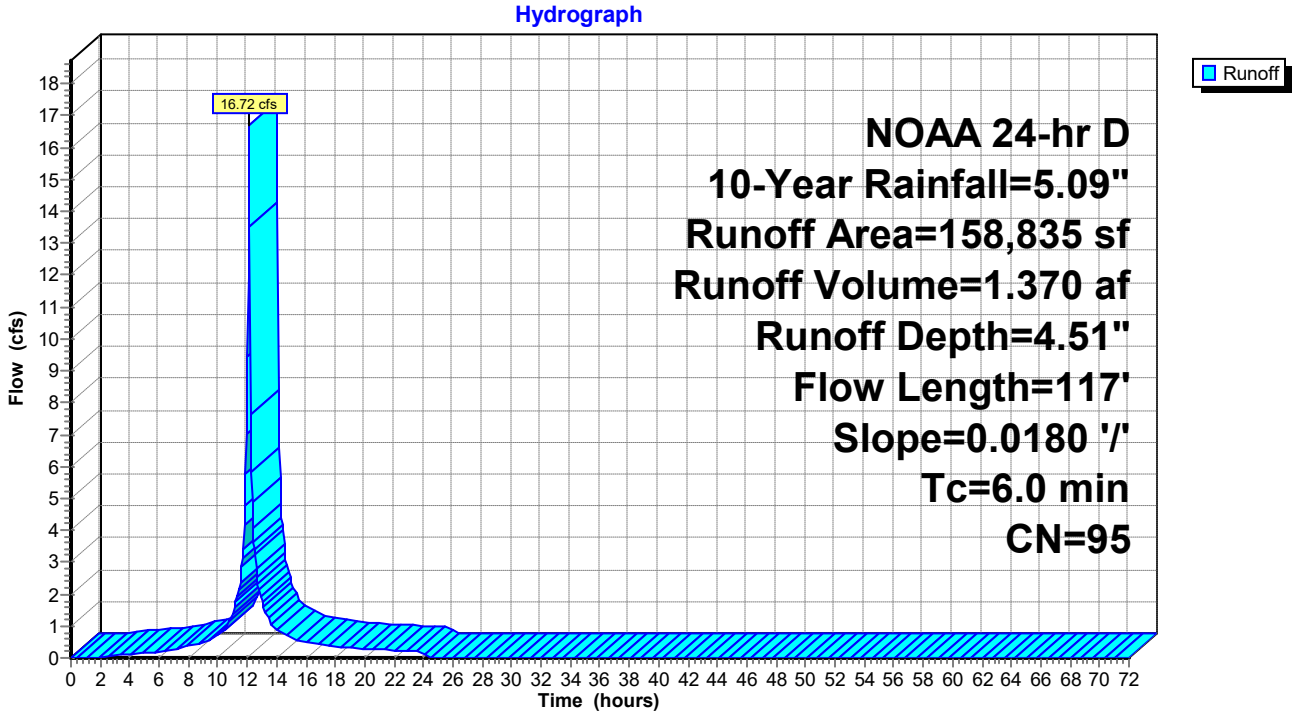
Runoff = 16.72 cfs @ 12.13 hrs, Volume= 1.370 af, Depth= 4.51"
Routed to Pond 2P : UNDERGROUND RECHARGE SYSTEM #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-Year Rainfall=5.09"

Area (sf)	CN	Description
44,527	98	Paved parking, HSG B
13,004	61	>75% Grass cover, Good, HSG B
101,304	98	Roofs, HSG B
158,835	95	Weighted Average
13,004		8.19% Pervious Area
145,831		91.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0180	1.37		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.1	17	0.0180	2.72		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
1.3	117	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-2:



Summary for Subcatchment PR-3:

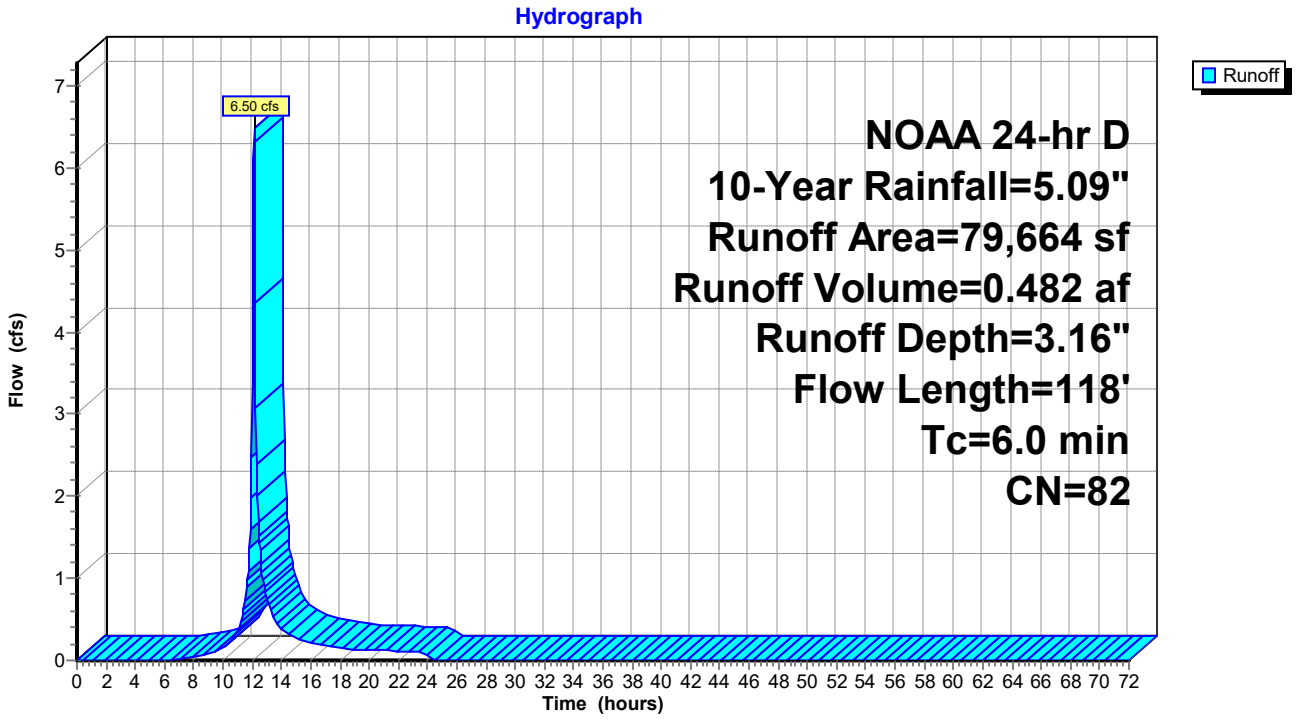
Runoff = 6.50 cfs @ 12.13 hrs, Volume= 0.482 af, Depth= 3.16"
Routed to Reach PR DP-1 : PROPOSED

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-Year Rainfall=5.09"

Area (sf)	CN	Description
45,650	98	Paved parking, HSG B
34,014	61	>75% Grass cover, Good, HSG B
79,664	82	Weighted Average
34,014		42.70% Pervious Area
45,650		57.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0170	1.34		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.1	18	0.0110	2.13		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
1.3	118	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-3:



Summary for Subcatchment PR-4:

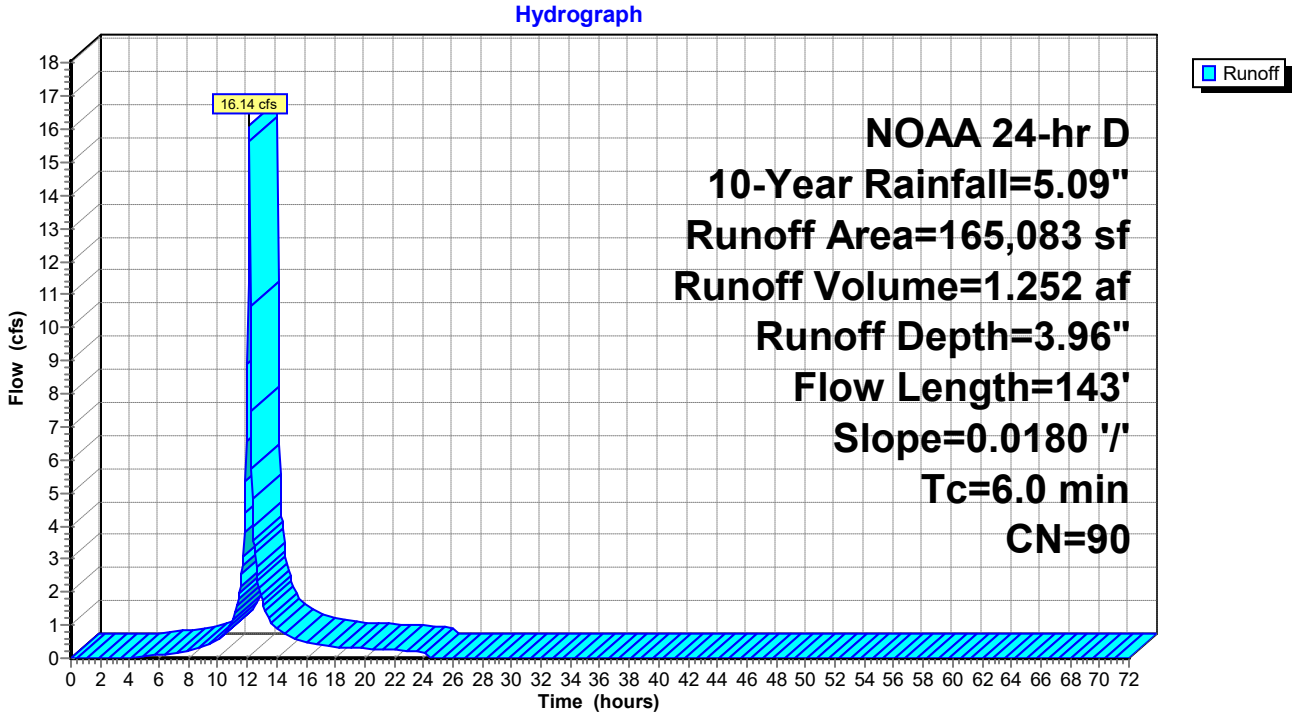
Runoff = 16.14 cfs @ 12.13 hrs, Volume= 1.252 af, Depth= 3.96"
Routed to Pond 3P : UNDERGROUND RECHARGE SYSTEM #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-Year Rainfall=5.09"

Area (sf)	CN	Description
30,812	61	>75% Grass cover, Good, HSG B
80,071	98	Paved parking, HSG B
47,328	98	Paved parking, HSG C
6,872	74	>75% Grass cover, Good, HSG C
165,083	90	Weighted Average
37,684		22.83% Pervious Area
127,399		77.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0180	1.37		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.3	43	0.0180	2.72		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
1.5	143	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-4:



Summary for Subcatchment PR-5:

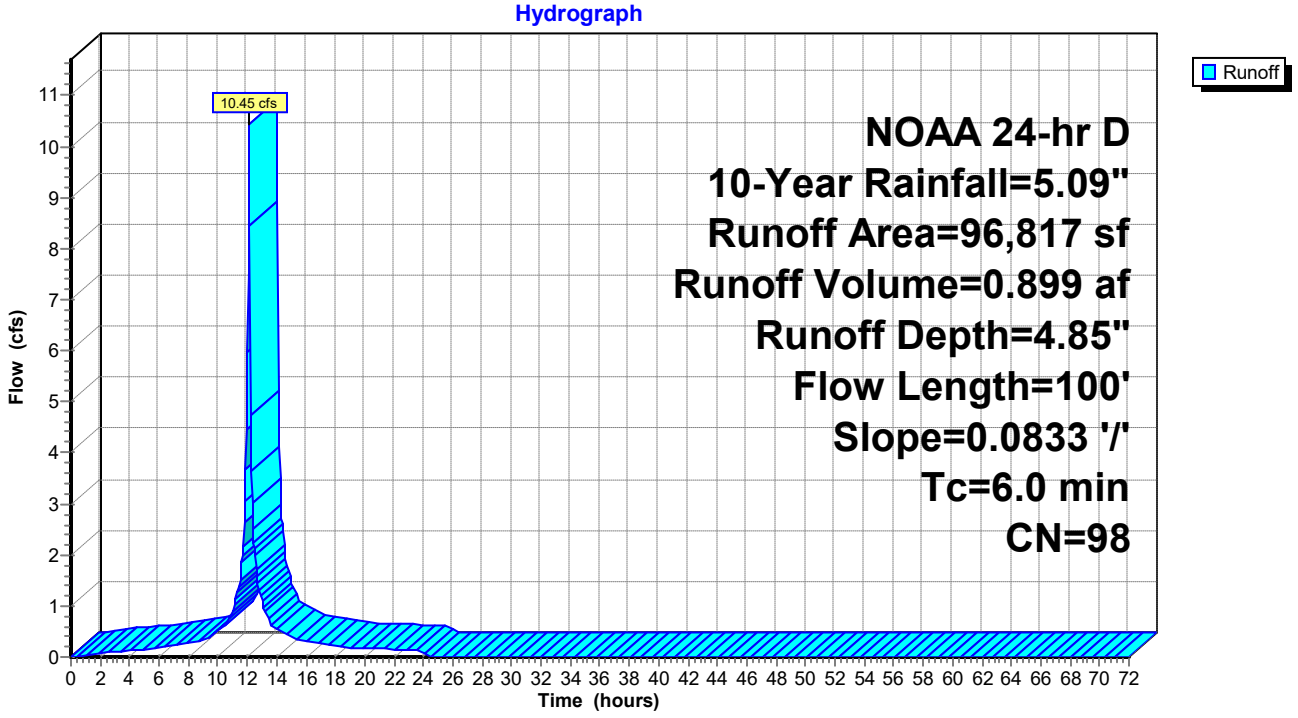
Runoff = 10.45 cfs @ 12.13 hrs, Volume= 0.899 af, Depth= 4.85"
Routed to Pond 6P : UNDERGROUND RECHARGE SYSTEM #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-Year Rainfall=5.09"

Area (sf)	CN	Description
96,817	98	Roofs, HSG B
96,817		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	100	0.0833	2.53		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.7	100	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-5:



Summary for Subcatchment PR-6:

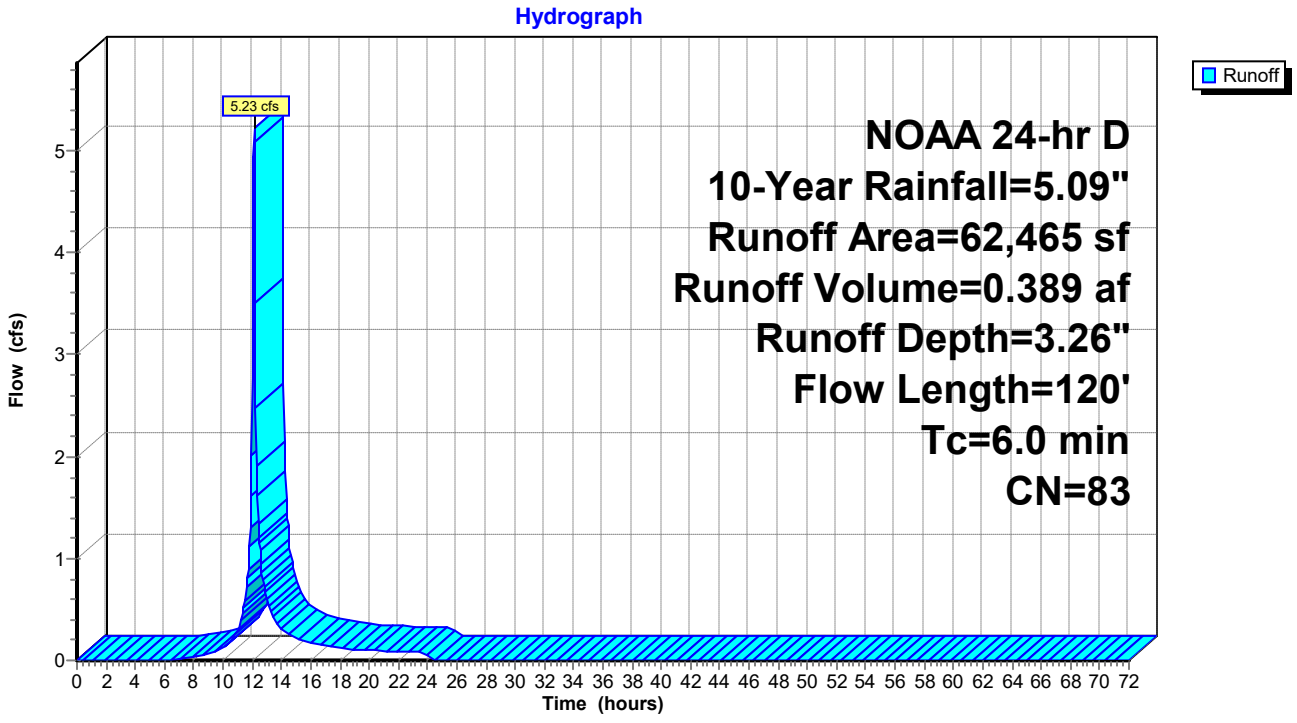
Runoff = 5.23 cfs @ 12.13 hrs, Volume= 0.389 af, Depth= 3.26"
Routed to Pond 4P : UNDERGROUND RECHARGE SYSTEM #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-Year Rainfall=5.09"

Area (sf)	CN	Description
46,670	98	Paved parking, HSG A
15,795	39	>75% Grass cover, Good, HSG A
62,465	83	Weighted Average
15,795		25.29% Pervious Area
46,670		74.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	100	0.0060	0.88		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.3	20	0.0030	1.11		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
2.2	120	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-6:



Summary for Subcatchment PR-7:

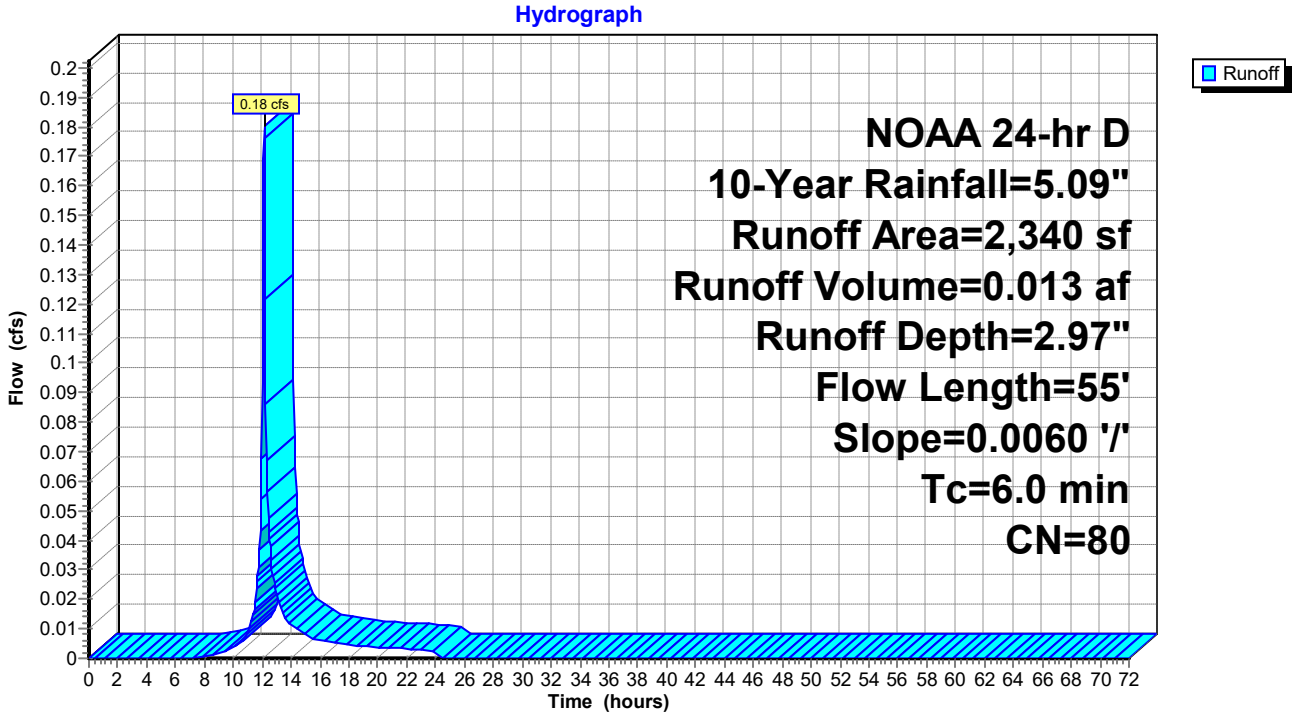
Runoff = 0.18 cfs @ 12.13 hrs, Volume= 0.013 af, Depth= 2.97"
Routed to Reach PR DP-1 : PROPOSED

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-Year Rainfall=5.09"

Area (sf)	CN	Description
624	98	Paved parking, HSG C
1,716	74	>75% Grass cover, Good, HSG C
2,340	80	Weighted Average
1,716		73.33% Pervious Area
624		26.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	55	0.0060	0.78		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
1.2	55	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-7:



Summary for Subcatchment PR-8:

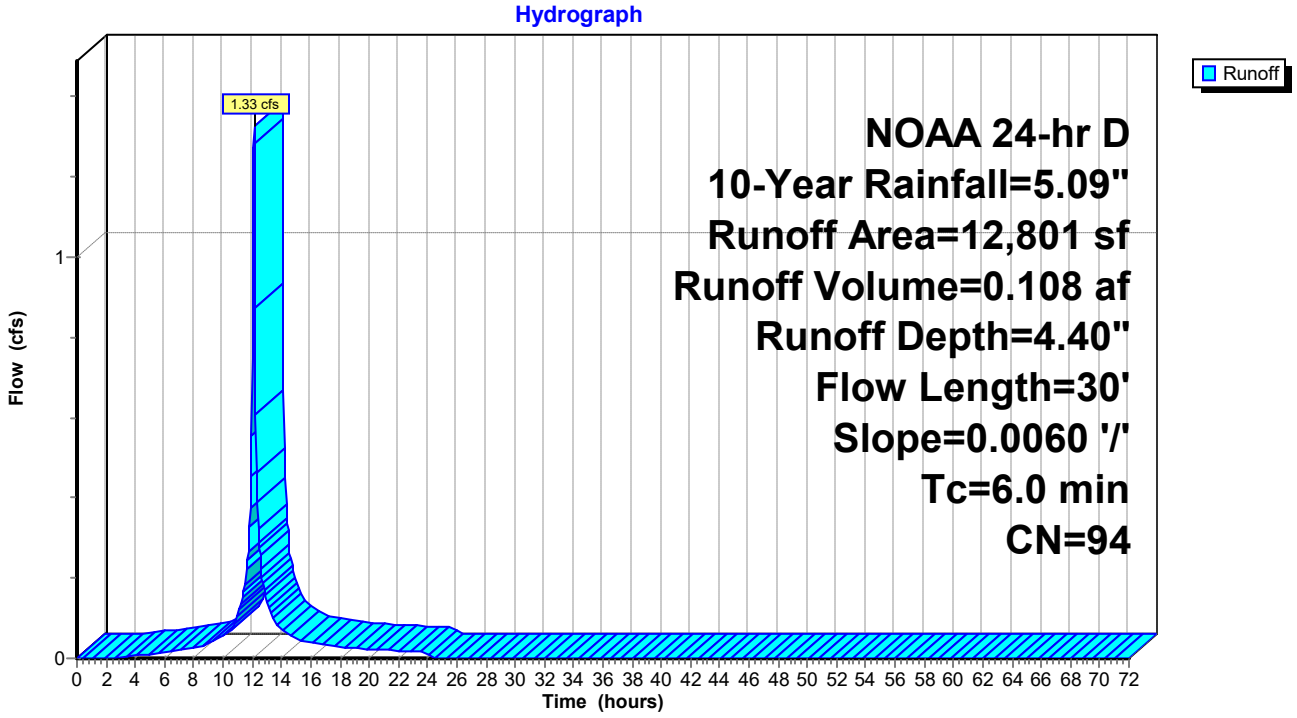
Runoff = 1.33 cfs @ 12.13 hrs, Volume= 0.108 af, Depth= 4.40"
Routed to Reach PR DP-1 : PROPOSED

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-Year Rainfall=5.09"

Area (sf)	CN	Description
10,551	98	Paved parking, HSG A
2,250	74	>75% Grass cover, Good, HSG C
12,801	94	Weighted Average
2,250		17.58% Pervious Area
10,551		82.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	30	0.0060	0.69		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.7	30	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-8:



Summary for Subcatchment PR-9:

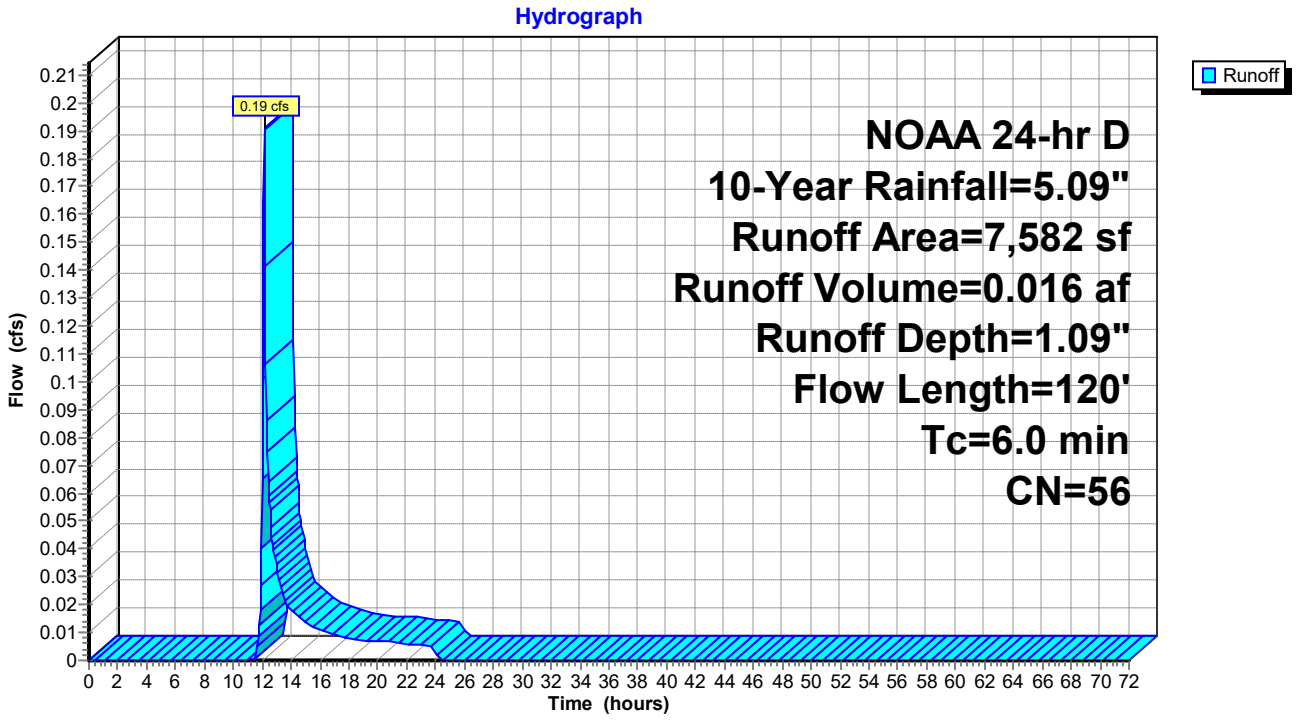
Runoff = 0.19 cfs @ 12.14 hrs, Volume= 0.016 af, Depth= 1.09"
Routed to Reach PR DP-2 : PROPOSED

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 10-Year Rainfall=5.09"

Area (sf)	CN	Description
2,203	98	Paved parking, HSG A
5,379	39	>75% Grass cover, Good, HSG A
7,582	56	Weighted Average
5,379		70.94% Pervious Area
2,203		29.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	100	0.0060	0.88		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.3	20	0.0030	1.11		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
2.2	120	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-9:



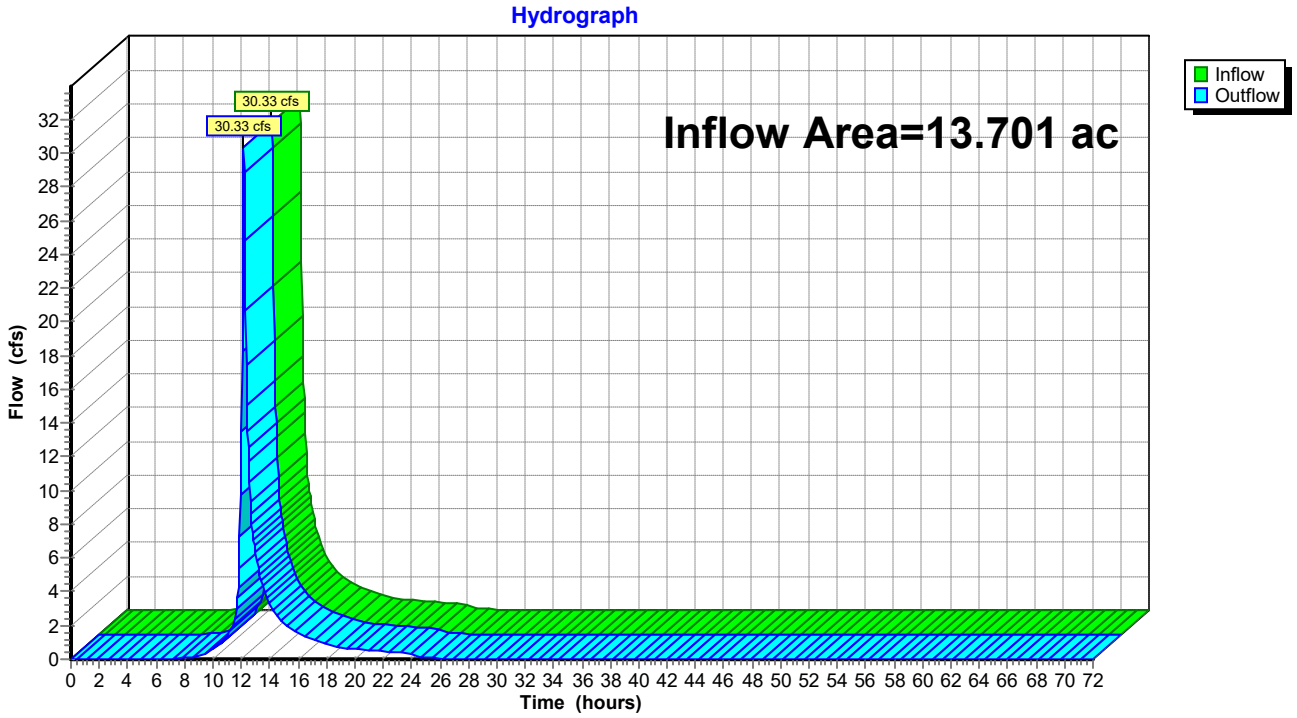
Summary for Reach PR DP-1: PROPOSED

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

Inflow Area = 13.701 ac, 83.40% Impervious, Inflow Depth = 2.48" for 10-Year event
Inflow = 30.33 cfs @ 12.17 hrs, Volume= 2.827 af
Outflow = 30.33 cfs @ 12.17 hrs, Volume= 2.827 af, Atten= 0%, Lag= 0.0 min

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

Reach PR DP-1: PROPOSED



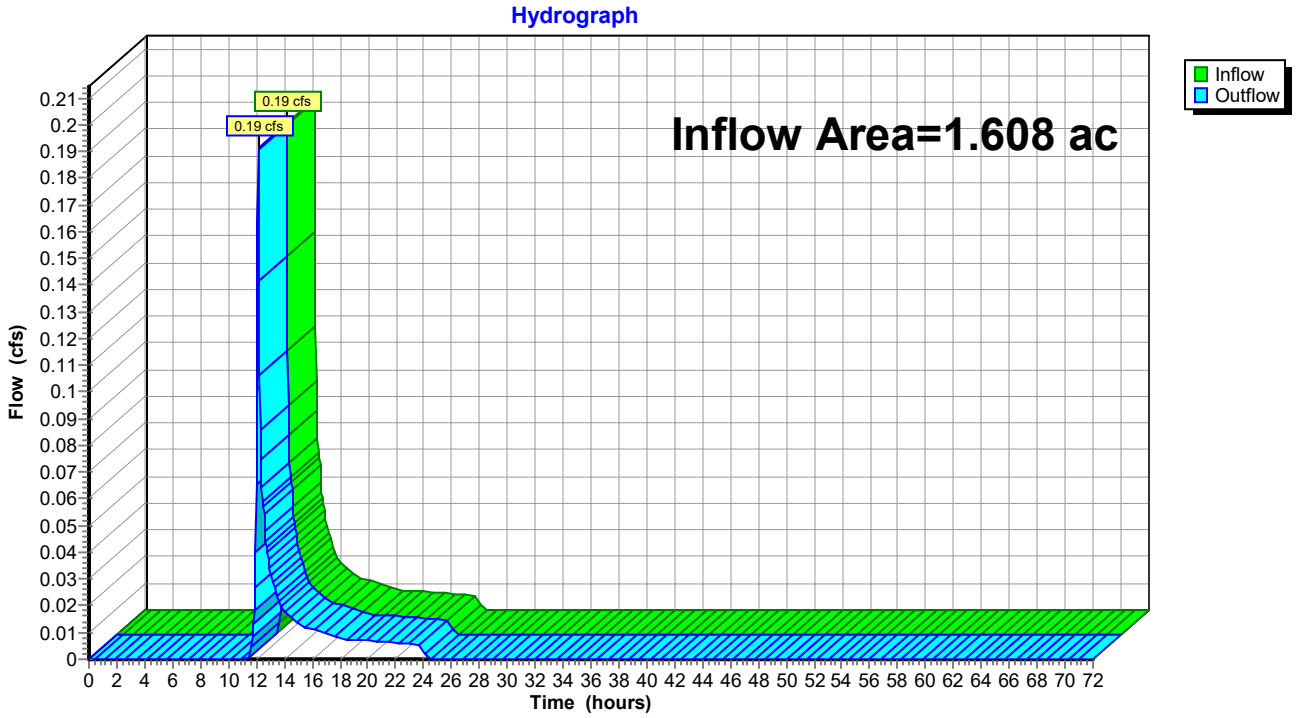
Summary for Reach PR DP-2: PROPOSED

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

Inflow Area = 1.608 ac, 69.77% Impervious, Inflow Depth = 0.12" for 10-Year event
Inflow = 0.19 cfs @ 12.14 hrs, Volume= 0.016 af
Outflow = 0.19 cfs @ 12.14 hrs, Volume= 0.016 af, Atten= 0%, Lag= 0.0 min

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

Reach PR DP-2: PROPOSED



Summary for Pond 2P: UNDERGROUND RECHARGE SYSTEM #2

Inflow Area = 3.646 ac, 91.81% Impervious, Inflow Depth = 4.51" for 10-Year event
Inflow = 16.72 cfs @ 12.13 hrs, Volume= 1.370 af
Outflow = 13.36 cfs @ 12.18 hrs, Volume= 1.370 af, Atten= 20%, Lag= 3.1 min
Discarded = 0.17 cfs @ 5.45 hrs, Volume= 0.573 af
Primary = 13.19 cfs @ 12.18 hrs, Volume= 0.797 af
Routed to Reach PR DP-1 : PROPOSED

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 94.67' @ 12.18 hrs Surf.Area= 7,168 sf Storage= 18,217 cf

Plug-Flow detention time= 307.2 min calculated for 1.370 af (100% of inflow)
Center-of-Mass det. time= 307.0 min (1,077.8 - 770.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	91.50'	1,254 cf	**56.00'W x 128.00'L x 4.67'H Field A** 33,451 cf Overall - 29,867 cf Embedded = 3,584 cf x 35.0% Voids
#2A	92.00'	22,205 cf	**retain_it retain_it 3.5'** x 112 Inside #1 Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf 7 Rows adjusted for 282.4 cf perimeter wall
		23,459 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	91.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Device 4	94.25'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 4	93.75'	**48.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	92.00'	**30.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 92.00' / 91.90' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf

Discarded OutFlow Max=0.17 cfs @ 5.45 hrs HW=91.55' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=12.92 cfs @ 12.18 hrs HW=94.66' (Free Discharge)
└**4=Culvert** (Passes 12.92 cfs of 23.63 cfs potential flow)
  ├**2=Sharp-Crested Rectangular Weir** (Weir Controls 5.13 cfs @ 2.10 fps)
  └**3=Orifice/Grate** (Orifice Controls 7.79 cfs @ 3.90 fps)

Pond 2P: UNDERGROUND RECHARGE SYSTEM #2 - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.5' (retain-it®)
Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf
Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf
7 Rows adjusted for 282.4 cf perimeter wall

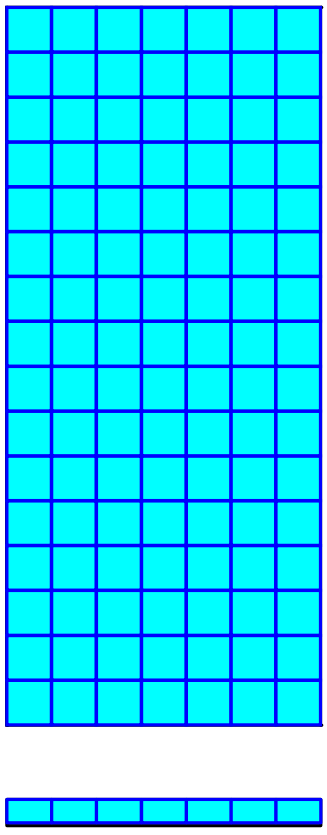
16 Chambers/Row x 8.00' Long = 128.00' Row Length
7 Rows x 96.0" Wide = 56.00' Base Width
6.0" Stone Base + 50.0" Chamber Height = 4.67' Field Height

6.1 cf Sidewall x 16 x 2 + 6.1 cf Endwall x 7 x 2 = 282.4 cf Perimeter Wall
112 Chambers x 200.8 cf - 282.4 cf Perimeter wall = 22,205.0 cf Chamber Storage
112 Chambers x 266.7 cf = 29,866.7 cf Displacement

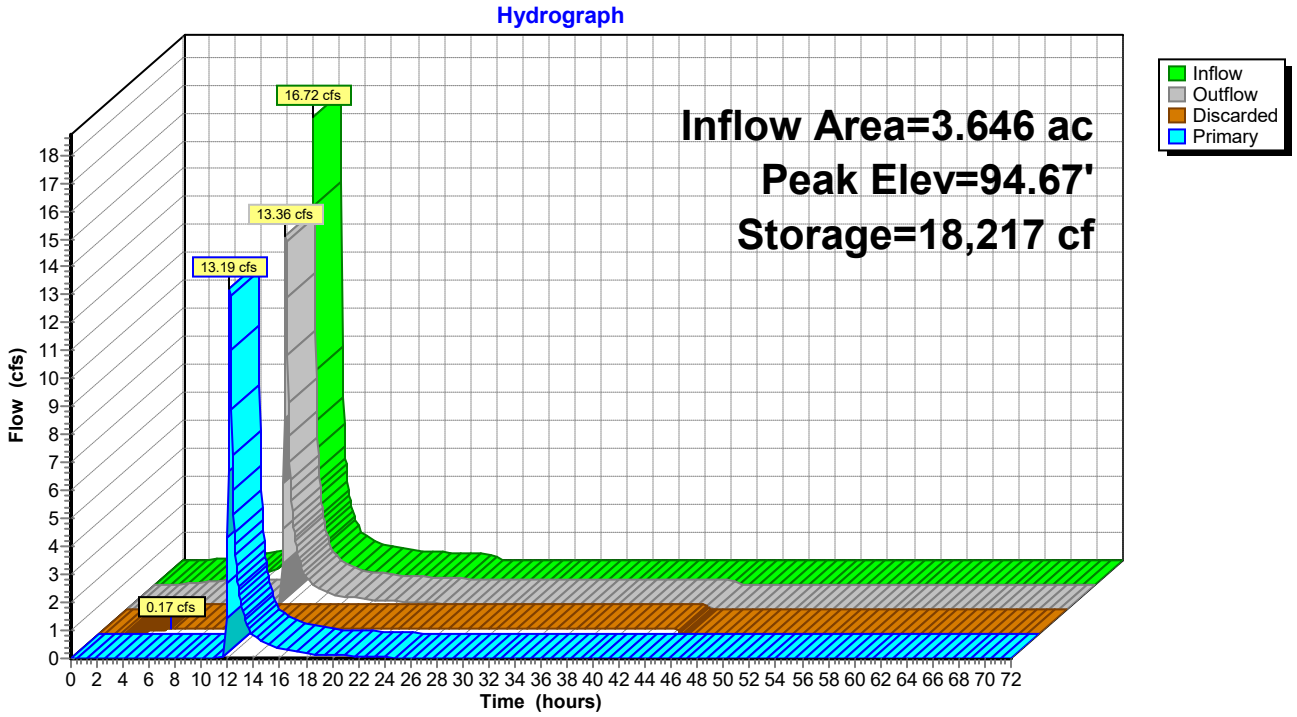
33,450.7 cf Field - 29,866.7 cf Chambers = 3,584.0 cf Stone x 35.0% Voids = 1,254.4 cf Stone Storage

Chamber Storage + Stone Storage = 23,459.4 cf = 0.539 af
Overall Storage Efficiency = 70.1%
Overall System Size = 128.00' x 56.00' x 4.67'

112 Chambers
1,238.9 cy Field
132.7 cy Stone



Pond 2P: UNDERGROUND RECHARGE SYSTEM #2



Summary for Pond 3P: UNDERGROUND RECHARGE SYSTEM #3

Inflow Area = 3.790 ac, 77.17% Impervious, Inflow Depth = 3.96" for 10-Year event
Inflow = 16.14 cfs @ 12.13 hrs, Volume= 1.252 af
Outflow = 10.55 cfs @ 12.21 hrs, Volume= 1.197 af, Atten= 35%, Lag= 5.0 min
Primary = 10.55 cfs @ 12.21 hrs, Volume= 1.197 af
Routed to Reach PR DP-1 : PROPOSED

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 94.62' @ 12.21 hrs Surf.Area= 6,800 sf Storage= 11,683 cf

Plug-Flow detention time= 80.6 min calculated for 1.197 af (96% of inflow)
Center-of-Mass det. time= 54.5 min (850.0 - 795.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	92.00'	2,893 cf	**34.00'W x 200.00'L x 4.67'H Field A** 31,733 cf Overall - 23,467 cf Embedded = 8,267 cf x 35.0% Voids
#2A	93.00'	16,787 cf	**retain_it retain_it 3.0'** x 100 Inside #1 Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf 4 Rows adjusted for 273.8 cf perimeter wall
		19,681 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 4	95.25'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Device 4	94.25'	**48.0" W x 4.0" H Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 4	93.00'	**48.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	93.00'	**48.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.00' / 92.95' S= 0.0050 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 12.57 sf

Primary OutFlow Max=10.44 cfs @ 12.21 hrs HW=94.61' (Free Discharge)
└**4=Culvert** (Passes 10.44 cfs of 13.79 cfs potential flow)
  ├**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  ├**2=Orifice** (Orifice Controls 2.72 cfs @ 2.04 fps)
  └**3=Orifice/Grate** (Orifice Controls 7.71 cfs @ 5.78 fps)

Pond 3P: UNDERGROUND RECHARGE SYSTEM #3 - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.0' (retain-it®)
Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf
Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf
4 Rows adjusted for 273.8 cf perimeter wall

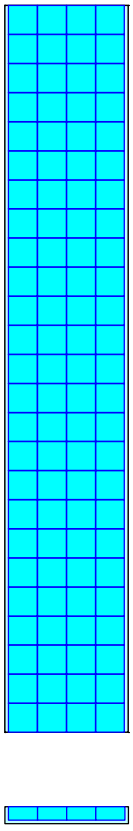
25 Chambers/Row x 8.00' Long = 200.00' Row Length
4 Rows x 96.0" Wide + 12.0" Side Stone x 2 = 34.00' Base Width
12.0" Stone Base + 44.0" Chamber Height = 4.67' Field Height

4.7 cf Sidewall x 25 x 2 + 4.7 cf Endwall x 4 x 2 = 273.8 cf Perimeter Wall
100 Chambers x 170.6 cf - 273.8 cf Perimeter wall = 16,787.3 cf Chamber Storage
100 Chambers x 234.7 cf = 23,466.7 cf Displacement

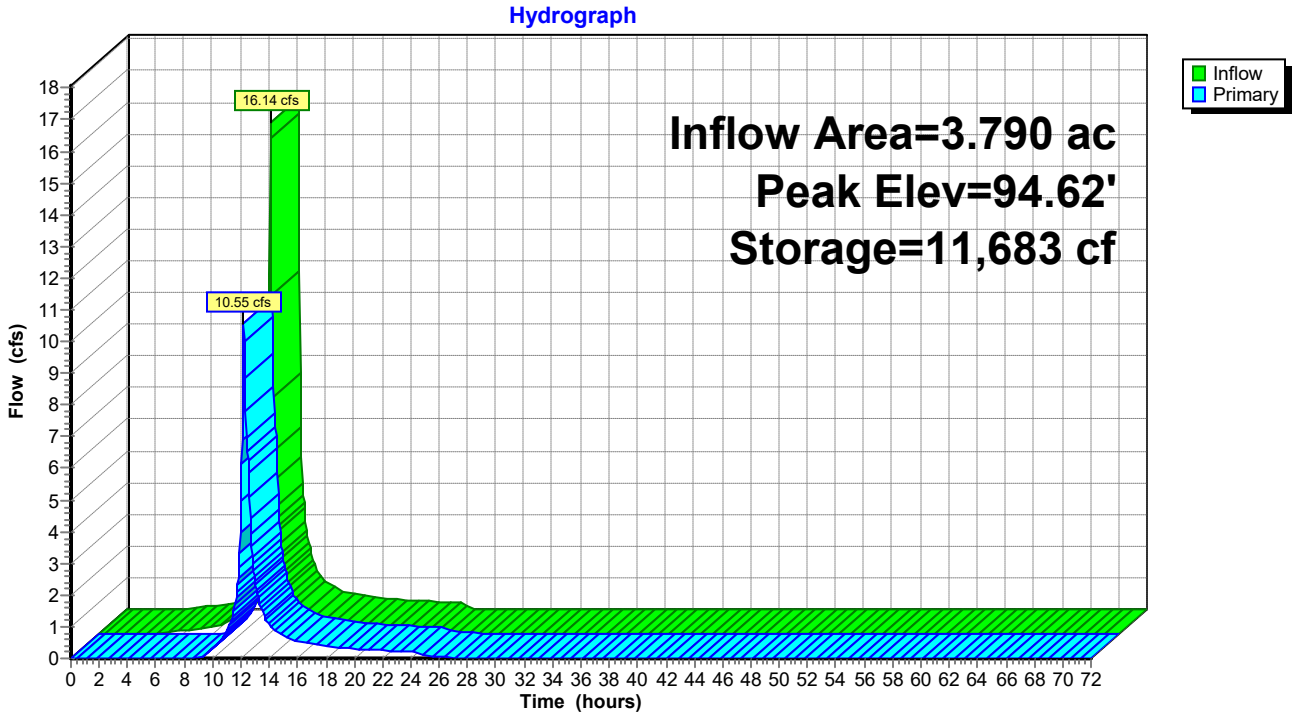
31,733.3 cf Field - 23,466.7 cf Chambers = 8,266.7 cf Stone x 35.0% Voids = 2,893.3 cf Stone Storage

Chamber Storage + Stone Storage = 19,680.6 cf = 0.452 af
Overall Storage Efficiency = 62.0%
Overall System Size = 200.00' x 34.00' x 4.67'

100 Chambers
1,175.3 cy Field
306.2 cy Stone



Pond 3P: UNDERGROUND RECHARGE SYSTEM #3



Summary for Pond 4P: UNDERGROUND RECHARGE SYSTEM #4

Inflow Area = 1.434 ac, 74.71% Impervious, Inflow Depth = 3.26" for 10-Year event
Inflow = 5.23 cfs @ 12.13 hrs, Volume= 0.389 af
Outflow = 2.41 cfs @ 12.00 hrs, Volume= 0.386 af, Atten= 54%, Lag= 0.0 min
Discarded = 2.41 cfs @ 12.00 hrs, Volume= 0.386 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach PR DP-2 : PROPOSED

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 91.65' @ 12.26 hrs Surf.Area= 2,048 sf Storage= 1,434 cf

Plug-Flow detention time= 7.8 min calculated for 0.386 af (99% of inflow)
Center-of-Mass det. time= 2.6 min (823.3 - 820.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	90.25'	717 cf	**32.00'W x 64.00'L x 4.67'H Field A** 9,557 cf Overall - 7,509 cf Embedded = 2,048 cf x 35.0% Voids
#2A	91.25'	5,346 cf	**retain_it retain_it 3.0'** x 32 Inside #1 Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf 4 Rows adjusted for 113.3 cf perimeter wall
		6,063 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	90.25'	**2.41 cfs Exfiltration at all elevations**
#2	Primary	93.90'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 93.90' / 93.85' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=2.41 cfs @ 12.00 hrs HW=90.32' (Free Discharge)
1=Exfiltration (Exfiltration Controls 2.41 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=90.25' (Free Discharge)
2=Culvert (Controls 0.00 cfs)

Pond 4P: UNDERGROUND RECHARGE SYSTEM #4 - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.0' (retain-it®)
Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf
Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf
4 Rows adjusted for 113.3 cf perimeter wall

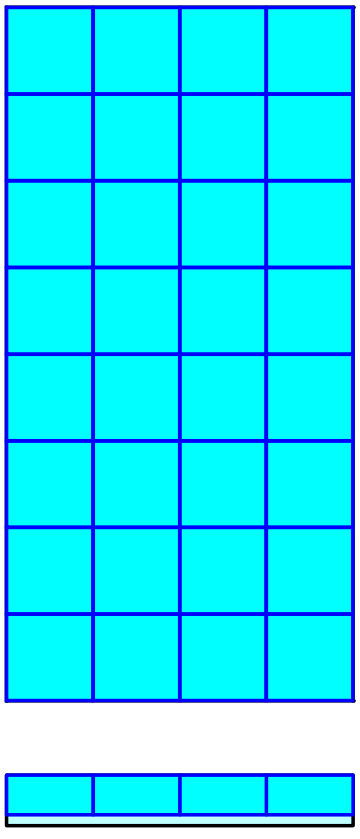
8 Chambers/Row x 8.00' Long = 64.00' Row Length
4 Rows x 96.0" Wide = 32.00' Base Width
12.0" Stone Base + 44.0" Chamber Height = 4.67' Field Height

4.7 cf Sidewall x 8 x 2 + 4.7 cf Endwall x 4 x 2 = 113.3 cf Perimeter Wall
32 Chambers x 170.6 cf - 113.3 cf Perimeter wall = 5,346.2 cf Chamber Storage
32 Chambers x 234.7 cf = 7,509.3 cf Displacement

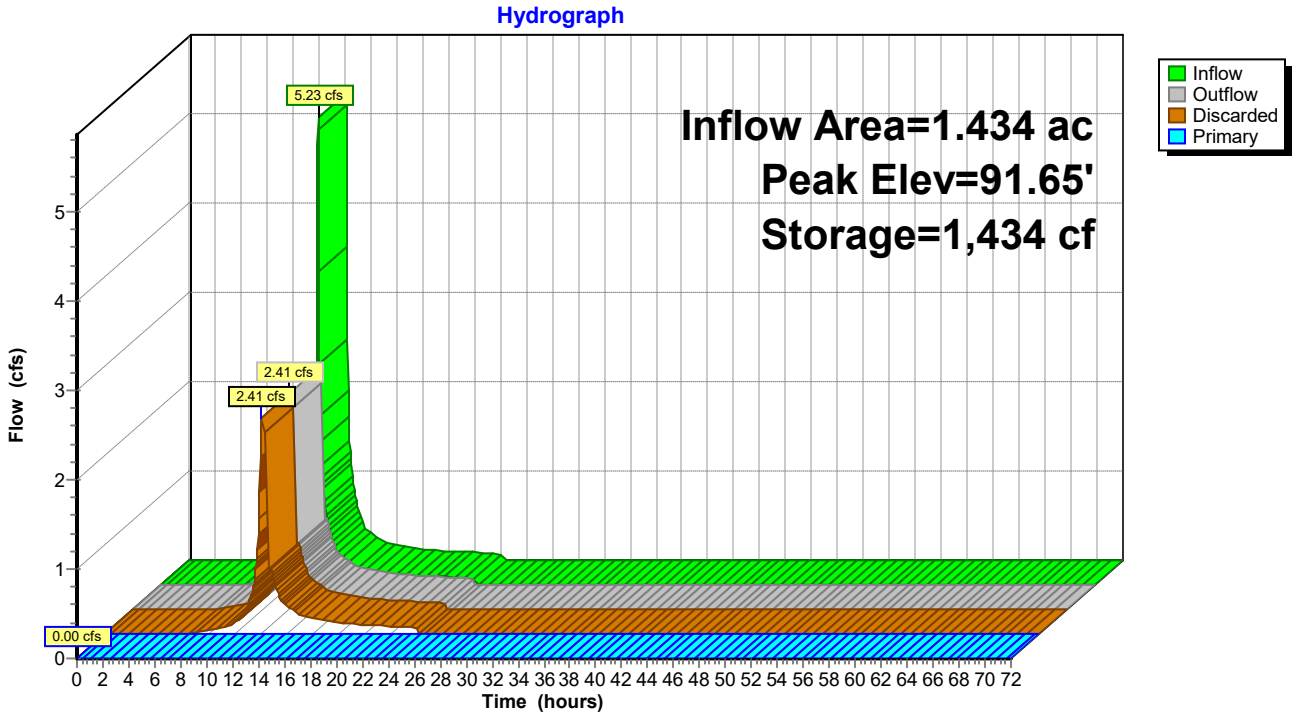
9,557.3 cf Field - 7,509.3 cf Chambers = 2,048.0 cf Stone x 35.0% Voids = 716.8 cf Stone Storage

Chamber Storage + Stone Storage = 6,063.0 cf = 0.139 af
Overall Storage Efficiency = 63.4%
Overall System Size = 64.00' x 32.00' x 4.67'

32 Chambers
354.0 cy Field
75.9 cy Stone



Pond 4P: UNDERGROUND RECHARGE SYSTEM #4



Summary for Pond 6P: UNDERGROUND RECHARGE SYSTEM #1

Inflow Area = 4.089 ac, 94.15% Impervious, Inflow Depth = 4.59" for 10-Year event
Inflow = 18.79 cfs @ 12.13 hrs, Volume= 1.565 af
Outflow = 1.38 cfs @ 13.44 hrs, Volume= 1.565 af, Atten= 93%, Lag= 78.7 min
Discarded = 0.42 cfs @ 8.05 hrs, Volume= 1.335 af
Primary = 0.95 cfs @ 13.44 hrs, Volume= 0.230 af
Routed to Reach PR DP-1 : PROPOSED

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 94.03' @ 13.44 hrs Surf.Area= 17,920 sf Storage= 35,472 cf

Plug-Flow detention time= 591.2 min calculated for 1.565 af (100% of inflow)
Center-of-Mass det. time= 591.1 min (1,354.0 - 763.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	91.50'	3,136 cf	**80.00'W x 224.00'L x 4.67'H Field A** 83,627 cf Overall - 74,667 cf Embedded = 8,960 cf x 35.0% Voids
#2A	92.00'	55,752 cf	**retain_it retain_it 3.5'** x 280 Inside #1 Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf 10 Rows adjusted for 466.6 cf perimeter wall
		58,888 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	91.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Device 4	94.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 4	93.75'	**24.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	93.00'	**18.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.00' / 92.90' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.42 cfs @ 8.05 hrs HW=91.55' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.42 cfs)

Primary OutFlow Max=0.95 cfs @ 13.44 hrs HW=94.03' (Free Discharge)
└**4=Culvert** (Passes 0.95 cfs of 3.42 cfs potential flow)
  ├**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**3=Orifice/Grate** (Orifice Controls 0.95 cfs @ 1.70 fps)

Pond 6P: UNDERGROUND RECHARGE SYSTEM #1 - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.5' (retain-it®)
Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf
Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf
10 Rows adjusted for 466.6 cf perimeter wall

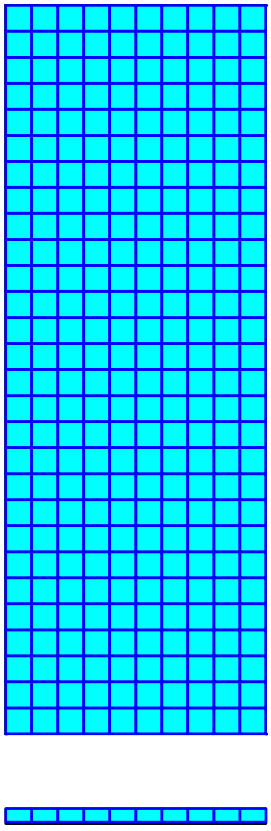
28 Chambers/Row x 8.00' Long = 224.00' Row Length
10 Rows x 96.0" Wide = 80.00' Base Width
6.0" Stone Base + 50.0" Chamber Height = 4.67' Field Height

6.1 cf Sidewall x 28 x 2 + 6.1 cf Endwall x 10 x 2 = 466.6 cf Perimeter Wall
280 Chambers x 200.8 cf - 466.6 cf Perimeter wall = 55,751.9 cf Chamber Storage
280 Chambers x 266.7 cf = 74,666.7 cf Displacement

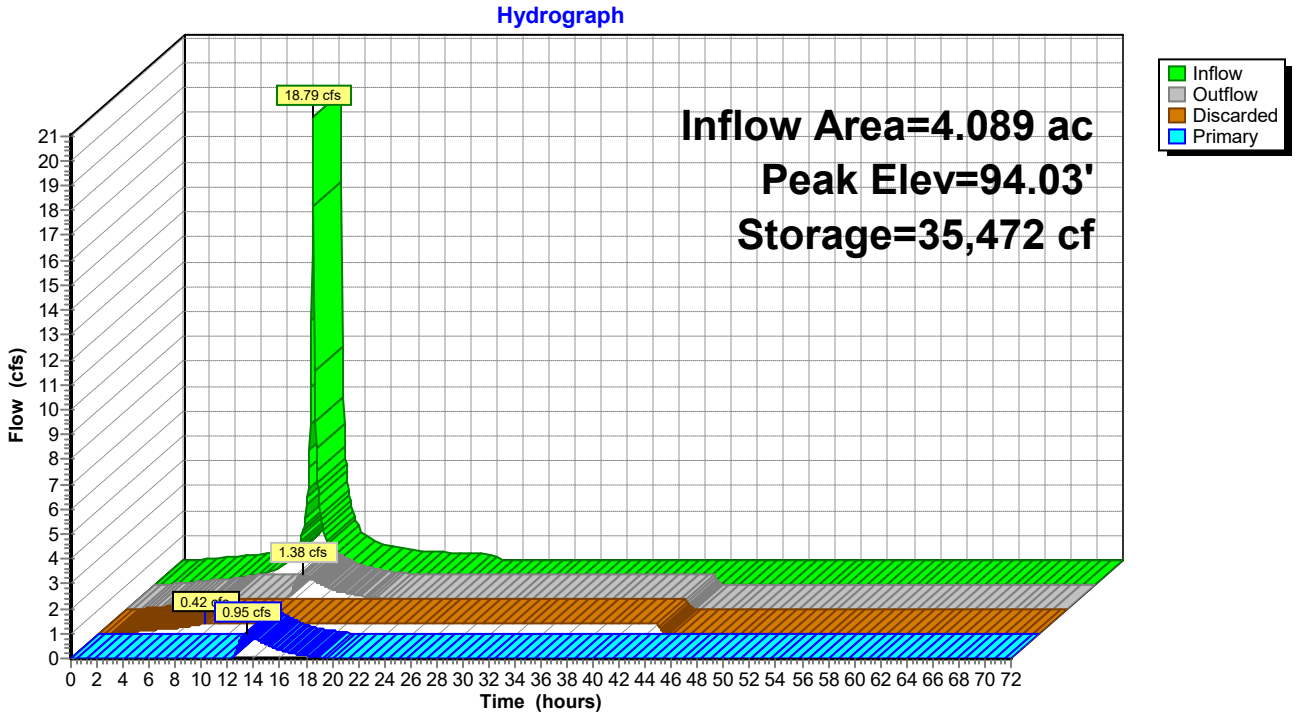
83,626.7 cf Field - 74,666.7 cf Chambers = 8,960.0 cf Stone x 35.0% Voids = 3,136.0 cf Stone Storage

Chamber Storage + Stone Storage = 58,887.9 cf = 1.352 af
Overall Storage Efficiency = 70.4%
Overall System Size = 224.00' x 80.00' x 4.67'

280 Chambers
3,097.3 cy Field
331.9 cy Stone



Pond 6P: UNDERGROUND RECHARGE SYSTEM #1



Summary for Subcatchment PR-1:

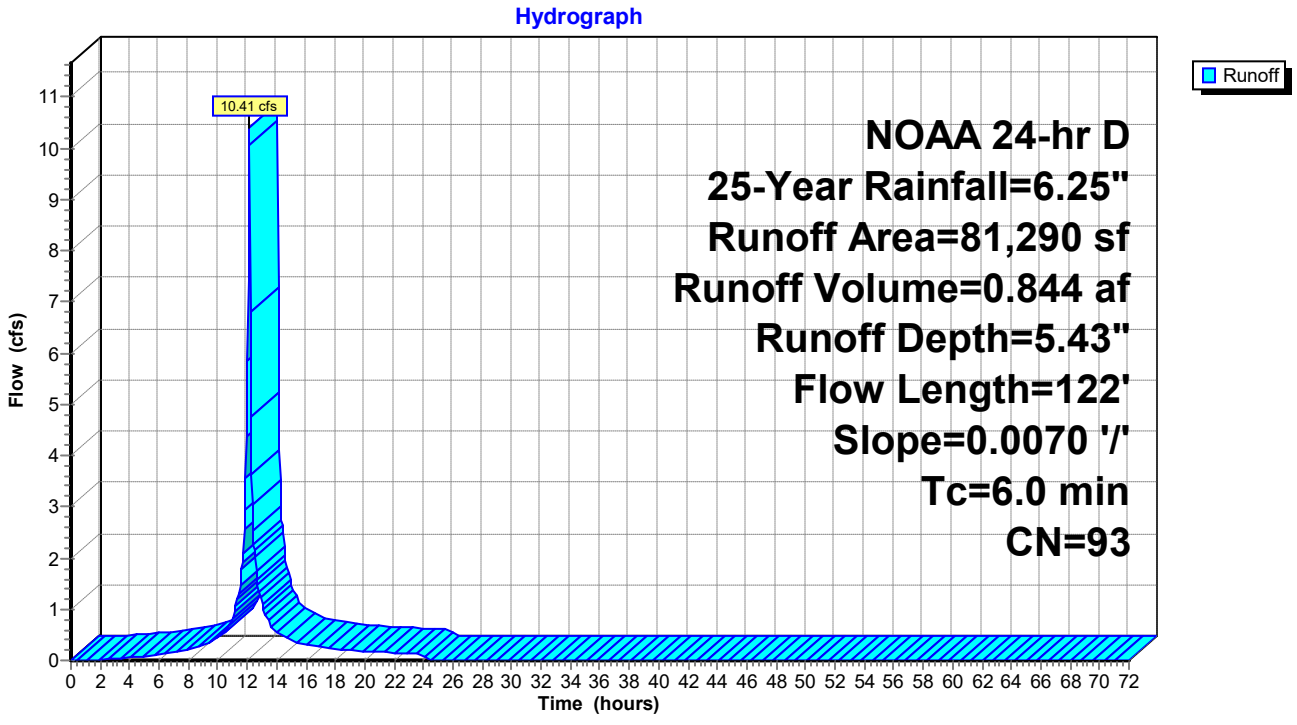
Runoff = 10.41 cfs @ 12.13 hrs, Volume= 0.844 af, Depth= 5.43"
Routed to Pond 6P : UNDERGROUND RECHARGE SYSTEM #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-Year Rainfall=6.25"

Area (sf)	CN	Description
70,874	98	Paved parking, HSG B
10,416	61	>75% Grass cover, Good, HSG B
81,290	93	Weighted Average
10,416		12.81% Pervious Area
70,874		87.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	100	0.0070	0.94		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.2	22	0.0070	1.70		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
2.0	122	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-1:



Summary for Subcatchment PR-2:

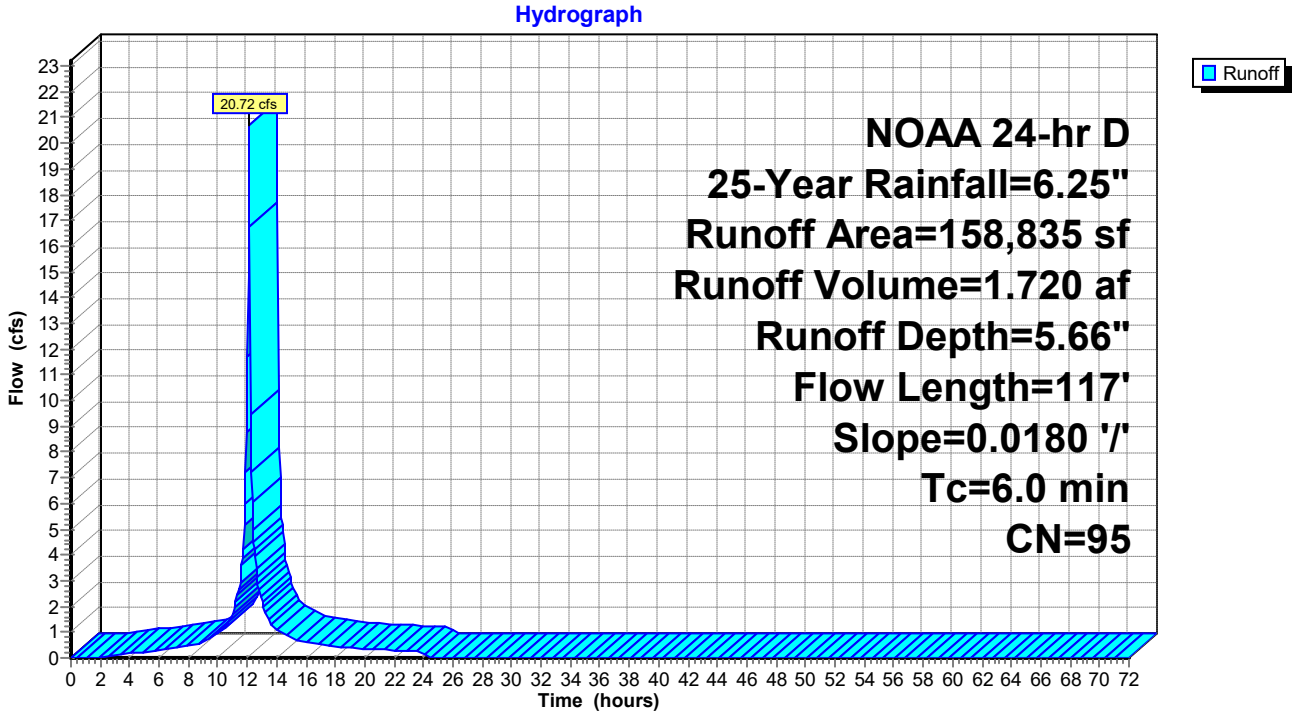
Runoff = 20.72 cfs @ 12.13 hrs, Volume= 1.720 af, Depth= 5.66"
Routed to Pond 2P : UNDERGROUND RECHARGE SYSTEM #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-Year Rainfall=6.25"

Area (sf)	CN	Description
44,527	98	Paved parking, HSG B
13,004	61	>75% Grass cover, Good, HSG B
101,304	98	Roofs, HSG B
158,835	95	Weighted Average
13,004		8.19% Pervious Area
145,831		91.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0180	1.37		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.1	17	0.0180	2.72		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
1.3	117	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-2:



Summary for Subcatchment PR-3:

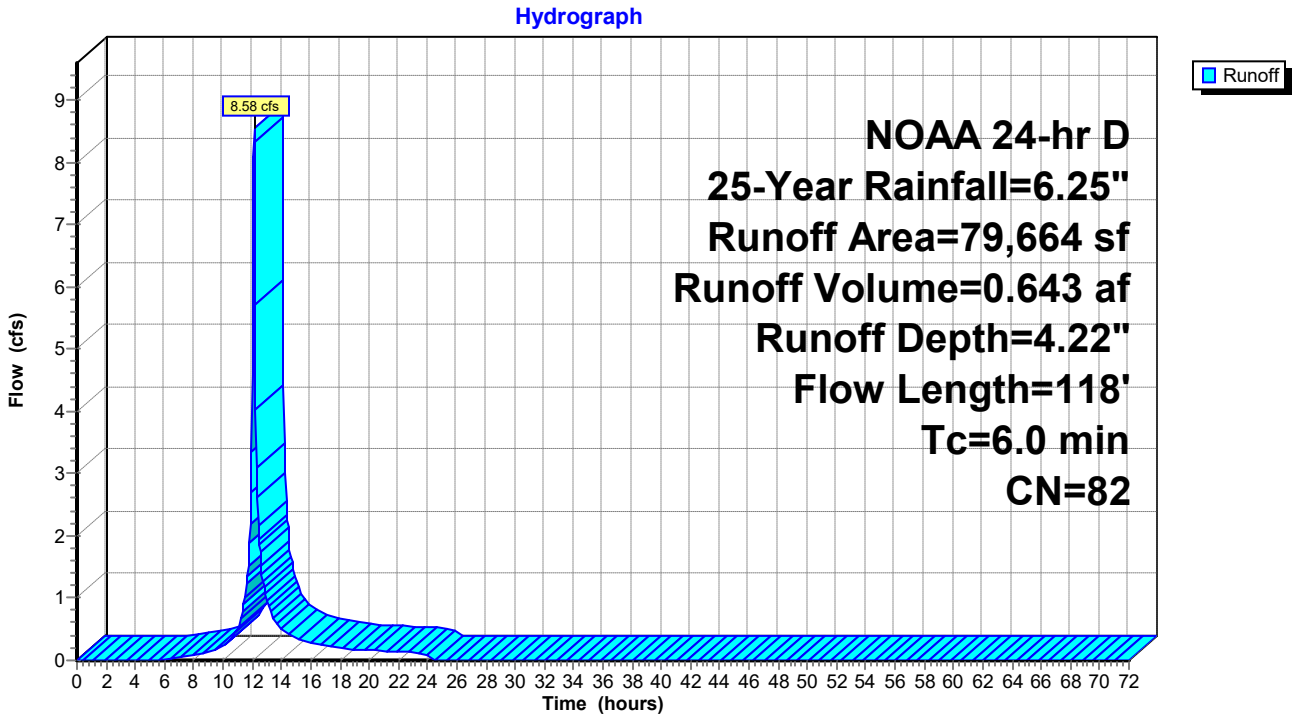
Runoff = 8.58 cfs @ 12.13 hrs, Volume= 0.643 af, Depth= 4.22"
Routed to Reach PR DP-1 : PROPOSED

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-Year Rainfall=6.25"

Area (sf)	CN	Description
45,650	98	Paved parking, HSG B
34,014	61	>75% Grass cover, Good, HSG B
79,664	82	Weighted Average
34,014		42.70% Pervious Area
45,650		57.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0170	1.34		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.1	18	0.0110	2.13		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
1.3	118	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-3:



Summary for Subcatchment PR-4:

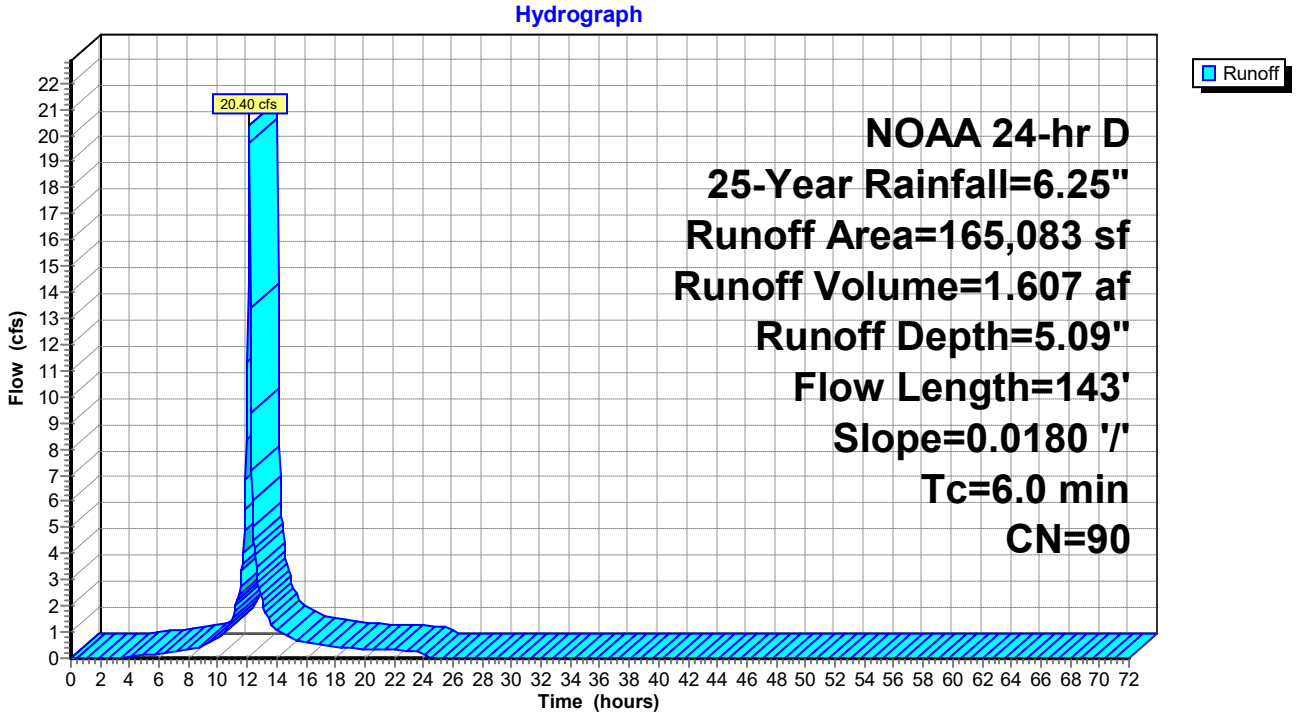
Runoff = 20.40 cfs @ 12.13 hrs, Volume= 1.607 af, Depth= 5.09"
Routed to Pond 3P : UNDERGROUND RECHARGE SYSTEM #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-Year Rainfall=6.25"

Area (sf)	CN	Description
30,812	61	>75% Grass cover, Good, HSG B
80,071	98	Paved parking, HSG B
47,328	98	Paved parking, HSG C
6,872	74	>75% Grass cover, Good, HSG C
165,083	90	Weighted Average
37,684		22.83% Pervious Area
127,399		77.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0180	1.37		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.3	43	0.0180	2.72		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
1.5	143	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-4:



Summary for Subcatchment PR-5:

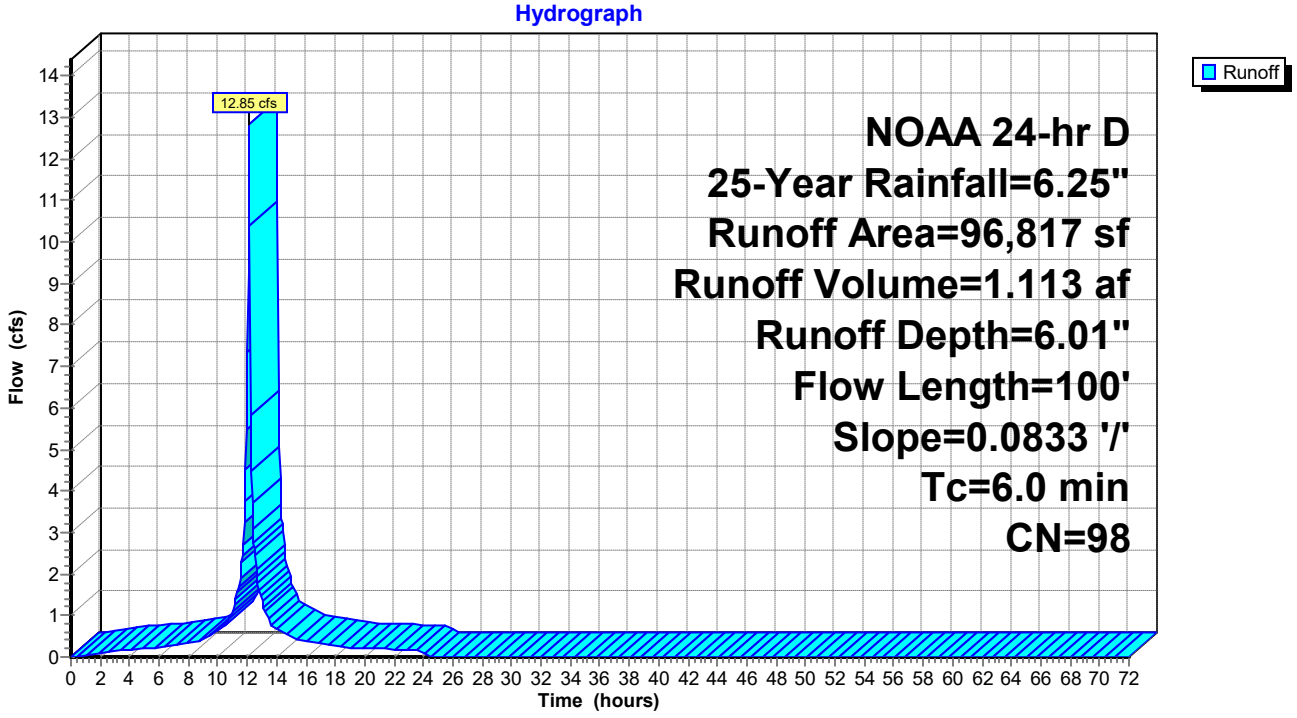
Runoff = 12.85 cfs @ 12.13 hrs, Volume= 1.113 af, Depth= 6.01"
Routed to Pond 6P : UNDERGROUND RECHARGE SYSTEM #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-Year Rainfall=6.25"

Area (sf)	CN	Description
96,817	98	Roofs, HSG B
96,817		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	100	0.0833	2.53		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.7	100	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-5:



Summary for Subcatchment PR-6:

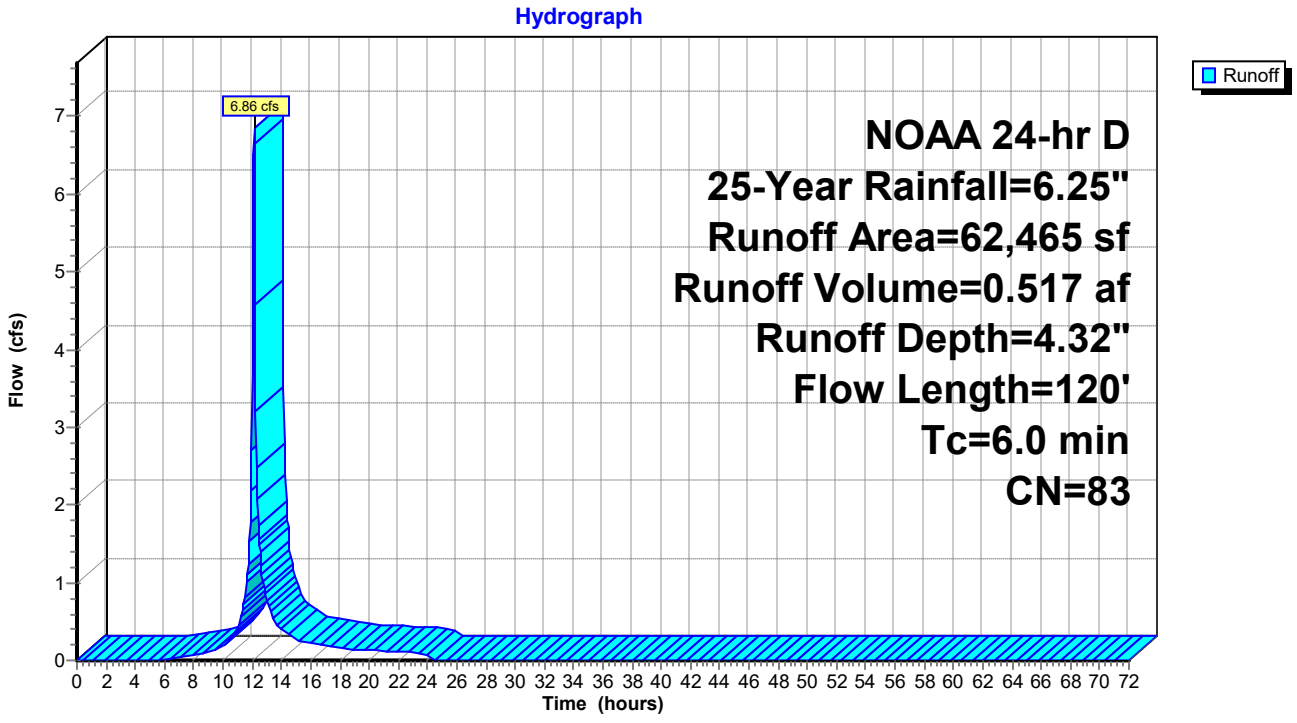
Runoff = 6.86 cfs @ 12.13 hrs, Volume= 0.517 af, Depth= 4.32"
Routed to Pond 4P : UNDERGROUND RECHARGE SYSTEM #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-Year Rainfall=6.25"

Area (sf)	CN	Description
46,670	98	Paved parking, HSG A
15,795	39	>75% Grass cover, Good, HSG A
62,465	83	Weighted Average
15,795		25.29% Pervious Area
46,670		74.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	100	0.0060	0.88		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.3	20	0.0030	1.11		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
2.2	120	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-6:



Summary for Subcatchment PR-7:

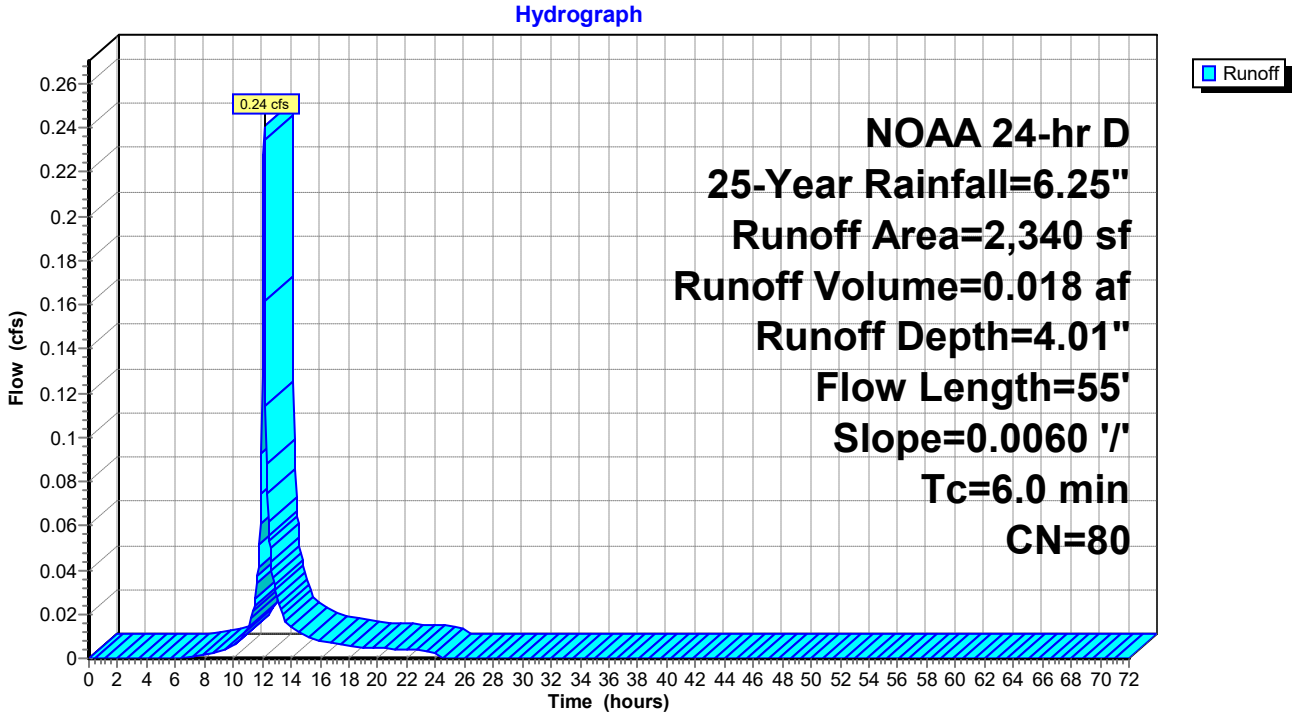
Runoff = 0.24 cfs @ 12.13 hrs, Volume= 0.018 af, Depth= 4.01"
Routed to Reach PR DP-1 : PROPOSED

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-Year Rainfall=6.25"

Area (sf)	CN	Description
624	98	Paved parking, HSG C
1,716	74	>75% Grass cover, Good, HSG C
2,340	80	Weighted Average
1,716		73.33% Pervious Area
624		26.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	55	0.0060	0.78		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
1.2	55	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-7:



Summary for Subcatchment PR-8:

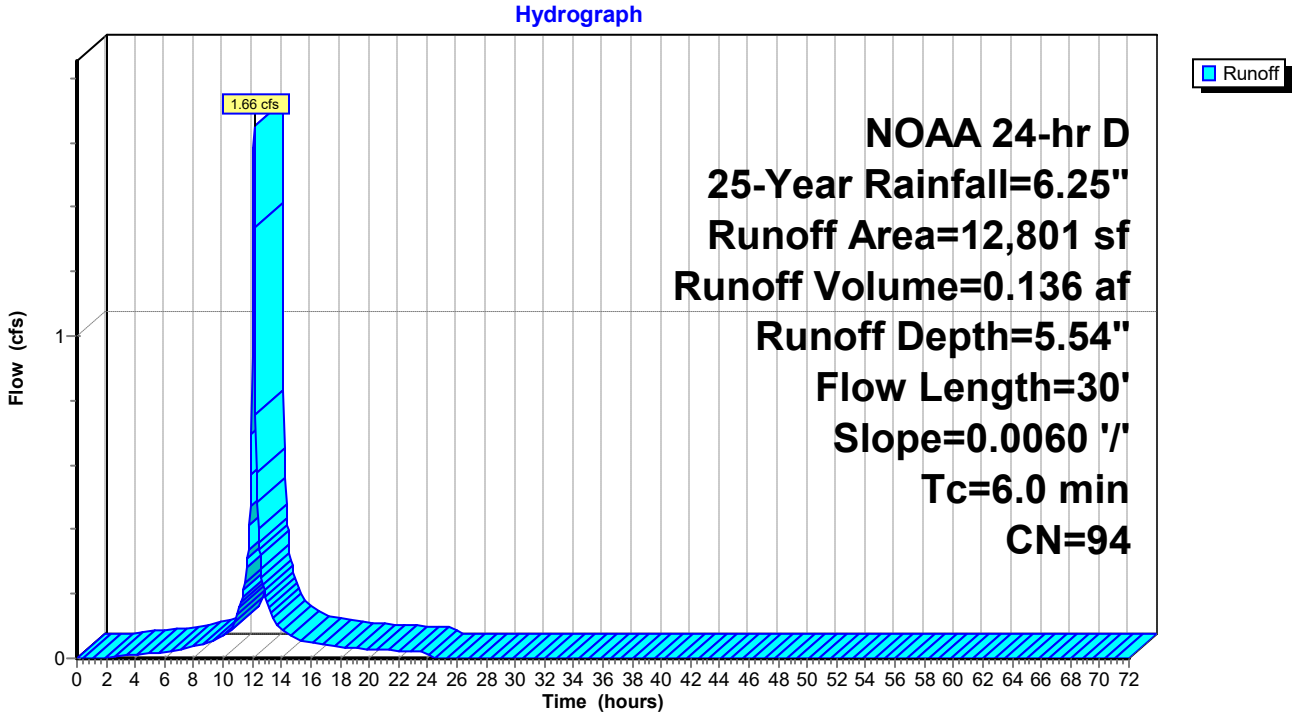
Runoff = 1.66 cfs @ 12.13 hrs, Volume= 0.136 af, Depth= 5.54"
Routed to Reach PR DP-1 : PROPOSED

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-Year Rainfall=6.25"

Area (sf)	CN	Description
10,551	98	Paved parking, HSG A
2,250	74	>75% Grass cover, Good, HSG C
12,801	94	Weighted Average
2,250		17.58% Pervious Area
10,551		82.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	30	0.0060	0.69		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.7	30	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-8:



Summary for Subcatchment PR-9:

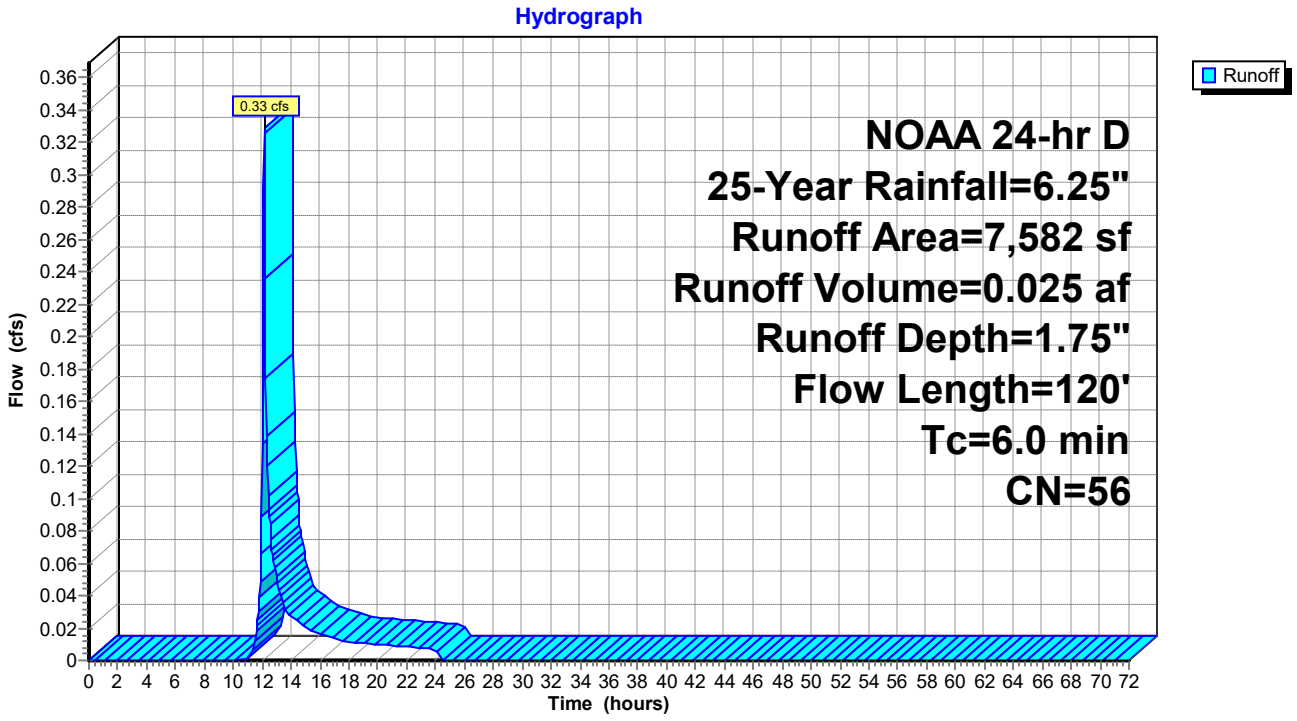
Runoff = 0.33 cfs @ 12.14 hrs, Volume= 0.025 af, Depth= 1.75"
Routed to Reach PR DP-2 : PROPOSED

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 25-Year Rainfall=6.25"

Area (sf)	CN	Description
2,203	98	Paved parking, HSG A
5,379	39	>75% Grass cover, Good, HSG A
7,582	56	Weighted Average
5,379		70.94% Pervious Area
2,203		29.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	100	0.0060	0.88		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.3	20	0.0030	1.11		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
2.2	120	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-9:



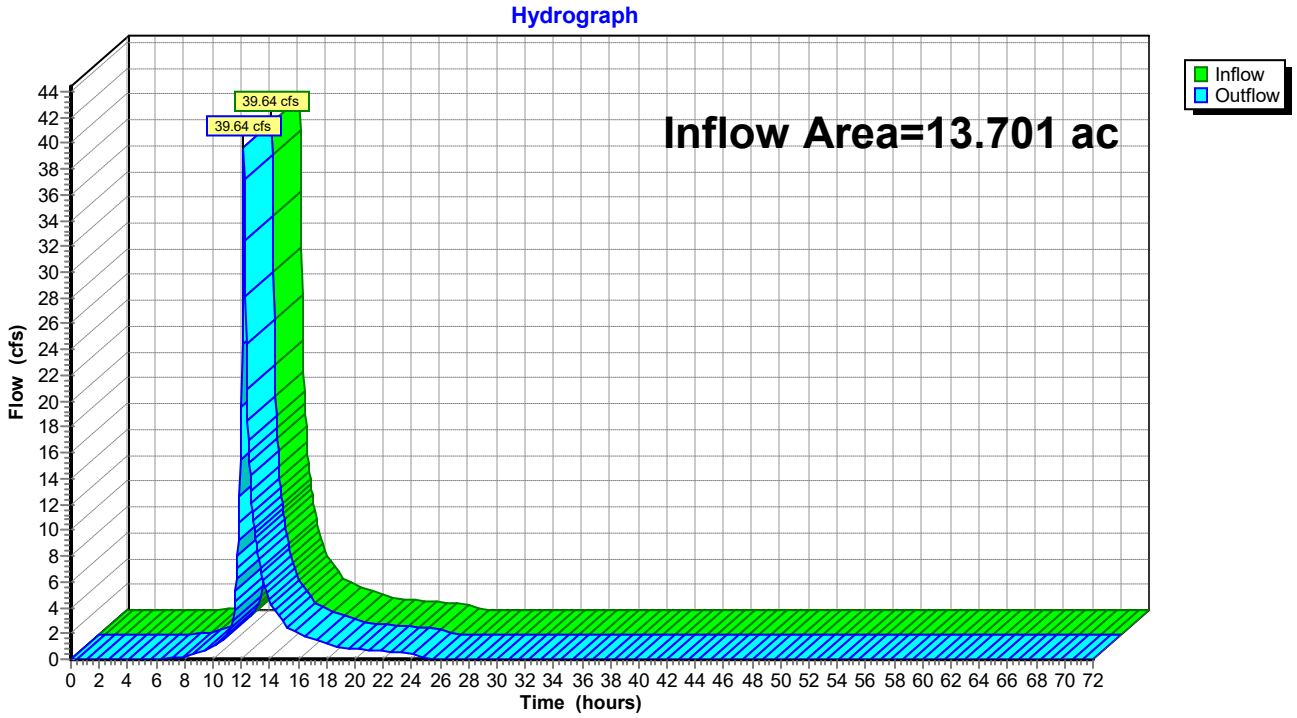
Summary for Reach PR DP-1: PROPOSED

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

Inflow Area = 13.701 ac, 83.40% Impervious, Inflow Depth = 3.54" for 25-Year event
Inflow = 39.64 cfs @ 12.16 hrs, Volume= 4.042 af
Outflow = 39.64 cfs @ 12.16 hrs, Volume= 4.042 af, Atten= 0%, Lag= 0.0 min

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

Reach PR DP-1: PROPOSED



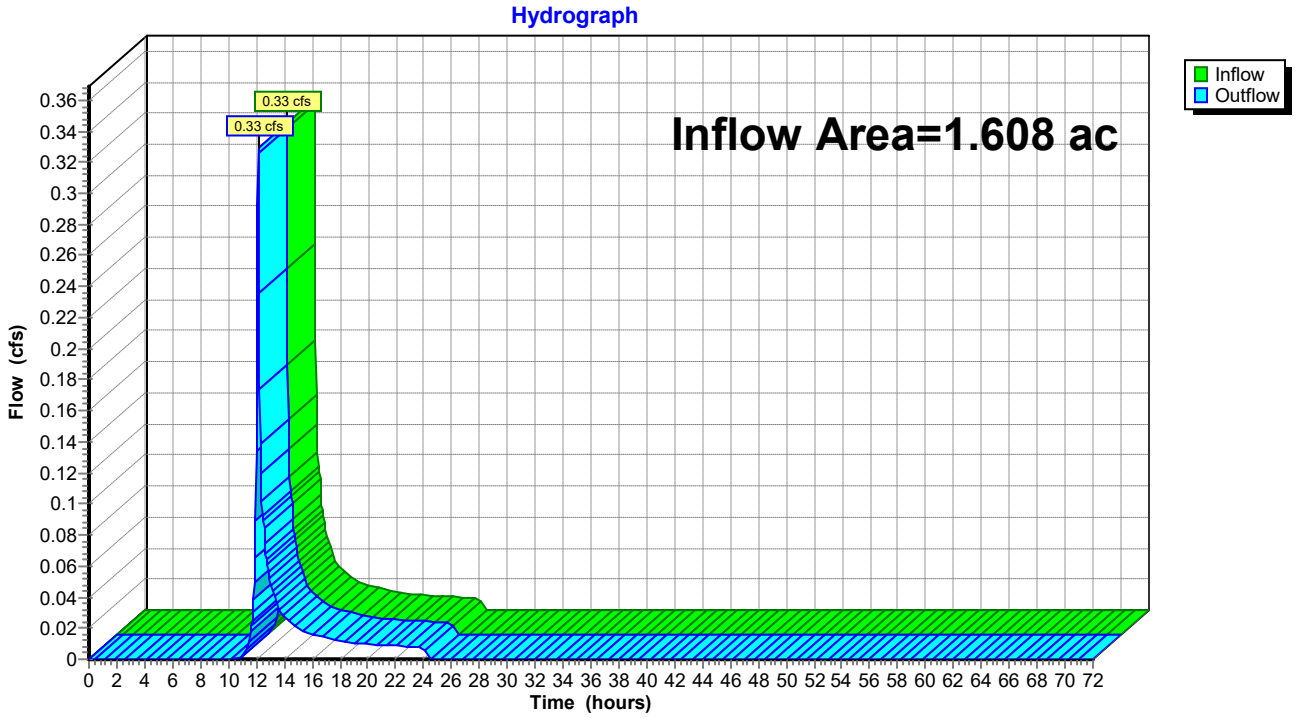
Summary for Reach PR DP-2: PROPOSED

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

Inflow Area = 1.608 ac, 69.77% Impervious, Inflow Depth = 0.19" for 25-Year event
Inflow = 0.33 cfs @ 12.14 hrs, Volume= 0.025 af
Outflow = 0.33 cfs @ 12.14 hrs, Volume= 0.025 af, Atten= 0%, Lag= 0.0 min

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

Reach PR DP-2: PROPOSED



Summary for Pond 2P: UNDERGROUND RECHARGE SYSTEM #2

Inflow Area = 3.646 ac, 91.81% Impervious, Inflow Depth = 5.66" for 25-Year event
Inflow = 20.72 cfs @ 12.13 hrs, Volume= 1.720 af
Outflow = 17.36 cfs @ 12.17 hrs, Volume= 1.720 af, Atten= 16%, Lag= 2.6 min
Discarded = 0.17 cfs @ 4.15 hrs, Volume= 0.585 af
Primary = 17.19 cfs @ 12.17 hrs, Volume= 1.135 af
Routed to Reach PR DP-1 : PROPOSED

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 94.83' @ 12.17 hrs Surf.Area= 7,168 sf Storage= 19,200 cf

Plug-Flow detention time= 255.9 min calculated for 1.720 af (100% of inflow)
Center-of-Mass det. time= 255.8 min (1,020.9 - 765.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	91.50'	1,254 cf	**56.00'W x 128.00'L x 4.67'H Field A** 33,451 cf Overall - 29,867 cf Embedded = 3,584 cf x 35.0% Voids
#2A	92.00'	22,205 cf	**retain_it retain_it 3.5'** x 112 Inside #1 Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf 7 Rows adjusted for 282.4 cf perimeter wall
		23,459 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	91.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Device 4	94.25'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 4	93.75'	**48.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	92.00'	**30.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 92.00' / 91.90' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf

Discarded OutFlow Max=0.17 cfs @ 4.15 hrs HW=91.55' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=16.77 cfs @ 12.17 hrs HW=94.81' (Free Discharge)
└**4=Culvert** (Passes 16.77 cfs of 25.44 cfs potential flow)
  ├**2=Sharp-Crested Rectangular Weir** (Weir Controls 8.12 cfs @ 2.45 fps)
  └**3=Orifice/Grate** (Orifice Controls 8.65 cfs @ 4.32 fps)

Pond 2P: UNDERGROUND RECHARGE SYSTEM #2 - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.5' (retain-it®)
Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf
Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf
7 Rows adjusted for 282.4 cf perimeter wall

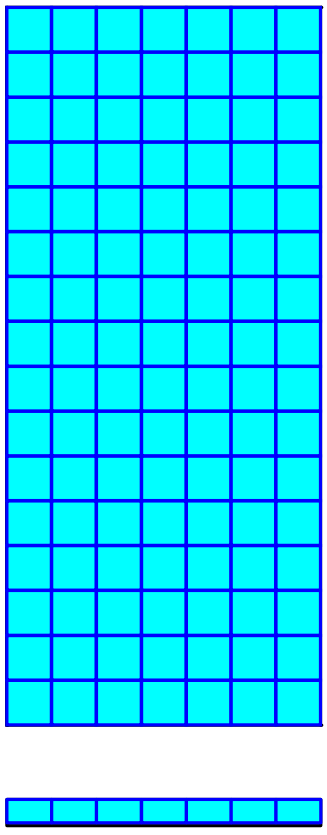
16 Chambers/Row x 8.00' Long = 128.00' Row Length
7 Rows x 96.0" Wide = 56.00' Base Width
6.0" Stone Base + 50.0" Chamber Height = 4.67' Field Height

6.1 cf Sidewall x 16 x 2 + 6.1 cf Endwall x 7 x 2 = 282.4 cf Perimeter Wall
112 Chambers x 200.8 cf - 282.4 cf Perimeter wall = 22,205.0 cf Chamber Storage
112 Chambers x 266.7 cf = 29,866.7 cf Displacement

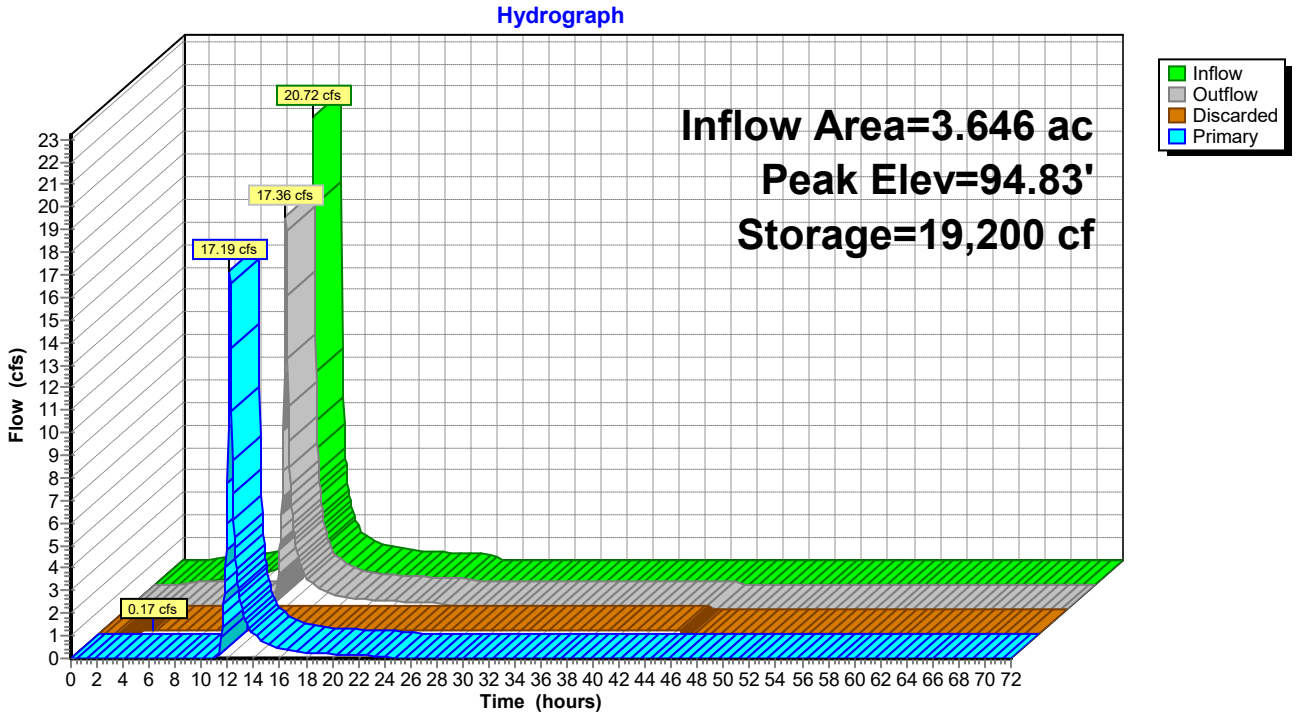
33,450.7 cf Field - 29,866.7 cf Chambers = 3,584.0 cf Stone x 35.0% Voids = 1,254.4 cf Stone Storage

Chamber Storage + Stone Storage = 23,459.4 cf = 0.539 af
Overall Storage Efficiency = 70.1%
Overall System Size = 128.00' x 56.00' x 4.67'

112 Chambers
1,238.9 cy Field
132.7 cy Stone



Pond 2P: UNDERGROUND RECHARGE SYSTEM #2



Summary for Pond 3P: UNDERGROUND RECHARGE SYSTEM #3

Inflow Area = 3.790 ac, 77.17% Impervious, Inflow Depth = 5.09" for 25-Year event
Inflow = 20.40 cfs @ 12.13 hrs, Volume= 1.607 af
Outflow = 13.23 cfs @ 12.21 hrs, Volume= 1.553 af, Atten= 35%, Lag= 4.9 min
Primary = 13.23 cfs @ 12.21 hrs, Volume= 1.553 af
Routed to Reach PR DP-1 : PROPOSED

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 94.95' @ 12.21 hrs Surf.Area= 6,800 sf Storage= 13,554 cf

Plug-Flow detention time= 68.4 min calculated for 1.552 af (97% of inflow)
Center-of-Mass det. time= 48.7 min (836.9 - 788.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	92.00'	2,893 cf	**34.00'W x 200.00'L x 4.67'H Field A** 31,733 cf Overall - 23,467 cf Embedded = 8,267 cf x 35.0% Voids
#2A	93.00'	16,787 cf	**retain_it retain_it 3.0'** x 100 Inside #1 Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf 4 Rows adjusted for 273.8 cf perimeter wall
		19,681 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 4	95.25'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Device 4	94.25'	**48.0" W x 4.0" H Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 4	93.00'	**48.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	93.00'	**48.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.00' / 92.95' S= 0.0050 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 12.57 sf

Primary OutFlow Max=13.14 cfs @ 12.21 hrs HW=94.94' (Free Discharge)
└**4=Culvert** (Passes 13.14 cfs of 19.34 cfs potential flow)
  ├**1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  ├**2=Orifice** (Orifice Controls 4.60 cfs @ 3.45 fps)
  └**3=Orifice/Grate** (Orifice Controls 8.53 cfs @ 6.40 fps)

Pond 3P: UNDERGROUND RECHARGE SYSTEM #3 - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.0' (retain-it®)
Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf
Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf
4 Rows adjusted for 273.8 cf perimeter wall

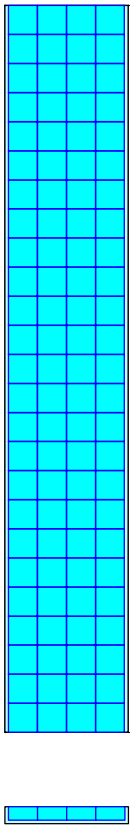
25 Chambers/Row x 8.00' Long = 200.00' Row Length
4 Rows x 96.0" Wide + 12.0" Side Stone x 2 = 34.00' Base Width
12.0" Stone Base + 44.0" Chamber Height = 4.67' Field Height

4.7 cf Sidewall x 25 x 2 + 4.7 cf Endwall x 4 x 2 = 273.8 cf Perimeter Wall
100 Chambers x 170.6 cf - 273.8 cf Perimeter wall = 16,787.3 cf Chamber Storage
100 Chambers x 234.7 cf = 23,466.7 cf Displacement

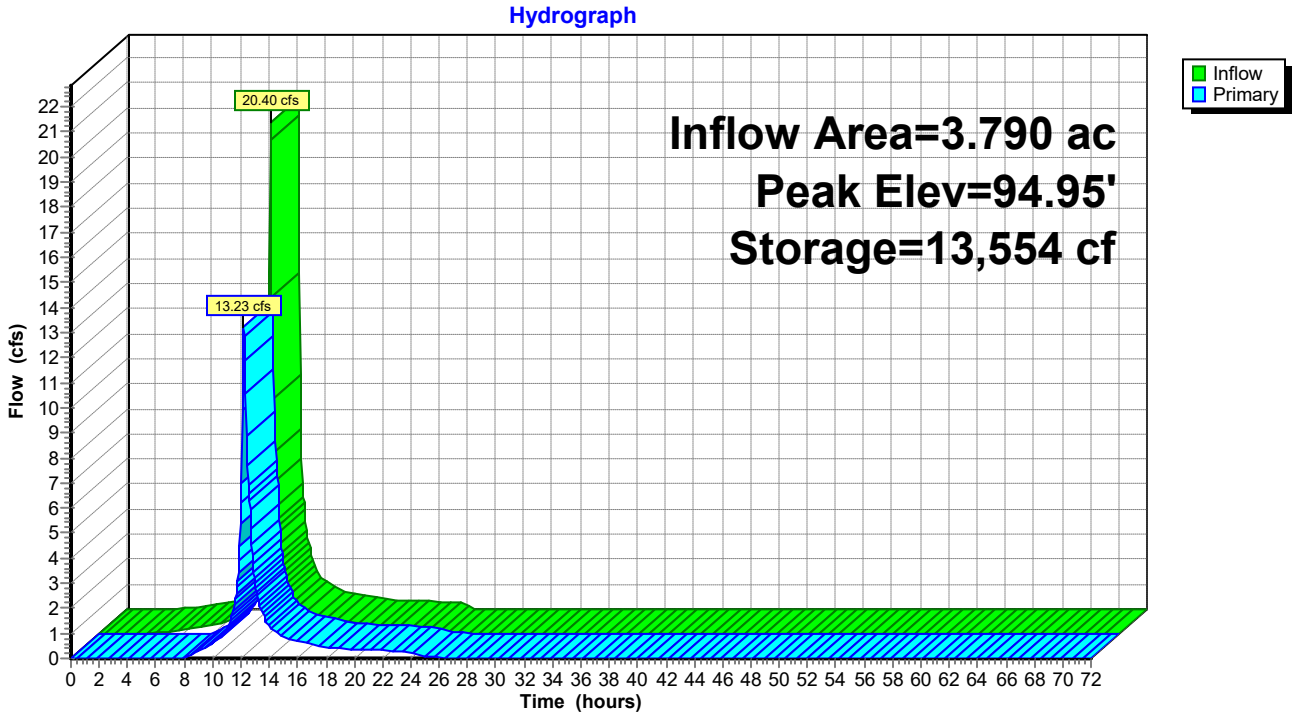
31,733.3 cf Field - 23,466.7 cf Chambers = 8,266.7 cf Stone x 35.0% Voids = 2,893.3 cf Stone Storage

Chamber Storage + Stone Storage = 19,680.6 cf = 0.452 af
Overall Storage Efficiency = 62.0%
Overall System Size = 200.00' x 34.00' x 4.67'

100 Chambers
1,175.3 cy Field
306.2 cy Stone



Pond 3P: UNDERGROUND RECHARGE SYSTEM #3



Summary for Pond 4P: UNDERGROUND RECHARGE SYSTEM #4

Inflow Area = 1.434 ac, 74.71% Impervious, Inflow Depth = 4.32" for 25-Year event
Inflow = 6.86 cfs @ 12.13 hrs, Volume= 0.517 af
Outflow = 2.41 cfs @ 11.95 hrs, Volume= 0.512 af, Atten= 65%, Lag= 0.0 min
Discarded = 2.41 cfs @ 11.95 hrs, Volume= 0.512 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach PR DP-2 : PROPOSED

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 92.40' @ 12.31 hrs Surf.Area= 2,048 sf Storage= 2,765 cf

Plug-Flow detention time= 11.0 min calculated for 0.512 af (99% of inflow)
Center-of-Mass det. time= 4.9 min (816.7 - 811.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	90.25'	717 cf	**32.00'W x 64.00'L x 4.67'H Field A** 9,557 cf Overall - 7,509 cf Embedded = 2,048 cf x 35.0% Voids
#2A	91.25'	5,346 cf	**retain_it retain_it 3.0'** x 32 Inside #1 Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf 4 Rows adjusted for 113.3 cf perimeter wall
		6,063 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	90.25'	**2.41 cfs Exfiltration at all elevations**
#2	Primary	93.90'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 93.90' / 93.85' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=2.41 cfs @ 11.95 hrs HW=90.32' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 2.41 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=90.25' (Free Discharge)
↑**2=Culvert** (Controls 0.00 cfs)

Pond 4P: UNDERGROUND RECHARGE SYSTEM #4 - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.0' (retain-it®)
Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf
Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf
4 Rows adjusted for 113.3 cf perimeter wall

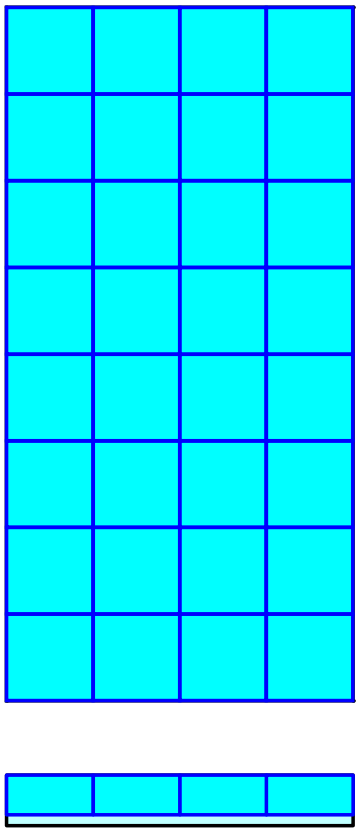
8 Chambers/Row x 8.00' Long = 64.00' Row Length
4 Rows x 96.0" Wide = 32.00' Base Width
12.0" Stone Base + 44.0" Chamber Height = 4.67' Field Height

4.7 cf Sidewall x 8 x 2 + 4.7 cf Endwall x 4 x 2 = 113.3 cf Perimeter Wall
32 Chambers x 170.6 cf - 113.3 cf Perimeter wall = 5,346.2 cf Chamber Storage
32 Chambers x 234.7 cf = 7,509.3 cf Displacement

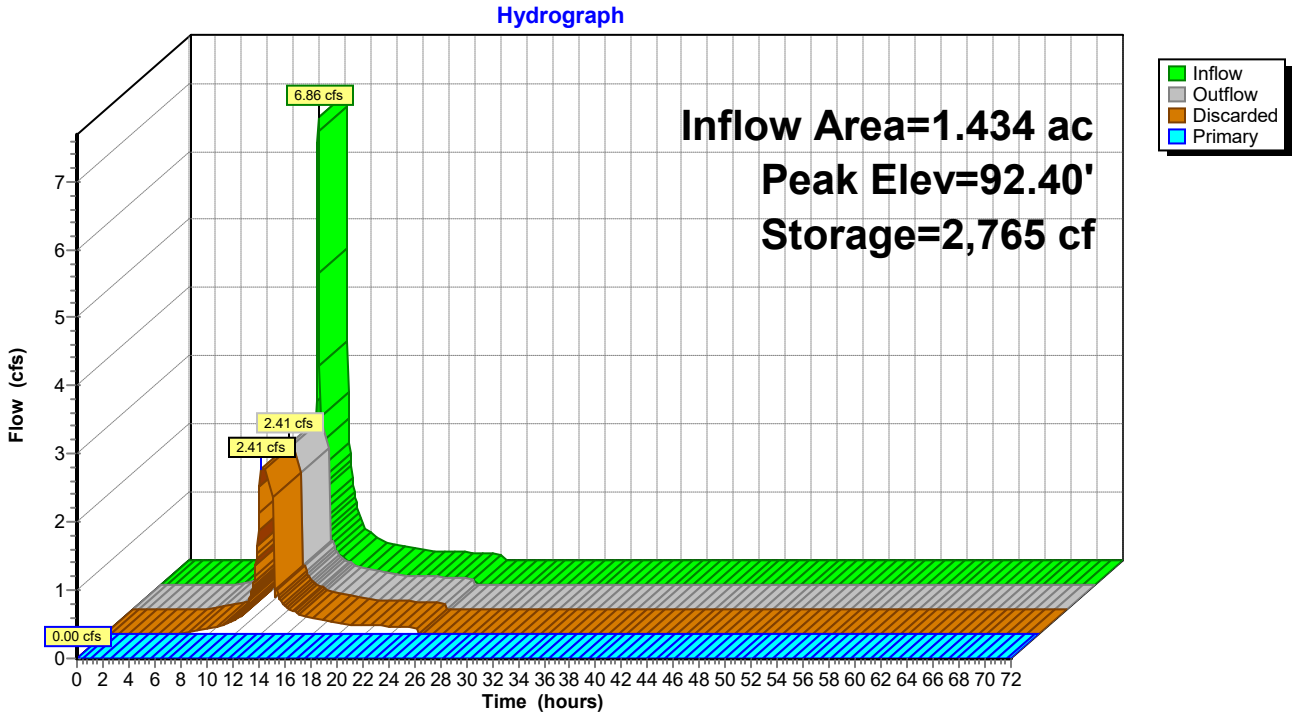
9,557.3 cf Field - 7,509.3 cf Chambers = 2,048.0 cf Stone x 35.0% Voids = 716.8 cf Stone Storage

Chamber Storage + Stone Storage = 6,063.0 cf = 0.139 af
Overall Storage Efficiency = 63.4%
Overall System Size = 64.00' x 32.00' x 4.67'

32 Chambers
354.0 cy Field
75.9 cy Stone



Pond 4P: UNDERGROUND RECHARGE SYSTEM #4



Summary for Pond 6P: UNDERGROUND RECHARGE SYSTEM #1

Inflow Area = 4.089 ac, 94.15% Impervious, Inflow Depth = 5.75" for 25-Year event
Inflow = 23.26 cfs @ 12.13 hrs, Volume= 1.958 af
Outflow = 3.12 cfs @ 12.77 hrs, Volume= 1.958 af, Atten= 87%, Lag= 38.3 min
Discarded = 0.42 cfs @ 7.00 hrs, Volume= 1.399 af
Primary = 2.69 cfs @ 12.77 hrs, Volume= 0.559 af
Routed to Reach PR DP-1 : PROPOSED

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 94.33' @ 12.77 hrs Surf.Area= 17,920 sf Storage= 40,272 cf

Plug-Flow detention time= 508.6 min calculated for 1.956 af (100% of inflow)
Center-of-Mass det. time= 509.1 min (1,267.5 - 758.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	91.50'	3,136 cf	**80.00'W x 224.00'L x 4.67'H Field A** 83,627 cf Overall - 74,667 cf Embedded = 8,960 cf x 35.0% Voids
#2A	92.00'	55,752 cf	**retain_it retain_it 3.5'** x 280 Inside #1 Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf 10 Rows adjusted for 466.6 cf perimeter wall
		58,888 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	91.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Device 4	94.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 4	93.75'	**24.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	93.00'	**18.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.00' / 92.90' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.42 cfs @ 7.00 hrs HW=91.55' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.42 cfs)

Primary OutFlow Max=2.70 cfs @ 12.77 hrs HW=94.33' (Free Discharge)
└**4=Culvert** (Passes 2.70 cfs of 5.17 cfs potential flow)
  ├**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**3=Orifice/Grate** (Orifice Controls 2.70 cfs @ 2.70 fps)

Pond 6P: UNDERGROUND RECHARGE SYSTEM #1 - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.5' (retain-it®)
Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf
Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf
10 Rows adjusted for 466.6 cf perimeter wall

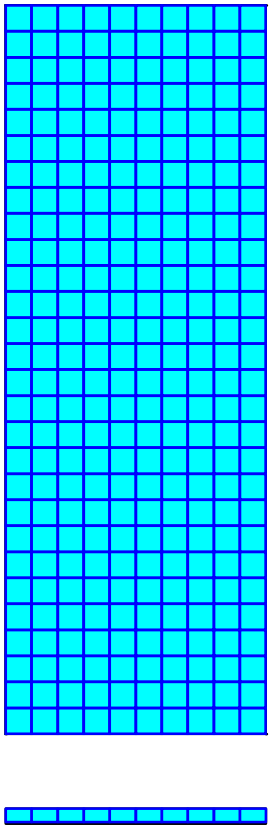
28 Chambers/Row x 8.00' Long = 224.00' Row Length
10 Rows x 96.0" Wide = 80.00' Base Width
6.0" Stone Base + 50.0" Chamber Height = 4.67' Field Height

6.1 cf Sidewall x 28 x 2 + 6.1 cf Endwall x 10 x 2 = 466.6 cf Perimeter Wall
280 Chambers x 200.8 cf - 466.6 cf Perimeter wall = 55,751.9 cf Chamber Storage
280 Chambers x 266.7 cf = 74,666.7 cf Displacement

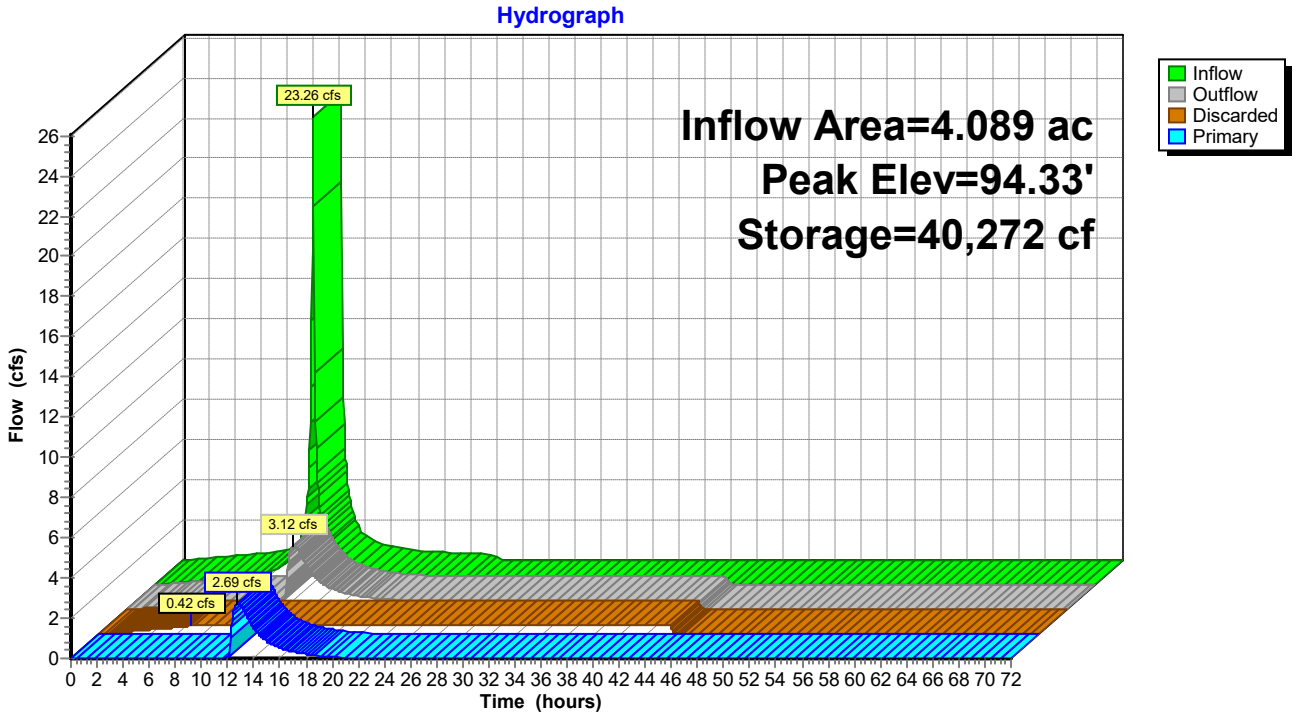
83,626.7 cf Field - 74,666.7 cf Chambers = 8,960.0 cf Stone x 35.0% Voids = 3,136.0 cf Stone Storage

Chamber Storage + Stone Storage = 58,887.9 cf = 1.352 af
Overall Storage Efficiency = 70.4%
Overall System Size = 224.00' x 80.00' x 4.67'

280 Chambers
3,097.3 cy Field
331.9 cy Stone



Pond 6P: UNDERGROUND RECHARGE SYSTEM #1



Summary for Subcatchment PR-1:

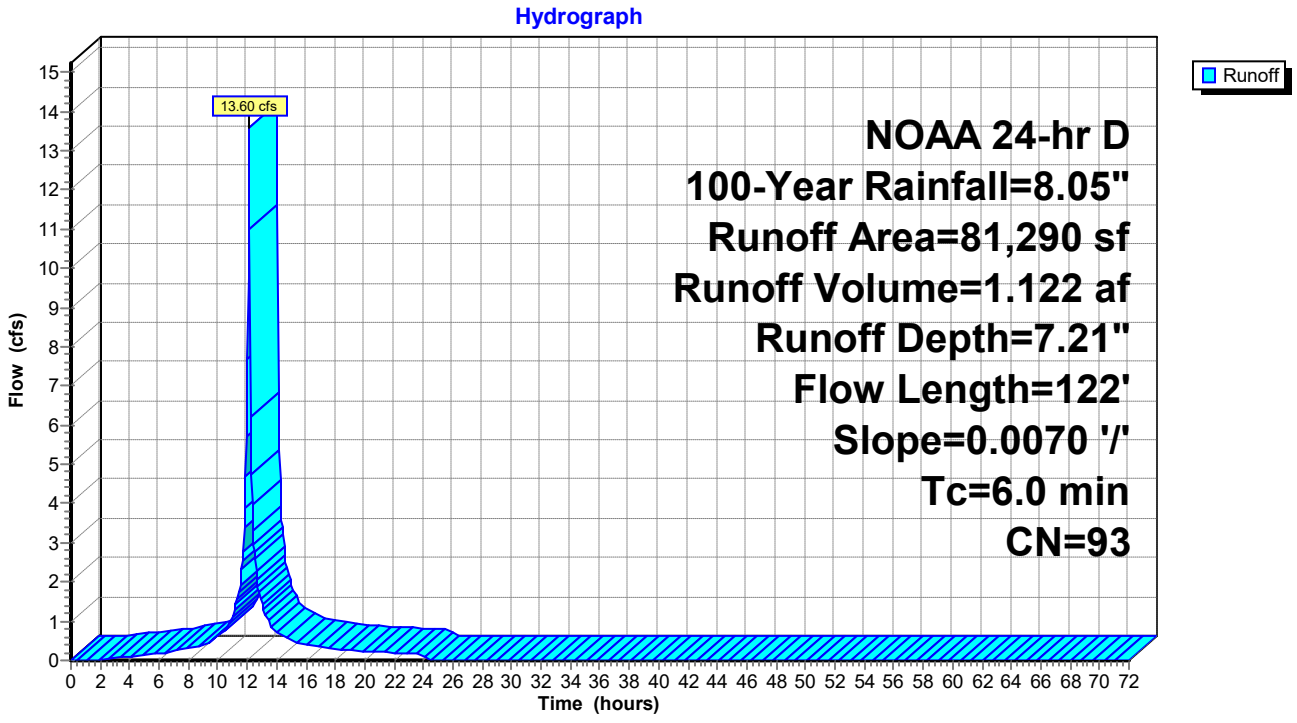
Runoff = 13.60 cfs @ 12.13 hrs, Volume= 1.122 af, Depth= 7.21"
Routed to Pond 6P : UNDERGROUND RECHARGE SYSTEM #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-Year Rainfall=8.05"

Area (sf)	CN	Description
70,874	98	Paved parking, HSG B
10,416	61	>75% Grass cover, Good, HSG B
81,290	93	Weighted Average
10,416		12.81% Pervious Area
70,874		87.19% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.8	100	0.0070	0.94		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.2	22	0.0070	1.70		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
2.0	122	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-1:



Summary for Subcatchment PR-2:

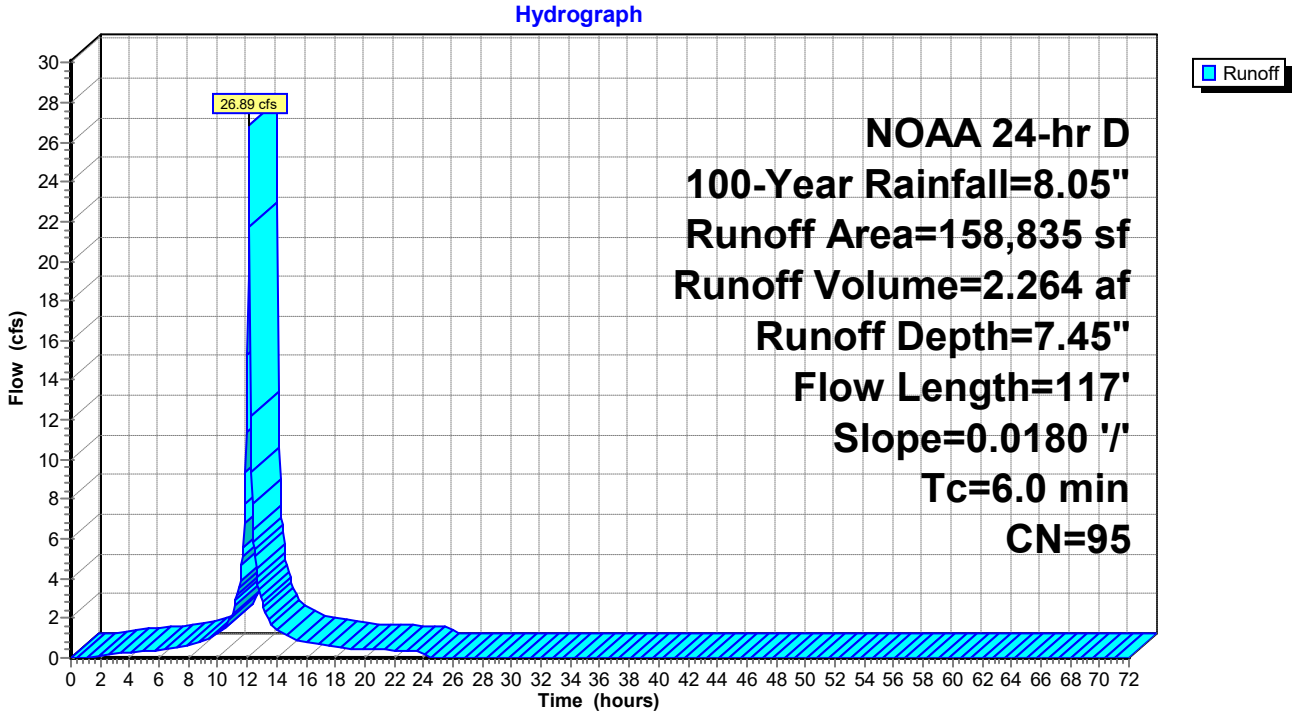
Runoff = 26.89 cfs @ 12.13 hrs, Volume= 2.264 af, Depth= 7.45"
Routed to Pond 2P : UNDERGROUND RECHARGE SYSTEM #2

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-Year Rainfall=8.05"

Area (sf)	CN	Description
44,527	98	Paved parking, HSG B
13,004	61	>75% Grass cover, Good, HSG B
101,304	98	Roofs, HSG B
158,835	95	Weighted Average
13,004		8.19% Pervious Area
145,831		91.81% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0180	1.37		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.1	17	0.0180	2.72		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
1.3	117	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-2:



Summary for Subcatchment PR-3:

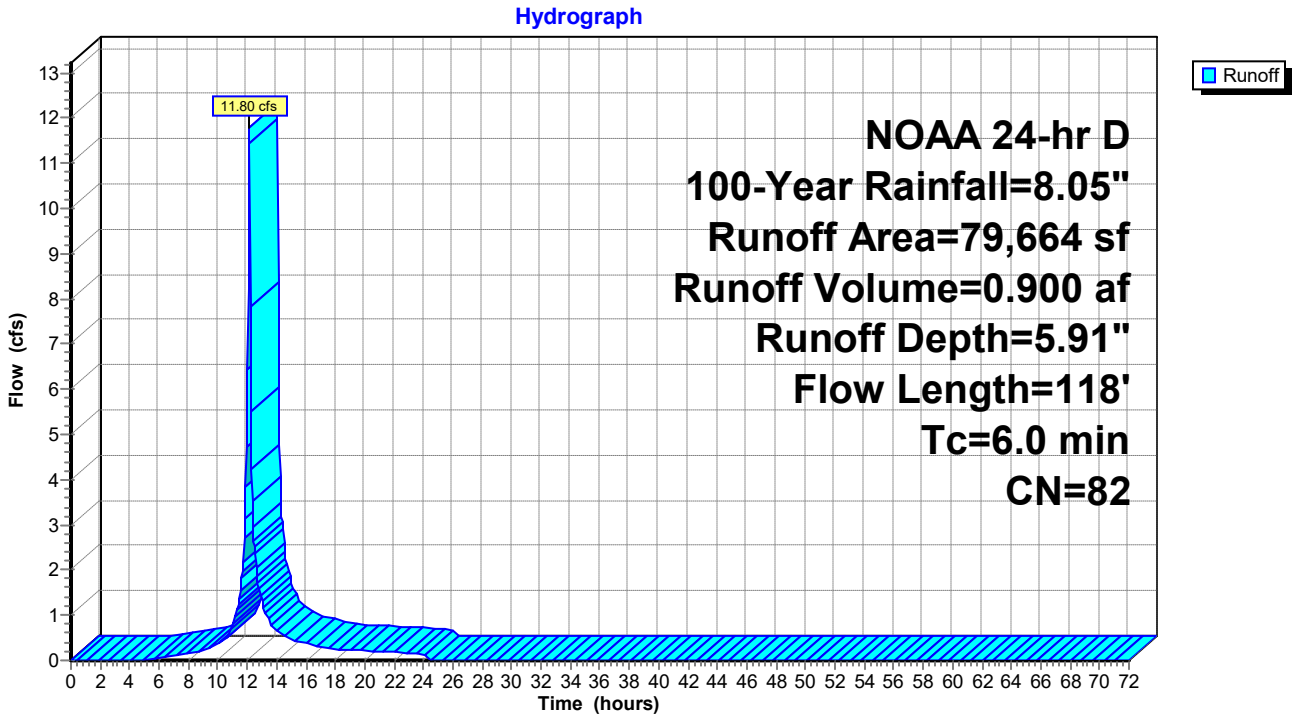
Runoff = 11.80 cfs @ 12.13 hrs, Volume= 0.900 af, Depth= 5.91"
Routed to Reach PR DP-1 : PROPOSED

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-Year Rainfall=8.05"

Area (sf)	CN	Description
45,650	98	Paved parking, HSG B
34,014	61	>75% Grass cover, Good, HSG B
79,664	82	Weighted Average
34,014		42.70% Pervious Area
45,650		57.30% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0170	1.34		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.1	18	0.0110	2.13		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
1.3	118	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-3:



Summary for Subcatchment PR-4:

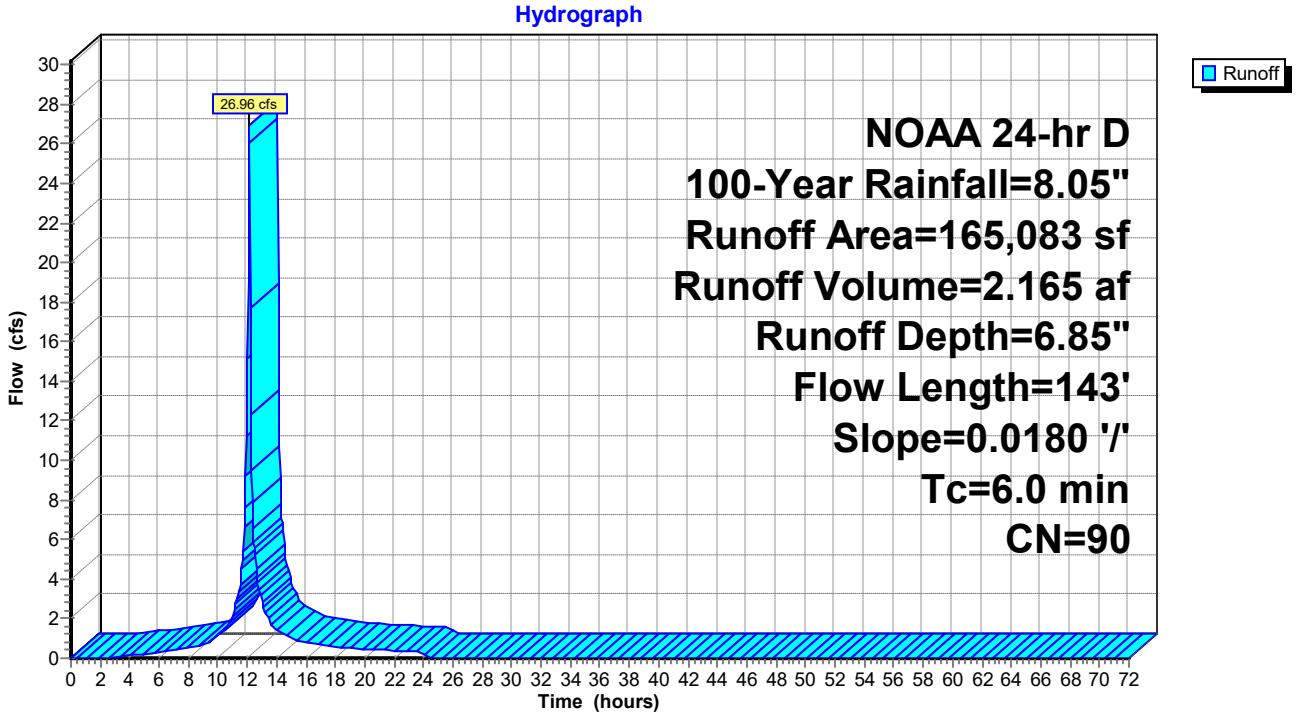
Runoff = 26.96 cfs @ 12.13 hrs, Volume= 2.165 af, Depth= 6.85"
Routed to Pond 3P : UNDERGROUND RECHARGE SYSTEM #3

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-Year Rainfall=8.05"

Area (sf)	CN	Description
30,812	61	>75% Grass cover, Good, HSG B
80,071	98	Paved parking, HSG B
47,328	98	Paved parking, HSG C
6,872	74	>75% Grass cover, Good, HSG C
165,083	90	Weighted Average
37,684		22.83% Pervious Area
127,399		77.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	100	0.0180	1.37		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.3	43	0.0180	2.72		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
1.5	143	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-4:



Summary for Subcatchment PR-5:

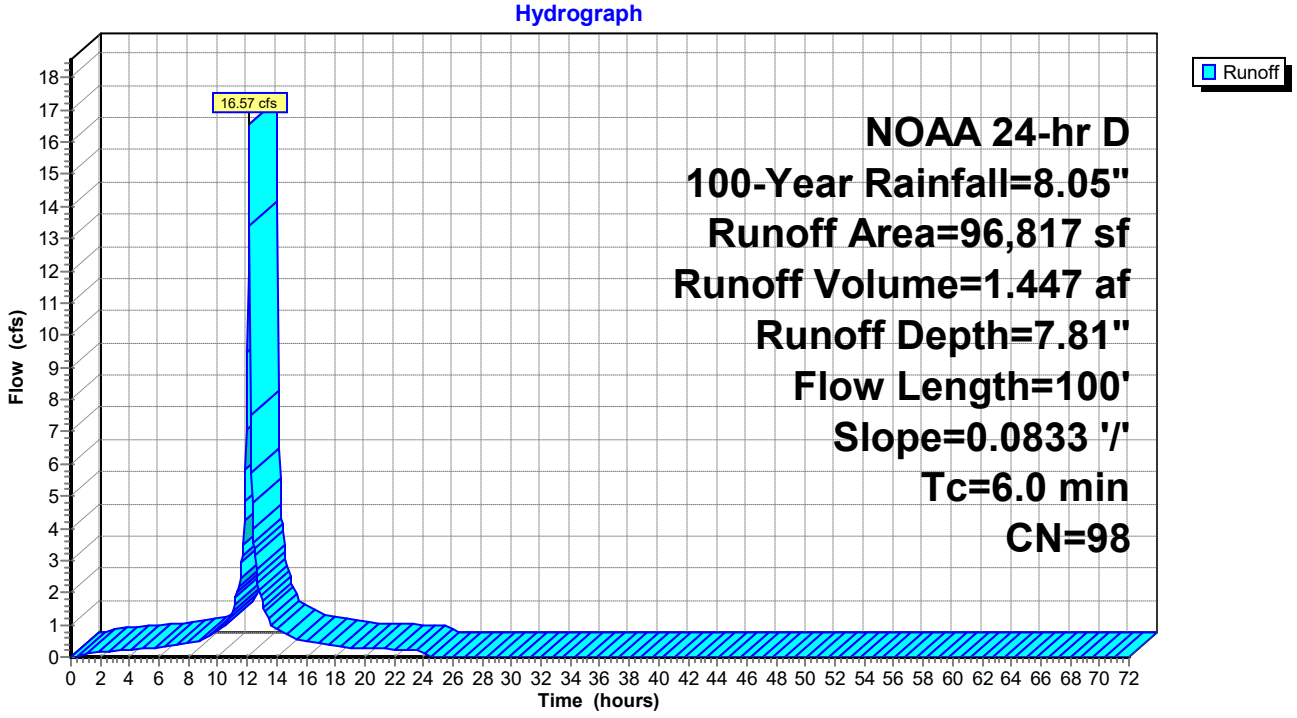
Runoff = 16.57 cfs @ 12.13 hrs, Volume= 1.447 af, Depth= 7.81"
Routed to Pond 6P : UNDERGROUND RECHARGE SYSTEM #1

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-Year Rainfall=8.05"

Area (sf)	CN	Description
96,817	98	Roofs, HSG B
96,817		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	100	0.0833	2.53		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.7	100	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-5:



Summary for Subcatchment PR-6:

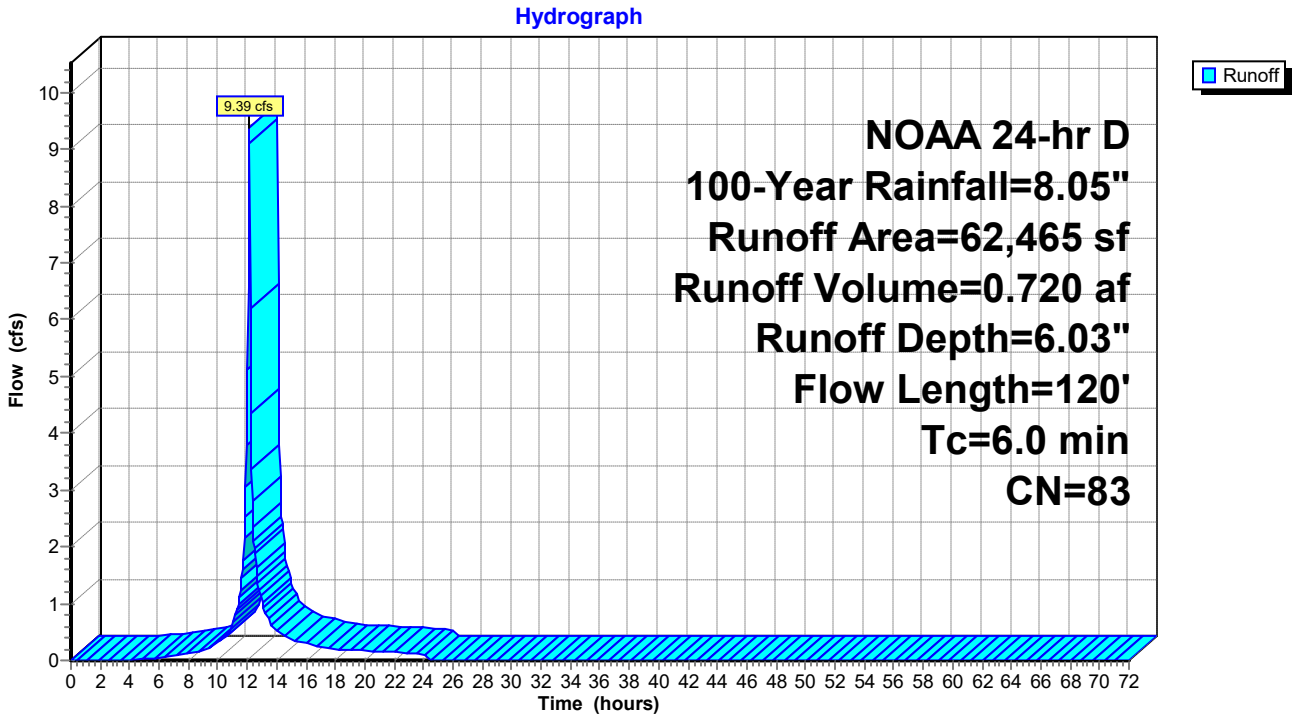
Runoff = 9.39 cfs @ 12.13 hrs, Volume= 0.720 af, Depth= 6.03"
Routed to Pond 4P : UNDERGROUND RECHARGE SYSTEM #4

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-Year Rainfall=8.05"

Area (sf)	CN	Description
46,670	98	Paved parking, HSG A
15,795	39	>75% Grass cover, Good, HSG A
62,465	83	Weighted Average
15,795		25.29% Pervious Area
46,670		74.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	100	0.0060	0.88		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.3	20	0.0030	1.11		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
2.2	120	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-6:



Summary for Subcatchment PR-7:

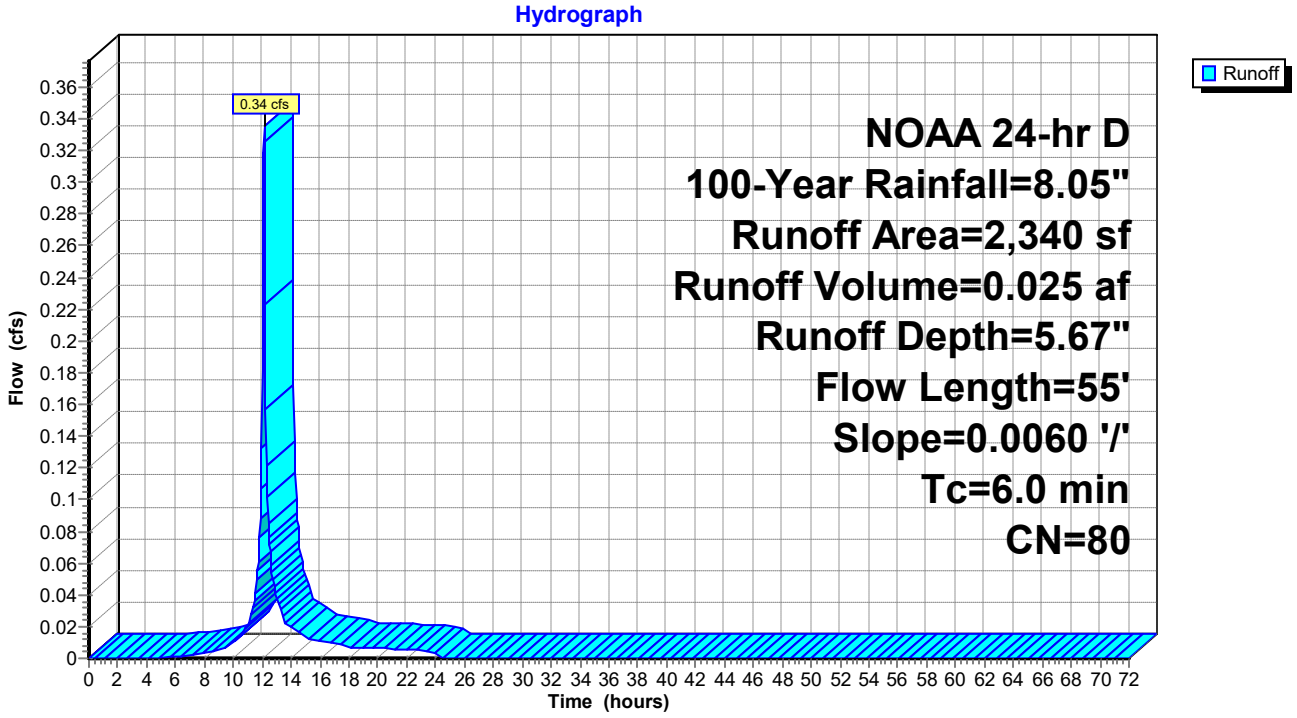
Runoff = 0.34 cfs @ 12.13 hrs, Volume= 0.025 af, Depth= 5.67"
Routed to Reach PR DP-1 : PROPOSED

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-Year Rainfall=8.05"

Area (sf)	CN	Description
624	98	Paved parking, HSG C
1,716	74	>75% Grass cover, Good, HSG C
2,340	80	Weighted Average
1,716		73.33% Pervious Area
624		26.67% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.2	55	0.0060	0.78		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
1.2	55	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-7:



Summary for Subcatchment PR-8:

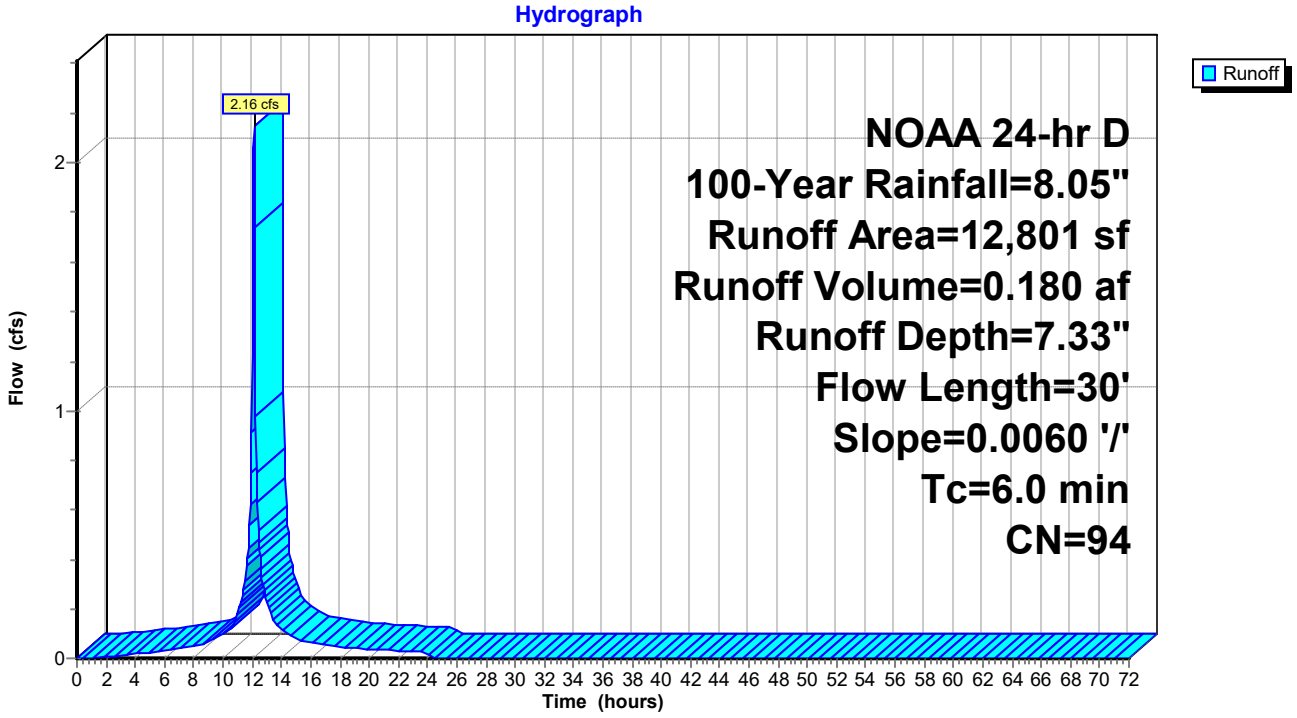
Runoff = 2.16 cfs @ 12.13 hrs, Volume= 0.180 af, Depth= 7.33"
Routed to Reach PR DP-1 : PROPOSED

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-Year Rainfall=8.05"

Area (sf)	CN	Description
10,551	98	Paved parking, HSG A
2,250	74	>75% Grass cover, Good, HSG C
12,801	94	Weighted Average
2,250		17.58% Pervious Area
10,551		82.42% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.7	30	0.0060	0.69		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.7	30	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-8:



Summary for Subcatchment PR-9:

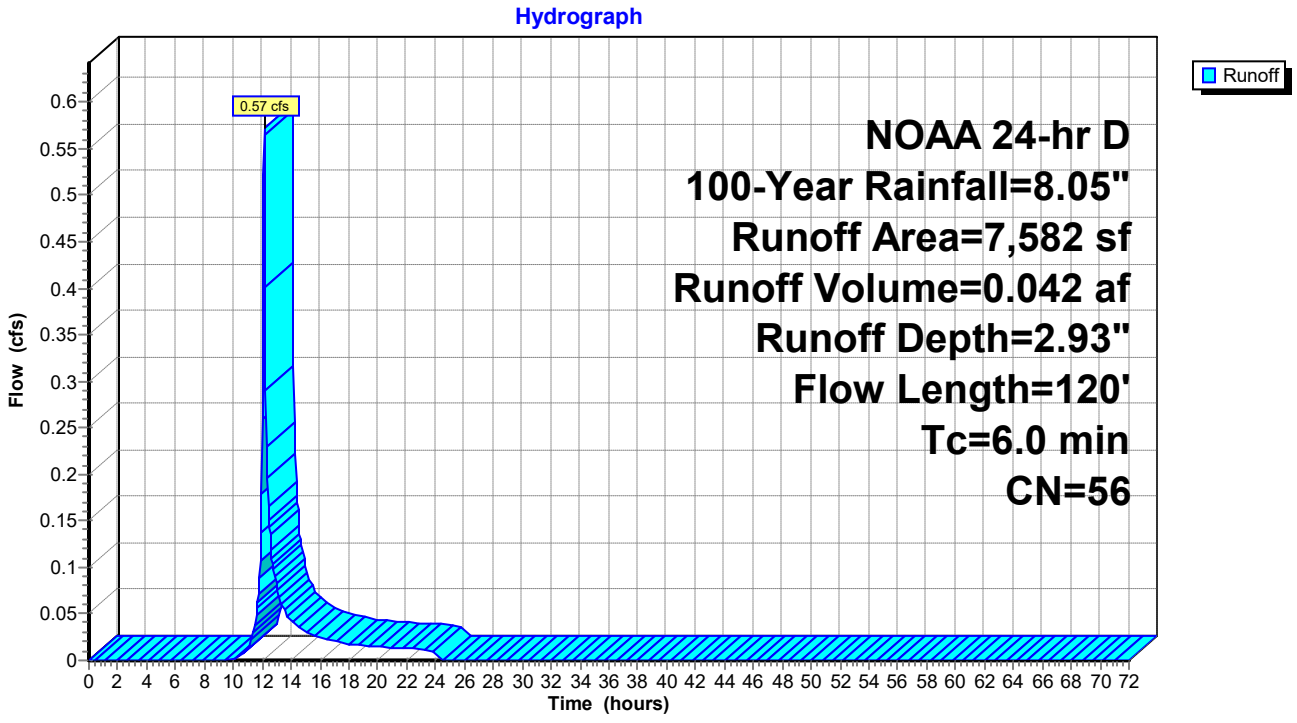
Runoff = 0.57 cfs @ 12.14 hrs, Volume= 0.042 af, Depth= 2.93"
Routed to Reach PR DP-2 : PROPOSED

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
NOAA 24-hr D 100-Year Rainfall=8.05"

Area (sf)	CN	Description
2,203	98	Paved parking, HSG A
5,379	39	>75% Grass cover, Good, HSG A
7,582	56	Weighted Average
5,379		70.94% Pervious Area
2,203		29.06% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.9	100	0.0060	0.88		**Sheet Flow, A-B** Smooth surfaces n= 0.011 P2= 3.46"
0.3	20	0.0030	1.11		**Shallow Concentrated Flow, B-C** Paved Kv= 20.3 fps
2.2	120	Total, Increased to minimum Tc = 6.0 min			

Subcatchment PR-9:



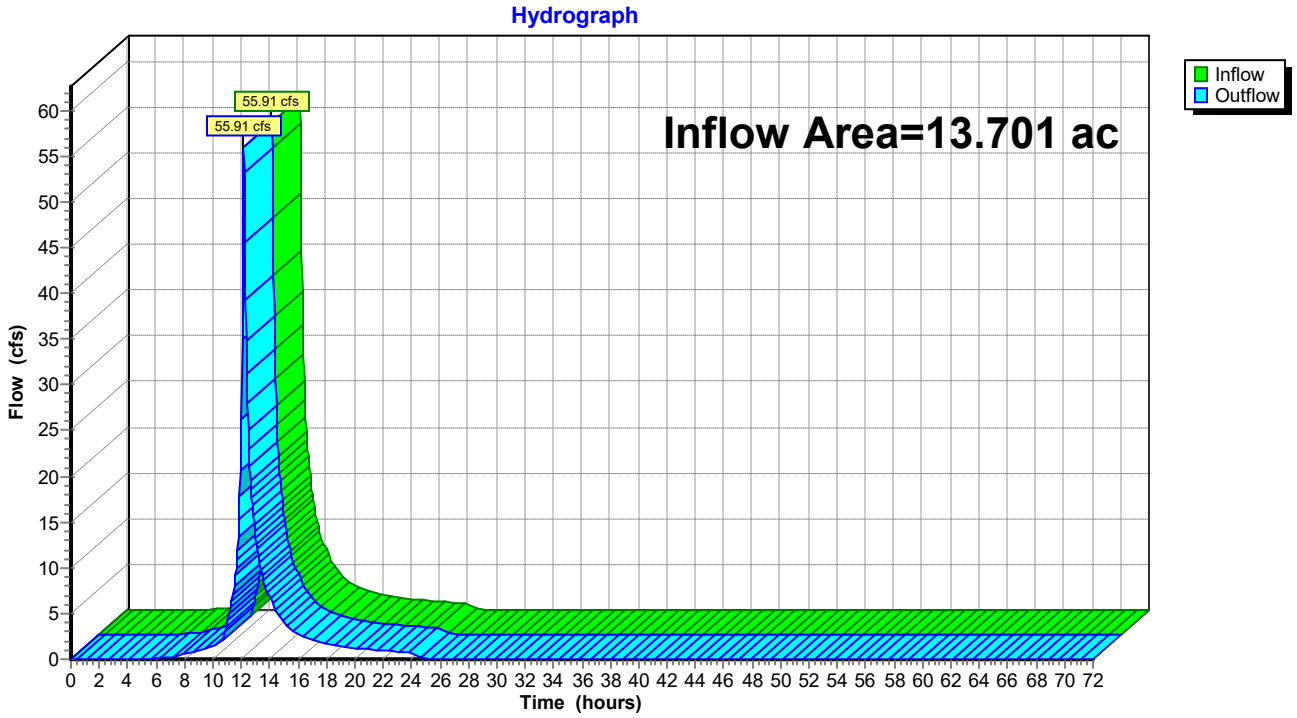
Summary for Reach PR DP-1: PROPOSED

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

Inflow Area = 13.701 ac, 83.40% Impervious, Inflow Depth = 5.24" for 100-Year event
Inflow = 55.91 cfs @ 12.16 hrs, Volume= 5.986 af
Outflow = 55.91 cfs @ 12.16 hrs, Volume= 5.986 af, Atten= 0%, Lag= 0.0 min

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

Reach PR DP-1: PROPOSED



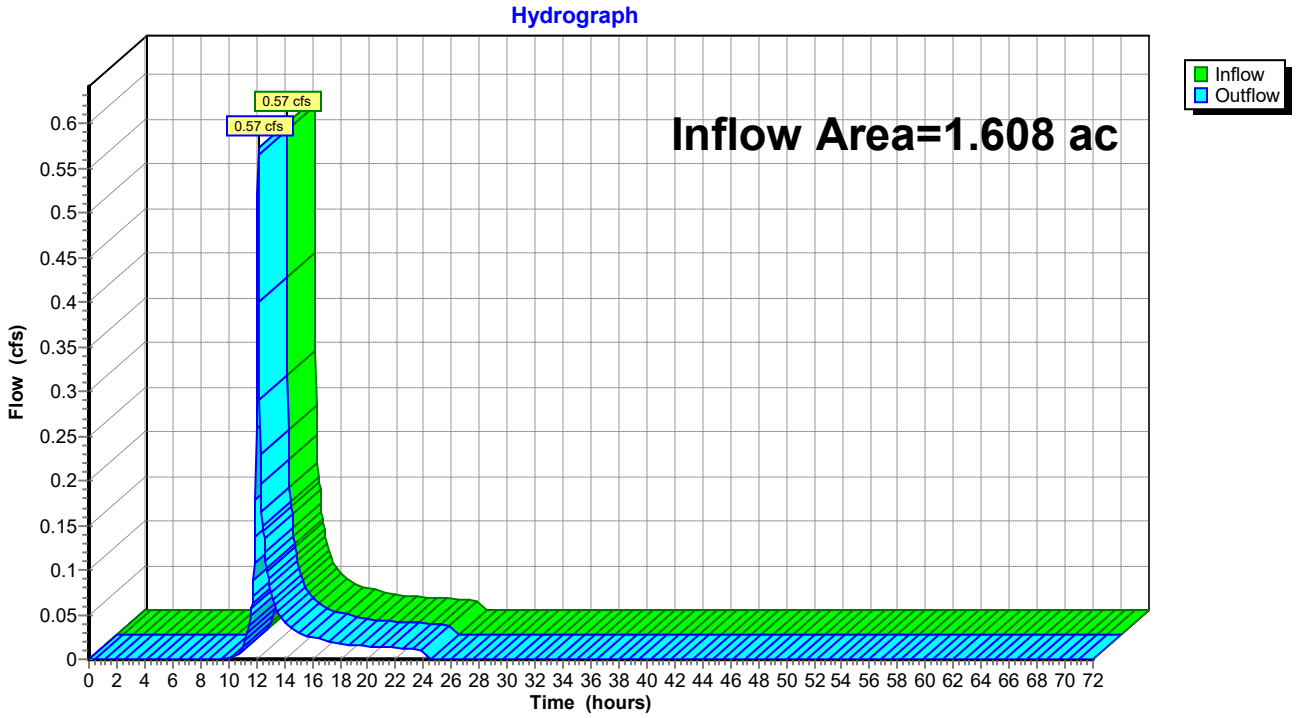
Summary for Reach PR DP-2: PROPOSED

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

Inflow Area = 1.608 ac, 69.77% Impervious, Inflow Depth = 0.32" for 100-Year event
Inflow = 0.57 cfs @ 12.14 hrs, Volume= 0.042 af
Outflow = 0.57 cfs @ 12.14 hrs, Volume= 0.042 af, Atten= 0%, Lag= 0.0 min

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

Reach PR DP-2: PROPOSED



Summary for Pond 2P: UNDERGROUND RECHARGE SYSTEM #2

Inflow Area = 3.646 ac, 91.81% Impervious, Inflow Depth = 7.45" for 100-Year event
Inflow = 26.89 cfs @ 12.13 hrs, Volume= 2.264 af
Outflow = 23.00 cfs @ 12.17 hrs, Volume= 2.264 af, Atten= 14%, Lag= 2.4 min
Discarded = 0.17 cfs @ 3.00 hrs, Volume= 0.597 af
Primary = 22.83 cfs @ 12.17 hrs, Volume= 1.667 af
Routed to Reach PR DP-1 : PROPOSED

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 95.03' @ 12.17 hrs Surf.Area= 7,168 sf Storage= 20,462 cf

Plug-Flow detention time= 206.8 min calculated for 2.264 af (100% of inflow)
Center-of-Mass det. time= 206.7 min (965.6 - 758.9)

Volume	Invert	Avail.Storage	Storage Description
#1A	91.50'	1,254 cf	**56.00'W x 128.00'L x 4.67'H Field A** 33,451 cf Overall - 29,867 cf Embedded = 3,584 cf x 35.0% Voids
#2A	92.00'	22,205 cf	**retain_it retain_it 3.5'** x 112 Inside #1 Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf 7 Rows adjusted for 282.4 cf perimeter wall
		23,459 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	91.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Device 4	94.25'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 4	93.75'	**48.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	92.00'	**30.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 92.00' / 91.90' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 4.91 sf

Discarded OutFlow Max=0.17 cfs @ 3.00 hrs HW=91.55' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.17 cfs)

Primary OutFlow Max=22.30 cfs @ 12.17 hrs HW=95.01' (Free Discharge)
└**4=Culvert** (Passes 22.30 cfs of 27.64 cfs potential flow)
  ├**2=Sharp-Crested Rectangular Weir** (Weir Controls 12.65 cfs @ 2.85 fps)
  └**3=Orifice/Grate** (Orifice Controls 9.65 cfs @ 4.82 fps)

Pond 2P: UNDERGROUND RECHARGE SYSTEM #2 - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.5' (retain-it®)
Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf
Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf
7 Rows adjusted for 282.4 cf perimeter wall

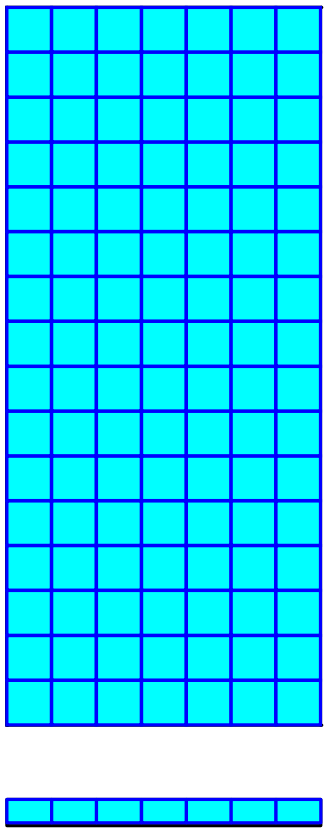
16 Chambers/Row x 8.00' Long = 128.00' Row Length
7 Rows x 96.0" Wide = 56.00' Base Width
6.0" Stone Base + 50.0" Chamber Height = 4.67' Field Height

6.1 cf Sidewall x 16 x 2 + 6.1 cf Endwall x 7 x 2 = 282.4 cf Perimeter Wall
112 Chambers x 200.8 cf - 282.4 cf Perimeter wall = 22,205.0 cf Chamber Storage
112 Chambers x 266.7 cf = 29,866.7 cf Displacement

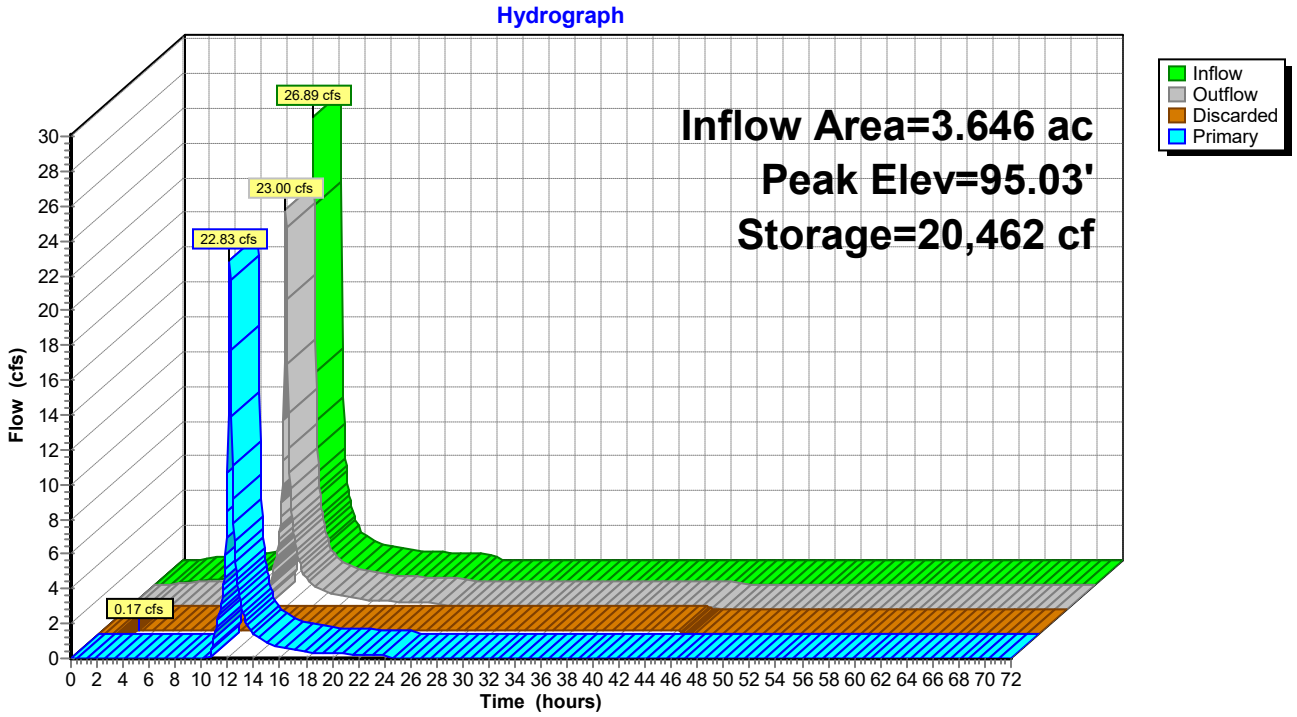
33,450.7 cf Field - 29,866.7 cf Chambers = 3,584.0 cf Stone x 35.0% Voids = 1,254.4 cf Stone Storage

Chamber Storage + Stone Storage = 23,459.4 cf = 0.539 af
Overall Storage Efficiency = 70.1%
Overall System Size = 128.00' x 56.00' x 4.67'

112 Chambers
1,238.9 cy Field
132.7 cy Stone



Pond 2P: UNDERGROUND RECHARGE SYSTEM #2



Summary for Pond 3P: UNDERGROUND RECHARGE SYSTEM #3

Inflow Area = 3.790 ac, 77.17% Impervious, Inflow Depth = 6.85" for 100-Year event
Inflow = 26.96 cfs @ 12.13 hrs, Volume= 2.165 af
Outflow = 18.17 cfs @ 12.21 hrs, Volume= 2.110 af, Atten= 33%, Lag= 4.7 min
Primary = 18.17 cfs @ 12.21 hrs, Volume= 2.110 af
Routed to Reach PR DP-1 : PROPOSED

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 3
Peak Elev= 95.46' @ 12.21 hrs Surf.Area= 6,800 sf Storage= 16,500 cf

Plug-Flow detention time= 57.7 min calculated for 2.109 af (97% of inflow)
Center-of-Mass det. time= 42.7 min (822.3 - 779.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	92.00'	2,893 cf	**34.00'W x 200.00'L x 4.67'H Field A** 31,733 cf Overall - 23,467 cf Embedded = 8,267 cf x 35.0% Voids
#2A	93.00'	16,787 cf	**retain_it retain_it 3.0'** x 100 Inside #1 Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf 4 Rows adjusted for 273.8 cf perimeter wall
		19,681 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 4	95.25'	**6.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Device 4	94.25'	**48.0" W x 4.0" H Vert. Orifice** C= 0.600 Limited to weir flow at low heads
#3	Device 4	93.00'	**48.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	93.00'	**48.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.00' / 92.95' S= 0.0050 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 12.57 sf

Primary OutFlow Max=17.96 cfs @ 12.21 hrs HW=95.45' (Free Discharge)
└**4=Culvert** (Passes 17.96 cfs of 29.60 cfs potential flow)
  ├**1=Sharp-Crested Rectangular Weir** (Weir Controls 1.74 cfs @ 1.46 fps)
  ├**2=Orifice** (Orifice Controls 6.52 cfs @ 4.89 fps)
  └**3=Orifice/Grate** (Orifice Controls 9.70 cfs @ 7.27 fps)

Pond 3P: UNDERGROUND RECHARGE SYSTEM #3 - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.0' (retain-it®)
Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf
Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf
4 Rows adjusted for 273.8 cf perimeter wall

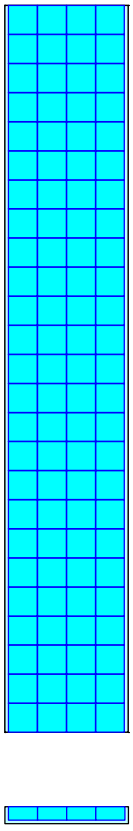
25 Chambers/Row x 8.00' Long = 200.00' Row Length
4 Rows x 96.0" Wide + 12.0" Side Stone x 2 = 34.00' Base Width
12.0" Stone Base + 44.0" Chamber Height = 4.67' Field Height

4.7 cf Sidewall x 25 x 2 + 4.7 cf Endwall x 4 x 2 = 273.8 cf Perimeter Wall
100 Chambers x 170.6 cf - 273.8 cf Perimeter wall = 16,787.3 cf Chamber Storage
100 Chambers x 234.7 cf = 23,466.7 cf Displacement

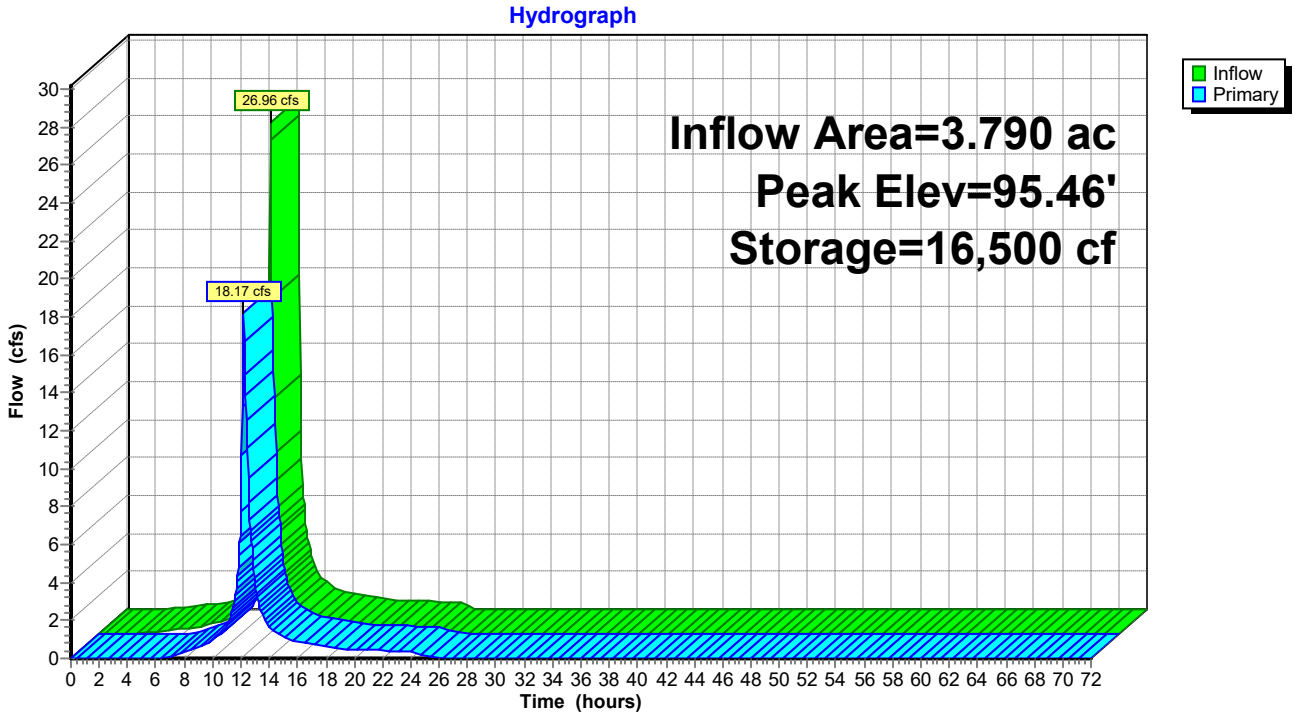
31,733.3 cf Field - 23,466.7 cf Chambers = 8,266.7 cf Stone x 35.0% Voids = 2,893.3 cf Stone Storage

Chamber Storage + Stone Storage = 19,680.6 cf = 0.452 af
Overall Storage Efficiency = 62.0%
Overall System Size = 200.00' x 34.00' x 4.67'

100 Chambers
1,175.3 cy Field
306.2 cy Stone



Pond 3P: UNDERGROUND RECHARGE SYSTEM #3



Summary for Pond 4P: UNDERGROUND RECHARGE SYSTEM #4

Inflow Area = 1.434 ac, 74.71% Impervious, Inflow Depth = 6.03" for 100-Year event
Inflow = 9.39 cfs @ 12.13 hrs, Volume= 0.720 af
Outflow = 2.41 cfs @ 11.85 hrs, Volume= 0.718 af, Atten= 74%, Lag= 0.0 min
Discarded = 2.41 cfs @ 11.85 hrs, Volume= 0.718 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Routed to Reach PR DP-2 : PROPOSED

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs / 2
Peak Elev= 93.82' @ 12.40 hrs Surf.Area= 2,048 sf Storage= 5,295 cf

Plug-Flow detention time= 12.2 min calculated for 0.717 af (100% of inflow)
Center-of-Mass det. time= 10.2 min (811.7 - 801.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	90.25'	717 cf	**32.00'W x 64.00'L x 4.67'H Field A** 9,557 cf Overall - 7,509 cf Embedded = 2,048 cf x 35.0% Voids
#2A	91.25'	5,346 cf	**retain_it retain_it 3.0'** x 32 Inside #1 Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf 4 Rows adjusted for 113.3 cf perimeter wall
		6,063 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	90.25'	**2.41 cfs Exfiltration at all elevations**
#2	Primary	93.90'	**12.0" Round Culvert** L= 10.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 93.90' / 93.85' S= 0.0050 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=2.41 cfs @ 11.85 hrs HW=90.30' (Free Discharge)
1=Exfiltration (Exfiltration Controls 2.41 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=90.25' (Free Discharge)
2=Culvert (Controls 0.00 cfs)

Pond 4P: UNDERGROUND RECHARGE SYSTEM #4 - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.0' (retain-it®)
Inside= 84.0"W x 36.0"H => 21.33 sf x 8.00'L = 170.6 cf
Outside= 96.0"W x 44.0"H => 29.33 sf x 8.00'L = 234.7 cf
4 Rows adjusted for 113.3 cf perimeter wall

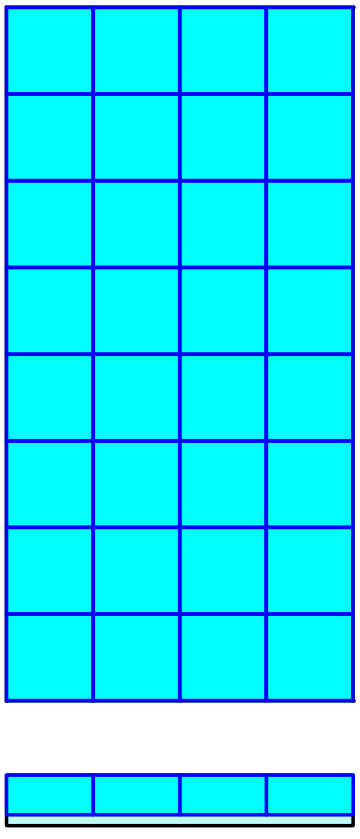
8 Chambers/Row x 8.00' Long = 64.00' Row Length
4 Rows x 96.0" Wide = 32.00' Base Width
12.0" Stone Base + 44.0" Chamber Height = 4.67' Field Height

4.7 cf Sidewall x 8 x 2 + 4.7 cf Endwall x 4 x 2 = 113.3 cf Perimeter Wall
32 Chambers x 170.6 cf - 113.3 cf Perimeter wall = 5,346.2 cf Chamber Storage
32 Chambers x 234.7 cf = 7,509.3 cf Displacement

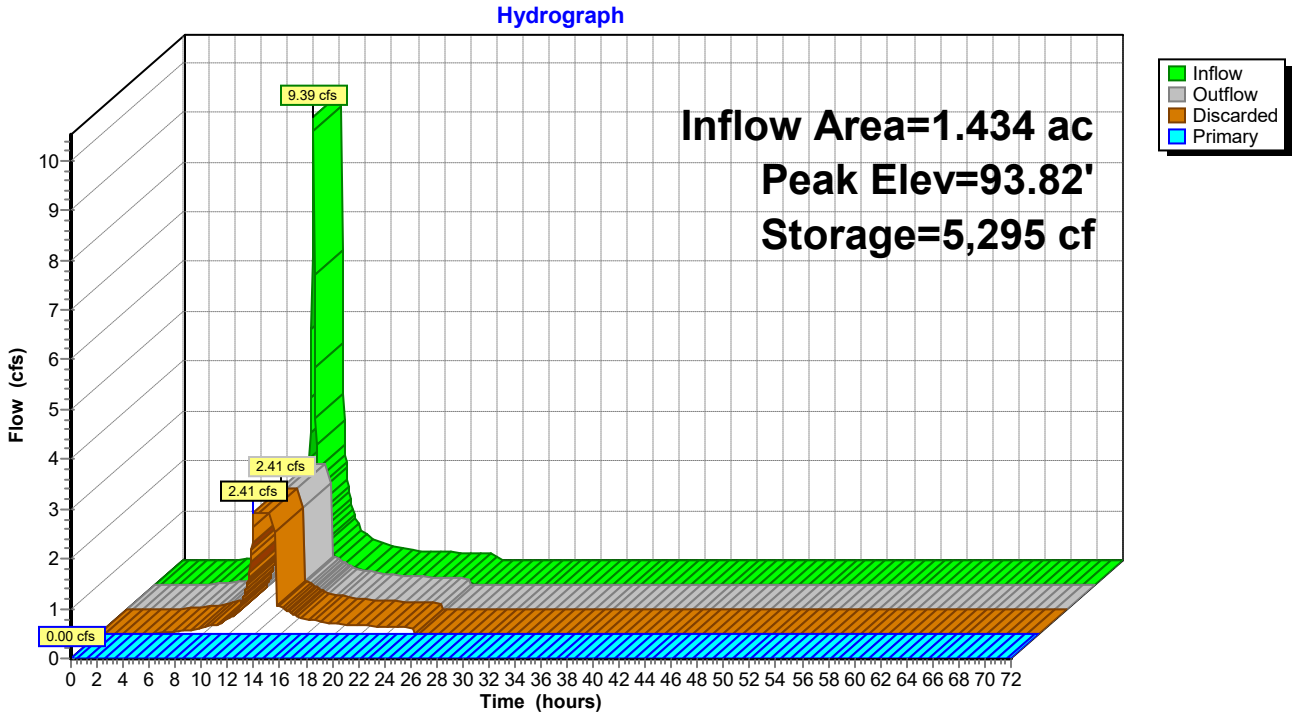
9,557.3 cf Field - 7,509.3 cf Chambers = 2,048.0 cf Stone x 35.0% Voids = 716.8 cf Stone Storage

Chamber Storage + Stone Storage = 6,063.0 cf = 0.139 af
Overall Storage Efficiency = 63.4%
Overall System Size = 64.00' x 32.00' x 4.67'

32 Chambers
354.0 cy Field
75.9 cy Stone



Pond 4P: UNDERGROUND RECHARGE SYSTEM #4



Summary for Pond 6P: UNDERGROUND RECHARGE SYSTEM #1

Inflow Area = 4.089 ac, 94.15% Impervious, Inflow Depth = 7.54" for 100-Year event
Inflow = 30.17 cfs @ 12.13 hrs, Volume= 2.568 af
Outflow = 6.37 cfs @ 12.47 hrs, Volume= 2.568 af, Atten= 79%, Lag= 20.8 min
Discarded = 0.42 cfs @ 5.45 hrs, Volume= 1.465 af
Primary = 5.95 cfs @ 12.47 hrs, Volume= 1.103 af
Routed to Reach PR DP-1 : PROPOSED

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 94.96' @ 12.47 hrs Surf.Area= 17,920 sf Storage= 50,277 cf

Plug-Flow detention time= 422.2 min calculated for 2.568 af (100% of inflow)
Center-of-Mass det. time= 422.1 min (1,175.4 - 753.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	91.50'	3,136 cf	**80.00'W x 224.00'L x 4.67'H Field A** 83,627 cf Overall - 74,667 cf Embedded = 8,960 cf x 35.0% Voids
#2A	92.00'	55,752 cf	**retain_it retain_it 3.5'** x 280 Inside #1 Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf 10 Rows adjusted for 466.6 cf perimeter wall
		58,888 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	91.50'	**1.020 in/hr Exfiltration over Surface area**
#2	Device 4	94.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 4	93.75'	**24.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Primary	93.00'	**18.0" Round Culvert** L= 10.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 93.00' / 92.90' S= 0.0100 '/' Cc= 0.900 n= 0.012 Corrugated PP, smooth interior, Flow Area= 1.77 sf

Discarded OutFlow Max=0.42 cfs @ 5.45 hrs HW=91.55' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.42 cfs)

Primary OutFlow Max=5.93 cfs @ 12.47 hrs HW=94.96' (Free Discharge)
└**4=Culvert** (Passes 5.93 cfs of 8.47 cfs potential flow)
  ├**2=Sharp-Crested Rectangular Weir** (Weir Controls 1.23 cfs @ 1.49 fps)
  └**3=Orifice/Grate** (Orifice Controls 4.70 cfs @ 4.70 fps)

Pond 6P: UNDERGROUND RECHARGE SYSTEM #1 - Chamber Wizard Field A

Chamber Model = retain_it retain_it 3.5' (retain-it®)
Inside= 84.0"W x 42.0"H => 25.10 sf x 8.00'L = 200.8 cf
Outside= 96.0"W x 50.0"H => 33.33 sf x 8.00'L = 266.7 cf
10 Rows adjusted for 466.6 cf perimeter wall

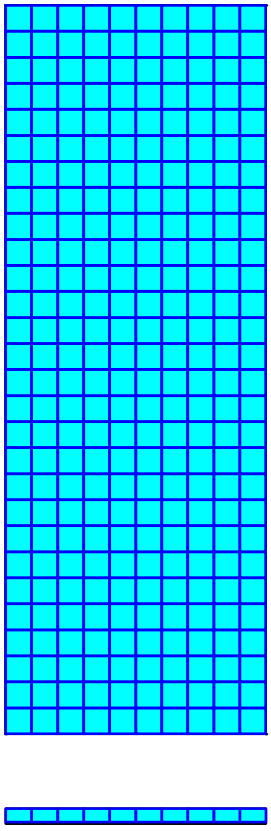
28 Chambers/Row x 8.00' Long = 224.00' Row Length
10 Rows x 96.0" Wide = 80.00' Base Width
6.0" Stone Base + 50.0" Chamber Height = 4.67' Field Height

6.1 cf Sidewall x 28 x 2 + 6.1 cf Endwall x 10 x 2 = 466.6 cf Perimeter Wall
280 Chambers x 200.8 cf - 466.6 cf Perimeter wall = 55,751.9 cf Chamber Storage
280 Chambers x 266.7 cf = 74,666.7 cf Displacement

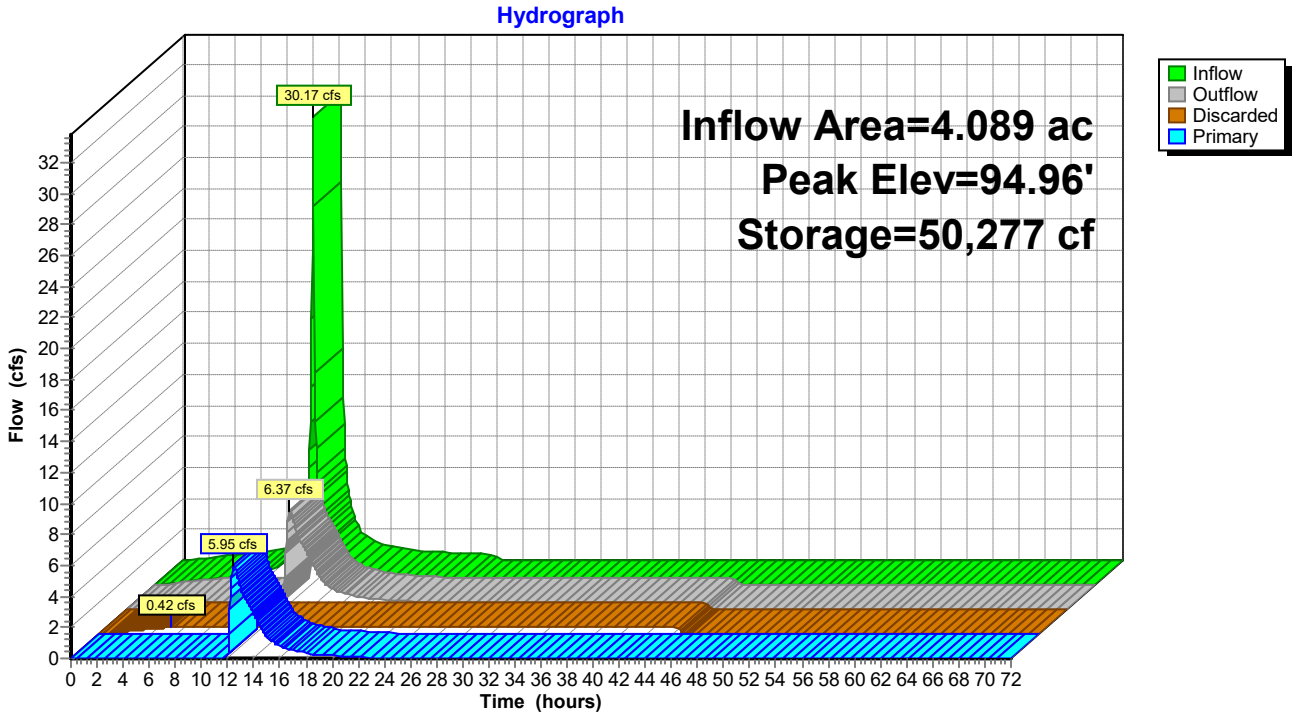
83,626.7 cf Field - 74,666.7 cf Chambers = 8,960.0 cf Stone x 35.0% Voids = 3,136.0 cf Stone Storage

Chamber Storage + Stone Storage = 58,887.9 cf = 1.352 af
Overall Storage Efficiency = 70.4%
Overall System Size = 224.00' x 80.00' x 4.67'

280 Chambers
3,097.3 cy Field
331.9 cy Stone



Pond 6P: UNDERGROUND RECHARGE SYSTEM #1



APPENDIX D

Closed Drainage System Design

Project Description

File Name	15363 Principio SSA Model.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	00:00:00	0:00:00
End Analysis On	00:00:00	1:00:00
Start Reporting On	00:00:00	0:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	0
Subbasins	40
Nodes	95
Junctions	78
Outfalls	17
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	78
Channels	0
Pipes	78
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

Return Period	25 year(s)

Subbasin Summary

SN	Subbasin ID	Area (ac)	Weighted Runoff Coefficient	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	DA-AD-253	1.69	0.52	0.64	0.33	0.56	5.61	0 00:06:00
2	DA-CB-100	0.05	0.68	0.64	0.44	0.02	0.23	0 00:06:00
3	DA-CB-101	0.07	0.70	0.64	0.45	0.03	0.29	0 00:06:00
4	DA-CB-102	0.50	0.75	0.64	0.48	0.24	2.39	0 00:06:00
5	DA-CB-103	0.18	0.63	0.64	0.40	0.07	0.73	0 00:06:00
6	DA-CB-104	0.48	0.76	0.64	0.49	0.23	2.31	0 00:06:00
7	DA-CB-105	0.33	0.72	0.64	0.46	0.15	1.52	0 00:06:00
8	DA-CB-106	0.02	0.84	0.64	0.54	0.01	0.12	0 00:06:00
9	DA-CB-107	0.03	0.72	0.64	0.46	0.02	0.16	0 00:06:00
10	DA-CB-108	0.34	0.85	0.64	0.54	0.18	1.83	0 00:06:00
11	DA-CB-109	0.62	0.76	0.64	0.49	0.30	3.03	0 00:06:00
12	DA-CB-110	0.19	0.60	0.64	0.38	0.07	0.72	0 00:06:00
13	DA-CB-111	0.34	0.84	0.64	0.54	0.18	1.83	0 00:06:00
14	DA-CB-112	0.04	0.86	0.64	0.55	0.02	0.21	0 00:06:00
15	DA-CB-119	0.25	0.39	0.64	0.25	0.06	0.64	0 00:06:00
16	DA-CB-120	0.47	0.51	0.64	0.33	0.15	1.54	0 00:06:00
17	DA-CB-121	1.10	0.53	0.64	0.34	0.37	3.72	0 00:06:00
18	DA-CB-122	0.58	0.79	0.64	0.51	0.29	2.93	0 00:06:00
19	DA-CB-123	0.33	0.90	0.64	0.58	0.19	1.91	0 00:06:00
20	DA-CB-124	0.58	0.55	0.64	0.35	0.20	2.03	0 00:06:00
21	DA-CB-125	0.31	0.90	0.64	0.58	0.18	1.80	0 00:06:00
22	DA-CB-126	0.89	0.61	0.64	0.39	0.35	3.45	0 00:06:00
23	DA-CB-127	0.34	0.90	0.64	0.58	0.20	1.95	0 00:06:00
24	DA-CB-128	0.32	0.79	0.64	0.51	0.16	1.61	0 00:06:00
25	DA-CB-129	0.23	0.87	0.64	0.56	0.13	1.25	0 00:06:00
26	DA-CB-130	0.38	0.76	0.64	0.49	0.18	1.83	0 00:06:00
27	DA-CB-131	0.56	0.60	0.64	0.38	0.21	2.15	0 00:06:00
28	DA-CB-132	0.49	0.84	0.64	0.54	0.26	2.61	0 00:06:00
29	DA-CB-133	0.30	0.90	0.64	0.58	0.17	1.70	0 00:06:00
30	DA-CB-134	0.56	0.53	0.64	0.34	0.19	1.89	0 00:06:00
31	DA-EXCB#3_thru_#7	3.13	0.67	0.64	0.43	1.34	13.38	0 00:06:00
32	DA-EX-CB-1	0.43	0.69	0.64	0.44	0.19	1.88	0 00:06:00
33	DA-EX-CB-2	0.04	0.70	0.64	0.45	0.02	0.20	0 00:06:00
34	DA-EX-ROOF#2	0.93	0.90	0.64	0.58	0.53	5.34	0 00:06:00
35	DA-EX-ROOF#3	0.93	0.90	0.64	0.58	0.53	5.33	0 00:06:00
36	DA-EX-ROOF#4	2.98	0.90	0.64	0.58	1.71	17.12	0 00:06:00
37	DA-EX-ROOF-1	0.99	0.90	0.64	0.58	0.57	5.71	0 00:06:00
38	DA-RD#1A	1.14	0.90	0.64	0.58	0.66	6.56	0 00:06:00
39	DA-RD-1	3.41	0.90	0.64	0.58	1.96	19.61	0 00:06:00
40	DA-WQI-113	0.18	0.60	0.64	0.38	0.07	0.68	0 00:06:00

Link Summary

From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio
		(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)	
DMH 228	1-Jun	54.04	89.45	89.34	0.20	48.0	0.013	53.66	64.81	0.83	4.78	3.35	0.84
1-Jun	Out-1Pipe - (129)	73.55	89.34	89.18	0.22	48.0	0.013	58.32	67.00	0.87	6.40	2.73	0.68
2-Jun	1-Jun	23.96	93.50	92.10	5.84	12.0	0.013	5.56	8.61	0.65	8.92	0.74	0.74
DMH-217	Out-01	34.58	90.40	90.00	1.16	36.0	0.013	28.06	71.74	0.39	7.53	1.56	0.52
OCS-211	DMH-217	49.91	91.90	91.00	1.80	30.0	0.013	24.58	82.11	0.30	11.48	1.22	0.49
OCS 208	DMH-217	109.25	91.90	90.50	1.28	18.0	0.013	0.42	15.89	0.03	1.74	0.83	0.56
DMH-216	DMH-217	236.00	91.85	90.50	0.57	30.0	0.013	5.49	31.02	0.18	2.32	1.22	0.49
DMH 253	DMH 254	100.04	93.26	92.76	0.50	15.0	0.013	2.75	4.57	0.60	3.33	0.80	0.64
DMH 254	WQS 244	61.46	92.66	92.35	0.50	15.0	0.013	2.88	4.57	0.63	3.28	0.93	0.75
EX. CB 2	DMH 254	8.70	94.14	93.93	2.37	12.0	0.013	0.20	5.48	0.04	2.90	0.14	0.14
CB 131	WQS-245	63.40	93.30	92.30	1.58	12.0	0.013	2.16	4.47	0.48	3.59	0.72	0.72
WQS-245	Out-1Pipe - (290)	9.35	92.20	92.00	2.14	12.0	0.013	3.89	5.21	0.75	5.63	0.82	0.82
CB 130	WQS-245	20.54	92.71	92.30	2.00	12.0	0.013	1.85	10.40	0.18	4.94	0.61	0.61
WQS 244	Out-1Pipe - (264)	57.21	92.25	92.00	0.44	18.0	0.013	4.54	6.93	0.66	3.94	0.93	0.62
DMH 256	DMH 257	38.59	95.62	95.43	0.50	12.0	0.013	0.85	2.53	0.34	2.71	0.42	0.42
DMH 257	DMH 258	251.20	95.33	94.07	0.50	12.0	0.013	0.85	2.52	0.34	2.89	0.40	0.40
DMH 258	DMH 252	24.02	93.97	93.85	0.50	12.0	0.013	0.85	2.52	0.34	2.65	0.43	0.43
CB-123	WQS-208	81.89	94.73	94.33	0.49	12.0	0.013	1.82	2.49	0.73	2.56	0.86	0.86
CB-124	WQS-208	32.10	94.50	94.33	0.53	12.0	0.013	1.98	2.59	0.76	2.62	0.93	0.93
WQS-208	Out-03	46.01	94.23	94.00	0.50	15.0	0.013	3.71	4.57	0.81	3.91	0.90	0.72
CB-122	WQS-206	84.77	94.70	94.25	0.53	15.0	0.013	2.79	4.71	0.59	2.45	1.10	0.88
WQS-206	Out-1Pipe - (280)	27.60	94.15	94.00	0.54	18.0	0.013	6.37	7.74	0.82	4.39	1.15	0.77
CB-121	WQS-206	29.13	94.40	94.25	0.51	15.0	0.013	3.71	4.64	0.80	3.03	1.24	0.99
CB-132	WQS-246	40.06	95.00	94.80	0.50	15.0	0.013	2.53	4.56	0.55	2.57	1.05	0.84
WQS-246	DMH 251	58.49	94.70	94.40	0.51	15.0	0.013	4.21	4.63	0.91	3.69	1.11	0.89
CB-127	WQS-246	78.92	95.10	94.80	0.38	12.0	0.013	1.96	2.20	0.89	2.50	1.00	1.00
TANK1	TANK2	208.81	95.67	94.63	0.50	15.0	0.012	25.22	26.65	0.95	6.04	1.05	0.84
TANK2	Out-1Pipe - (100) (3)	64.09	93.00	92.10	1.40	15.0	0.015	25.27	33.75	0.75	6.71	0.94	0.75
DMH260	TANK1	59.70	96.75	95.92	1.39	15.0	0.013	6.43	7.62	0.84	6.02	1.02	0.81
RD#1	DMH259	8.72	96.20	96.12	0.92	30.0	0.015	19.56	34.06	0.57	4.50	2.07	0.83
DMH259	TANK1	19.22	96.02	95.92	0.52	30.0	0.013	19.45	29.59	0.66	5.34	1.73	0.70
DMH 230	DMH 229	66.34	90.33	90.20	0.20	48.0	0.012	56.72	68.89	0.82	8.52	3.69	0.92
DMH 229	DMH 228	370.77	90.20	89.45	0.20	48.0	0.013	54.36	64.60	0.84	5.91	3.55	0.89
CB 101	DMH 200	20.00	94.64	94.20	2.20	12.0	0.013	0.29	5.28	0.05	3.31	0.17	0.17
DMH 200	DMH 201	47.50	93.20	92.40	1.68	12.0	0.013	2.94	4.62	0.64	4.07	0.94	0.94
WQS 203	Out-1Pipe - (177)	5.50	92.10	92.00	1.82	15.0	0.013	5.54	8.71	0.64	5.70	0.92	0.74
CB 104	DMH 202	13.19	94.30	94.00	2.27	12.0	0.013	2.29	5.37	0.43	4.90	0.61	0.62
DMH 202	DMH 201	94.38	93.90	92.40	1.59	12.0	0.013	2.92	4.49	0.65	4.14	0.84	0.84
CB 106	DMH 206	22.63	94.60	94.10	2.21	12.0	0.013	0.12	5.30	0.02	2.58	0.11	0.11
WQS 204	Out-1Pipe - (180)	7.05	92.10	92.00	1.42	12.0	0.013	3.53	4.24	0.83	4.97	0.85	0.85
DMH 207	DMH 205	82.39	93.90	92.50	1.70	12.0	0.013	1.95	4.64	0.42	3.39	0.73	0.73
WQI 113	Out-1Pipe - (187)	26.16	92.70	92.00	2.68	12.0	0.013	0.68	6.31	0.11	4.76	0.24	0.24
CB 109	WQS 209	18.82	94.30	94.00	1.59	12.0	0.013	2.98	4.50	0.66	4.96	0.76	0.76
CB 105	DMH 206	9.15	94.30	94.10	2.18	12.0	0.013	1.51	5.27	0.29	4.54	0.44	0.44
DMH 206	DMH 205	47.24	93.50	92.50	2.12	12.0	0.013	1.62	5.18	0.31	3.36	0.69	0.69
DMH 205	WQS 204	12.59	92.40	92.20	1.59	12.0	0.013	3.57	4.49	0.80	4.58	1.00	1.00
DMH 201	WQS 203	6.49	92.30	92.20	1.54	15.0	0.013	5.54	8.02	0.69	4.73	1.14	0.91
CB 111	WQS 212	25.53	94.30	94.04	1.02	12.0	0.013	1.82	3.60	0.51	3.47	0.64	0.64
CB 102	DMH 200	9.53	94.30	94.20	1.05	12.0	0.013	2.37	3.65	0.65	4.06	0.69	0.70
CB 103	DMH 202	18.30	94.64	94.30	1.86	12.0	0.013	0.81	4.86	0.17	4.16	0.29	0.37
CB 108	DMH 207	24.28	94.30	94.00	1.24	12.0	0.013	1.81	3.96	0.46	4.26	0.53	0.53
CB 107	DMH 207	22.58	94.68	94.00	3.01	12.0	0.013	1.27	6.18	0.21	5.85	0.23	0.37
CB 110	WQS 209	21.74	94.64	94.25	1.79	12.0	0.013	0.72	4.77	0.15	3.68	0.37	0.37
CB 112	WQS 212	27.73	94.64	94.37	0.97	12.0	0.013	0.20	3.52	0.06	2.01	0.22	0.22
CB 100	DMH 200	92.93	94.50	93.30	1.29	12.0	0.013	1.18	4.05	0.29	2.75	0.55	0.62
WQS 212	Out-1Pipe - (205)	7.91	92.20	92.00	2.53	12.0	0.013	2.06	16.02	0.13	4.02	0.62	0.62
CB 125	WQS 205	102.64	95.65	95.15	0.49	12.0	0.013	1.64	2.49	0.66	2.41	0.90	0.90
WQS 205	DMH 239	48.10	95.05	94.55	1.04	15.0	0.013	4.84	6.59	0.74	4.12	1.16	0.93
DMH 239	DMH 242	34.72	94.45	94.25	0.58	15.0	0.013	4.81	4.90	0.98	4.30	1.08	0.86
DMH 242	Out-1Pipe - (217) (2)	164.70	94.00	93.00	0.61	18.0	0.013	4.77	5.79	0.82	3.83	1.00	0.66
CB 126	WQS 205	29.60	95.40	95.15	0.84	15.0	0.013	3.39	5.94	0.57	3.40	1.02	0.82
URS#4	OCS 234	68.92	93.00	93.00	0.00	48.0	0.013	26.98	45.42	0.59	6.42	1.77	0.44
OCS 234	DMH 235	23.01	93.00	92.55	1.96	48.0	0.013	22.33	200.89	0.11	7.84	1.77	0.44
WQS 233	Out-1Pipe - (231)	116.21	94.15	93.50	0.56	12.0	0.013	2.09	2.66	0.78	3.66	0.68	0.69
CB 120	WQS 233	46.38	95.15	94.25	1.94	12.0	0.013	1.54	4.96	0.31	3.65	0.54	0.54
CB 119	WQS 233	13.24	94.73	94.50	1.74	12.0	0.013	0.63	4.70	0.13	3.24	0.36	0.36
DMH 235	DMH 230	74.10	90.57	90.33	0.32	48.0	0.013	52.05	81.75	0.64	6.64	3.87	0.97
WQS 209	Out-1Pipe - (260)	4.98	92.10	92.00	2.01	12.0	0.013	3.67	4.66	0.79	5.24	0.83	0.83
EX. CB 1	WQS 244	15.81	93.36	93.10	1.64	12.0	0.013	1.86	4.57	0.41	4.56	0.51	0.52

Link Summary

From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio
		(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)	
CB 129	DMH 253	72.35	93.72	93.36	0.50	12.0	0.013	1.67	2.52	0.66	3.50	0.68	0.72
WQS-207	Out-1Pipe - (282)	44.27	94.22	94.00	0.50	15.0	0.013	3.44	4.55	0.76	3.82	0.86	0.69
CB-133	WQS-207	75.29	94.70	94.32	0.50	12.0	0.013	1.63	2.53	0.65	2.45	0.80	0.80
CB-134	WQS-207	23.66	94.45	94.32	0.55	12.0	0.013	1.86	2.64	0.71	2.55	0.88	0.88
CB 128	DMH 253	17.19	94.30	94.00	1.75	12.0	0.013	1.60	4.71	0.34	4.52	0.46	0.46
SRS#4	OCS 253	5.90	93.90	93.90	0.00	12.0	0.013	0.09	1.13	0.08	1.42	0.29	0.29
OCS 253	DMH 252	15.25	93.90	93.85	0.33	12.0	0.013	0.11	2.04	0.05	0.98	0.32	0.32
DMH 252	Out-1Pipe - (293)	16.13	93.80	93.68	0.74	15.0	0.013	0.85	5.57	0.15	2.88	0.36	0.29
DMH 251	Out-1Pipe - (304)	61.90	94.30	94.00	0.48	15.0	0.013	4.18	4.50	0.93	4.05	0.98	0.78

Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)
1	CB 100	94.50	98.50
2	CB 101	94.64	98.64
3	CB 102	94.30	98.30
4	CB 103	94.64	98.64
5	CB 104	94.30	98.30
6	CB 105	94.30	98.30
7	CB 106	94.60	98.60
8	CB 107	94.68	98.68
9	CB 108	94.30	98.30
10	CB 109	94.30	98.30
11	CB 110	94.64	98.64
12	CB 111	94.30	98.30
13	CB 112	94.64	98.91
14	CB 119	94.73	98.90
15	CB 120	95.15	99.15
16	CB 125	95.65	98.40
17	CB 126	95.40	98.40
18	CB 128	94.30	98.30
19	CB 129	93.72	98.80
20	CB 130	94.05	96.80
21	CB 131	93.30	97.30
22	CB-121	94.40	97.90
23	CB-122	94.70	97.90
24	CB-123	94.50	97.90
25	CB-124	94.00	97.90
26	CB-127	95.10	98.10
27	CB-132	95.00	98.10
28	CB-133	94.70	97.90
29	CB-134	94.45	97.90
30	DMH 200	93.20	98.44
31	DMH 201	92.30	99.00
32	DMH 202	93.90	98.49
33	DMH 205	92.40	98.95
34	DMH 206	93.50	98.40
35	DMH 207	93.90	98.60
36	DMH 228	89.45	100.65
37	DMH 229	90.20	99.53
38	DMH 230	90.33	98.82
39	DMH 235	90.57	99.53
40	DMH 239	94.45	99.82
41	DMH 242	94.00	100.15
42	DMH 251	94.30	98.13
43	DMH 252	93.80	97.34
44	DMH 253	93.26	98.76
45	DMH 254	92.66	98.24
46	DMH 256	95.62	99.10
47	DMH 257	95.33	99.65
48	DMH 258	93.97	97.54
49	DMH-216	91.85	101.70
50	DMH-217	86.80	98.85
51	DMH259	95.90	100.80
52	DMH260	96.50	99.55
53	EX. CB 1	93.36	97.36
54	EX. CB 2	94.14	98.14
55	1-Jun	89.34	94.00
56	2-Jun	91.50	95.90
57	OCS 208	93.00	98.63
58	OCS 234	93.00	99.90
59	OCS 253	93.90	97.08
60	OCS-211	93.00	99.00
61	RD#1	96.05	98.00
62	SRS#4	93.90	95.00
63	TANK1	95.50	99.90
64	TANK2	93.00	99.90
65	URS#4	93.00	97.46
66	WQI 113	94.70	98.70
67	WQS 203	92.10	99.23
68	WQS 204	92.10	99.07
69	WQS 205	95.05	99.00
70	WQS 209	93.60	98.67

Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)
71	WQS 212	92.20	98.64
72	WQS 233	94.15	99.11
73	WQS 244	92.25	97.55
74	WQS-206	94.15	98.20
75	WQS-207	94.22	98.70
76	WQS-208	93.60	98.60
77	WQS-245	92.20	96.92
78	WQS-246	94.70	98.50

APPENDIX E

Long-Term Pollution Prevention and Stormwater Operation and Maintenance Plan

Nitsch Engineering

Building better communities with you

April 16, 2024
Revised July 30, 2024

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

P&G Andover Manufacturing Center Enhancement Project
30 Burtt Road
Andover, MA 01810

Prepared for:

Fennick McCredie Architecture
70 Franklin Street
Boston, MA

Prepared by:

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

Nitsch Project #15363

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

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SECTION 1 Introduction

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

Responsible Party: Keith Richardson
Andover Site Environmental and Sustainability Leader
30 Burtt Road, Andover, MA 01810
(978)749-5358

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

Standard 4

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

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

Standard 9

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

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

SECTION 2 Long-Term Pollution Prevention Plan

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

Storage of Hazardous Materials

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

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

Storage of Waste Products

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

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

Spill Prevention and Response

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

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

Minimize Soil Erosion

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

Management of Deicing Chemicals and Snow

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

During typical snow plowing operations, snow shall be pushed to the designated snow removal areas. Snow shall not be stockpiled in wetland resource areas or the 100-foot Buffer Zone or catch basins. In severe conditions where snow cannot be stockpiled on site, the snow shall be removed from the site and properly disposed of in accordance with DEP Guideline BRP601-01.

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

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

Coordination with other Permits and Requirements

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

SECTION 3 Stormwater Management System Operation and Maintenance Plan

Introduction

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

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

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

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

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

Stormwater Operation and Maintenance Requirements

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

Deep Sump and Hooded Catch Basins

Inspect or clean catch basins four times per year and at the end of foliage and snow-removal seasons. Other inspection and maintenance requirements include:

1. Remove organic material, sediment and hydrocarbons four times per year or whenever the depth of deposits is greater than or equal to one half the depth from the bottom of the invert of the lowest pipe in the basin.
2. Always clean out catch basins after street sweeping. If any evidence of hydrocarbons is found during inspection, immediately remove the material using absorbent pads or other suitable measures and dispose of legally. Remove other accumulated debris as necessary.
3. If handling runoff from land uses with higher potential pollutant loads or discharging runoff near or to a critical area, more frequent cleaning may be necessary.
4. Transport and disposal of accumulated sediment off-site shall be in accordance with applicable local, state and federal guidelines and regulations.

Area Drains

Inspect area drains at least once per month and remove debris from the grate. Clean out accumulated sediments at least once per year and more frequently as necessary.

Water Quality Units (Proprietary Separators)

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

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

Subsurface Detention/Infiltration Structures

1. Inspect subsurface detention/infiltration structures twice per year. Inspect the inlets and observation ports to determine if there is accumulated sediment within the system. Remove all debris and accumulated sediment that may clog the system.

Rain Guardian Inlets

Maintain Rain Guardian units with the recommendations set forth by the manufacturer. General Inspection and maintenance procedures for the proprietary devices are provided below:

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

Repair of the Stormwater Management System

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

Estimated Operations and Maintenance Budget

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

Table 2. Operations and Maintenance Budget

BMP Type	# of BMPs	Annual O & M Cost (per BMP)	Total Cost
Catch Basin	31	$240-$480	$7,440-$14,880
Subsurface Infiltration System	4	$200-$400	$800-$1,600
Water Quality Units	19	$120-$360	$2,280-$6,840
		Total:	$10,520-$23,320

Reporting

The Owner shall maintain a record of drainage system inspections and maintenance (per this Plan) and submit a yearly report to the Andover Conservation Commission.

STORMWATER MANAGEMENT SYSTEM INSPECTION FORM

P&G Andover Manufacturing Center Enhancement Project
Inspected by:_____
Andover, MA **Date:_____**

Component	Status/Inspection	Action Taken
Deep Sump Catch Basins, Area Drains and Drain Manholes		
CB 131		
CB 120		
CB 119		
CB 101		
CB 100		
CB 102		
CB 103		
CB 104		

CB 105		
CB 107		
CB 108		
EX CB 1		
EX CB 2		
CB 128		
CB 129		
CB 130		
CB 126 Silt Prison		
CB 121 Silt Prison		

CB 134 Silt Prison		
CB 123 Silt Prison		
CB 124 Silt Prison		
CB 122 Silt Prison		
CB 133 Silt Prison		
CB 132 Silt Prison		
CB 111		
CB 112		
CB 110		
CB 109		

DMH 257		
DMH 249		
DMH 258		
DMH 202		
DMH 205		
DMH 206		
DMH 207		
DMH 217		
DMH 200		
DMH 229		

DMH 235		
DMH 260		
DMH 201		
DMH 251		
DMH 252		
DMH 253		
DMH 240		
DMH 228		
DMH 256		
DMH 239		

DMH 242		
DMH 241		
DMH 247		
DMH 248		
DMH 216		
DMH 230		
DMH 251		
AD 253		
WQS 245		
WQS 233		

WQS 244		
WQS 204		
WQS 246		
WQS 205		
WQS 203		
WQS 206		
WQS 208		
WQS 207		
WQS 212		
WQS 209		

Subsurface System #1		
Subsurface System #2		
Subsurface System #3		
Subsurface System #4		
Outlet Control Structures		
Flared End Section #1		
Existing Flared End Section 48” Pipe		
Rain Guardian #1		
Rain Guardian #2		
Rain Guardian #3		

Rain Guardian #4		
General site conditions – evidence of erosion, etc.		

SUBMIT COPIES OF STORMWATER MANAGEMENT SYSTEM INSPECTION FORM TO THE ANDOVER CONSERVATION COMMISSION WITH THE YEARLY REPORT.

APPENDIX F

Draft Stormwater Pollution Prevention Plan (SWPPP)

DRAFT Stormwater Pollution Prevention Plan (SWPPP)

For Construction Activities At:

P&G Andover Manufacturing Center Enhancement Project
30 Burtt Road
Andover, MA 01810
Site Telephone Number: (978) 749-5010

SWPPP Prepared For:

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SWPPP Preparation Date:

04/16/2024

Estimated Project Dates:

Project Start Date: XX/XX/XXXX
Project Completion Date: XX/XX/XXXX

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SECTION 1: CONTACT INFORMATION/RESPONSIBLE PARTIES

1.1 Operator(s) / Subcontractor(s)

Operator(s):

Construction Manager Responsibilities:
Construction Manager shall maintain the Stormwater Pollution Prevention Plan (SWPPP) documentation and will conduct and document self-inspections required under the 2022 Construction General Permit (CGP) once every 7 days and within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge). Construction Manager will provide copies of inspections reports to the Owner's Representative within 24 hours following each inspection. Incidents of non-compliance will be immediately brought to the attention of the Owner's Representative. Construction Manager shall be responsible for maintaining compliance with the SWPPP, including all requirements in the CGP and will maintain erosion and sediment control Best Management Practices (BMPs) in all areas of the site under its day-to-day control.

Construction Manager shall file a Notice of Intent (NOI) to be covered by the CGP and obtain coverage by the Environmental Protection Agency (EPA) before beginning construction at the project. Permit coverage will be maintained throughout the project. Construction Manager shall not file a Notice of Termination (NOT) until all disturbed areas of the site under its day-to-day control have been fully stabilized with permanent erosion controls that satisfy the final stabilization requirements in the CGP or have met another criteria of the NOT. Photo documentation shall be included with the NOT. Construction Manager will maintain a clean site and construction trash and debris will be picked up and disposed of properly by the end of each day.

Each Operator is responsible for advising employees and subcontractors working on this project of the requirements in the CGP and SWPPP. Particular emphasis should be placed on ensuring that employees and subcontractors do not damage BMPs and maintain compliance with the CGP.

Construction Manager Company Name
Construction Manager Contact Person, Position
Street Address
Town, State, Zip Code
T: xxx-xxx-xxxx
Email address:

Owner's Representative Responsibilities:

Fennick McCredie Architecture shall provide general oversight of the project including review of the SWPPP and any amendments, inspection reports, and corrective actions. Fennick McCredie Architecture shall file a NOI to be covered by the CGP and obtain coverage by the EPA before beginning construction at the project. Permit coverage will be maintained throughout the project. Fennick McCredie Architecture shall not file a notice of Termination until all disturbed areas of the site have been fully stabilized with permanent erosion controls that satisfy the final stabilization requirements in the CGP. Photo documentation shall be included with the NOT. Fennick McCredie Architecture will coordinate with the Construction Manager to maintain a clean site so that trash and debris will be picked up and disposed of properly by the end of the day.

Each Operator is responsible for advising employees and subcontractors working on this project of the requirements in the CGP and SWPPP. Particular emphasis should be placed on ensuring that employees and subcontractors do not damage BMPs and maintain compliance with the CGP.

Fennick McCredie Architecture
Jonathan McCredie, Principal
70 Franklin Street
Boston, MA 02110
T: 617-350-7900
Email Address: info@FMarchitecture.com

Site Contractor(s):

Company Name
Contact person, Position
Street Address
Town, State, Zip Code
T: xxx-xxx-xxxx
Email Address:

Emergency 24-Hour Contact:

Company
Emergency Contact person, Position
T: xxx-xxx-xxxx

1.2 Stormwater Team

Construction Manager: Company

Stormwater Role/Responsibility: Responsible for overseeing the development of the SWPPP, modifications and updates to the SWPPP, and for compliance with the requirements in the CGP (e.g., installing and maintaining stormwater controls, conducting site inspections, picking up trash, application and storage of treatment chemicals (if applicable), taking corrective actions where required, etc.). Responsible for having ready access to an electronic or paper copy of the 2022 CGP and the SWPPP.

Contact:
Construction Manager Contact Person, Position
T: xxx-xxx-xxxx
Email address

I, Construction Manager Contact Person, have read the CGP and Understand the Applicable Requirements and have completed Training Required by CGP Part 6.2.
☐ Yes
Date: _____

Site Contractor: Company

Stormwater Role/Responsibility: Responsible for compliance with the requirements in this permit (e.g., installing and maintaining stormwater controls, conducting site inspections, repairing controls and taking corrective actions where required, etc.). Responsible for having ready access to an electronic or paper copy of the 2022 CGP and the SWPPP.

Contact:
Contact Person, Position
T: xxx-xxx-xxxx
Email Address

I, Site Contractor Contact Person, have read the CGP and Understand the Applicable Requirements and have completed Training Required by CGP Part 6.2.
☒ Yes
Date: _____

Refer to the Subcontractor Certifications/Agreements in Attachment G.
Refer to SWPPP Training Documentation in Attachment I.

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SECTION 2: SITE EVALUATION, ASSESSMENT, AND PLANNING

2.1 Project/Site Information

Project Name and Address

Project/Site Name: Principio
Project Street/Location: 30 Burtt Road
City/Town: Andover
State: Massachusetts
ZIP Code: 01810
County or Similar Subdivision: Essex

Project Latitude/Longitude

(Use **one** of three possible formats, and specify method)

Latitude:	Longitude:
1. 42.6082º (degrees, decimals)	1. -71.1698º (degrees, decimals)

Method for determining latitude/longitude:
☐ USGS topographic map (specify scale: _____) ☐ GPS
☒ Other (please specify): Google Maps

Horizontal Reference Datum:
☐ NAD 27 ☒ NAD 83 ☐ WGS 84

If you used a U.S.G.S topographic map, what was the scale? _____

Additional Project Information

Is the project/site located on Indian country lands, or located on a property of religious or cultural significance to an Indian tribe? ☐ Yes ☒ No

Are you applying for permit coverage as a "federal operator" as defined in Appendix A of the CGP?
☐ Yes ☒ No

Will there be demolition of any structure built or renovated before January 1, 1980?
☐ Yes ☒ No

If yes, do any of the structures being demolished have at least 10,000 square feet of floor space?
☐ Yes ☐ No

Was pre-development land use used for agriculture (see Appendix A of the CGP for definition of "agricultural land")?
☐ Yes ☒ No

Type of Construction Site (check all that apply): ☐ Single-Family Residential
☐ Multi-Family Residential ☐ Commercial ☒ Industrial ☐ Institutional ☐ Highway or Road
☐ Utility ☐ Other _____

2.2 Discharge Information

Does your project/site discharge stormwater into a Municipal Separate Storm Sewer System (MS4)?
☒ Yes ☐ No

Are there any surface waters that are located within 50 feet of your construction disturbances?
☒ Yes ☐ No

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Table 1 – Names of Receiving Waters

Name(s) of the first surface water that receives stormwater directly from your site and/or from the MS4 (note: multiple rows provided where your site has more than one point of discharge that flows to different surface waters)
001. Shawsheen River
002. Unidentified Tributary
003.

Table 2 – Impaired Waters / TMDLs (Answer the following for each surface water listed in Table 1 above)

	Is this surface water listed as "impaired" on the CWA303(d) list?	If you answered yes, then answer the following:			
		What pollutant(s) are causing the impairment?	Has a TMDL been completed?	Title and ID of the TMDL document	Pollutant(s) for which there is a TMDL
001.	☒ YES ☐ NO	**Curly-Leaf Pondweed Dissolved Oxygen Escherichia Coli (E. Coli) Fecal Coliform**	☐ YES ☒ NO	**Draft Storm Water Pollutant Total Maximum Daily Load for Headwaters of the Shawsheen River**	**Fecal Coliform and Pathogens**
002.	☒ YES ☐ NO	**Escherichia Coli (E. Coli)**	☒ YES ☐ NO	**Draft Storm Water Pollutant Total Maximum Daily Load for Headwaters of the Shawsheen River**	**Fecal Coliform and Pathogens**
003.	☐ YES ☐ NO		☐ YES ☐ NO		

Table 3 – Tier 2, 2.5, or 3 Waters (Answer the following for each surface water listed in Table 1 above)

	Is this surface water designated as a Tier 2, Tier 2.5, or Tier 3 water?	If you answered yes, specify which Tier (2, 2.5, or 3) the surface water is designated as?
001.	☐ YES ☒ NO	
002.	☐ YES ☒ NO	
003.	☐ YES ☐ NO	

2.3 Nature of the Construction Activities

General Description of Project

Provide a general description of the construction project:

The Project is renovation of the current P&G manufacturing facility. Improvements include additional parking facilities and an updated stormwater management system

Size of Construction Project

Size of Property: xx acres

Total Area of Construction Disturbances: xx acres

Maximum Area to be Disturbed at Any One Time: xx acres

Type of Construction Site (check all that apply):

☐ Single-Family Residential ☐ Multi-Family Residential ☐ Commercial ☒ Industrial
☐ Institutional ☐ Highway or Road ☐ Utility ☐ Other

Will you be discharging dewatering water from your site? ☐ Yes ☐ No

If yes, will you be discharging dewatering water from a current or former Federal or State remediation site? ☐ Yes ☐ No

Construction Support Activities

Include a description of the construction support activities or reference Site Maps in Attachment A that include this information. – To be provided by Site Contractor

Contact Information for Construction Support Activity:
Name: XXX
Telephone: XXX-XXX-XXXX
Email: XXXX
Address and/or Latitude and Longitude:

Business Hours

Day-Day Xa.m-Xp.m.

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2.4 Sequence and Estimated Dates of Construction Activities

Phase I: Demolition
This phase consists of the demolition of site features and utilities as shown on the Site Preparation Plan provided in Attachment A.

- Schedule:
- Area Disturbed During Phase:
- This phase will include the installation of all stormwater control measures as shown on the Site Preparation Plan provided in Attachment A. Stormwater controls will be removed at the end of Phase III upon stabilization of the site.

Phase II: Exterior Utilities
This phase consists of the installation of all exterior utilities on the site.

- Schedule:
- Area Disturbed During Phase:
- All stormwater controls will be installed prior to earth disturbance as described in Phase I. Stormwater controls will be removed at the end of Phase III upon stabilization of the site.

Phase III: Landscaping and Paving
This phase consists of the landscaping and paving of the site.

- Schedule:
- Area Disturbed During Phase:
- Stormwater controls will be installed as described in Phase I. Stormwater controls will remain in place until site work is complete and the site is stabilized.

2.5 Authorized Non-Stormwater Discharges

List of Allowable Non-Stormwater Discharges Present at the Site

Type of Allowable Non-Stormwater Discharge	Likely to be Present at Your Site?
Discharges from emergency fire-fighting activities	☒ YES ☐ NO
Fire hydrant flushings	☒ YES ☐ NO
Landscape irrigation	☒ YES ☐ NO
Waters used to wash vehicles and equipment, provided that there is no discharge of soaps, solvents, or detergents used for such purposes	☐ YES ☒ NO
Water used to control dust	☐ YES ☒ NO
Potable water including uncontaminated water line flushings	☒ YES ☐ NO
External building washdown, provided soaps, solvents, and detergents are not used, and external surfaces do not contain hazardous substances (as defined in Appendix A of the CGP) (e.g., paint or caulk containing polychlorinated biphenyls (PCBs))	☐ YES ☒ NO
Pavement wash waters, provided spills or leaks of toxic or hazardous substances have not occurred (unless all spill material has been removed) and where soaps, solvents, and detergents are not used.	☐ YES ☒ NO
Uncontaminated air conditioning or compressor condensate	☐ YES ☒ NO
Uncontaminated, non-turbid discharges of ground water or spring water	☒ YES ☐ NO
Foundation or footing drains where flows are not contaminated with process materials such as solvents or contaminated groundwater	☒ YES ☐ NO
Uncontaminated construction dewatering water discharged in accordance with Part 2.4 of the CGP	☒ YES ☐ NO

Note: You are prohibited from directing pavement wash waters directly into any water of the U.S., storm drain inlet, or stormwater conveyance, unless the conveyance is connected to a sediment basin, sediment trap, or similarly effective control.

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2.6 Site Maps

Site Maps must include the following:

a) Boundaries of the property. The map(s) in the SWPPP must show the overall boundary of the property.
b) Locations where construction activities will occur. The map(s) in the SWPPP must show the locations where construction activities will occur, including
    i. Locations where earth-disturbing activities will occur (note any phasing), including any demolition activities;
    ii. Approximate slopes before and after major grading activities (note any steep slopes);
    iii. Locations where sediment, soil, or other construction materials will be stockpiled;
    iv. Any water of the U.S. crossings;
    v. Designated points where vehicles will exit onto paved roads;
    vi. Locations of structures and other impervious surfaces upon completion of construction; and
    vii. Locations of onsite and off-site construction support activity areas covered by the permit (see Part 1.2.1.c).
c) Locations of any receiving waters, including wetlands within and one mile downstream of the site's discharge point(s). Also identify if any are listed as impaired, or are identified as a Tier 2, Tier 2.5, or Tier 3 water.
d) Areas of federally-listed critical habitats for endangered or threatened species within the site and/or at discharge locations.
e) Type and extent of pre-construction cover on the site (e.g., vegetative cover, forest, pasture, pavement, structures).
f) Drainage patterns of stormwater and authorized non-stormwater before and after major grading activities.
g) Stormwater and authorized non-stormwater discharge locations. The permit requires the site map to show information pertaining to discharge locations including:
    i. Locations where stormwater and/or authorized non-stormwater will be discharged to storm drain inlets, including a notation of whether the inlet conveys stormwater to a sediment basin, sediment trap, or similarly effective control; and
    ii. Locations where stormwater or allowable non-stormwater will be discharged directly to receiving waters, including wetlands (i.e., not via a storm drain inlet).
    iii. Locations where turbidity benchmark monitoring will take place to comply with Part 3.3, if applicable to your site.
h) Locations of all potential pollutant-generating activities identified in Part 7.2.3.g. The permit requires identification in the site map of all potential pollutant-generating activities identified in Part 7.2.3.g.
i) Designated areas where construction wastes that are covered by the exception in Part 2.3.3e.ii (i.e., they are not pollutant-generating) will be stored.
j) Locations of stormwater controls, including natural buffer areas and any shared controls utilized to comply with this permit. The permit requires identification on the site map of the location of stormwater control measures.
k) Locations where polymers, flocculants, or other treatment chemicals will be used and stored. The permit requires identification on the site map of the locations where polymers, flocculants, or other treatment chemicals will be used and stored.

SECTION 3: DOCUMENTATION OF COMPLIANCE WITH OTHER FEDERAL REQUIREMENTS

3.1 Endangered Species Protection

The following section identifies which criterion the project is eligible for coverage under the 2022 CGP using information from both the National Marine Fisheries Services (NMFS) and U.S. Fish and Wildlife Service (USFWS) to identify Endangered Species Act-listed (ESA-listed) species and designated critical habitat.

Eligibility Criterion

Under which criterion listed in Appendix D of the CGP are you eligible for coverage under this permit?

☐ **A** ☐ **B** ☒ **C** ☐ **D** ☐ **E** ☐ F

☒ Check to confirm you have provided documentation in your SWPPP as required by CGP Appendix D.

For reference purposes, the eligibility criteria listed in Appendix D of the CGP are as follows:

Criterion A. No ESA-listed species and/or designated critical habitat present in action area. Using the process outlined in Appendix D of the CGP, you certify that ESA-listed species and designated critical habitat(s) under the jurisdiction of the USFWS or NMFS are not likely to occur in your site's "action area" as defined in Appendix A of the CGP. Note: NMFS' jurisdiction includes ESA-listed marine and estuarine species that spawn in inland rivers.

Criterion B. Eligibility requirements met by another operator under the 2022 CGP. The construction site's discharges and discharge-related activities were already addressed in another operator's valid certification of eligibility for your action area under eligibility Criterion A, C, D, E, or F of the 2022 CGP and you have confirmed that no additional ESA-listed species and/or under the jurisdiction of USFWS and/or NMFS not considered in the prior certification may be present or located in the "action area". To certify your eligibility under this Criterion, there must be no lapse of NPDES permit coverage in the other operator's certification. By certifying eligibility under this Criterion, you agree to comply with any conditions upon which the other upon which the other CGP operator's certification was based. You must include in your NOI the NPDES ID from the other operator's notification of authorization under this permit and list any measures that you must comply with. If your certification is based on another 2022 CGP operator's certification under Criterion C, you must provide EPA with the relevant supporting information required of existing dischargers in Criterion C in your NOI form.

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Criterion C. Discharges not likely to result in any short- or long-term adverse effects to ESA-listed species and/or designated critical habitat. ESA-listed species and/or designated critical habitat(s) under the jurisdiction of the USFWS and/or NMFS are likely to occur in or near your site's "action area," and you certify to EPA that your site's discharges and discharge-related activities are not likely to result in any short- or long-term adverse effects to ESA-listed threatened or endangered species and/or designated critical habitat. This certification may include consideration of any stormwater controls and/or management practices you will adopt to ensure that your discharges and discharge-related activities are not likely to result in any short- or long-term adverse effects to ESA-listed species and/or designated critical habitat. To certify your eligibility under this criterion, indicate in your NOI: 1) the ESA-listed species and/or designated habitat located in your "action area" using the process outlined in Appendix D of this permit; 2) the distance between the site and the listed species and/or designated critical habitat in the action area (in miles); and 3) a rationale describing specifically how short- or long-term adverse effects to ESA-listed species will be avoided from the discharges and discharge-related activities. Note: You must also include a copy of your site map from your SWPPP showing the upland and in-water extent of your "action area" with your NOI.)

Criterion D. Coordination with USFWS and/or NMFS has successfully concluded. Coordination between you and the USFWS and/or NMFS has concluded. The coordination must have addressed the effects of your site's discharges and discharge-related activities on ESA-listed species and/or designated critical habitat under the jurisdiction of USFWS and/or NMFS, and resulted in a written confirmation from USFWS and/or NMFS that the effects of your site's discharges and discharge-related activities are not likely to result in any short- or long-term adverse effects By certifying eligibility under this criterion, you agree to comply with any conditions you must meet for your site's discharges and discharge-related activities to not likely result in any short- or long-term adverse effects. You must include copies of the correspondence between yourself and the Services in your SWPPP and your NOI.

Criterion E. ESA Section 7 consultation has successfully concluded. Consultation between a Federal Agency and the USFWS and/or NMFS under section 7 of the ESA has been concluded. Consultation can be either formal or informal, and would have occurred only as a result of a separate Federal action (e.g. during application for an individual wastewater discharge permit or the issuance of a wetlands dredge and fill permit), and the consultation must have addressed the effects of the construction site activity's discharges and discharge-related activities on all ESA-listed threatened or endangered species and all designated critical habitat under the jurisdiction of each Service, as appropriate, in your action area. The result of this consultation must be either:

i. a biological opinion currently in effect that determined that the action in question (taking into account the effects of your site's discharges and discharge-related activities) is likely to adversely affect, but is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat; The biological opinion must have included the effects of your facility's discharges and discharge-related activities on all the listed species and designated critical habitat in your action area under the jurisdiction of each Service, as appropriate. To be eligible under (i), any reasonable and prudent measures specified in the incidental take statement must be implemented;

ii. written concurrence (e.g. letter of concurrence) from the applicable Service(s) with a determination that your site's discharges and discharge-related activities are not likely to adversely affect USFWS and/or NMFS as part of this worksheet. ESA-listed species and/or designated critical habitat. The concurrence letter must have included the effects of your facility's discharges and discharge-related activities on all the ESA-listed species and/or designated critical habitat on your species list(s) acquired

The consultation does not warrant reinitiation under 50 CFR §402.16; or, if reinitiation of consultation is required (e.g., due to a new species listing, critical habitat designation, or new information), the Federal action agency has reinitiated the consultation and the result of the consultation is consistent with the statements above. (Note: you must include any reinitiation documentation from the Services or consulting Federal agency with your NOI.)

You must include copies of the correspondence between yourself and the Services in your SWPPP and your NOI.

Criterion F. Issuance of section 10 permit. Your construction activities are authorized through the issuance of a permit under section 10 of the ESA, and this authorization addresses the effects of the site's discharges and discharge-related activities on federally-listed species and federally-designated critical habitat. You must include copies of the correspondence between yourself and the Services in your SWPPP and your NOI.

3.2 Historic Properties Screening Process

Appendix E (of the CGP), Step 1

Do you plan on installing any of the following stormwater controls at your site? Check all that apply below, and proceed to Appendix E, Step 2.

- ☐ Dike
- ☐ Berm
- ☒ Catch Basin
- ☐ Pond
- ☐ Stormwater Conveyance Channel (e.g., ditch, trench, perimeter drain, swale, etc.)
- ☐ Culvert
- ☒ Other type of ground-disturbing stormwater control: Water Quality Structures, Outlet Control Structure, Subsurface Infiltration System, Drain Manhole

If you will not be installing any ground-disturbing stormwater controls, no further documentation is required for Section 3.2 of the Template.

Appendix E, Step 2

If you answered yes in Step 1, have prior cultural resource surveys or other evaluations determined that historic properties do not exist, or that prior disturbances at the site have precluded the existence of historic properties? ☒ YES ☐ NO

If yes, provide documentation of the basis for your determination. If no, proceed to Appendix E, Step 3.

3.3 Safe Drinking Water Act Underground Injection Control Requirements

Do you plan to install any of the following controls? Check all that apply below.

- ☐ Infiltration trenches (if stormwater is directed to any bored, drilled, driven shaft or dug hole that is deeper than its widest surface dimension, or has a subsurface fluid distribution system);
- ☒ Commercially manufactured pre-cast or pre-built proprietary subsurface detention vaults, chambers, or other devices designed to capture and infiltrate stormwater flow; and
- ☐ Drywells, seepage pits, or improved sinkholes (if stormwater is directed to any bored, drilled, driven shaft or dug hole that is deeper than its widest surface dimension, or has a subsurface fluid distribution system)

If one or more of the above apply, then, INSERT COPIES OF LETTERS, EMAILS, OR OTHER COMMUNICATION BETWEEN YOU AND THE STATE AGENCY OR EPA REGIONAL OFFICE

SECTION 4: EROSION AND SEDIMENT CONTROLS REQUIREMENTS

Section 4 of this document describes the stormwater controls that will be implemented throughout construction. The operator must install and maintain all stormwater controls in compliance with Parts 2.2 and 2.3 of the CGP. The operator must install stormwater controls by the time construction activity in any givern portion of the site begins.

The stormwater controls shall be designed and installed in accordance with good engineering practices and applicable design specifications. Specifications titled "312500- Erosion and Sedimentation Controls," dated ******* and prepared by Nitsch Engineering and details titled "Erosion and Sedimentation Control Details," dated ******* and prepared by Nitsch Engineering have been provided to the contractor under separate cover.

4.1 Natural Buffers or Equivalent Sediment Controls

Buffer Compliance Alternatives

Are there any surface waters within 50 feet of your project's earth disturbances? ☒ YES ☒ NO

(Note: If no, no further documentation is required for Part 4.1 in the SWPPP Template. Continue to Part 4.2.)

Check the compliance alternative that you have chosen:

☒ I will provide and maintain a 50-foot undisturbed natural buffer.

(Note [1]: You must show the 50-foot boundary line of the natural buffer on your site map.)

(Note [2]: You must show on your site map how all discharges from your construction disturbances through the natural buffer area will first be treated by the site's erosion and sediment controls. Also, show on the site map any velocity dissipation devices used to prevent erosion within the natural buffer area.)

☐ I will provide and maintain an undisturbed natural buffer that is less than 50 feet and is supplemented by additional erosion and sediment controls, which in combination achieves the sediment load reduction equivalent to a 50-foot undisturbed natural buffer.

(Note [1]: You must show the boundary line of the natural buffer on your site map.)

(Note [2]: You must show on your site map how all discharges from your construction disturbances through the natural buffer area will first be treated by the site's erosion and sediment controls. Also, show on the site map any velocity dissipation devices used to prevent erosion within the natural buffer area.)

☐ It is infeasible to provide and maintain an undisturbed natural buffer of any size, therefore I will implement erosion and sediment controls that achieve the sediment load reduction equivalent to a 50-foot undisturbed natural buffer.

☐ I qualify for one of the exceptions in Appendix G Section G.2.2 of the CGP. (If you have checked this box, provide information on the applicable buffer exception that applies, below.)

4.2 Perimeter Controls

General

The site will be enclosed by a temporary construction fence as shown on the Erosion and Sedimentation Control Plan in Attachment A. Construction gates will be located at the entrance to the site as shown on the Erosion and

Sedimentation Control Plan and all entrances will have stabilized construction entrances. All gates and entrances to the site will be secured during non-working hours. The areas of the site that will receive pollutant discharges will be surrounded by a Specific Perimeter Control listed below as shown on the Erosion and Sedimentation Control Plan in Attachment A. Sediment tracked offsite must be removed by the end of the same workday.

Specific Perimeter Controls

Perimeter Control # 1

- BMP Description: Silt Fence.
- Installation Schedule: Prior to the Start of Construction.
- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge.)
- Maintenance: Ensure that all stormwater controls remain in effective condition as described in part 2.1.4 of the CGP. Remove any sediment before it has accumulated to one-half of the above-ground height of any perimeter control.
- Responsible Staff: Construction Manager and Site Contractor(s).

Perimeter Control # 2

- BMP Description: Silt Fence with Wattles.
- Installation Schedule: Prior to the Start of Construction.
- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge.)
- Maintenance: Ensure that all stormwater controls remain in effective condition as described in part 2.1.4 of the CGP. Remove any sediment before it has accumulated to one-half of the above-ground height of any perimeter control.
- Responsible Staff: Construction Manager and Site Contractor(s).

Perimeter Control # 3

- BMP Description: Super Silt Fence.
- Installation Schedule: Prior to the Start of Construction.
- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge.)
- Maintenance: Ensure that all stormwater controls remain in effective condition as described in part 2.1.4 of the CGP. Remove any sediment before it has accumulated to one-half of the above-ground height of any perimeter control.
- Responsible Staff: Construction Manager and Site Contractor(s).

Perimeter Control # 4

- BMP Description: Wattles.
- Installation Schedule: Prior to the Start of Construction.
- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge.)
- Maintenance: Ensure that all stormwater controls remain in effective

condition as described in part 2.1.4 of the CGP.
Remove any sediment before it has accumulated to one-half of the above-ground height of any perimeter control.

- Responsible Staff: Construction Manager and Site Contractor(s).

Perimeter Control # 5

- BMP Description: Silt Fence with Straw Bales.
- Installation Schedule: Prior to the Start of Construction and/or immediately after stockpile is established.
- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge.)
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
  Remove any sediment before it has accumulated to one-half of the above-ground height of any perimeter control.
- Responsible Staff: Construction Manager and Site Contractor(s).

4.3 Sediment Track-Out

General

Gates will be located as shown on the Erosion and Sedimentation Control Plan in Attachment A to allow for construction vehicle access. Construction access points will have a stabilized construction entrance station or wheel wash station to minimize the track-out of sediment onto off-site streets, other paved areas, and sidewalks from vehicles exiting the construction site. Where sediment has been tracked out from your site onto paved roads, sidewalks, or other paved areas outside of your site, remove the deposited sediment by the end of the same business day in which the track-out occurs or by the end of the next business day if track-out occurs on a non-business day. Remove the track-out by sweeping, shoveling, or vacuuming these surfaces, or by using other similarly effective means of sediment removal. You are prohibited from hosing or sweeping tracked out sediment into any stormwater conveyance, storm drain inlet, or water of the U.S.

Specific Track-Out Controls

Track-Out Control # 1

- BMP Description: Street Sweeping.
- Installation Schedule: Start of construction.
- Inspection Schedule: The areas adjacent to the site should be inspected daily to determine if street sweeping is required.
- Responsible Staff Construction Manager and Site Contractor(s).

Track-Out Control # 2

- BMP Description: Stabilized Construction Entrance.
- Installation Schedule: Start of construction.
- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge.)
- Maintenance: Ensure that all stormwater controls remain in effective condition as described in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

Track-Out Control # 3

- BMP Description: Wheel Wash Station.
- Installation Schedule: Start of construction.
- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge.)
- Maintenance: Ensure that all stormwater controls remain in effective. condition as described in part 2.1.4 of the CGP(s). The operator must provide an effective means of minimizing the discharge of pollutants from equipment and vehicle washing, wheel wash water, and other types of wash waters. The operator must ensure there is no discharge of soaps, solvents, or detergents in equipment and vehicle wash water. For storage of soaps, detergents, or solvents, the operator shall provide either a cover to minimze the exposure of these detergents to precipitation and to stormwater, or a similarily effective means designed to minimze discharge of pollutants from these areas.
- Responsible Staff: Construction Manager and Site Contractor.

4.4 Stockpiled Sediment or Soil

General

All soil stockpiles will be located outside of any natural buffers and away from existing and proposed catch basins and area drains and outside of proposed infiltration system footprints. A sediment barrier shall be installed along all downgradient perimeter areas. Examples of sediment barriers include silt fence, super silt fence, or wattles.

You are prohibited from hosing down or sweeping soil or sediment accumulated on pavement or other impervious surfaces into any stormwater conveyance, storm drain inlet, or water of the U.S.

For stockpiles that will be unused for 14 or more days, a cover such as a tarp or blown straw shall be provided or temporary stabilization should be provided (consistent with Part 2.2.14 of the CGP). Exposure while adding or removing materials from a pile shall be minimized.

Specific Stockpile Controls

Stockpile Control # 1

- BMP Description: Silt Fence.
- Installation Schedule: Immediately after stockpile is established.
- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge.)
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP. Remove any sediment before it has accumulated to one-half of the above-ground height of any perimeter control.
- Responsible Staff: Construction Manager and Site Contractor(s).

Stockpile Control # 2

- BMP Description: Wattles.
- Installation Schedule: Immediately after stockpile is established.
- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25

inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge.)

- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
  Remove any sediment before it has accumulated to one-half of the above-ground height of any perimeter control.
- Responsible Staff: Construction Manager and Site Contractor(s).

Stockpile Control # 3

- BMP Description: Tarp.
- Installation Schedule: When stockpile will remain inactive for 14 or more calendar days.
- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge.)
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
  Remove any sediment before it has accumulated to one-half of the above-ground height of any perimeter control.
- Responsible Staff: Construction Manager and Site Contractor(s).

Stockpile Control # 4

- BMP Description: Straw Bales.
- Installation Schedule: Immediately after stockpile is established.
- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge.)
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
  Remove any sediment before it has accumulated to one-half of the above-ground height of any perimeter control.
- Responsible Staff: Construction Manager and Site Contractor(s).

Stockpile Control # 5

- BMP Description: Blown Straw.
- Installation Schedule: When stockpile will remain inactive for 14 or more calendar days.
- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge.)
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
  Remove any sediment before it has accumulated to one-half of the above-ground height of any perimeter control.
- Responsible Staff: Construction Manager and Site Contractor(s).

Stockpile Control # 6

- BMP Description: Hydroseeding.
- Installation Schedule: When stockpile will remain inactive for 14 or more calendar days.
- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25

inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge.)

- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
  Remove any sediment before it has accumulated to one-half of the above-ground height of any perimeter control.
- Responsible Staff: Construction Manager and Site Contractor(s).

4.5 Minimize Dust

General
Disturbed land will be temporarily stabilized as required by the CGP. Dust will be minimized using measures including sprinkling/irrigation, vegetative cover, mulch, and/or stone. Stockpiles will be handled in accordance with section 4.4 of the SWPPP.

Earth-disturbing activities are considered temporarily ceased when work will not resume for a period of 14 or more calendar days. Stabilization shall be initiated when earth-disturbing activities are temporarily or permanently ceased. Stabilization activities shall be complete within 7 calendar days after the initiation of soil stabilization measures.

Specific Dust Controls

Dust Control # 1

- BMP Description: Sprinkling/Irrigation.
- Installation Schedule: As needed throughout earthwork activities as determined by the site contractor and construction manager.
- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge.)
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

Dust Control # 2

- BMP Description: Straw or Mulch.
- Installation Schedule: As needed throughout earthwork activities as determined by the site contractor and construction manager. When disturbed land will remain inactive for 14 or more calendar days.
- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge.)
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

4.6 Minimize the Disturbance of Steep Slopes

General

Steep slopes are defined as slopes of 15% or greater in grade. No steep slopes are proposed as part of this project. The EPA notes that the requirement to minimize disturbances to steep slopes does not apply to the creation of stockpiles.

4.7 Preserve Native Topsoil

Onsite native topsoil shall be preserved, unless infeasible. Preserving native topsoil is not required where the intended function of a specific area of the site dictates that the topsoil be disturbed or removed.

Stockpiling topsoil at off-site locations or transferring topsoil to other locations is an example of a way to preserve native topsoil.

The contractor shall perform construction sequencing such that earth materials are exposed for a minimum of time before they are covered, seeded, or otherwise stabilized.

4.8 Minimize Soil Compaction

General

In areas where infiltration practices will be installed or areas of the site where final vegetative stabilization will occur, soil compaction shall be minimized. This includes restricting vehicle access and equipment use.

Areas used for post-construction infiltration shall be constructed after all ground surfaces are fully stabilized when feasible. If proposed infiltration areas are constructed prior to the site being fully stabilized, additional erosion controls shall be installed. All stockpiled and material storage areas shall be located outside of the areas proposed for post-construction infiltration.

Areas of post-construction landscaping shall be constructed after all ground surface are fully stabilized. If proposed landscaped areas are constructed prior to the site being fully stabilized, additional erosion controls shall be installed. All soil stockpiles and material storage areas shall be located outside of the areas proposed for post-construction landscaping where feasible. Where this is not feasible, use techniques that rehabilitate and condition the soils as necessary to support vegetative growth prior to planting.

4.9 Storm Drain Inlets

General
All existing and proposed storm drain inlets affected by construction activities should be protected using an Inlet Sediment Filter as shown on the Erosion and Sedimentation Control Plan provided in Attachment A.

Clean or remove and replace the protection measures as sediment accumulates, the filter becomes clogged, and/or performance is compromised. Where there is evidence of sediment accumulation adjacent to the inlet protection measure, remove the deposited sediment by the end of the same business day in which it is found or by the end of the following business day if removal by the same business day is not feasible.

Specific Storm Drain Inlet Controls

Storm Drain Inlet Control # 1

- BMP Description: Inlet Sediment Filter.
- Installation Schedule: Prior to the Start of Construction.

- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge.)
- Maintenance: Ensure that all stormwater controls remain in effective. condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

Storm Drain Inlet Control # 2

- BMP Description: Inlet Protection with Gravel.
- Installation Schedule: Prior to the Start of Construction .
- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge.)
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

Storm Drain Inlet Control # 3

- BMP Description: Inlet Protection with Block and Gravel.
- Installation Schedule: Prior to the Start of Construction.
- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge.)
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

4.10 Minimize Erosion of Stormwater Conveyances

There are no proposed stormwater conveyance channels associated with this project.

4.11 Sediment Basins

There are no proposed sediment basins associated with this project.

4.12 Chemical Treatment

There are no proposed chemical treatments associated with this project.

4.13 Dewatering Practices

Dewatering will occur in a way that minimizes the discharge of pollutants in ground water or accumulated stormwater that is removed from excavations, trenches, foundations, vaults, or other similar points of accumulation.

Dewatering water shall be treated in compliance with Section 2.4 of the CGP and water with visible floating solids or foam may not be discharged.

At a minimum, for backwash water shall be hauled away for disposal or returned to the beginning of the treatment process, and filter media used in dewatering devices shall be replaced and cleaned when the pressure differential equals or exceeds the manufacturer's specifications.
Any applicable permits shall be obtained from local permitting authorities.

Dewatering Control # 1

- BMP Description: Sediment basin or Sediment Trap.
- Installation Schedule: Start of construction of stormwater conveyance channel.
- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge.)
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

Dewatering Control # 2

- BMP Description: Sediment socks.
- Installation Schedule: Start of construction of stormwater conveyance channel.
- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge.)
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

Dewatering Control # 3

- BMP Description: Dewatering Tanks.
- Installation Schedule: Start of construction of stormwater conveyance channel.
- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge) and as required by the manufacturer.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

Dewatering Control # 4

- BMP Description: Filtration Systems.
- Installation Schedule: Start of construction of stormwater conveyance channel.
- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge and as required by the manufacturer.
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP.
- Responsible Staff: Construction Manager and Site Contractor(s).

4.14 Other Stormwater Controls

Any changes in construction activity that that include means of stormwater control not included in this document will be identified, the SWPPP will be amended, and the appropriate erosion and sedimentation controls will be implemented.

4.15 Site Stabilization

Initiate the installation of stabilization measures immediately in any areas of exposed soil where construction activities have permanently ceased or will be temporarily inactive for 14 or more calendar days. Complete the installation of stabilization measures as soon as practicable, but no later than 7 calendar days after stabilization has been initiated.

Site Stabilization Practice #1
☐ *Vegetative* ☒ *Non-Vegetative*
☒ *Temporary* ☐ *Permanent*

- BMP Description: Soil Stabilization Mat.
- Installation Schedule: As/if required.
- Maintenance and Inspection: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25” of snow within a 24-hour period sufficient to cause a discharge.)
- Responsible Staff: Construction Manager and Site Contractor(s).

Site Stabilization Practice #2
☒ *Vegetative* ☐ *Non-Vegetative*
☒ *Temporary* ☐ *Permanent*

- BMP Description: Temporary Seeding.
- Installation Schedule: As/if required.
- Maintenance and Inspection: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25” of snow within a 24-hour period sufficient to cause a discharge.)
- Responsible Staff: Construction Manager and Site Contractor(s).

SECTION 5: POLLUTION PREVENTION STANDARDS

5.1 Potential Sources of Pollution

Potential sources of sediment to stormwater runoff:

- Stockpiles and construction staging
- Clearing and grubbing operations
- Grading and site excavation
- Topsoil stripping
- Landscape operations
- Soil tracking offsite from construction vehicles
- Runoff from unstabilized areas
- Construction debris

Potential pollutants and sources, other than sediment, to stormwater runoff:

- Combined Staging Area – fueling activities, equipment maintenance, sanitary facilities, and hazardous waste storage
- Materials Storage Area – building materials, solvents, adhesives, paving materials, paints, aggregates, trash, etc.
- Construction Activity-paving, curb installation, concrete pouring, and building construction

Staging areas are shown on the Erosion and Sedimentation Control Plan provided in Attachment A.

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Construction Site Pollutants

Pollutant-Generating Activity	**Pollutants or Pollutant Constituents** (that could be discharged if exposed to stormwater)	**Location on Site** (or reference SWPPP site map where this is shown)
Pesticides (insecticides, fungicides, herbicides, rodenticides)	Chlorinated hydrocarbons, organophosphates, carbonates, arsenic	Herbicides used for noxious weed control
Fertilizers	Nitrogen, phosphorous	Newly seeded areas
Plaster	Calcium sulphate, calcium carbonate, sulfuric acid	Building construction
Cleaning Solvents	Perchloroethylene, methylene chloride, trichloroethylene, petroleum distillates	No equipment cleaning allowed in project limits
Asphalt	Oil, petroleum distillates	Streets and parking lots
Concrete	Limestone, sand pH, chromium	Curb and gutter, sidewalk, building construction
Glue, Adhesives	Polymers, epoxies	Building construction
Paints	Metal oxides, Stoddard solvent, talc, calcium carbonate, arsenic	Building construction
Curing compounds	Naphtha	Curb and gutter, building construction
Wood preservatives	Stoddard solvent, petroleum distillates, arsenic, copper, chromium	Timber pads, bracing, building construction
Hydraulic Oils/fluids	Mineral oil	Leaks/broken hoses from equipment
Gasoline	Benzene, ethyl benzene, toluene, xylene, MTBE	Secondary containment/staging area
Diesel Fuel	Petroleum distillate, oil & grease, naphthalene, xylenes	Secondary containment/staging area
Kerosene	Coal oil, petroleum distillates	Secondary containment/staging area
Antifreeze/coolant	Ethylene glycol, propylene glycol, heavy metals (copper, lead, zinc)	Leaks or broken hoses from equipment
Sanitary toilets	Bacteria, parasites, and viruses	Staging area

5.2 Spill Prevention and Response

BMP Description: Spill kit, vehicle washing, silt sack catch basin protection, silt fence
Installation Schedule: Start of construction activity
Maintenance and Inspection: Minimum weekly & as necessary
Responsible Staff: Construction Manager and Site Contractor

- Major vehicle maintenance onsite is prohibited
- Re-fueling of vehicles within 25 feet of a drainage structure is prohibited
- Spill kit shall be kept onsite consisting of:
  - Gloves
  - Absorbent mats
  - Drip pan

Spill Prevention and Control Plan

- Refer to contractor's Spill Plan.
- Manufacturers' recommended spill control methods will be posted onsite and site personnel will be made aware of the requirements.
- Cleanup supplies will be kept onsite in a materials storage area. This equipment will include: goggles, brooms, dustpans, mops, rags, gloves, oil absorbent, sawdust, plastic and metal trash cans, and other materials and supplies specifically designated for cleanup.
- All spills will be immediately cleaned up after discovery.
- The spill area will be well ventilated.
- Cleanup personnel will wear suitable protective clothing.
- Spills of toxic and/or hazardous material will be reported to state, local, and Federal authorities, as required by law. Spills shall also be reported immediately to the owner.
- A spill incident report will be filed detailing the amount and extent of the spill, material(s) involved, and effectiveness of the cleanup. This report will be on file at the Construction Manager/Site Contractor office, as well as kept onsite in the field office. A copy shall also be filed with the Hazard Communication Coordinator (HCC).

The Construction Manager/Site Contractor will designate someone onsite that will serve as the Spill Cleanup Coordinator. At least two other personnel will be designated as alternate spill coordinators. All spill control personnel will be trained in spill prevention, control, and cleanup. The names of the responsible personnel will be posted at the jobsite office of the Construction Manager/ Site Contractor.

5.3 Fueling and Maintenance of Equipment or Vehicles

General

Minor vehicle and equipment emergency maintenance can be performed onsite away from drainage structures. Major vehicle and equipment maintenance must be performed offsite. Equipment/vehicle storage areas and any onsite fuel tanks will be inspected weekly and after storm events. Equipment and vehicles will be inspected for leaks, equipment damage, and other service problems on each day of use. Any leaks will be repaired immediately or the equipment/vehicle will be removed from the site.

Minor vehicle and equipment emergency maintenance shall occur when a vehicle cannot be safely removed from the site. The vehicle should be repaired so it can be taken off-site so that the rest of the maintenance can occur.

Major vehicle maintenance onsite is prohibited. Re-fueling or maintenance of vehicles within 25 feet of a drainage structure shall be prohibited. Drip pans, drip cloths, or absorbent pads should be used when replacing spent fluids. Secondary containment and cover should be provided where appropriate. The fluids should be collect and stored prior to being disposed of offsite. Spill kits should be readily available.

Specific Pollution Prevention Practice #1

- BMP Description: Spill Kit.
- Installation Schedule: Onsite throughout construction.
- Responsible Staff: Construction Manager and Site Contractor.

Specific Pollution Prevention Practice #1

- BMP Description: Drip Pans, Drip Cloths, Absorbent Pads.
- Installation Schedule: Onsite throughout construction.
- Responsible Staff: Construction Manager and Site Contractor.

5.4 Washing of Equipment and Vehicles

General

Vehicle and equipment washout areas shall be constructed by the contractor away from receiving water and storm drain inlets or constructed or natural site drainage features so that no untreated water enters the storm drain system. Soaps, detergents, or solvents must be stored in a way to prevent these detergents from coming into contact with rainwater, or a similarly effective means designed to prevent the discharge of pollutants from these areas.

Specific Pollution Prevention Practices

Pollution Prevention Practice # 1

- BMP Description: Designated vehicle/equipment washing areas
- Installation Schedule: Start of construction.
- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25” of snow within a 24-hour period sufficient to cause a discharge.)
- Responsible Staff: Construction Manager and Site Contractor

Pollution Prevention Practice # 2

- BMP Description: Spill kit, vehicle washing, straw bale catch basin protection, silt fence
- Installation Schedule: Start of construction activity
- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25” of snow within a 24-hour period sufficient to cause a discharge.)
- Responsible Staff: Construction Manager and Site Contractor

5.5 Storage, Handling, and Disposal of Construction Products, Materials, and Wastes

5.5.1 Building Products

General

The contractor will recycle all construction materials possible. For materials that cannot be recycled, solid waste will be disposed of in accordance with DEP Regulations for Solid Waste Facilities, 310 CMR 10.00.

Any building materials required to be stored onsite will be stored at a combined staging and materials storage area as shown on the CMP. Larger items will be elevated by appropriate methods to minimize contact with runoff. The storage area will be inspected weekly and after storm events. It will be kept clean, organized, and equipped with appropriate cleaning supplies.

Building product usage shall follow the following good housekeeping BMPs:

- The Responsible Staff: Construction Manager or Site Contractor representative will inspect daily for inspection of the work area to ensure proper management of waste materials.
- Store only enough material onsite required for that job as to satisfy current construction needs.
- Store required materials in tightly lidded containers under cover.
- Store materials in original containers with clearly legible labels.
- Separate and store materials apart from each other.
- Do not mix materials unless specifically in accordance with manufacturers' recommendations.
- Use all products from a container before disposing of the container.
- Follow manufacturers' instructions for handling, storage, and disposing of all materials.
- All materials shall be stored in an area to prevent the discharge of pollutants from building products.

Specific Pollution Prevention Practices

Pollution Prevention Practice # 1

- BMP Description: Perimeter Protection control around Stockpiles.
- Installation Schedule: Start of construction/ Immediately after stockpile is established.
- Inspection Schedule: Once every 7 days *and* within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge.)
- Maintenance: Ensure that all stormwater controls remain in effective condition as decribed in part 2.1.4 of the CGP. Remove any sediment before it has accumulated to one-half of the above-ground height of any perimeter control.
- Responsible Staff: Construction Manager and Site Contractor(s).

5.5.2 Pesticides, Herbicides, Insecticides, Fertilizers, and Landscape Materials

- In storage areas, provide either (1) cover to minimize the exposure of these chemicals to precipitation and to stormwater or (2) a similarly effective means designed to minimize the discharge of pollutants from these areas.
- Comply with all application and disposal requirements included on the registered pesticide, herbicide, insecticide, and fertilizer label.

5.5.3 Diesel Fuel, Oil, Hydraulic Fluids, Other Petroleum Products, and Other Chemicals

General

- Only skilled personnel in a designated area will perform fueling of vehicles onsite.
- Vehicles used onsite will be monitored for fuel and oil leaks.
- Vehicles used onsite will be maintained in good working order.
- Asphalt substances will be applied in accordance with manufacturers' recommendations.
- The use of petroleum products as a release agent for asphalt transport trucks is prohibited.
- Vehicle fueling will only be done in vehicle fueling areas located by the contractor. See section 5.3 of the SWPPP.

- The contractor shall be responsible for locating the fuel storage and re-fueling area onsite to minimize disturbance to construction activates and site area.
- Construction equipment not in active use for 5 minutes or more will be turned off.

5.5.4 Hazardous or Toxic Waste

(Note: Examples include paints, solvents, petroleum-based products, wood preservatives, additives, curing compounds, acids.)

General

- Keep products in their original containers.
- Original container labels should be clearly visible.
- Material safety data sheets will be kept onsite and be available.
- Follow all state, local, and Federal regulations regarding the handling, use, storage, and disposal of hazardous material.

Paints:

- All paint containers will be tightly sealed when not in use.
- Remove excess paint in original labeled containers from the jobsite.
- Paint will not be disposed of onsite. Remove excess paint material from the site and legally dispose of.
- Paint shall not be disposed of in the storm drain system.

5.5.5 Construction and Domestic Waste

General
The contractor will manage domestic waste onsite. The contractor will provide waste containers of sufficient size and number to contain construction and domestic wastes. The waste container lids will be kept closed when not in use and lids will be closed at the end of the business day for those containers that are actively used throughout the day. For waste containers that do not have lids, provide either a cover or a similarly effective means designed to minimize discharge of pollutants. Clean up immediately if containers overflow.

Pollution Prevention Practice # 1

- BMP Description: Dumpster.
- Installation Schedule: Start of construction.
- Maintenance and Inspection: Weekly and covered daily.
- Responsible Staff: Construction Manager and Site Contractor(s).

Pollution Prevention Practice # 2

- BMP Description: Litter/debris pick-up.
- Installation Schedule: Start of construction.
- Maintenance and Inspection: Daily.
- Responsible Staff: Construction Manager and Site Contractor(s).

5.5.6 Sanitary Waste

All sanitary waste portable toilets shall be positioned so that they are secure and will not be tipped or knocked over, and located away from any stormwater inlets or conveyances.

Pollution Prevention Practice # 1

- BMP Description: Porta John.
- Installation Schedule: Start of construction.
- Maintenance and Inspection: As manufacturer requires.
- Responsible Staff: Construction Manager and Site Contractor(s).

5.6 Washing of Applicators and Containers used for Paint, Concrete, or Other Materials

General
Washing of applicators and containers used for paint, concrete, or other materials shall follow the following good housekeeping BMPs:

- An effective means of eliminating the discharge of water from the washout and cleanout of stucco, paint, concrete, form release oils, curing compounds, and other construction materials.
- All washwater must be directed into a leak-proof container or leak-proof pit. The container or pit must be designed so that no overflows can occur due to inadequate sizing or precipitation.
- Washout and cleanout wastes should be handled as follows:
  - Do not dump liquid wastes into storm sewers.
  - Dispose of liquid wastes in accordance with applicable requirements.
  - Remove and dispose of hardened concrete waste consistent with the handling of other construction wastes.
- Locate any washout or cleanout activities as far away as possible from surface waters and stormwater inlets or conveyances, and to the extent practicable, designate areas to be used for these activities and conduct such activities only in these areas.

Pollution Prevention Practice # 1

- BMP Description: Designated applicator and container washing areas.
- Installation Schedule: Start of construction.
- Maintenance and Inspection: Daily.
- Responsible Staff: Construction Manager and Site Contractor(s).

5.7 Fertilizers

General
If fertilizer is required onsite, installation will follow the following guidelines:

- Fertilizers will be used at the application rates called for in the specifications for the project.
- Once applied, fertilizer will be worked into the soil to minimize wash off from irrigation and stormwater.
- Fertilizer will be stored under cover.
- The contents of partially used fertilizer bags will be transferred to re-sealable, watertight containers clearly labeled with their contents.
- Avoid applying before heavy rains.
- Never apply to frozen ground.
- Never apply to stormwater conveyance channels with flowing water.

5.8 Other Pollution Prevention Practices

Any changes in construction activity that produce other allowable non-stormwater discharges will be identified, the SWPPP will be amended and the appropriate erosion and sedimentation controls will be implemented.

SECTION 6: INSPECTION, MAINTENANCE, AND CORRECTIVE ACTION

6.1 Inspection Personnel and Procedures

Personnel Responsible for Inspections

Construction Manager
Contact Person

Site Contractor
Contact person

(Note: All personnel conducting inspections must be considered a "qualified person." CGP Part 4.1.1 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 skills to assess conditions at the construction site that could impact stormwater quality, and the skills to assess the effectiveness of any stormwater controls selected and installed to meet the requirements of this permit.)

Inspection Schedule

Specific Inspection Frequency

The contractor shall inspect and maintain erosion control measures, and remove sediment therefrom, Once every 7 days and within 24 hours of a storm event of 0.25 inches or greater (this includes the occurrence of runoff from snow melt from a storm that produces 3.25" of snow within a 24-hour period sufficient to cause a discharge.)

Rain Gauge Location:

Latitude 42°40'17", Longitude 71°08'59" NAD27
Essex County, Massachusetts, Hydrologic Unit 01070006
Drainage area: 72.8 square miles
Datum of gage: 34.20 feet above NAVD88.

Inspection frequency may be reduced to twice per month (no more than 14 days apart) for the first month in areas of the site where the stabilization steps outlines in Parts 2.2.14 of the CGP have been completed. After the first month, inspection frequency may be reduced to once per month. If construction activity resumes in this portion of the site at a later date, the inspection frequency immediately increases to that required in Parts 4.2 and 4.3 as applicable. You must document the beginning and ending dates of this period in the SWPPP.

Inspection frequency may be reduced to once per month and within 24 hours of the occurrence of a storm event of 0.25 inches or greater if the project is located in an arid, semi-arid, or drought-stricken area and construction is occurring during the seasonally dry period or a period in which drought is predicted to occur. If this inspection frequency is followed, you must document the beginning and ending dates of this period in the SWPPP.

Inspections can be temporarily suspended under the following conditions:

- Earth-disturbing activity is suspended due to frozen condition;
- Runoff is unlikely due to continuous frozen conditions that are likely to continue at the site for at least three months based on historic seasonal averaged. **If unexpected weather conditions**

make discharges likely, the operators must immediately resume the regular inspection schedule;

- Land disturbances have been suspended; and
- All disturbed areas of the site have been stabilized in accordance with Part 2.2.14a of the CGP.

Inspection frequency may be reduced to once per month under the following conditions:

- The operator is still conducting earth disturbing activities under frozen conditions;
- Runoff is unlikely due to continuous frozen conditions that are likely to continue at the site for at least three months based on historic seasonal averages. **If unexpected weather conditions make discharges likely, the operator must immediately resume the regular inspection schedule**; and
- Except for areas in which the operator is conducting earth-disturbing activities, disturbed areas of the site have been stabilized in accordance with Part 2.2.14a of the CGP.

Inspection Report Forms
Copies of inspection reports are in Attachment D.

6.2 Corrective Action

Personnel Responsible for Corrective Actions
Contact Person, Construction Manager Company
Contact Person, Site Contractor

Corrective Action Forms
A copy of the Corrective Action Form is in Attachment E.

6.3 Delegation of Authority

Duly Authorized Representative(s) or Position(s):
Construction Manager Company
Contact Person
Contact Person Title
Street Address
Town/City, State Zip Code
xxx-xxx-xxxx
Email address

SECTION 7: SWPPP TRAINING DOCUMENTATION

Refer to Attachment I for a Training Log to be completed for each SWPPP training session.

Refer to Attachment I for certificates from completion of EPA Inspector course

Table 7-1: Documentation for Completion of Training

Name	Date Training Completed

DRAFT

SECTION 8: CERTIFICATION AND NOTIFICATION

Operator – Owner's Representative

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 have no personal knowledge that the information submitted is other than 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.

Name: _____ Title: _____

Signature: _____ Date: _____

Operator – Construction Manager

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 have no personal knowledge that the information submitted is other than 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.

Name: _____ Title: _____

Signature: _____ Date: _____

SECTION 9: TURBIDITY BENCHMARK MONITORING FOR DEWATERING DISCHARGES

If required to comply with Part 3.3 turbidity benchmark monitoring requirements for discharging to sensitive waters, the following procedures will be followed.

Applicability	Sampling Requirement	Turbidity Benchmark	Corrective Action	Reporting
Sites discharging dewatering water to a sediment-impaired water or to a water designated as a Tier 2, Tier 2.5, or Tier 3 for antidegradation purposes.	Collect at least one turbidity sample per day, from each discharge point, on any day there is a dewatering discharge. Use turbidity sampling procedures specified in Part 3.3.1.	Compare the weekly average of your turbidity monitoring results to the 50 NTU benchmark (or alternate benchmark if approved by EPA).	If the weekly average of turbidity monitoring results exceeds the 50 NTU turbidity benchmark (or alternate benchmark if approved by EPA), you are required to take follow-up corrective action in accordance with Part 5.2.2.	Report all weekly average turbidity monitoring results on a quarterly basis via NeT-CGP (unless use of the paper monitoring form in Appendix K is approved by EPA) no later than 30 days following the end of each monitoring quarter.

Procedures:

Collecting and evaluating samples	Describe how you will collect and evaluate samples
Reporting results and keeping monitoring information records	Describe how you will report results to EPA and keep monitoring information records
Taking corrective action when necessary	Describe how you will take corrective action when necesary

Turbidity Meter:

Type of turbidity meter	Insert the type of turbidity meter

Turbidity meter manuals and manufacturer instructions

Insert a copy of any manuals and manufacturer instructions in Appendix N of this SWPPP Template.

Coordinating Arrangements for Turbidity Monitoring (if applicable):

Permitted operator name	Insert operator name
Permitted operator NPDES ID	Insert operator NPDES ID
Coordinating Arrangement	Describe the coordinating arrangement including which parties are tasked with specifc responsibilities

[Repeat as necessary.]

Alternate turbidity benchmark (if applicable – alternate benchmarks must be approved by EPA):

Alternate turbidity benchmark (NTU)	Insert alternate turbidity benchmark
Data and documentation used to request the alternate benchmark	Insert the data and documentation that was submitted to EPA to request the alternate benchmark

SWPPP ATTACHMENTS

Attachment A – Site Maps

Attachment B – 2022 Construction General Permit

Attachment C – NOI and EPA Authorization Email

Attachment D – Site Inspection Form and Dewatering Inspection Form (If Applicable)

Attachment E – Corrective Action Form

Attachment F – SWPPP Amendment Log

Attachment G – Subcontractor Certifications/Agreements

Attachment H – Grading and Stabilization Activities Log

Attachment I – SWPPP Training Documentation

Attachment J – Delegation of Authority Form

Attachment K – Endangered Species Documentation

Attachment L – Historic Preservation Documentation

Attachment M – Rainfall Gauge Recording

Attachment N – Turbidity Meter Manual and Manufacturer's Instructions

Attachment O – Order of Conditions

DRAFT

Attachment A – Site Maps



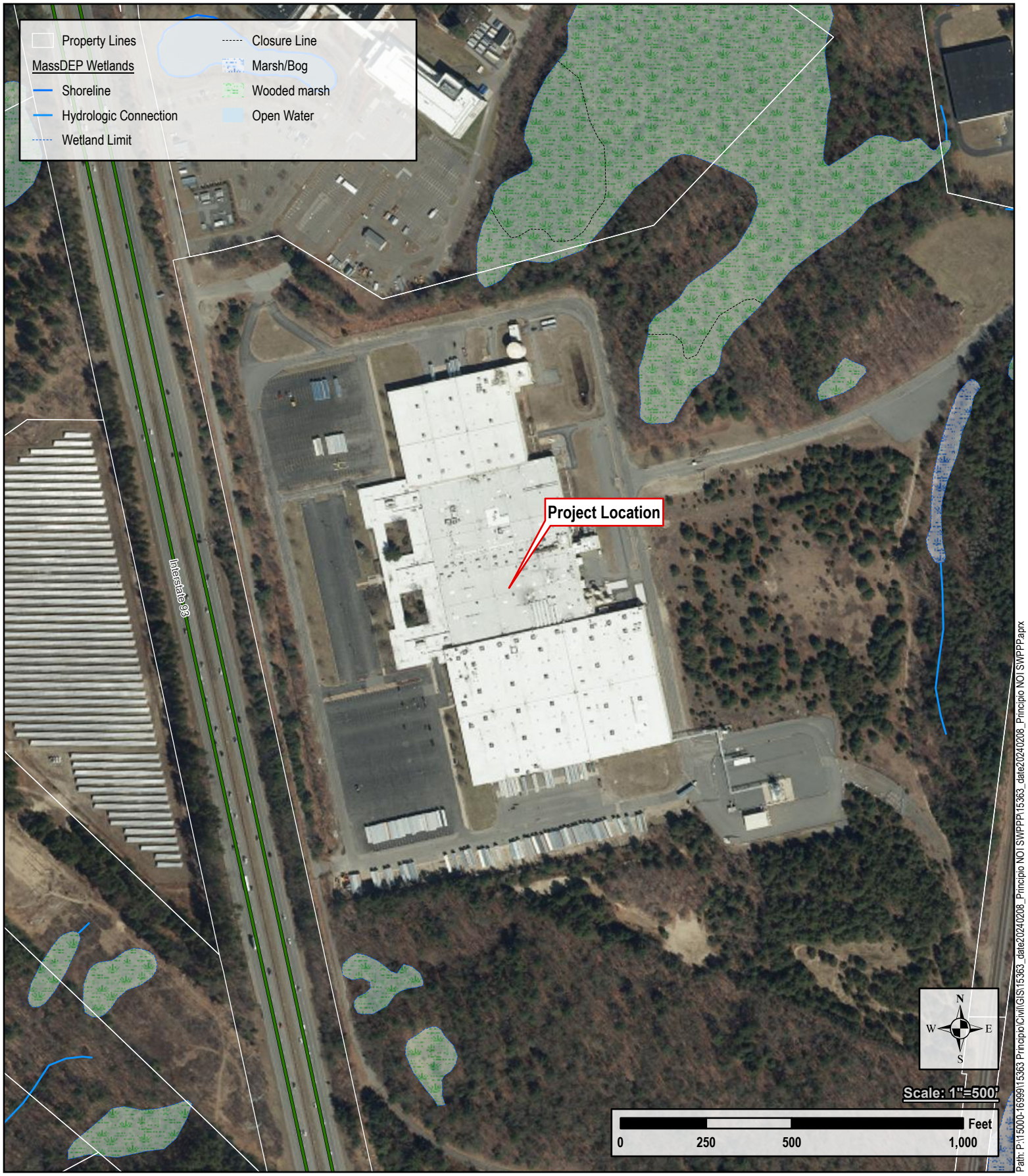
Aerial Locus

30 Burtt Road
Andover, MA 01810

2/8/2024

Data Source: MassGIS
Nitsch Project #15363

Nitsch Engineering



Path: P:\15000-16999\15363 Principio\Civil\GIS\15363_date20240208_Principio NOI SWPPP\15363_date20240208_Principio NOI SWPPP.aprx

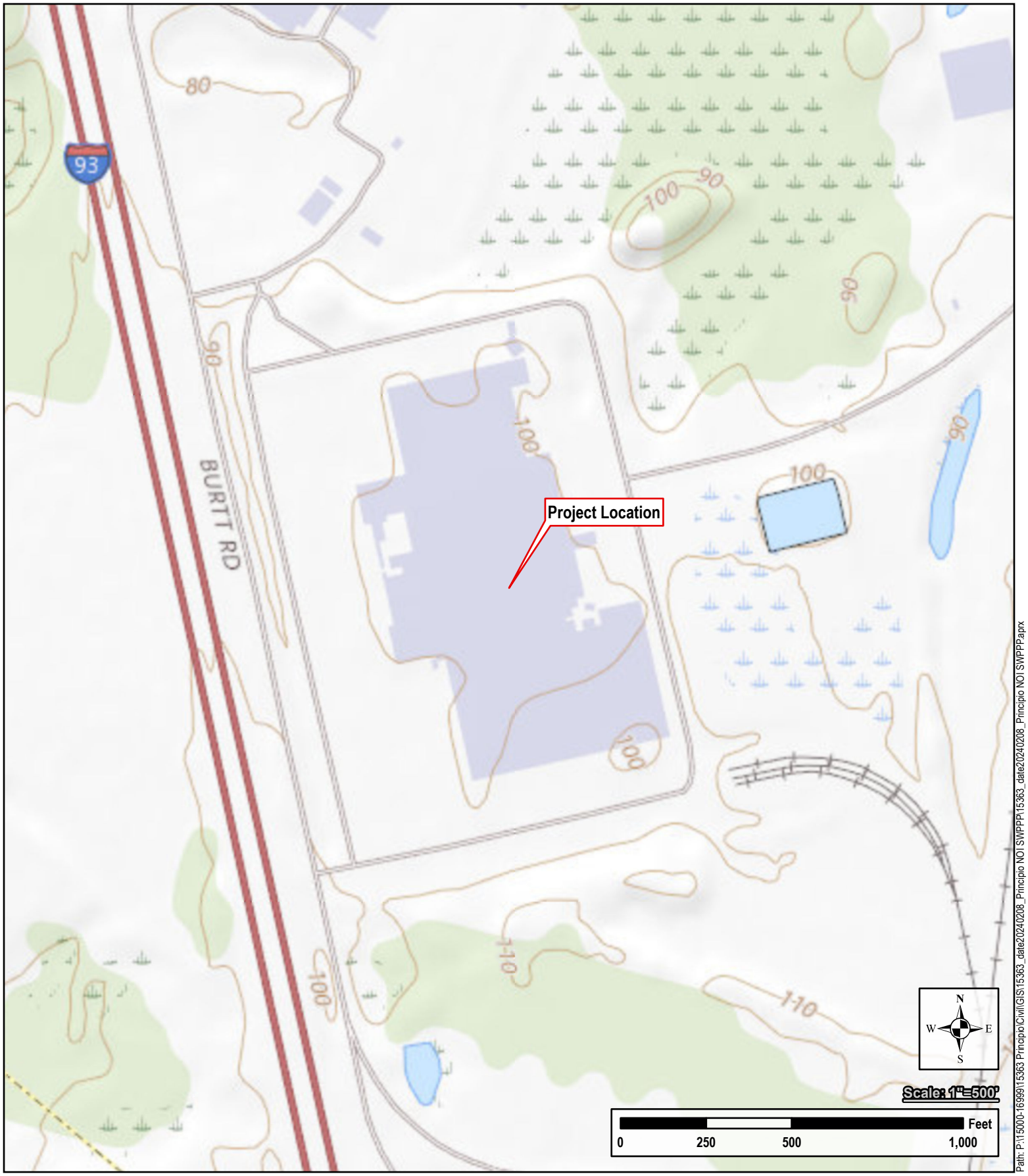
MassDEP Wetlands

30 Burtt Road
Andover, MA 01810

2/8/2024

Data Source: MassGIS
Nitsch Project #15363

Nitsch Engineering



Path: P:\15000-16999\15363 Principio\Civil\GIS\15363_date20240208_Principio NOI SWPPP\15363_date20240208_Principio NOI SWPPP.aprx

USGS Locus

30 Burtt Road
Andover, MA 01810

2/8/2024

Data Source: USGS
Nitsch Project #15363

Nitsch Engineering

Attachment B – 2022 Construction General Permit

DRAFT

National Pollutant Discharge Elimination System (NPDES)
Construction General Permit (CGP) for Stormwater Discharges from Construction Activities

In compliance with the provisions of the Clean Water Act, 33 U.S.C. §1251 et. seq., (hereafter CWA), as amended by the Water Quality Act of 1987, P.L. 100-4, "operators" of construction activities (defined in Appendix A) that meet the requirements of Part 1.1 of this National Pollutant Discharge Elimination System (NPDES) Construction General Permit (CGP), are authorized to discharge pollutants in accordance with the effluent limitations and conditions set forth herein. Permit coverage is required from the "commencement of construction activities" (see Appendix A) until one of the conditions for terminating CGP coverage has been met (see Part 8.2).

This permit becomes effective on 12:00 am, February 17, 2022.

This permit and the authorization to discharge expire at 11:59pm, February 16, 2027.

Signed and issued this 18 day of January 2022

DEBORAH SZARO
Digitally signed by DEBORAH SZARO
Date: 2022.01.18 08:31:14 -05'00'

Deborah Szaro,
Acting Regional Administrator, EPA Region 1.

Signed and issued this 18 day of January 2022

JAVIER LAUREANO
Digitally signed by JAVIER LAUREANO
Date: 2022.01.18 11:21:16 -05'00'

Javier Laureano,
Director, Water Division, EPA Region 2.

Signed and issued this 18 day of January 2022

CARMEN GUERRERO PEREZ
Digitally signed by CARMEN GUERRERO PEREZ
Date: 2022.01.18 10:19:51 -04'00'

Carmen Guerrero-Perez,
Director, Caribbean Environmental Protection Division, EPA Region 2.

Signed and issued this 18 day of January 2022

CATHERINE LIBERTZ
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Catherine A. Libertz,
Director, Water Division, EPA Region 3.

Signed and issued this 18 day of January 2022

JEANEANNE GETTLE
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Jeaneanne Gettle,
Director, Water Division, EPA Region 4.

Signed and issued this 18 day of January 2022

Digitally signed by TERA FONG
Date: 2022.01.18 13:03:49 -06'00'

Tera Fong,
Director, Water Division, EPA Region 5.

Signed and issued this 18 day of January 2022

CHARLES MAGUIRE
Digitally signed by CHARLES MAGUIRE
DN: c=US, o=U.S. Government, ou=Environmental Protection Agency, cn=CHARLES MAGUIRE, 0.9.2342.19200300.100.1.1=68001003650036
Date: 2022.01.18 14:06:55 -06'00'

Charles W. Maguire,
Director, Water Division, EPA Region 6.

Signed and issued this 18 day of January 2022

JEFFERY ROBICHAUD
Digitally signed by JEFFERY ROBICHAUD
Date: 2022.01.18 14:41:37 -06'00'

Jeffery Robichaud,
Director, Water Division, EPA Region 7.

Signed and issued this 18 day of January 2022

DARCY OCONNOR
Digitally signed by DARCY OCONNOR
Date: 2022.01.18 14:00:05 -07'00'

Darcy O'Connor,
Director, Water Division, EPA Region 8.

Signed and issued this 18 day of January 2022

TOMAS TORRES
Digitally signed by TOMAS TORRES
Date: 2022.01.18 13:30:16 -08'00'

Tomás Torres,
Director, Water Division, EPA Region 9.

Signed and issued this 18 day of January 2022

DANIEL OPALSKI
Digitally signed by DANIEL OPALSKI
Date: 2022.01.18 15:10:20 -08'00'

Daniel D. Opalski,
Director, Water Division, EPA Region 10.

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1 HOW TO OBTAIN COVERAGE UNDER THE CONSTRUCTION GENERAL PERMIT (CGP)

To be covered under this permit, you must meet the eligibility conditions and follow the requirements for obtaining permit coverage in this Part.

1.1 ELIGIBILITY CONDITIONS

1.1.1 You are an "operator" of a construction site for which discharges will be covered under this permit. For the purposes of this permit and in the context of stormwater discharges associated with construction activity, an "operator" is any party associated with a construction project that meets either of the following two criteria:

a. The party has operational control over construction plans and specifications, including the ability to make modifications to those plans and specifications; or

b. The party has day-to-day operational control of those activities at a project that are necessary to ensure compliance with the permit conditions.

Where there are multiple operators associated with the same project, all operators must obtain permit coverage.[1] Subcontractors generally are not considered operators for the purposes of this permit.

1.1.2 Your site's construction activities:

a. Will disturb one or more acres of land, or will disturb less than one acre of land but are part of a common plan of development or sale (as defined in Appendix A) that will ultimately disturb one or more acres of land; or

b. Have been designated by EPA as needing permit coverage under 40 CFR § 122.26(a)(1)(v) or 40 CFR § 122.26(b)(15)(ii);

1.1.3 Your site is located in an area where EPA is the permitting authority and where coverage under this permit is available (see Appendix B);

1.1.4 Discharges from your site are not:

a. Already covered by a different NPDES permit for the same discharge; or

b. In the process of having coverage under a different NPDES permit for the same discharge denied, terminated, or revoked.[2, 3]

1.1.5 You can demonstrate you meet one of the criteria in the Endangered Species Protection section of the Notice of Intent (NOI) that you submit for coverage under this permit, per Part 1.4, with respect to the protection of Federally listed endangered or threatened species and Federally designated critical habitat under the Endangered Species Act

[1] If the operator of a "construction support activity" (see Part 1.2.1c) is different than the operator of the main site, that operator must also obtain permit coverage. See Part 7.1 for clarification on the sharing of permit-related functions between and among operators on the same site and for conditions that apply to developing a SWPPP for multiple operators associated with the same site.

[2] Parts 1.1.4a and 1.1.4b do not include sites currently covered under the 2017 CGP that are in the process of obtaining coverage under this permit, nor sites covered under this permit that are transferring coverage to a different operator.

[3] Notwithstanding a site being made ineligible for coverage under this permit because it falls under the description of Parts 1.1.4a or 1.1.4b, above, EPA may waive the applicable eligibility requirement after specific review if it determines that coverage under this permit is appropriate.

(ESA). If the EPA Regional Office grants you a waiver from electronic reporting per Part 1.4.2, you must complete the ESA worksheet in Appendix D to demonstrate you meet one of the criteria and submit it with your paper NOI (Appendix I).

1.1.6 You have completed the screening process in Appendix E relating to the protection of historic properties; and

1.1.7 You have complied with all requirements in Part 9 imposed by the applicable State, Indian Tribe, or Territory in which your construction activities and/or discharge will occur.

1.1.8 For "new sources" (as defined in Appendix A) only:

a. EPA has not, prior to authorization under this permit, determined that discharges from your site will not meet applicable water quality standards. Where such a determination is made prior to authorization, EPA may notify you that an individual permit application is necessary. However, EPA may authorize your coverage under this permit after you have included appropriate controls and implementation procedures designed to bring your discharge into compliance with this permit, specifically the requirement to meet water quality standards. In the absence of information demonstrating otherwise, EPA expects that compliance with the requirements of this permit, including the requirements applicable to such discharges in Part 3, will result in discharges that meet applicable water quality standards.

b. Discharges from your site to a Tier 2, Tier 2.5, or Tier 3 water[4] will not lower the water quality of the applicable water. In the absence of information demonstrating otherwise, EPA expects that compliance with the requirements of this permit, including the requirements applicable to such discharges in Part 3.2, will result in discharges that will not lower the water quality of such waters.

1.1.9 If you plan to add "cationic treatment chemicals" (as defined in Appendix A) to stormwater and/or authorized non-stormwater prior to discharge, you may not submit your NOI until you notify your applicable EPA Regional Office (see Appendix J) in advance and the EPA Regional Office authorizes coverage under this permit after you have included appropriate controls and implementation procedures designed to ensure that your use of cationic treatment chemicals will result in discharges that meet applicable water quality standards.

[4] Note: Your site will be considered to discharge to a Tier 2, Tier 2.5, or Tier 3 water if the first receiving water to which you discharge is identified by a State, Tribe, or EPA as a Tier 2, Tier 2.5, or Tier 3 water. For discharges that enter a storm sewer system prior to discharge, the first receiving water to which you discharge is the waterbody that receives the stormwater discharge from the storm sewer system. The current list of Tier 2, Tier 2.5, and Tier 3 waters located in the areas eligible for coverage under this permit can be found at https://www.epa.gov/npdes/construction-general-permit-resources-tools-and-templates. You can also use EPA's Discharge Mapping Tool (https://www.epa.gov/npdes/epas-stormwater-discharge-mapping-tools) to assist you in identifying whether any receiving waters to which you discharge are listed as impaired (and the pollutant for which it is impaired) and whether an approved total maximum daily load (TMDL) exists for that waterbody.

1.2 TYPES OF DISCHARGES AUTHORIZED[5]

1.2.1 The following stormwater discharges are authorized under this permit provided that appropriate stormwater controls are designed, installed, and maintained (see Parts 2 and 3):

- **a.** Stormwater discharges, including stormwater runoff, snowmelt runoff, and surface runoff and drainage, associated with construction activity under 40 CFR § 122.26(b)(14) or § 122.26(b)(15)(i);
- **b.** Stormwater discharges designated by EPA as needing a permit under 40 CFR §122.26(a)(1)(v) or § 122.26(b)(15)(ii);
- **c.** Stormwater discharges from on or off-site construction support activities (e.g., concrete or asphalt batch plants, equipment staging yards, material storage areas, excavated material disposal areas, borrow areas) provided that:
  - **i.** The support activity is directly related to the construction site required to have permit coverage for stormwater discharges;
  - **ii.** The support activity is not a commercial operation, nor does it serve multiple unrelated construction sites;
  - **iii.** The support activity does not continue to operate beyond the completion of the construction activity at the site it supports; and
  - **iv.** Stormwater controls are implemented in accordance with Part 2 and Part 3 for discharges from the support activity areas; and
- **d.** Stormwater discharges from earth-disturbing activities associated with the construction of staging areas and the construction of access roads conducted prior to active mining.

1.2.2 The following non-stormwater discharges associated with your construction activity are authorized under this permit provided that, with the exception of water used to control dust and to irrigate vegetation in stabilized areas, these discharges are not routed to areas of exposed soil on your site and you comply with any applicable requirements for these discharges in Parts 2 and 3:

- **a.** Discharges from emergency fire-fighting activities;
- **b.** Fire hydrant flushings;
- **c.** Landscape irrigation;
- **d.** Water used to wash vehicles and equipment, provided that there is no discharge of soaps, solvents, or detergents used for such purposes;
- **e.** Water used to control dust;
- **f.** Potable water including uncontaminated water line flushings;

[5] See "Discharge" as defined in Appendix A. Note: Any discharges not expressly authorized in this permit cannot become authorized or shielded from liability under CWA Section 402(k) by disclosure to EPA, State, or local authorities after issuance of this permit via any means, including the Notice of Intent (NOI) to be covered by the permit, the SWPPP, or during an inspection.

g. External building washdown, provided soaps, solvents, and detergents are not used, and external surfaces do not contain hazardous substances (as defined in Appendix A) (e.g., paint or caulk containing polychlorinated biphenyls (PCBs));

h. Pavement wash waters, provided spills or leaks of toxic or hazardous substances have not occurred (unless all spill material has been removed) and where soaps, solvents, and detergents are not used. You are prohibited from directing pavement wash waters directly into any receiving water, storm drain inlet, or constructed or natural site drainage features, unless the feature is connected to a sediment basin, sediment trap, or similarly effective control;

i. Uncontaminated air conditioning or compressor condensate;

j. Uncontaminated, non-turbid discharges of ground water or spring water;

k. Foundation or footing drains where flows are not contaminated with process materials such as solvents or contaminated ground water; and

l. Uncontaminated construction dewatering water[6] discharged in accordance with Part 2.4.

1.2.3 Also authorized under this permit are discharges of stormwater listed above in Part 1.2.1, or authorized non-stormwater discharges listed above in Part 1.2.2, commingled with a discharge authorized by a different NPDES permit and/or a discharge that does not require NPDES permit authorization.

1.3 PROHIBITED DISCHARGES[7]

The discharges listed in this Part are prohibited outright or authorized only under the identified conditions. To prevent the discharges in Parts 1.3.1 through 1.3.5, operators must comply with the applicable pollution prevention requirements in Part 2.3 or ensure the discharge is authorized by another NPDES permit consistent with Part 1.2.3 for commingled discharges.

1.3.1 Wastewater from washout of concrete, unless managed by an appropriate control as described in Part 2.3.4;

1.3.2 Wastewater from washout and/or cleanout of stucco, paint, form release oils, curing compounds, and other construction materials;

1.3.3 Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance;

1.3.4 Soaps, solvents, or detergents used in vehicle and equipment washing or external building washdown; and

1.3.5 Toxic or hazardous substances from a spill or other release.

[6] EPA notes that operators may need to comply with additional procedures to verify that the dewatering discharge is uncontaminated. Operators should review Part 9 to determine if any of these requirements apply to their discharge and should ensure that they have complied with any State, Tribal, or local dewatering requirements that apply.

[7] EPA includes these prohibited non-stormwater discharges here as a reminder to the operator that the only non-stormwater discharges authorized by this permit are at Part 1.2.2. Any unauthorized non-stormwater discharges must be covered under an individual permit or alternative general permit.

1.4 SUBMITTING YOUR NOTICE OF INTENT (NOI)

All "operators" (as defined in Appendix A) associated with your construction site who meet the Part 1.1 eligibility conditions, and who seek coverage under this permit, must submit to EPA a complete and accurate NOI in accordance with the deadlines in Table 1 prior to commencement of construction activities (as defined in Appendix A).

Exception: If you are conducting construction activities in response to a public emergency (e.g., mud slides, earthquake, extreme flooding conditions, widespread disruption in essential public services), and the related work requires immediate authorization to avoid imminent endangerment to human health, public safety, or the environment, or to reestablish essential public services, you may discharge on the condition that a complete and accurate NOI is submitted within 30 calendar days after commencing construction activities (see Table 1) establishing that you are eligible for coverage under this permit. You must also provide documentation in your Stormwater Pollution Prevention Plan (SWPPP) to substantiate the occurrence of the public emergency pursuant to Part 7.2.3i.

1.4.1 Prerequisite for Submitting Your NOI

You must develop a SWPPP consistent with Part 7 before submitting your NOI for coverage under this permit.

1.4.2 How to Submit Your NOI

You must use EPA's NPDES eReporting Tool (NeT) to electronically prepare and submit your NOI for coverage under the 2022 CGP unless you received a waiver from your applicable EPA Regional Office.

To access NeT, go to https://cdx.epa.gov/cdx.

Waivers from electronic reporting may be granted based on one of the following conditions:

a. If your operational headquarters is physically located in a geographic area (i.e., ZIP code or census tract) that is identified as under-served for broadband Internet access in the most recent report from the Federal Communications Commission; or

b. If you have limitations regarding available computer access or computer capability.

If the EPA Regional Office grants you approval to use a paper NOI, and you elect to use it, you must complete the form in Appendix H.

1.4.3 Deadlines for Submitting Your NOI and Your Official Date of Permit Coverage

Table 1 provides the deadlines for submitting your NOI and the official start date of your permit coverage, which differ depending on when you commence construction activities.

Table 1 NOI Submittal Deadlines and Official Start Date for Permit Coverage.

Type of Operator	NOI Submittal Deadline[8]	Permit Authorization Date[9]
Operator of a new site (i.e., a site where construction activities commence on or after February 17, 2022)	At least 14 calendar days before commencing construction activities.	14 calendar days after EPA notifies you that it has received a complete NOI, unless EPA notifies you that your authorization is delayed or denied.
Operator of an existing site (i.e., a site with 2017 CGP coverage where construction activities commenced prior to February 17, 2022)	No later than May 18, 2022.	14 calendar days after EPA notifies you that it has received a complete NOI, unless EPA notifies you that your authorization is delayed or denied. Provided you submit your NOI no later than May 18, 2022, your authorization under the 2017 CGP is automatically continued until you have been granted coverage under this permit or an alternative NPDES permit, or coverage is otherwise terminated.
New operator of a permitted site (i.e., an operator that through transfer of ownership and/or operation replaces the operator of an already permitted construction site that is either a "new site" or an "existing site")	At least 14 calendar days before the date the transfer to the new operator will take place.	14 calendar days after EPA notifies you that it has received a complete NOI, unless EPA notifies you that your authorization is delayed or denied.
Operator of an "emergency-related project" (i.e., a project initiated in response to a public emergency (e.g., mud slides, earthquake, extreme flooding conditions, disruption in essential public services), for which the related work requires immediate authorization to avoid imminent endangerment to human health or the environment, or to reestablish essential public services)	No later than 30 calendar days after commencing construction activities.	You are considered provisionally covered under the terms and conditions of this permit immediately, and fully covered 14 calendar days after EPA notifies you that it has received a complete NOI, unless EPA notifies you that your authorization is delayed or denied.

[8] If you miss the deadline to submit your NOI, any and all discharges from your construction activities will continue to be unauthorized under the CWA until they are covered by this or a different NPDES permit. EPA may take enforcement action for any unpermitted discharges that occur between the commencement of construction activities and discharge authorization.

[9] Discharges are not authorized if your NOI is incomplete or inaccurate or if you are not eligible for permit coverage.

1.4.4 Modifying your NOI

If after submitting your NOI you need to correct or update any fields, you may do so by submitting a "Change NOI" form using NeT. Waivers from electronic reporting may be granted as specified in Part 1.4.2. If the EPA Regional Office has granted you approval to submit a paper NOI modification, you may indicate any NOI changes on the same NOI form in Appendix H.

When there is a change to the site's operator, the new operator must submit a new NOI, and the previous operator must submit a Notice of Termination (NOT) form as specified in Part 8.3.

The following modifications to an NOI form will result in a 14-day review process:

- Changes to the name of the operator;
- Changes to the project or site name;
- Changes to the estimated area to be disturbed;
- Changes to the name of the receiving water[10], or additions to the applicable receiving waters;
- Changes to eligibility information related to endangered species protection or historic preservation;
- Changes to information provided related to the use of chemical treatment at your site; and
- Changes to answers provided regarding the demolition of structures over 10,000 square feet of floor space built or renovated before January 1, 1980.

During the 14-day review process, you may continue to operate based on the information provided in your original NOI, but you must wait until the review period has ended before you may commence or continue activities on any portion of your site that would be affected by any of the above modifications, unless EPA notifies you that the authorization is delayed or denied.

1.4.5 Your Official End Date of Permit Coverage

Once covered under this permit, your coverage will last until the date that:

a. You terminate permit coverage consistent with Part 8; or

b. You receive permit coverage under a different NPDES permit or a reissued or replacement version of this permit after expiring on February 16, 2027; or

c. You fail to submit an NOI for coverage under a reissued or replacement version of this permit before the deadline for existing construction sites where construction activities continue after this permit has expired.

1.5 REQUIREMENT TO POST A NOTICE OF YOUR PERMIT COVERAGE

You must post a sign or other notice of your permit coverage at a safe, publicly accessible location in close proximity to the construction site. The notice must be located so it is visible from the public road that is nearest to the active part of the construction

[10] As defined in Appendix A, a "receiving water" is "a "Water of the United States" as defined in 40 CFR §122.2 into which the regulated stormwater discharges.

site, and it must use a font large enough to be readily viewed from a public right-of-way.[11] At a minimum, the notice must include:

a. The NPDES ID (i.e., permit tracking number assigned to your NOI and the EPA webpage where a copy of the NOI can be found (https://permitsearch.epa.gov/epermit-search/ui/search));

b. A contact name and phone number for obtaining additional construction site information;

c. The Uniform Resource Locator (URL) for the SWPPP (if available), or the following statement: "If you would like to obtain a copy of the Stormwater Pollution Prevention Plan (SWPPP) for this site, contact the EPA Regional Office at [*include the appropriate CGP Regional Office contact information found at* https://www.epa.gov/npdes/contact-us-stormwater#regional];" and

d. The following statement "If you observe indicators of stormwater pollutants in the discharge or in the receiving water, contact the EPA through the following website: https://www.epa.gov/enforcement/report-environmental-violations."

2 TECHNOLOGY-BASED EFFLUENT LIMITATIONS

You must comply with the following technology-based effluent limitations in this Part for all authorized discharges.[12]

2.1 GENERAL STORMWATER CONTROL DESIGN, INSTALLATION, AND MAINTENANCE REQUIREMENTS

You must design, install, and maintain stormwater controls required in Parts 2.2, 2.3, and 2.4 to minimize the discharge of pollutants in stormwater from construction activities.[13] To meet this requirement, you must:

2.1.1 Account for the following factors in designing your stormwater controls:

a. The expected amount, frequency, intensity, and duration of precipitation;[14]

b. The nature of stormwater runoff (i.e., flow) and run-on at the site, including factors such as expected flow from impervious surfaces, slopes, and site drainage features. You must design stormwater controls to control stormwater volume, velocity, and peak flow rates to minimize discharges of pollutants in stormwater and to minimize channel and streambank erosion and scour in the immediate vicinity of discharge points; and

c. The soil type and range of soil particle sizes expected to be present on the site.

[11] If the active part of the construction site is not visible from a public road, then place the notice of permit coverage in a position that is visible from the nearest public road and as close as possible to the construction site.

[12] For each of the effluent limits in Part 2, as applicable to your site, you must include in your SWPPP (1) a description of the specific control(s) to be implemented to meet the effluent limit; (2) any applicable design specifications; (3) routine maintenance specifications; and (4) the projected schedule for installation/implementation. See Part 7.2.6.

[13] The permit does not recommend or endorse specific products or vendors.

[14] Stormwater controls must be designed using the most recent data available to account for recent precipitation patterns and trends.

If your site is exposed to or has previously experienced major storms, such as hurricanes, storm surge, extreme/heavy precipitation, and flood events, you should also include consideration of and contingencies for whether implementing structural improvements, enhanced/resilient stormwater controls, and other mitigation measures may help minimize impacts from stormwater discharges from such major storm events.

2.1.2 Design and install all stormwater controls in accordance with good engineering practices, including applicable design specifications.[15]

2.1.3 Complete installation of stormwater controls by the time each phase of construction activities has begun.

a. By the time construction activity in any given portion of the site begins, install and make operational any downgradient sediment controls (e.g., buffers, perimeter controls, exit point controls, storm drain inlet protection) that control discharges from the initial site clearing, grading, excavating, and other earth-disturbing activities.[16]

b. Following the installation of these initial controls, install and make operational all stormwater controls needed to control discharges prior to subsequent earth-disturbing activities.

2.1.4 Ensure all stormwater controls are maintained and remain in effective operating condition during permit coverage and are protected from activities that would reduce their effectiveness.

a. Comply with any specific maintenance requirements for the stormwater controls listed in this permit, as well as any recommended by the manufacturer.[17]

b. If at any time you find that a stormwater control needs routine maintenance (i.e., minor repairs or other upkeep performed to ensure the site's stormwater controls remain in effective operating condition, not including significant repairs or the need to install a new or replacement control), you must immediately initiate the needed work, and complete such work by the close of the next business day. If it is infeasible to complete the routine maintenance by the close of the next business day, you must document why this is the case and why the repair or other upkeep to be performed should still be considered routine maintenance in your inspection report under Part 4.7.1c and complete such work no later than seven (7) calendar days from the time of discovery of the condition requiring maintenance.

c. If you must repeatedly (i.e., three (3) or more times) make the same routine maintenance fixes to the same control at the same location, even if the fix can be completed by the close of the next business day, you must either:

i. Complete work to fix any subsequent repeat occurrences of this same problem under the corrective action procedures in Part 5, including keeping any records

[15] Design specifications may be found in manufacturer specifications and/or in applicable erosion and sediment control manuals or ordinances. Any departures from such specifications must reflect good engineering practices and must be explained in your SWPPP. You must also comply with any additional design and installation requirements specified for the effluent limits in Parts 2.2, 2.3, and 2.4.

[16] Note that the requirement to install stormwater controls prior to each phase of construction activities for the site does not apply to the earth disturbance associated with the actual installation of these controls. Operators should take all reasonable actions to minimize the discharges of pollutants during the installation of stormwater controls.

[17] Any departures from such maintenance recommendations made by the manufacturer must reflect good engineering practices and must be explained in your SWPPP.

of the condition and how it was corrected under Part 5.4; or

ii. Document in your inspection report under Part 4.7.1c why the specific reoccurrence of this same problem should still be addressed as a routine maintenance fix under this Part.[18]

d. If at any time you find that a stormwater control needs a significant repair or that a new or replacement control is needed, you must comply with the corrective action deadlines for completing such work in in Part 5.2.1c.

2.2 EROSION AND SEDIMENT CONTROL REQUIREMENTS

You must implement erosion and sediment controls in accordance with the following requirements to minimize the discharge of pollutants in stormwater from construction activities.

2.2.1 Provide and maintain natural buffers and/or equivalent erosion and sediment controls for discharges to any receiving waters that is located within 50 feet of the site's earth disturbances.

a. Compliance Alternatives. For any discharges to receiving waters located within 50 feet of your site's earth disturbances, you must comply with one of the following alternatives:

i. Provide and maintain a 50-foot undisturbed natural buffer; or

ii. Provide and maintain an undisturbed natural buffer that is less than 50 feet and is supplemented by erosion and sediment controls that achieve, in combination, the sediment load reduction equivalent to a 50-foot undisturbed natural buffer; or

iii. If infeasible to provide and maintain an undisturbed natural buffer of any size, implement erosion and sediment controls to achieve the sediment load reduction equivalent to a 50-foot undisturbed natural buffer.

See Appendix F, Part F.2 for additional conditions applicable to each compliance alternative.

b. Exceptions. See Appendix F, Part F.2 for exceptions to the compliance alternatives.

2.2.2 Direct stormwater to vegetated areas and maximize stormwater infiltration and filtering to reduce pollutant discharges, unless infiltration would be inadvisable due to the underlying geology (e.g., karst topography) and ground water contamination concerns, or infeasible due to site conditions.[19]

[18] Such documentation could include, for example, that minor repairs completed within the required timeframe are all that is necessary to ensure that the stormwater control continues to operate as designed and installed and that the stormwater control remains appropriate for the flow reaching it.

[19] Operators should consider whether factors such as specific contaminant concerns from the construction site, the underlying soils or geology, hydrology, depth to the ground water table, or proximity to source water or wellhead protection area(s) make the site unsuitable for infiltrating construction stormwater. Site conditions that may be of particular concern include proximity to: a current or future drinking water aquifer; a drinking water well or spring (including private/household wells); highly conductive geology such as karst; known pollutant hot spots, such as hazardous waste sites, landfills, gas stations, brownfields; an on-site sewage system or underground storage tank; or soils that do not allow for infiltration. Operators may find it helpful to consult EPA's Drinking Water Mapping Application to Protect Source Waters (DWMAPS). DWMAPS is an online mapping tool that can be used to locate drinking water providers, potential sources of contamination, polluted waterways, and information on protection initiatives in the site area.

2.2.3 Install sediment controls along any perimeter areas of the site that are downslope from any exposed soil or other disturbed areas.[20]

a. The perimeter control must be installed upgradient of any natural buffers established under Part 2.2.1, unless the control is being implemented pursuant to Part 2.2.1a.ii-iii;

b. To prevent stormwater from circumventing the edge of the perimeter control, install the perimeter control on the contour of the slope and extend both ends of the control up slope (e.g., at 45 degrees) forming a crescent rather than a straight line;

c. After installation, to ensure that perimeter controls continue to work effectively:

i. Remove sediment before it has accumulated to one-half of the above-ground height of any perimeter control; and

ii. After a storm event, if there is evidence of stormwater circumventing or undercutting the perimeter control, extend controls and/or repair undercut areas to fix the problem.

d. Exception. For areas at "linear construction sites" (as defined in Appendix A) where perimeter controls are infeasible (e.g., due to a limited or restricted right-of-way), implement other practices as necessary to minimize pollutant discharges to perimeter areas of the site.

2.2.4 Minimize sediment track-out.

a. Restrict vehicle use to properly designated exit points;

b. Use appropriate stabilization techniques[21] at all points that exit onto paved roads;

i. Exception: Stabilization is not required for exit points at linear utility construction sites that are used only episodically and for very short durations over the life of the project, provided other exit point controls[22] are implemented to minimize sediment track-out;

c. Implement additional track-out controls[23] as necessary to ensure that sediment removal occurs prior to vehicle exit; and

d. Where sediment has been tracked-out from your site onto paved roads, sidewalks, or other paved areas outside of your site, remove the deposited sediment by the end of the same business day in which the track-out occurs or by the end of the next business day if track-out occurs on a non-business day. Remove the track-out by sweeping, shoveling, or vacuuming these surfaces, or by using other similarly effective means of sediment removal. You are prohibited from hosing or sweeping tracked-out

[20] Examples of perimeter controls include filter berms; different types of silt fence such as wire-backed silt fence, super silt fence, or multi-layer geotextile silt fence; compost filter socks; gravel barriers; and temporary diversion dikes.

[21] Examples of appropriate stabilization techniques include the use of aggregate stone with an underlying geotextile or non-woven filter fabric, and turf mats.

[22] Examples of other exit point controls include preventing the use of exit points during wet periods; minimizing exit point use by keeping vehicles on site to the extent possible; limiting exit point size to the width needed for vehicle and equipment usage; using scarifying and compaction techniques on the soil; and avoiding establishing exit points in environmentally sensitive areas (e.g., *karst areas; steep slopes)*.

[23] Examples of additional track-out controls include the use of wheel washing, rumble strips, and rattle plates.

sediment into any constructed or natural site drainage feature, storm drain inlet, or receiving water.[24]

2.2.5 Manage stockpiles or land clearing debris piles composed, in whole or in part, of sediment and/or soil:[25]

a. Locate the piles outside of any natural buffers established under Part 2.2.1 and away from any constructed or natural site drainage features, storm drain inlets, and areas where stormwater flow is concentrated;

b. Install a sediment barrier along all downgradient perimeter areas of stockpiled soil or land clearing debris piles;[26]

c. For piles that will be unused for 14 or more days, provide cover[27] or appropriate temporary stabilization (consistent with Part 2.2.14);

d. You are prohibited from hosing down or sweeping soil or sediment accumulated on pavement or other impervious surfaces into any constructed or natural site drainage feature, storm drain inlet, or receiving water.

2.2.6 Minimize dust. On areas of exposed soil, minimize dust through the appropriate application of water or other dust suppression techniques to control the generation of pollutants that could be discharged in stormwater from the site.

2.2.7 Minimize steep slope disturbances. Minimize the disturbance of "steep slopes" (as defined in Appendix A).[28]

2.2.8 Preserve native topsoil, unless infeasible.[29]

2.2.9 Minimize soil compaction.[30] In areas of your site where final vegetative stabilization will occur or where infiltration practices will be installed:

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[24] Fine grains that remain visible (e.g., staining) on the surfaces of off-site streets, other paved areas, and sidewalks after you have implemented sediment removal practices are not a violation of Part 2.2.4.

[25] The requirements in Part 2.2.5 do not apply to the storage of rock, such as rip rap, landscape rock, pipe bedding gravel, and boulders. Refer to Part 2.3.3a for the requirements that apply to these types of materials.

[26] Examples of sediment barriers include berms, dikes, fiber rolls, silt fences, sandbags, gravel bags, or straw bale.

[27] Examples of cover include tarps, blown straw and hydroseeding.

[28] Where disturbance to steep slopes cannot be avoided, operators should consider implementing controls suitable for steep slope disturbances that are effective at minimizing erosion and sediment discharge (e.g., preservation of existing vegetation, hydraulic mulch, geotextiles and mats, compost blankets, earth dikes or drainage swales, terraces, velocity dissipation devices). To identify slopes and soil types that are of comparatively higher risk for sediment discharge in areas of the country where the CGP is in effect, operators can use the tables in Appendix F (see Tables F-2 thru F-6).

[29] Stockpiling topsoil at off-site locations, or transferring topsoil to other locations, is an example of a practice that is consistent with the requirements in Part 2.2.8. Preserving native topsoil is not required where the intended function of a specific area of the site dictates that the topsoil be disturbed or removed. For example, some sites may be designed to be highly impervious after construction, and therefore little or no vegetation is intended to remain, or may not have space to stockpile native topsoil on site for later use, in which case it may not be feasible to preserve topsoil.

[30] Minimizing soil compaction is not required where the intended function of a specific area of the site dictates that it be compacted.

a. Restrict vehicle and equipment use in these locations to avoid soil compaction; and

b. Before seeding or planting areas of exposed soil that have been compacted, use techniques that rehabilitate and condition the soils as necessary to support vegetative growth.

2.2.10 Protect storm drain inlets.

a. Install inlet protection measures that remove sediment from discharges prior to entry into any storm drain inlet that carries stormwater from your site to a receiving water, provided you have authority to access the storm drain inlet.[31] Inlet protection measures are not required for storm drain inlets that are conveyed to a sediment basin, sediment trap, or similarly effective control; and

b. Clean, or remove and replace, the inlet protection measures as sediment accumulates, the filter becomes clogged, and/or performance is compromised. Where there is evidence of sediment accumulation adjacent to the inlet protection measure, remove the deposited sediment by the end of the same business day in which it is found or by the end of the following business day if removal by the same business day is not feasible.

2.2.11 Control stormwater discharges, including both peak flowrates and total stormwater volume, to minimize channel and streambank erosion and scour in the immediate vicinity of discharge points.[32]

2.2.12 If you install a sediment basin or similar impoundment:

a. Situate the basin or impoundment outside of any receiving water. and any natural buffers established under Part 2.2.1;

b. Design the basin or impoundment to avoid collecting water from wetlands;

c. Design the basin or impoundment to provide storage for either:

i. The calculated volume of runoff from a 2-year, 24-hour storm;[33] or

ii. 3,600 cubic feet per acre drained.

d. Utilize outlet structures that withdraw water from the surface of the sediment basin or similar impoundment, unless infeasible;[34]

e. Use erosion controls and velocity dissipation devices to prevent erosion at inlets and outlets; and

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[31] Inlet protection measures can be removed in the event of flood conditions or to prevent erosion.

[32] Examples of stormwater controls that can be used to comply with this requirement include the use of erosion controls and/or velocity dissipation devices (e.g., check dams, sediment traps), within and along the length of a constructed site drainage feature and at the outfall to slow down stormwater.

[33] Operators may refer to https://www.epa.gov/npdes/construction-general-permit-resources-tools-and-templates for guidance on determining the volume of precipitation associated with their site's local 2-year, 24-hour storm event.

[34] The circumstances in which it is infeasible to design outlet structures in this manner are rare. Exceptions may include areas with extended cold weather, where using surface outlets may not be feasible during certain time periods (although they must be used during other periods). If you determine that it is infeasible to meet this requirement, you must provide documentation in your SWPPP to support your determination, including the specific conditions or time periods when this exception will apply.

f. Remove accumulated sediment to maintain at least one-half of the design capacity and conduct all other appropriate maintenance to ensure the basin or impoundment remains in effective operating condition.

2.2.13 If using treatment chemicals (e.g., *polymers, flocculants, coagulants*):

a. Use conventional erosion and sediment controls before and after the application of treatment chemicals. Chemicals may only be applied where treated stormwater is directed to a sediment control *(e.g., sediment basin, perimeter control)* before discharge.

b. Select appropriate treatment chemicals*.* Chemicals must be appropriately suited to the types of soils likely to be exposed during construction and present in the discharges being treated *(i.e., the expected turbidity, pH, and flow rate of stormwater flowing into the chemical treatment system or area)*.

c. Minimize discharge risk from stored chemicals. Store all treatment chemicals in leak-proof containers that are kept under storm-resistant cover and surrounded by secondary containment structures *(e.g., spill berms, dikes, spill containment pallets),* or provide equivalent measures designed and maintained to minimize the potential discharge of treatment chemicals in stormwater or by any other means *(e.g., storing chemicals in a covered area, having a spill kit available on site and ensuring personnel are available to respond expeditiously in the event of a leak or spill)*.

d. Comply with State/local requirements. Comply with applicable State and local requirements regarding the use of treatment chemicals.

e. Use chemicals in accordance with good engineering practices and specifications of the chemical provider/supplier. Use treatment chemicals and chemical treatment systems in accordance with good engineering practices, and with dosing specifications and sediment removal design specifications provided by the provider/supplier of the applicable chemicals, or document in your SWPPP specific departures from these specifications and how they reflect good engineering practice.

f. Ensure proper training. Ensure all persons who handle and use treatment chemicals at the construction site are provided with appropriate, product-specific training prior to beginning application of treatment chemicals. Among other things, the training must cover proper dosing requirements.

g. Perform additional measures specified by the EPA Regional Office for the authorized use of cationic chemicals. If you have been authorized to use cationic chemicals at your site pursuant to Part 1.1.9, you must perform all additional measures as conditioned by your authorization to ensure the use of such chemicals will not result in discharges that do not meet water quality standards.

2.2.14 Stabilize exposed portions of the site. Implement and maintain stabilization measures (*e.g., seeding protected by erosion controls until vegetation is established,*[35] *sodding, mulching, erosion control blankets, hydromulch, gravel*) that minimize erosion from any areas of exposed soil on the site in accordance with Part.

[35] If you will be evaluating the use of some type of erosion control netting to the site as part of your site stabilization, EPA encourages you to consider employing products that have been shown to minimize

a. Stabilization Deadlines:[36]

Table 2 Deadlines for Initiating and Completing Site Stabilization.

Total Amount of Land Disturbance Occurring At Any One Time[37]	**Deadline**
i. Five acres or less (≤5.0) **Note: this includes sites disturbing more than five acres (>5.0) total over the course of a project, but that limit disturbance at any one time (i.e., *phase the disturbance*) to five acres or less (≤5.0)**	• Initiate the installation of stabilization measures immediately[38] in any areas of exposed soil where construction activities have permanently ceased or will be temporarily inactive for 14 or more calendar days;[39] and • Complete the installation of stabilization measures as soon as practicable, but no later than 14 calendar days

impacts on wildlife. For instance, the U.S. Fish & Wildlife Service provides recommendations on the type of netting practices that are considered "wildlife friendly," including those that use natural fiber or 100 percent biodegradable materials and that use a loose weave with a non-welded, movable jointed netting, as well as those products that are not wildlife friendly including square plastic netting that are degradable (e.g., photodegradable, UV-degradable, oxo-degradable), netting made from polypropylene, nylon, polyethylene, or polyester. Other recommendations include removing the netting product when it is no longer needed. See https://www.fws.gov/midwest/eastlansing/library/pdf/WildlifeFriendlyErosionControlProducts_revised.pdf for further information. There also may be State, Tribal, or local requirements about using wildlife friendly erosion control products.

[36] EPA may determine, based on an inspection carried out under Part 4.8 and corrective actions required under Part 5.3, that the level of sediment discharge on the site makes it necessary to require a faster schedule for completing stabilization. For instance, if sediment discharges from an area of exposed soil that is required to be stabilized are compromising the performance of existing stormwater controls, EPA may require stabilization to correct this problem.

[37] Limiting disturbances to five (5) acres or less at any one time means that at no time during the project do the cumulative earth disturbances exceed five (5) acres. The following examples would qualify as limiting disturbances at any one time to five (5) acres or less:

1. The total area of disturbance for a project is five (5) acres or less.
2. The total area of disturbance for a project will exceed five (5) acres, but the operator ensures that no more than five (5) acres will be disturbed at any one time through implementation of stabilization measures. In this way, site stabilization can be used to "free up" land that can be disturbed without exceeding the five (5)-acre cap to qualify for the 14-day stabilization deadline. For instance, if an operator completes stabilization of two (2) acres of land on a five (5)-acre disturbance, then two (2) additional acres could be disturbed while still qualifying for the longer 14-day stabilization deadline.

[38] The following are examples of activities that would constitute the immediate initiation of stabilization:

1. Prepping the soil for vegetative or non-vegetative stabilization as long as seeding, planting, and/or installation of non-vegetative stabilization products takes place as soon as practicable, but no later than one (1) calendar day of completing soil preparation;
2. Applying mulch or other non-vegetative product to the exposed area;
3. Seeding or planting the exposed area;
4. Starting any of the activities in # 1 – 3 on a portion of the entire area that will be stabilized; and
5. Finalizing arrangements to have stabilization product fully installed in compliance with the deadlines for completing stabilization.

[39] The requirement to initiate stabilization immediately is triggered as soon as you know that construction work on a portion of the site is temporarily ceased and will not resume for 14 or more days, or as soon as you know that construction work is permanently ceased. In the context of this provision, "immediately" means as soon as practicable, but no later than the end of the next business day, following the day when the construction activities have temporarily or permanently ceased.

Total Amount of Land Disturbance Occurring At Any One Time[37]	Deadline
	after stabilization has been initiated.[40]
ii. More than five acres (>5.0)	• Initiate the installation of stabilization measures immediately[41] in any areas of exposed soil where construction activities have permanently ceased or will be temporarily inactive for 14 or more calendar days;[42] and • Complete the installation of stabilization measures as soon as practicable, but no later than seven (7) calendar days after stabilization has been initiated.[43]

b. Exceptions:

i. Arid, semi-arid, and drought-stricken areas (as defined in Appendix A)**.** If it is the seasonally dry period (as defined in Appendix A)[44] or a period in which drought is occurring, and vegetative stabilization measures are being used:

(a) Immediately initiate and, within 14 calendar days of temporary or permanent cessation of work in any portion of your site, complete the installation of temporary non-vegetative stabilization measures to the extent necessary to prevent erosion;

(b) As soon as practicable, given conditions or circumstances on the site, complete all activities necessary to seed or plant the area to be stabilized; and

(c) If construction is occurring during the seasonally dry period, indicate in your SWPPP the beginning and ending dates of the seasonally dry period and your site conditions. Also include the schedule you will follow for initiating and completing vegetative stabilization.

ii. Unforeseen circumstances. Operators that are affected by unforeseen circumstances[45] that delay the initiation and/or completion of vegetative stabilization:

[40] If vegetative stabilization measures are being implemented, stabilization is considered "installed" when all activities necessary to seed or plant the area are completed, including the application of any non-vegetative protective cover (e.g., mulch, erosion control blanket), if applicable. If non-vegetative stabilization measures are being implemented, stabilization is considered "installed" when all such measures are implemented or applied.

[41] See footnote 38.

[42] See footnote 39.

[43] See footnote 40.

[44] The term "seasonally dry period" as defined in Appendix A refers to a month in which the long-term average total precipitation is less than or equal to 0.5 inches. Refer to EPA's Seasonally Dry Period Locator Tool at https://www.epa.gov/npdes/construction-general-permit-resources-tools-and-templates and supporting maps for assistance in determining whether a site is operating during a seasonally dry period for the area.

[45] Examples include problems with the supply of seed stock or with the availability of specialized equipment and unsuitability of soil conditions due to excessive precipitation and/or flooding.

(a) Immediately initiate and, within 14 calendar days, complete the installation of temporary non-vegetative stabilization measures to prevent erosion;

(b) Complete all soil conditioning, seeding, watering or irrigation installation, mulching, and other required activities related to the planting and initial establishment of vegetation as soon as conditions or circumstances allow it on your site; and

(c) Document in the SWPPP the circumstances that prevent you from meeting the deadlines in Part 2.2.14a and the schedule you will follow for initiating and completing stabilization.

iii. Discharges to a sediment- or nutrient-impaired water or to a water that is identified by your State, Tribe, or EPA as Tier 2, Tier 2.5, or Tier 3 for antidegradation purposes. Complete stabilization as soon as practicable, but no later than seven (7) calendar days after stabilization has been initiated.

c. Final Stabilization Criteria (for any areas not covered by permanent structures)**:**

i. Establish uniform, perennial vegetation *(*i.e.*, evenly distributed, without large bare areas)* to provide 70 percent or more of the vegetative cover native to local undisturbed areas; and/or

ii. Implement permanent non-vegetative stabilization measures[46] to provide effective cover of any areas of exposed soil.

iii. Exceptions:

(a) **Arid, semi-arid, and drought-stricken areas** (as defined in Appendix A). Final stabilization is met if the area has been seeded or planted to establish vegetation that provides 70 percent or more of the vegetative cover native to local undisturbed areas within three (3) years and, to the extent necessary to prevent erosion on the seeded or planted area, non-vegetative erosion controls have been applied to provide cover for at least three years without active maintenance.

(b) **Disturbed areas on agricultural land that are restored to their preconstruction agricultural use.** The Part 2.2.14c final stabilization criteria do not apply.

(c) **Areas that need to remain disturbed.** In limited circumstances, stabilization may not be required if the intended function of a specific area of the site necessitates that it remain disturbed, and only the minimum area needed remains disturbed *(*e.g.*, dirt access roads, utility pole pads, areas being used for storage of vehicles, equipment, materials)*.

2.3 POLLUTION PREVENTION REQUIREMENTS[47]

You must implement pollution prevention controls in accordance with the following requirements to minimize the discharge of pollutants in stormwater and to prevent the discharge of pollutants from spilled or leaked materials from construction activities.

[46] Examples of permanent non-vegetative stabilization measures include riprap, gravel, gabions, and geotextiles.

[47] Under this permit, you are not required to minimize exposure for any products or materials where the exposure to precipitation and to stormwater will not result in a discharge of pollutants, or where exposure of a specific material or product poses little risk of stormwater contamination (such as final products and materials intended for outdoor use).

2.3.1 For equipment and vehicle fueling and maintenance:

a. Provide an effective means of eliminating the discharge of spilled or leaked chemicals, including fuels and oils, from these activities;[48]

b. If applicable, comply with the Spill Prevention Control and Countermeasures (SPCC) requirements in 40 CFR part 112 and Section 311 of the CWA;

c. Ensure adequate supplies are available at all times to handle spills, leaks, and disposal of used liquids;

d. Use drip pans and absorbents under or around leaky vehicles;

e. Dispose of or recycle oil and oily wastes in accordance with other Federal, State, Tribal, or local requirements; and

f. Clean up spills or contaminated surfaces immediately, using dry clean up measures (do not clean contaminated surfaces by hosing the area down), and eliminate the source of the spill to prevent a discharge or a continuation of an ongoing discharge.

2.3.2 For equipment and vehicle washing:

a. Provide an effective means of minimizing the discharge of pollutants from equipment and vehicle washing, wheel wash water, and other types of wash waters;[49]

b. Ensure there is no discharge of soaps, solvents, or detergents in equipment and vehicle wash water; and

c. For storage of soaps, detergents, or solvents, provide either (1) cover *(*e.g., *plastic sheeting, temporary roofs)* to minimize the exposure of these detergents to precipitation and to stormwater, or (2) a similarly effective means designed to minimize the discharge of pollutants from these areas.

2.3.3 For storage, handling, and disposal of building products, materials, and wastes:[50]

a. *For building materials and building products*,[51] provide either (1) cover (e.g., *plastic sheeting, temporary roofs*) to minimize the exposure of these products to

[48] Examples of effective means include:

- Locating activities away from receiving waters, storm drain inlets, and constructed or natural site drainage feature so that stormwater coming into contact with these activities cannot reach waters of the U.S.;
- Providing secondary containment (e.g., *spill berms, dikes, spill containment pallets*) and cover where appropriate; and
- Having a spill kit available on site and ensuring personnel are available to respond expeditiously in the event of a leak or spill.

[49] Examples of effective means include locating activities away from receiving waters and storm drain inlets or constructed or natural site drainage features and directing wash waters to a sediment basin or sediment trap, using filtration devices, such as filter bags or sand filters, or using other similarly effective controls.

[50] Compliance with the requirements of this permit does not relieve compliance requirements with respect to Federal, State, or local laws and regulations governing the storage, handling, and disposal of solid, hazardous, or toxic wastes and materials.

[51] Examples of building materials and building products typically present at construction sites include asphalt sealants, copper flashing, roofing materials, adhesives, concrete admixtures, and gravel and mulch stockpiles.

precipitation and to stormwater, or (2) a similarly effective means designed to minimize the discharge of pollutants from these areas.

Exception: Minimization of exposure is not required in cases where the exposure to precipitation and to stormwater will not result in a discharge of pollutants, or where exposure of a specific material or product poses little risk of stormwater contamination (such as final products and materials intended for outdoor use).

b. *For pesticides, herbicides, insecticides, fertilizers, and landscape materials:*

i. In storage areas, provide either (1) cover (e.g., *plastic sheeting, temporary roofs*) to minimize the exposure of these chemicals to precipitation and to stormwater, or (2) a similarly effective means designed to minimize the discharge of pollutants from these areas; and

ii. Comply with all application and disposal requirements included on the registered pesticide, herbicide, insecticide, and fertilizer label (see also Part 2.3.5).

c. *For diesel fuel, oil, hydraulic fluids, other petroleum products, and other chemicals:* The following requirements apply to the storage and handling of chemicals on your site. If you are already implementing controls as part of an SPCC or other spill prevention plan that meet or exceed the requirements of this Part, you may continue to do so and be considered in compliance with these provisions provided you reference the applicable parts of the SPCC or other plans in your SWPPP as required in Part 7.2.6b.viii.

i. If any chemical container has a storage capacity of less than 55 gallons:

(a) The containers must be water-tight, and must be kept closed, sealed, and secured when not being actively used;

(b) If stored outside, use a spill containment pallet or similar device to capture small leaks or spills; and

(c) Have a spill kit available on site that is in good working condition (i.e., not damaged, expired, or used up) and ensure personnel are available to respond immediately in the event of a leak or spill.

ii. If any chemical container has a storage capacity of 55 gallons or more:

(a) The containers must be water-tight, and must be kept closed, sealed, and secured when not being actively used;

(b) Store containers a minimum of 50 feet from receiving waters, constructed or natural site drainage features, and storm drain inlets. If infeasible due to site constraints, store containers as far away from these features as the site permits. If site constraints prevent you from storing containers 50 feet away from receiving waters or the other features identified, you must document in your SWPPP the specific reasons why the 50-foot setback is infeasible, and how you will store containers as far away as the site permits;

(c) Provide either (1) cover (e.g., temporary roofs) to minimize the exposure of these containers to precipitation and to stormwater, or (2) secondary containment (e.g., curbing, spill berms, dikes, spill containment pallets, double-wall, above-ground storage tank); and

(d) Have a spill kit available on site that is in good working condition (i.e., not

damaged, expired, or used up) and ensure personnel are available to respond immediately in the event of a leak or spill. Additional secondary containment measures are listed at 40 CFR § 112.7(c)(1).

iii. Clean up spills immediately, using dry clean-up methods where possible, and dispose of used materials properly. You are prohibited from hosing the area down to clean surfaces or spills. Eliminate the source of the spill to prevent a discharge or a furtherance of an ongoing discharge.

d. *For hazardous or toxic wastes:*[52]

i. Separate hazardous or toxic waste from construction and domestic waste;

ii. Store waste in sealed containers, constructed of suitable materials to prevent leakage and corrosion, and labeled in accordance with applicable Resource Conservation and Recovery Act (RCRA) requirements and all other applicable Federal, State, Tribal, or local requirements;

iii. Store all outside containers within appropriately-sized secondary containment (e.g., *spill berms, dikes, spill containment pallets*) to prevent spills from being discharged, or provide a similarly effective means designed to prevent the discharge of pollutants from these areas *(*e.g., *storing chemicals in a covered area, having a spill kit available on site);*

iv. Dispose of hazardous or toxic waste in accordance with the manufacturer's recommended method of disposal and in compliance with Federal, State, Tribal, and local requirements;

v. Clean up spills immediately, using dry clean-up methods, and dispose of used materials properly. You are prohibited from hosing the area down to clean surfaces or spills. Eliminate the source of the spill to prevent a discharge or a furtherance of an ongoing discharge; and

vi. Follow all other Federal, State, Tribal, and local requirements regarding hazardous or toxic waste.

e. *For construction and domestic wastes:*[53]

i. Provide waste containers *(*e.g., *dumpster, trash receptacle)* of sufficient size and number to contain construction and domestic wastes;

(a) For waste containers with lids, keep waste container lids closed when not in use, and close lids at the end of the business day and during storm events. For waste containers without lids, provide either (1) cover *(*e.g., *a tarp, plastic sheeting, temporary roof)* to minimize exposure of wastes to precipitation, or (2) a similarly effective means designed to minimize the discharge of pollutants *(*e.g., *secondary containment)*;

(b) On business days, clean up and dispose of waste in designated waste

[52] Examples of hazardous or toxic waste that may be present at construction sites include paints, caulks, sealants, fluorescent light ballasts, solvents, petroleum-based products, wood preservatives, additives, curing compounds, and acids.

[53] Examples of construction and domestic wastes include packaging materials, scrap construction materials, masonry products, timber, pipe and electrical cuttings, plastics, styrofoam, concrete, demolition debris; and other trash or discarded materials.

containers; and

(c) Clean up immediately if containers overflow, and if there is litter elsewhere on the site from escaped trash.

ii. Waste containers are not required for the waste remnant or unused portions of construction materials or final products that are covered by the exception in Part 2.2.3a provided that:

(a) These wastes are stored separately from other construction or domestic wastes addressed by Part 2.3.3e.i (i.e., wastes not covered by the exception in Part 2.3.3a). If the wastes are mixed, they must be stored in waste containers as required in Part 2.3.3e.i; and

(b) These wastes are stored in designated areas of the site, the wastes are described in the SWPPP (see Part 7.2.6b.ix), and identified in the site plan (see Part 7.2.4i).

f. *For sanitary waste*, position portable toilets so they are secure and will not be tipped or knocked over, and are located away from receiving waters, storm drain inlets, and constructed or natural site drainage features.

2.3.4 For washing applicators and containers used for stucco, paint, concrete, form release oils, curing compounds, or other materials:

a. Direct wash water into a leak-proof container or leak-proof and lined pit designed so no overflows can occur due to inadequate sizing or precipitation;

b. Handle washout or cleanout wastes as follows:

i. For liquid wastes:

(a) Do not dump liquid wastes or allow them to enter into constructed or natural site drainage features, storm inlets, or receiving waters;

(b) Do not allow liquid wastes to be disposed of through infiltration or to otherwise be disposed of on the ground;

(c) Comply with applicable State, Tribal, or local requirements for disposal

ii. Remove and dispose of hardened concrete waste consistent with your handling of other construction wastes in Part 2.3.3e; and

c. Locate any washout or cleanout activities as far away as possible from receiving waters, constructed or natural site drainage features, and storm drain inlets, and, to the extent feasible, designate areas to be used for these activities and conduct such activities only in these areas.

2.3.5 For the application of fertilizers:

a. Apply at a rate and in amounts consistent with manufacturer's specifications, or document in the SWPPP departures from the manufacturer specifications where appropriate in accordance with Part 7.2.6b.x;

b. Apply at the appropriate time of year for your location, and preferably timed to coincide as closely as possible to the period of maximum vegetation uptake and growth;

c. Avoid applying before heavy rains that could cause excess nutrients to be discharged;

d. Never apply to frozen ground;

e. Never apply to constructed or natural site drainage features; and

f. Follow all other Federal, State, Tribal, and local requirements regarding fertilizer application.

2.3.6 Emergency Spill Notification Requirements

Discharges of toxic or hazardous substances from a spill or other release are prohibited, consistent with Part 1.3.5. Where a leak, spill, or other 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 24-hour period, you must notify the National Response Center (NRC) at (800) 424-8802 or, in the Washington, DC metropolitan area, call (202) 267-2675 in accordance with the requirements of 40 CFR part 110, 40 CFR part 117, and 40 CFR part 302 as soon as you have knowledge of the release. You must also, within seven (7) calendar days of knowledge of the release, provide a description of the release, the circumstances leading to the release, and the date of the release. State, Tribal, or local requirements may necessitate additional reporting of spills or discharges to local emergency response, public health, or drinking water supply agencies.

2.4 CONSTRUCTION DEWATERING REQUIREMENTS

Comply with the following requirements to minimize the discharge of pollutants from dewatering[54] operations.

2.4.1 Route dewatering water through a sediment control (e.g., sediment trap or basin, pumped water filter bag) designed to prevent discharges with visual turbidity; [55]

2.4.2 Do not discharge visible floating solids or foam;

2.4.3 The discharge must not cause the formation of a visible sheen on the water surface, or visible oily deposits on the bottom or shoreline of the receiving water. Use an oil-water separator or suitable filtration device (such as a cartridge filter) designed to remove oil, grease, or other products if dewatering water is found to or expected to contain these materials;

2.4.4 To the extent feasible, use well-vegetated (e.g., grassy or wooded), upland areas of the site to infiltrate dewatering water before discharge.[56] You are prohibited from using receiving waters as part of the treatment area;

2.4.5 To prevent dewatering-related erosion and related sediment discharges:

a. Use stable, erosion-resistant surfaces (e.g., well-vegetated grassy areas, clean filter stone, geotextile underlayment) to discharge from dewatering controls;

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[54] "Dewatering" is defined in Appendix A as "the act of draining accumulated stormwater and/or ground water from building foundations, vaults, and trenches, or other similar points of accumulation."

[55] For the purposes of this permit, visual turbidity is present where there is a sediment plume in the discharge or the discharge appears cloudy, or opaque, or has a visible contrast that can be identified by an observer.

[56] See footnote 19.

b. Do not place dewatering controls, such as pumped water filter bags, on steep slopes (as defined in Appendix A); and

c. At all points where dewatering water is discharged, comply with the velocity dissipation requirements of Part 2.2.11.

2.4.6 For backwash water, either haul it away for disposal or return it to the beginning of the treatment process;

2.4.7 Replace and clean the filter media used in dewatering devices when the pressure differential equals or exceeds the manufacturer's specifications; and

2.4.8 Comply with dewatering-specific inspection requirements in Part 4.

3 WATER QUALITY-BASED EFFLUENT LIMITATIONS

3.1 GENERAL EFFLUENT LIMITATION TO MEET APPLICABLE WATER QUALITY STANDARDS

Discharges must be controlled as necessary to meet applicable water quality standards. Discharges must also comply with any additional State or Tribal requirements that are in Part 9.

In the absence of information demonstrating otherwise, EPA expects that compliance with the conditions in this permit will result in stormwater discharges being controlled as necessary to meet applicable water quality standards. If at any time you become aware, or EPA determines, that discharges are not being controlled as necessary to meet applicable water quality standards, you must take corrective action as required in Parts 5.1 and 5.2, and document the corrective actions as required in Part 5.4.

EPA may insist that you install additional controls (to meet the narrative water quality-based effluent limit above) on a site-specific basis, or require you to obtain coverage under an individual permit, if information in your NOI or from other sources indicates that your discharges are not controlled as necessary to meet applicable water quality standards. This includes situations where additional controls are necessary to comply with a wasteload allocation in an EPA-established or approved TMDL.

If during your coverage under a previous permit, you were required to install and maintain stormwater controls specifically to meet the assumptions and requirements of an EPA-approved or established TMDL (for any parameter) or to otherwise control your discharge to meet water quality standards, you must continue to implement such controls as part of your coverage under this permit.

3.2 WATER QUALITY-BASED CONDITIONS FOR SITES DISCHARGING TO CERTAIN IMPAIRED AND HIGH QUALITY RECEIVING WATERS

For any portion of the site that discharges to a sediment or nutrient-impaired water or to a water that is identified by your State, Tribe, or EPA as Tier 2, Tier 2.5, or Tier 3 for antidegradation purposes,[57] you must comply with the inspection frequency specified in Part 4.3 and you must comply with the stabilization deadline specified in Part 2.2.14b.iii.[58]

[57] Refer to Appendix A for definitions of "impaired water" and "Tier 2," "Tier 2.5," and "Tier 3" waters. For assistance in determining whether your site discharges to impaired waters, EPA has developed a tool that is available at https://www.epa.gov/npdes/epas-stormwater-discharge-mapping-tools. For assistance in determining whether your site discharges to a Tier 2, 2.5, or 3 water, refer to the list of such waters at https://www.epa.gov/npdes/construction-general-permit-resources-tools-and-templates.

[58] If you qualify for any of the reduced inspection frequencies in Part 4.4, you may conduct inspections in

If you discharge to a water that is impaired for a parameter other than a sediment-related parameter or nutrients, EPA will inform you if any additional controls are necessary for your discharge to be controlled as necessary to meet water quality standards. These controls might include those necessary for your discharge to be consistent with the assumptions of any available wasteload allocation in any applicable TMDL. In addition, EPA may require you to apply for and obtain coverage under an individual NPDES permit.

In addition, on a case-by-case basis, EPA may notify operators of new sites or operators of existing sites with increased discharges that additional analyses, stormwater controls, and/or other measures are necessary to comply with the applicable antidegradation requirements, or notify you that an individual permit application is necessary.

If you discharge to a water that is impaired for polychlorinated biphenyls (PCBs) and are engaging in demolition of any structure with at least 10,000 square feet of floor space built or renovated before January 1, 1980, you must:

a. Implement controls[59] to minimize the exposure of PCB-containing building materials, including paint, caulk, and pre-1980 fluorescent lighting fixtures, to precipitation and to stormwater; and

b. Ensure that disposal of such materials is performed in compliance with applicable State, Federal, and local laws.

3.3 TURBIDITY BENCHMARK MONITORING FOR SITES DISCHARGING DEWATERING WATER TO PROTECT THE WATER QUALITY OF SENSITIVE WATERS

For sites discharging dewatering water to "sensitive waters" (i.e., receiving waters listed as impaired for sediment or a sediment-related parameter (as defined in Appendix A), or receiving waters designated as a Tier 2, Tier 2.5, or Tier 3 for antidegradation purposes) you are required to comply with the benchmark monitoring requirements in this Part and document the procedures you will use at your site in your SWPPP pursuant to Part 7.2.8. A summary of these requirements is included in Table 1.

EPA notes that the benchmark threshold is not an effluent limitation, rather it is an indicator that the dewatering controls may not be working to protect water quality, which the operator must investigate and correct as appropriate. A benchmark exceedance is not a permit violation. However, if a benchmark exceedance triggers corrective action in Part 5.1.5a, failure to conduct any required action is a permit violation.

Where there are multiple operators associated with the same site, the operators may coordinate with one another to carry out the monitoring requirements of this Part in order to avoid duplicating efforts. Such coordinating arrangements must be described in the SWPPP consistent with Part 7.2.8. Regardless of how the operators divide the

accordance with Part 4.4 for any portion of your site that discharges to a sensitive water.

[59] Examples of controls to minimize exposure of PCBs to precipitation and stormwater include separating work areas from non-work areas and selecting appropriate personal protective equipment and tools, constructing a containment area so that all dust or debris generated by the work remains within the protected area, and using tools that minimize dust and heat (<212°F). For additional information, refer to Part 2.3.3 of the CGP Fact Sheet.

responsibilities for monitoring and reporting, each operator remains responsible for compliance with these requirements.[60]

3.3.1 Turbidity monitoring requirements[61]

a. **Sampling frequency.** You must collect at least one turbidity sample from your dewatering discharge each day a discharge occurs.

b. **Sampling location.** Samples must be taken at all points where dewatering water is discharged. Samples must be taken after the dewatering water has been treated by installed treatment devices pursuant to Parts 2.4.1 and 2.4.3 and prior to its discharge off site into a receiving water, constructed or natural site drainage feature, or storm drain inlet.

c. **Representative samples.** Samples taken must be representative of the dewatering discharge for any given day as required in Appendix G (standard permit conditions), Part G.10.2.

d. **Test methods.** Samples must be measured using a turbidity meter that reports results in nephelometric turbidity units (NTUs) and conforms with a Part 136-approved method (e.g., methods 180.1 and 2130). You are required to use the meter, and conduct a calibration verification prior to each day's use, consistent with the manufacturer's instructions.

3.3.2 Turbidity benchmark

a. The benchmark threshold for turbidity for this permit is 50 NTUs (referred to elsewhere in this permit as the "standard 50 NTU benchmark") unless EPA has authorized the use of an alternate benchmark in accordance with Part 3.3.2b.

b. **Request for alternate benchmark threshold.**

i. At any time prior to or during your coverage under this permit, you may request that EPA approve a benchmark for your site that is higher than 50 NTUs if you have information demonstrating the higher number is the same as your receiving water's water quality standard for turbidity. Unless EPA approves an alternate benchmark, you will be required to use the standard 50 NTU benchmark. To request approval of an alternate benchmark, you must submit the following information to your applicable EPA Regional Office (see Appendix K):
(a) The current turbidity water quality standard that applies to your receiving

[60] For instance, if Operator A relies on Operator B to meet the Part 3.3.1 turbidity monitoring requirements, the Part 3.3.4 reporting and recordkeeping requirements, and the Part 5.2.2 corrective action provisions when applicable, Operator A does not have to duplicate these same functions if Operator B is implementing them for both operators to be in compliance with the permit. However, Operator A remains responsible for complying with these permit requirements if Operator B fails to take actions that were necessary for Operator A to comply with the permit. See also footnote 83. EPA notes that both Operator A and B are required to submit turbidity monitoring reports as required under Part 3.3.4, however, Operator A's report does not need to include the data collected by Operator B as long as Operator B submits the required data and Operator A's report indicates that it is relying on Operator B to report the data. See Part 3.3.4a.

[61] Operators may find it useful to consult EPA's *Monitoring and Inspection Guide for Construction Dewatering*, available at https://www.epa.gov/npdes/construction-general-permit-resources-tools-and-templates, which provides guidelines on how to correctly monitor for turbidity, determine if the weekly average exceeds the benchmark, and, if so, how to proceed with corrective action.

water and the source/citation.[62]

(b) If the applicable turbidity water quality standard requires information on natural or background turbidity levels (e.g., "no more than 10 NTU above natural turbidity levels") to determine the specific standard for the receiving water, include available data that can be used to establish the natural turbidity levels of your receiving water (including literature studies or Federal, State, Tribal, or local government data). Data must be representative of the natural turbidity levels of your specific receiving water. Identify the source(s) of all data provided, including if the data are from samples you collected of the receiving water.

ii. EPA will inform you of its decision on whether to approve the requested alternate benchmark within 30 days. EPA may approve your request, request additional time (e.g., if additional information is needed to substantiate the data you provided), or deny your request. Unless and until EPA approves your request to use an alternate benchmark, you are required to use the standard benchmark of 50 NTUs and take any required corrective actions if an exceedance occurs.

3.3.3 Comparison of turbidity samples to benchmark. Compare the weekly average[63] of your turbidity monitoring results to the standard 50 NTU benchmark, or alternate benchmark if approved by EPA.

a. If the weekly average of your turbidity monitoring results exceeds the standard benchmark (or your approved alternate benchmark), you are required to conduct follow-up corrective action in accordance with Part 5.2.2 and document any corrective action taken in your corrective action log in accordance with Part 5.4.

b. For averaging purposes, a "monitoring week" starts with a Monday and ends on Sunday. Once a new monitoring week starts, you will need to calculate a new average for that week of turbidity monitoring results.[64] A weekly average may consist of one or more turbidity monitoring results.

c. Although you are not required to collect and analyze more than one turbidity sample per day from your dewatering discharge, if you do collect and analyze more than one sample on any given day, you must include any additional results in the

[62] For instance, if your site is located in Washington, DC, and you are discharging to a Class B water, for which the water quality standard is that turbidity may not increase above ambient levels by more than 20 percent, you would reference "Water Quality Standards for the District of Columbia, Chapter 11, Section 1104.8."

[63] A "weekly average" is defined as the sum of all of the turbidity samples taken during a "monitoring week" divided by the number of samples measured during that week. Average values should be calculated to the nearest whole number.

[64] For example, if turbidity samples from your dewatering discharge in week 1 result in values of 30 NTU on Tuesday, 40 NTU on Wednesday, and 45 NTU on Thursday, your weekly average turbidity value would be 38.33 NTU ((30+40+45) ÷ 3 = 38 NTU). If in week 2, your turbidity samples resulted in values of 45 NTU on Monday, 30 NTU on Tuesday, 25 NTU on Wednesday, and 15 NTU on Thursday, you would calculate a new average for that week, which would yield an average turbidity value of 28.75 NTU ((45+30+25+15) ÷ 4 = 29 NTU). By comparison, if your samples on consecutive days from Friday to Monday were 60 NTU, 45 NTU, 40 NTU, and 43 NTU, respectively, and there are no other dewatering discharges for the remainder of the week, you would calculate one weekly average for the Friday to Sunday to be 48 NTU ((60+45+40) ÷ 3 = 48 NTU), and a separate weekly average for the one Monday to be 43 NTU (43 ÷ 1 = 43 NTU).

calculation of your weekly average (i.e., add all individual results for that monitoring week and divide by the total number of samples).[65]

d. If you are conducting turbidity monitoring for more than one dewatering discharge point, you must calculate a weekly average turbidity value for each discharge point and compare each to the turbidity benchmark.

3.3.4 Reporting and recordkeeping.

a. You must submit reports of your weekly average turbidity data to EPA no later than 30 days following the end of each monitoring quarter. If there are monitoring weeks in which there was no dewatering discharge, or if there is a monitoring quarter with no dewatering discharge, indicate this in your turbidity monitoring report. If another operator associated with your same site is conducting turbidity monitoring on your behalf pursuant to Part 3.3, indicate this in your turbidity monitoring report.

b. For the purposes of this permit, the following monitoring quarters and reporting deadlines apply:

Table 3. Monitoring Quarters and Deadlines for Reporting Turbidity Benchmark Monitoring Data.

Monitoring Quarter #	**Months**	**Reporting Deadline** (no later than 30 days after end of the monitoring quarter)
1	January 1 – March 31	April 30
2	April 1 – June 30	July 30
3	July 1 – September 30	October 30
4	October 1 – December 31	January 30

c. You must use EPA's NPDES eReporting Tool (NeT) to electronically submit your quarterly turbidity data, unless, consistent with Part 1.4.2, you received a waiver from your applicable EPA Regional Office. If the EPA Regional Office grants you approval to use a paper turbidity monitoring report form, and you elect to use it, you must complete the form in Appendix K. If EPA approves of your request to use an alternate turbidity benchmark pursuant to Part 3.3.2b, EPA will substitute the alternate benchmark in your NeT account.

d. For each day in which you are required to monitor, you must record the monitoring information required by Appendix G, Parts G.10.2 and G.10.3 and retain all such information for a period of at least three years from the date this permit expires or from the date your authorization is terminated.

[65] For example, if during a monitoring week you take two turbidity samples on Tuesday with a value of 30 NTU and 35 NTU, three samples on Wednesday with a value of 40 NTU, 45 NTU, and 48 NTU, and one sample on Thursday with a value of 45 NTU, your weekly average turbidity value for this week would be 41 NTU ((30+35+40+45+48+45) ÷ 6 = 41 NTU).

Table 4. Summary of Turbidity Benchmark Monitoring Requirements.

Applicability	Sampling Requirement	Turbidity Benchmark	Corrective Action	Reporting
Sites discharging dewatering water to a sediment-impaired water or to a water designated as a Tier 2, Tier 2.5, or Tier 3 for antidegradation purposes.	Collect at least one turbidity sample per day, from each discharge point, on any day there is a dewatering discharge. Use turbidity sampling procedures specified in Part 3.3.1.	Compare the weekly average of your turbidity monitoring results to the 50 NTU benchmark (or alternate benchmark if approved by EPA).	If the weekly average of turbidity monitoring results exceeds the 50 NTU turbidity benchmark (or alternate benchmark if approved by EPA), you are required to take follow-up corrective action in accordance with Part 5.2.2.	Report all weekly average turbidity monitoring results on a quarterly basis via NeT-CGP (unless use of the paper monitoring form in Appendix K is approved by EPA) no later than 30 days following the end of each monitoring quarter.

4 INSPECTION REQUIREMENTS

4.1 PERSON(S) RESPONSIBLE FOR CONDUCTING SITE AND DEWATERING INSPECTIONS

The person(s) inspecting your site may be a person on your staff or a third party you hire to conduct such inspections. You are responsible for ensuring that any person conducting inspections pursuant to this Part is a "qualified person." A qualified person is someone who has completed the training required by Part 6.3.

4.2 FREQUENCY OF INSPECTIONS.[66]

At a minimum, you must conduct a site inspection in accordance with one of the two schedules listed below, unless you are subject to the Part 4.3 site inspection frequency for discharges to sediment or nutrient-impaired or high quality waters, or qualify for a Part 4.4 reduction in the inspection frequency:

4.2.1 At least once every seven (7) calendar days; *or*

4.2.2 Once every 14 calendar days *and* within 24 hours[67] of the occurrence of:

- **a.** A storm event that produces 0.25 inches or more of rain within a 24-hour period.
  - **i.** If a storm event produces 0.25 inches or more of rain within a 24-hour period (including when there are multiple, smaller storms that alone produce less than 0.25 inches but together produce 0.25 inches or more in 24 hours), you are required to conduct one inspection within 24 hours of when 0.25 inches of rain or more has fallen.

[66] Inspections are only required during the site's normal working hours.

[67] For the purposes of the inspection requirements in this Part, conducting an inspection "within 24 hours" means that once either of the two conditions in Parts 4.2.2a or 4.2.2b are met you have 24 hours from that time to conduct an inspection. For clarification, the 24 hours is counted as a continuous passage of time, and not counted by business hours (e.g., 3 business days of 8 hours each). When the 24-hour inspection time frame occurs entirely outside of normal working hours, you must conduct an inspection by no later than the end of the next business day.

ii. If a storm event produces 0.25 inches or more of rain within a 24-hour period on the first day of a storm and continues to produce 0.25 inches or more of rain on subsequent days, you must conduct an inspection within 24 hours of the first day of the storm and within 24 hours after the last day of the storm that produces 0.25 inches or more of rain (i.e., only two inspections would be required for such a storm event).[68]

b. A discharge caused by snowmelt from a storm event that produces 3.25 inches[69] or more of snow within a 24-hour period. You are required to conduct one inspection once the discharge of snowmelt from a 3.25-inch or more snow accumulation occurs. Additional snowmelt inspections are only required if following the discharge from the first snowmelt, there is a discharge from a separate storm event that produces 3.25 inches or more of snow.

4.2.3 To determine whether a storm event meets either of the thresholds in Parts 4.2.2a or 4.2.2b:

a. For rain, you must either keep a properly maintained rain gauge on your site, or obtain the storm event information from a weather station that is representative of your location. For any 24-hour period during which there is 0.25 inches or more of rainfall, you must record the total rainfall measured for that day in accordance with Part 4.7.1d.

b. For snow, you must either take measurements of snowfall at your site,[70] or rely on similar information from a local weather forecasting provider that is representative of your location.

4.3 INCREASE IN INSPECTION FREQUENCY FOR CERTAIN SITES.

The increased inspection frequencies established in this Part take the place of the Part 4.2 inspection frequencies for the portion of the site affected.

4.3.1 For any portion of the site that discharges to a sediment or nutrient-impaired water or to a water that is identified by your State, Tribe, or EPA as Tier 2, Tier 2.5, or Tier 3 for antidegradation purposes (see Part 3.2), you must conduct an once every seven (7) calendar days *and* within 24 hours of the occurrence of a storm event that produces 0.25 inches or more of rain within a 24-hour period, or within 24 hours of a snowmelt discharge from a storm event that produces 3.25 inches or more of snow within a 24-hour period.

[68] For example, if 0.30 inches of rain falls on Day 1, 0.25 inches of rain falls on Day 2, and 0.10 inches of rain fall on Day 3, you would be required to conduct a first inspection within 24 hours of the Day 1 rainfall and a second inspection within 24 hours of the Day 2 rainfall, but a third inspection would not be required within 24 hours of the Day 3 rainfall.

[69] This is the amount of snow that is equivalent to 0.25 inches of rain, based on information from the National Oceanic and Atmospheric Administration (NOAA) indicating that 13 inches of snow is, on average, equivalent to 1 inch of rain. See https://www.nssl.noaa.gov/education/svrwx101/winter/faq/.

[70] For snowfall measurements, EPA suggests use of NOAA's National Weather Service guidelines at https://www.weather.gov/jkl/snow_measurement. These guidelines recommend use of a "snowboard" (a piece of wood about 16 inches by 16 inches) that is placed in an unobstructed part of the site on a hard surface.

Refer to Parts 4.2.3a and 4.2.3b for the requirements to determine if a storm event produces enough rain or snow to trigger the inspection requirement.

4.3.2 For sites discharging dewatering water, you must conduct an inspection in accordance with Part 4.6.3 during the discharge once per day on which the discharge occurs. The Part 4.2 inspection frequency still applies to all other portions of the site, unless the site is affected by either the increased frequency in Part 4.3.1 or the reduced frequency in Part 4.4.

4.4 REDUCTIONS IN INSPECTION FREQUENCY

4.4.1 Stabilized areas.

a. You may reduce the frequency of inspections to twice per month for the first month, no more than 14 calendar days apart, then once per month until permit coverage is terminated consistent with Part 8 in any area of your site where the stabilization steps in Part 2.2.14a have been completed. If construction activity resumes in this portion of the site at a later date, the inspection frequency immediately increases to that required in Parts 4.2 and 4.3, as applicable. You must document the beginning and ending dates of this period in your SWPPP.

b. Exception. For "linear construction sites" (as defined in Appendix A) where disturbed portions have undergone final stabilization at the same time active construction continues on others, you may reduce the frequency of inspections to twice per month for the first month, no more than 14 calendar days apart, in any area of your site where the stabilization steps in Part 2.2.14a have been completed. After the first month, inspect once more within 24 hours of the occurrence of a storm event that produces 0.25 inches of rain or more within a 24-hour period, or within 24 hours of a snowmelt discharge from a storm event that produces 3.25 inches or more of snow within a 24-hour period. If there are no issues or evidence of stabilization problems, you may suspend further inspections. If "wash-out" of stabilization materials and/or sediment is observed, following re-stabilization, inspections must resume at the inspection frequency required in Part 4.4.1a. Inspections must continue until final stabilization is visually confirmed following a storm event that produces 0.25 inches of rain or more within a 24-hour period.

4.4.2 Arid, semi-arid, or drought-stricken areas (as defined in Appendix A). If it is the seasonally dry period[71] or a period in which drought is occurring, you may reduce the frequency of inspections to once per month and within 24 hours of the occurrence of a storm event that produces 0.25 inches of rain or more within a 24-hour period, or within 24 hours of a snowmelt discharge from a storm event that produces 3.25 inches or more of snow within a 24-hour period. You must document that you are using this reduced schedule and the beginning and ending dates of the seasonally dry period in your SWPPP. Follow the procedures in Part 4.2.3a and 4.2.3b, accordingly, to determine if a storm event occurs that produces 0.25 inches or more of rain or 3.25 inches or more of snow within a 24-hour period. For any 24-hour period during which there is 0.25 inches or more of rainfall, or 3.25 inches or more of snow, you must record the total rainfall or snow measured for that day in accordance with Part 4.7.1d.

[71] See footnote 44.

4.4.3 Frozen conditions:

a. If you are suspending construction activities due to frozen conditions, you may temporarily suspend inspections on your site until thawing conditions (as defined in Appendix A) begin to occur if:

i. Discharges are unlikely due to continuous frozen conditions that are likely to continue at your site for at least three (3) months based on historic seasonal averages.[72] If unexpected weather conditions (such as above freezing temperatures or rain events) make discharges likely, you must immediately resume your regular inspection frequency as described in Parts 4.2 and 4.3, as applicable;

ii. Land disturbances have been suspended; and

iii. All disturbed areas of the site have been stabilized in accordance with Part 2.2.14a.

b. If you are still conducting construction activities during frozen conditions, you may reduce your inspection frequency to once per month if:

i. Discharges are unlikely due to continuous frozen conditions that are likely to continue at your site for at least three (3) months based on historic seasonal averages. If unexpected weather conditions (such as above freezing temperatures or rain events) make discharges likely, you must immediately resume your regular inspection frequency as described in Parts 4.2 and 4.3, as applicable; and

ii. Except for areas in which you are actively conducting construction activities, disturbed areas of the site have been stabilized in accordance with Part 2.2.14a.

You must document the beginning and ending dates of this period in your SWPPP.

4.5 AREAS THAT MUST BE INSPECTED

During your site inspection, you must at a minimum inspect the following areas of your site:

4.5.1 All areas that have been cleared, graded, or excavated and that have not yet completed stabilization consistent with Part 2.2.14a;

4.5.2 All stormwater controls, including pollution prevention controls, installed at the site to comply with this permit;[73]

4.5.3 Material, waste, borrow, and equipment storage and maintenance areas that are covered by this permit;

4.5.4 All areas where stormwater typically flows within the site, including constructed or natural site drainage features designed to divert, convey, and/or treat stormwater;

4.5.5 All areas where construction dewatering is taking place, including controls to treat the dewatering discharge and any channelized flow of water to and from those controls;

[72] Use data sets that include the most recent data available to account for recent precipitation patterns and trends.

[73] This includes the requirement to inspect for sediment that has been tracked out from the site onto paved roads, sidewalks, or other paved areas consistent with Part 2.2.4.

4.5.6 All points of discharge from the site; and

4.5.7 All locations where stabilization measures have been implemented.

You are not required to inspect areas that, at the time of the inspection, are considered unsafe to your inspection personnel.

4.6 REQUIREMENTS FOR INSPECTIONS

4.6.1 During each site inspection, you must at a minimum:

a. Check whether all stormwater controls *(*i.e.*, erosion and sediment controls and pollution prevention controls)* are properly installed, appear to be operational, and are working as intended to minimize pollutant discharges.

b. Check for the presence of conditions that could lead to spills, leaks, or other accumulations of pollutants on the site.

c. Identify any locations where new or modified stormwater controls are necessary to meet the requirements of Parts 2 and/or 3.

d. Check for signs of visible erosion and sedimentation *(*i.e.*, sediment deposits)* that have occurred and are attributable to your discharge at points of discharge and, if applicable, on the banks of any receiving waters flowing within or immediately adjacent to the site;

e. Check for signs of sediment deposition that are visible from your site and attributable to your discharge (e.g., sand bars with no vegetation growing on top in receiving waters or in other constructed or natural site drainage features, or the buildup of sediment deposits on nearby streets, curbs, or open conveyance channels).

f. Identify any incidents of noncompliance observed.

4.6.2 If a discharge is occurring during your inspection:

a. Identify all discharge points at the site; and

b. Observe and document the visual quality of the discharge, and take note of the characteristics of the stormwater discharge, including color; odor; floating, settled, or suspended solids; foam; oil sheen; and other indicators of stormwater pollutants. Check also for signs of these same pollutant characteristics that are visible from your site and attributable to your discharge in receiving waters or in other constructed or natural site drainage features.

4.6.3 For dewatering inspections conducted pursuant to Parts 4.3.2, record the following in a report within 24 hours of completing the inspection:

a. The inspection date;

b. Names and titles of personnel making the inspection;

c. Approximate times that the dewatering discharge began and ended on the day of inspection;[74]

d. Estimates of the rate (in gallons per day) of discharge on the day of inspection;

[74] If the dewatering discharge is a continuous discharge that continues after normal business hours, indicate that the discharge is continuous.

e. Whether or not any of the following indications of pollutant discharge were observed at the point of discharge to any receiving waters flowing through or immediately adjacent to the site and/or to constructed or natural site drainage features or storm drain inlets:[75]

i. a sediment plume, suspended solids, unusual color, presence of odor, decreased clarity, or presence of foam; and/or

ii. a visible sheen on the water surface or visible oily deposits on the bottom or shoreline of the receiving water; and

f. Photographs of (1) the dewatering water prior to treatment by a dewatering control(s) and the final discharge after treatment; (2) the dewatering control(s); and (3) the point of discharge to any receiving waters flowing through or immediately adjacent to the site and/or to constructed or natural site drainage features, storm drain inlets, and other conveyances to receiving waters.

You must also comply with the Part 4.7.2, 4.7.3, and 4.7.4 requirements for signing the reports, keeping them available on site, and retaining copies.

4.6.4 Based on the results of your inspection:

a. Complete any necessary maintenance repairs or replacements under Part 2.1.4 or under Part 5, whichever applies; and

b. Modify your SWPPP site map in accordance with Part 7.4.1 to reflect changes to your stormwater controls that are no longer accurately reflected on the current site map.

4.7 INSPECTION REPORT

4.7.1 You must complete an inspection report within 24 hours of completing any site inspection. Each inspection report (except for dewatering inspection reports, which are covered in Part 4.6.3) must include the following:

a. The inspection date;

b. Names and titles of personnel making the inspection;

c. A summary of your inspection findings, covering at a minimum the observations you made in accordance with Part 4.6, including any problems found during your inspection that make it necessary to perform routine maintenance pursuant to Part 2.1.4b or corrective action pursuant to Part 5. Include also any documentation as to why the corrective action procedures under Part 5 are unnecessary to fix a problem that repeatedly occurs as described in Part 2.1.4c;

d. If you are inspecting your site at the frequency specified in Part 4.2.2, Part 4.3, or Part 4.4.1b, and you conducted an inspection because of a storm event that produced rainfall measuring 0.25 inches or more within a 24-hour period, you must include the applicable rain gauge or weather station readings that triggered the inspection. Similarly, if you conducted an inspection because of a snowmelt discharge from a storm event that produced 3.25 inches or more of snow within a 24-hour period, you must include any measurements taken of snowfall at your site, or weather station information you relied on; and

[75] If the operator observes any of these indicators of pollutant discharge, corrective action is required consistent with Parts 5.1.5b and 5.2.2.

e. If you determined that it is unsafe to inspect a portion of your site, you must describe the reason you found it to be unsafe and specify the locations to which this condition applies.

4.7.2 Each inspection report must be signed by the operator's signatory in accordance with Appendix G, Part G.11 of this permit.

4.7.3 You must keep a copy of all inspection reports at the site or at an easily accessible location, so that it can be made immediately available at the time of an on-site inspection or upon request by EPA.[76]

4.7.4 You must retain all inspection reports completed for this Part for at least three (3) years from the date that your permit coverage expires or is terminated.

4.8 INSPECTIONS BY EPA

You must allow EPA, or an authorized representative of EPA, to conduct the following activities at reasonable times. To the extent that you are utilizing shared controls, that are not on site, to comply with this permit, you must make arrangements for EPA to have access at all reasonable times to those areas where the shared controls are located.

4.8.1 Enter onto all areas of the site, including any construction support activity areas covered by this permit, any off-site areas where shared controls are utilized to comply with this permit, discharge locations, adjoining waterbodies, and locations where records are kept under the conditions of this permit;

4.8.2 Access and copy any records that must be kept under the conditions of this permit;

4.8.3 Inspect your construction site, including any construction support activity areas covered by this permit (see Part 1.2.1c), any stormwater controls installed and maintained at the site, and any off-site shared controls utilized to comply with this permit; and

4.8.4 Sample or monitor for the purpose of ensuring compliance.

5 CORRECTIVE ACTIONS

5.1 CONDITIONS TRIGGERING CORRECTIVE ACTION.

You must take corrective action to address any of the following conditions identified at your site:

5.1.1 A stormwater control needs a significant repair or a new or replacement control is needed, or, in accordance with Part 2.1.4c, you find it necessary to repeatedly (i.e., three (3) or more times) conduct the same routine maintenance fix to the same control at the same location (unless you document in your inspection report under Part 4.7.1c that the specific reoccurrence of this same problem should still be addressed as a routine maintenance fix under Part 2.1.4); or

5.1.2 A stormwater control necessary to comply with the requirements of this permit was never installed, or was installed incorrectly; or

[76] Inspection reports may be prepared, signed, and kept electronically, rather than in paper form, if the records are: (a) in a format that can be read in a similar manner as a paper record; (b) legally dependable with no less evidentiary value than their paper equivalent; and (c) immediately accessible to the inspector during an inspection to the same extent as a paper copy stored at the site would be, if the records were stored in paper form. For additional guidance on the proper practices to follow for the electronic retention of inspection report records, refer to the Fact Sheet discussion related to Part 4.7.3.

5.1.3 Your discharges are not meeting applicable water quality standards;

5.1.4 A prohibited discharge has occurred (see Part 1.3); or

5.1.5 During discharge from site dewatering activities:

a. The weekly average of your turbidity monitoring results exceeds the 50 NTU benchmark (or alternate benchmark if approved by EPA pursuant to Part 3.3.2b); or

b. You observe or you are informed by EPA, State, or local authorities of the presence of the conditions specified in Part 4.6.3e.

5.2 CORRECTIVE ACTION DEADLINES

5.2.1 If responding to any of the Part 5.1.1, 5.1.2, 5.1.3, or 5.1.4 triggering conditions, you must:

a. Immediately take all reasonable steps to address the condition, including cleaning up any contaminated surfaces so the material will not discharge in subsequent storm events; and

b. When the problem does not require a new or replacement control or significant repair, the corrective action must be completed by the close of the next business day; or

c. When the problem requires a new or replacement control or significant repair, install the new or modified control and make it operational, or complete the repair, by no later than seven (7) calendar days from the time of discovery. If it is infeasible to complete the installation or repair within seven (7) calendar days, you must document in your records why it is infeasible to complete the installation or repair within the 7-day timeframe and document your schedule for installing the stormwater control(s) and making it operational as soon as feasible after the 7-day timeframe. Where these actions result in changes to any of the stormwater controls or procedures documented in your SWPPP, you must modify your SWPPP accordingly within seven (7) calendar days of completing this work.

5.2.2 If responding to either of the Part 5.1.5 triggering conditions related to site dewatering activities, you must:

a. Immediately take all reasonable steps to minimize or prevent the discharge of pollutants until you can implement a solution, including shutting off the dewatering discharge as soon as possible depending on the severity of the condition[77] taking safety considerations into account;

b. Determine whether the dewatering controls are operating effectively and whether they are causing the conditions; and

c. Make any necessary adjustments, repairs, or replacements to the dewatering controls to lower the turbidity levels below the benchmark or remove the visible plume or sheen.

[77] For instance, if the weekly average of your turbidity monitoring results or a single sample is extremely high (e.g., a single turbidity sample results in 355 NTUs or higher), you should take action to safely shut off the discharge so that you can evaluate the cause of the high turbidity. Note: A single turbidity sample of 355 NTUs or higher means that the weekly average turbidity value will exceed 50 NTU regardless of the turbidity values the other days during the week.

When you have completed these steps and made any changes deemed necessary, you may resume discharging from your dewatering activities.

5.3 CORRECTIVE ACTION REQUIRED BY EPA

You must comply with any corrective actions required by EPA as a result of permit violations found during an inspection carried out under Part 4.8.

5.4 CORRECTIVE ACTION LOG

5.4.1 For each corrective action taken in accordance with this Part, you must record the following in a corrective action log:

- **a.** Within 24 hours of identifying the corrective action condition, document the specific condition and the date and time it was identified.
- **b.** Within 24 hours of completing the corrective action (in accordance with the deadlines in Part 5.2), document the actions taken to address the condition, including whether any SWPPP modifications are required.

5.4.2 Each entry into the corrective action log, consisting of the information required by both Parts 5.4.1a and 5.4.1b, must be signed by the operator's signatory in accordance with Appendix G, Part G.11.2 of this permit.

5.4.3 You must keep a copy of the corrective action log at the site or at an easily accessible location, so that it can be made immediately available at the time of an on-site inspection or upon request by EPA.[78]

5.4.4 You must retain the corrective action log for at least three (3) years from the date that your permit coverage expires or is terminated.

6 STORMWATER TEAM FORMATION/STAFF TRAINING REQUIREMENTS

6.1 STORMWATER TEAM

Each operator, or group of multiple operators, must assemble a "stormwater team" that will be responsible for carrying out activities necessary to comply with this permit. The stormwater team must include the following people:

- **a.** Personnel who are responsible for the design, installation, maintenance, and/or repair of stormwater controls (including pollution prevention controls);
- **b.** Personnel responsible for the application and storage of treatment chemicals (if applicable);
- **c.** Personnel who are responsible for conducting inspections as required in Part 4.1; and
- **d.** Personnel who are responsible for taking corrective actions as required in Part 5.

Members of the stormwater team must be identified in the SWPPP pursuant to Part 7.2.2.

[78] The corrective action log may be prepared, signed, and kept electronically, rather than in paper form, if the records are: (a) in a format that can be read in a similar manner as a paper record; (b) legally dependable with no less evidentiary value than their paper equivalent; and (c) immediately accessible to the inspector during an inspection to the same extent as a paper copy stored at the site would be, if the records were stored in paper form. For additional guidance on the proper practices to follow for the electronic retention of corrective action log records, refer to the Fact Sheet discussion related to Part 4.7.3.

6.2 GENERAL TRAINING REQUIREMENTS FOR STORMWATER TEAM MEMBERS

Prior to the commencement of construction activities, you must ensure that all persons[79] assigned to the stormwater team understand the requirements of this permit and their specific responsibilities with respect to those requirements, including the following related to the scope of their job duties:

a. The permit requirements and deadlines associated with installation, maintenance, and removal of stormwater controls, as well as site stabilization;

b. The location of all stormwater controls on the site required by this permit and how they are to be maintained;

c. The proper procedures to follow with respect to the permit's pollution prevention requirements; and

d. When and how to conduct inspections, record applicable findings, and take corrective actions. Specific training requirements for persons conducting site inspections are included in Part 6.3.

You are responsible for ensuring that all activities on the site comply with the requirements of this permit. You are not required to provide or document formal training for subcontractors or other outside service providers (unless the subcontractors or outside service providers are responsible for conducting the inspections required in Part 4, in which case you must provide such documentation consistent with Part 7.2.2), but you must ensure that such personnel understand any requirements of this permit that may be affected by the work they are subcontracted to perform.

6.3 TRAINING REQUIREMENTS FOR PERSONS CONDUCTING INSPECTIONS

For projects that receive coverage under this permit on or after February 17, 2023, to be considered a qualified person under Part 4.1 for conducting inspections under Part 4, you must, at a minimum, either:

a. Have completed the EPA construction inspection course developed for this permit and have passed the exam; or

b. Hold a current valid construction inspection certification or license from a program that, at a minimum, covers the following:[80]

- **i.** Principles and practices of erosion and sediment control and pollution prevention practices at construction sites;
- **ii.** Proper installation and maintenance of erosion and sediment controls and pollution prevention practices used at construction sites; and
- **iii.** Performance of inspections, including the proper completion of required reports and documentation, consistent with the requirements of Part 4.

[79] If the person requiring training is a new employee who starts after you commence construction activities, you must ensure that this person has the proper understanding as required above prior to assuming particular responsibilities related to compliance with this permit. For emergency-related projects, the requirement to train personnel prior to commencement of construction activities does not apply, however, such personnel must have the required training prior to NOI submission.

[80] If one of the following topics (e.g., installation and maintenance of pollution prevention practices) is not covered by the non-EPA training program, you may consider supplementing the training with the analogous module of the EPA course (e.g., Module 4) that covers the missing topic.

For projects that receive coverage under this permit prior to February 17, 2023, any personnel conducting site inspections pursuant to Part 4 on your site must, at a minimum, be a person knowledgeable in the principles and practice 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.[81]

6.4 STORMWATER TEAM'S ACCESS TO PERMIT DOCUMENTS

Each member of the stormwater team must have easy access to an electronic or paper copy of applicable portions of this permit, the most updated copy of your SWPPP, and other relevant documents or information that must be kept with the SWPPP.

7 STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

7.1 GENERAL REQUIREMENTS

All operators associated with a construction site under this permit must develop a SWPPP consistent with the requirements in Part 7 prior to their submittal of the NOI.[82, 83, 84] The SWPPP must be kept up-to-date throughout coverage under this permit.

If a SWPPP was prepared under a previous version of this permit, the operator must review and update the SWPPP to ensure that this permit's requirements are addressed prior to submitting an NOI for coverage under this permit.

7.2 SWPPP CONTENTS

At a minimum, the SWPPP must include the information specified in this Part and as specified in other parts of this permit.

7.2.1 All Site Operators. Include a list of all other operators who will be engaged in construction activities at the site, and the areas of the site over which each operator has control.

[81] If you receive coverage for a project prior to February 17, 2023, and construction activities for the same project will continue after February 17, 2023, the personnel conducting inspections do not need to take the additional training specified in Parts 6.3a and 6.3b for inspections conducted on the project site. If the same operator obtains coverage for a different project on or after February 17, 2023, personnel conducting inspections would be required to meet the requirements for a qualified person by completing the training in either Part 6.3a or Part 6.3b.

[82] The SWPPP does not establish the effluent limits and/or other permit terms and conditions that apply to your site's discharges; these limits, terms, and conditions are established in this permit.

[83] Where there are multiple operators associated with the same site, they may develop a group SWPPP instead of multiple individual SWPPPs. Regardless of whether there is a group SWPPP or multiple individual SWPPPs, each operator is responsible for compliance with the permit's terms and conditions. In other words, if Operator A relies on Operator B to satisfy its permit obligations, Operator A does not have to duplicate those permit-related functions if Operator B is implementing them such that both operators are in compliance with the permit. However, Operator A remains responsible for permit compliance if Operator B fails to take actions necessary for Operator A to comply with the permit. In addition, all operators must ensure, either directly or through coordination with other operators, that their activities do not cause a violation or compromise any other operators' controls and/or any shared controls. See also footnote 60.

[84] There are a number of commercially available products to assist operators in developing the SWPPP, as well as companies that can be hired to help develop a site-specific SWPPP. The permit does not state which are recommended, nor does EPA endorse any specific products or vendors. Where operators choose to rely on these products or services, the choice of which ones to use to comply with the requirements of this Part is a decision for the operator alone.

7.2.2 Stormwater Team. Identify the personnel (by name and position) that you have made part of the stormwater team pursuant to Part 6.1, as well as their individual responsibilities, including which members are responsible for conducting inspections.

Include verification that each member of the stormwater team has received the training required by Part 6.2. Include documentation that members of the stormwater team responsible for conducting inspections pursuant to Part 4 have received the training required by Part 6.3. If personnel on your team elect to complete the EPA inspector training program pursuant to Part 6.3a, you must include copies of the certificate showing that the relevant personnel have completed the training and passed the exam. If personnel on your team elect to complete a non-EPA inspector training program pursuant to Part 6.3b, you must include documentation showing that these persons have successfully completed the program and their certification or license is still current. You must also confirm that the non-EPA inspector training program satisfies the minimum elements for such programs in Part 6.3b.

7.2.3 Nature of Construction Activities. Include the following:

- **a.** A description of the nature of your construction activities, including the age or dates of past renovations for structures that are undergoing demolition;
- **b.** The size of the property (in acres or length in miles if a linear construction site);
- **c.** The total area expected to be disturbed by the construction activities (to the nearest quarter acre or nearest quarter mile if a linear construction site);
- **d.** A description of any on-site and off-site construction support activity areas covered by this permit (see Part 1.2.1c);
- **e.** The maximum area expected to be disturbed at any one time, including on-site and off-site construction support activity areas;
- **f.** A description and projected schedule for the following:[85]
  - **i.** Commencement of construction activities in each portion of the site, including clearing and grubbing, mass grading, demolition activities, site preparation (i.e., excavating, cutting and filling), final grading, and creation of soil and vegetation stockpiles requiring stabilization;
  - **ii.** Temporary or permanent cessation of construction activities in each portion of the site;
  - **iii.** Temporary or final stabilization of exposed areas for each portion of the site; and
  - **iv.** Removal of temporary stormwater controls and construction equipment or vehicles, and the cessation of construction-related pollutant-generating activities.

[85] If plans change due to unforeseen circumstances or for other reasons, the requirement to describe the sequence and estimated dates of construction activities is not meant to "lock in" the operator to meeting these dates. When departures from initial projections are necessary, this should be documented in the SWPPP itself, or in associated records, as appropriate.

g. A list and description of all pollutant-generating activities[86] on the site. For each pollutant-generating activity, include an inventory of pollutants or pollutant constituents (e.g., *sediment, fertilizers, pesticides, paints, caulks, sealants, fluorescent light ballasts, contaminated substrates, solvents, fuels*) associated with that activity, which could be discharged in stormwater from your construction site. You must take into account where potential spills and leaks could occur that contribute pollutants to stormwater discharges, and any known hazardous or toxic substances, such as PCBs and asbestos, that will be disturbed or removed during construction;

h. Business days and hours for the project;

i. If you are conducting construction activities in response to a public emergency (see Part 1.4), a description of the cause of the public emergency *(*e.g., *mud slides, earthquake, extreme flooding conditions, widespread disruption in essential public services)*, information substantiating its occurrence *(*e.g., *State disaster declaration or similar State or local declaration)*, and a description of the construction necessary to reestablish affected public services.

7.2.4 Site Map. Include a legible map, or series of maps, showing the following features of the site:

a. Boundaries of the property;

b. Locations where construction activities will occur, including:

i. Locations where earth-disturbing activities will occur (note any phasing), including any demolition activities;

ii. Approximate slopes before and after major grading activities (note any steep slopes (as defined in Appendix A));

iii. Locations where sediment, soil, or other construction materials will be stockpiled;

iv. Any receiving water crossings;

v. Designated points where vehicles will exit onto paved roads;

vi. Locations of structures and other impervious surfaces upon completion of construction; and

vii. Locations of on-site and off-site construction support activity areas covered by this permit (see Part 1.2.1c).

c. Locations of any receiving waters within the site and all receiving waters within one mile downstream of the site's discharge point(s). Also identify if any of these receiving waters are listed as impaired or are identified as a Tier 2, Tier 2.5, or Tier 3 water;

d. Any areas of Federally listed critical habitat within the action area of the site as defined in Appendix A;

e. Type and extent of pre-construction cover on the site (e.g., vegetative cover, forest, pasture, pavement, structures);

f. Drainage patterns of stormwater and authorized non-stormwater before and after major grading activities;

[86] Examples of pollutant-generating activities include paving operations; concrete, paint, and stucco washout and waste disposal; solid waste storage and disposal; and dewatering activities.

g. Stormwater and authorized non-stormwater discharge locations, including:

i. Locations where stormwater and/or authorized non-stormwater will be discharged to storm drain inlets, including a notation of whether the inlet conveys stormwater to a sediment basin, sediment trap, or similarly effective control;[87]

ii. Locations where stormwater or authorized non-stormwater will be discharged directly to receiving waters (i.e., not via a storm drain inlet); and

iii. Locations where turbidity benchmark monitoring will take place to comply with Part 3.3, if applicable to your site.

h. Locations of all potential pollutant-generating activities identified in Part 7.2.3g;

i. Designated areas where construction wastes that are covered by the exception in Part 2.3.3e.ii because they are not pollutant-generating will be stored;

j. Locations of stormwater controls, including natural buffer areas and any shared controls utilized to comply with this permit; and

k. Locations where polymers, flocculants, or other treatment chemicals will be used and stored.

7.2.5 Non-Stormwater Discharges. Identify all authorized non-stormwater discharges in Part 1.2.2 that will or may occur.

7.2.6 Description of Stormwater Controls.

a. For each of the Part 2.2 erosion and sediment control requirements, Part 2.3 pollution prevention requirements, and Part 2.4 construction dewatering requirements, as applicable to your site, you must include the following:

i. A description of the specific control(s) to be implemented to meet these requirements;

ii. The design specifications for controls described in Part 7.2.6a.i (including references to any manufacturer specifications and/or erosion and sediment control manuals/ordinances relied upon);[88]

iii. Routine stormwater control maintenance specifications; and

iv. The projected schedule for stormwater control installation/implementation.

b. You must also include any of the following additional information as applicable.

i. **Natural buffers and/or equivalent sediment controls** (see Part 2.2.1 and Appendix F). You must include the following:

(a) The compliance alternative to be implemented;

(b) If complying with alternative 2, the width of natural buffer retained;

[87] The requirement to show storm drain inlets in the immediate vicinity of the site on your site map only applies to those inlets that are easily identifiable from your site or from a publicly accessible area immediately adjacent to your site.

[88] Design specifications may be found in manufacturer specifications and/or in applicable erosion and sediment control manuals or ordinances. Any departures from such specifications must reflect good engineering practice and must be explained in the SWPPP.

(c) If complying with alternative 2 or 3, the erosion and sediment control(s) you will use to achieve an equivalent sediment reduction, and any information you relied upon to demonstrate the equivalency;

(d) If complying with alternative 3, a description of why it is infeasible for you to provide and maintain an undisturbed natural buffer of any size;

(e) For "linear construction sites" where it is infeasible to implement compliance alternative 1, 2, or 3, a rationale for this determination, and a description of any buffer width retained and/or supplemental erosion and sediment controls installed; and

(f) A description of any disturbances that are exempt under Part 2.2.1 that occur within 50 feet of a receiving water.

ii. Perimeter controls for a "linear construction site" (see Part 2.2.3d). For areas where perimeter controls are not feasible, include documentation to support this determination and a description of the other practices that will be implemented to minimize discharges of pollutants in stormwater associated with construction activities.

Note: Routine maintenance specifications for perimeter controls documented in the SWPPP must include the Part 2.2.3c.i requirement that sediment be removed before it has accumulated to one-half of the above-ground height of any perimeter control.

iii. Sediment track-out controls (see Parts 2.2.4b and 2.2.4c). Document the specific stabilization techniques and/or controls that will be implemented to remove sediment prior to vehicle exit.

iv. Inlet protection measures (see Part 2.2.10a). Where inlet protection measures are not required because the storm drain inlets to which your site discharges are conveyed to a sediment basin, sediment trap, or similarly effective control, include a short description of the control that receives the stormwater flow from the site.

v. Sediment basins (see Part 2.2.12). In circumstances where it is infeasible to utilize outlet structures that withdraw water from the surface, include documentation to support this determination, including the specific conditions or time periods when this exception will apply.

vi. Treatment chemicals (see Part 2.2.13), you must include the following:

(a) A listing of the soil types that are expected to be exposed during construction in areas of the project that will drain to chemical treatment systems. Also include a listing of soil types expected to be found in fill material to be used in these same areas, to the extent you have this information prior to construction;

(b) A listing of all treatment chemicals to be used at the site and why the selection of these chemicals is suited to the soil characteristics of your site;

(c) If the applicable EPA Regional Office authorized you to use cationic treatment chemicals for sediment control, include the specific controls and implementation procedures designed to ensure that your use of cationic

treatment chemicals will not lead to a discharge that does not meet water quality standards;

(d) The dosage of all treatment chemicals to be used at the site or the methodology to be used to determine dosage;

(e) Information from any applicable Safety Data Sheet (SDS);

(f) Schematic drawings of any chemically enhanced stormwater controls or chemical treatment systems to be used for application of the treatment chemicals;

(g) A description of how chemicals will be stored consistent with Part 2.2.13c;

(h) References to applicable State or local requirements affecting the use of treatment chemicals, and copies of applicable manufacturer's specifications regarding the use of your specific treatment chemicals and/or chemical treatment systems; and

(i) A description of the training that personnel who handle and apply chemicals have received prior to permit coverage, or will receive prior to use of the treatment chemicals at your site.

vii. Stabilization measures (see Part 2.2.14). You must include the following:

(a) The specific vegetative and/or non-vegetative practices that will be used;

(b) The stabilization deadline that will be met in accordance with Part 2.2.14;

(c) If complying with the deadlines for sites in arid, semi-arid, or drought-stricken areas, the beginning and ending dates of the seasonally dry period (as defined in Appendix A)[89] and the schedule you will follow for initiating and completing vegetative stabilization; and

(d) If complying with deadlines for sites affected by unforeseen circumstances that delay the initiation and/or completion of vegetative stabilization, document the circumstances and the schedule for initiating and completing stabilization.

viii. Spill prevention and response procedures (see Parts 1.3.5, 2.3.3c, 2.3.3d, and 2.3.6). You must include the following:

(a) Procedures for expeditiously stopping, containing, and cleaning up spills, leaks, and other releases. Identify the name or position of the employee(s) responsible for detection and response of spills or leaks; and

(b) Procedures for notification of appropriate facility personnel, emergency response agencies, and regulatory agencies where a leak, spill, or other release containing a hazardous substance or oil in an amount equal to or in excess of a reportable quantity consistent with Part 2.3.6 and established under either 40 CFR part 110, 40 CFR part 117, or 40 CFR part 302, occurs

[89] See footnote 44.

during a 24-hour period. Contact information must be in locations that are readily accessible and available to all employees.

You may also reference the existence of SPCC plans developed for the construction activity under Section 311 of the CWA, or spill control programs otherwise required by an NPDES permit for the construction activity, provided that you keep a copy of that other plan on site.[90]

ix. Waste management procedures (see Part 2.3.3). Describe the procedures you will follow for handling, storing, and disposing of all wastes generated at your site consistent with all applicable Federal, State, Tribal, and local requirements, including clearing and demolition debris, sediment removed from the site, construction and domestic waste, hazardous or toxic waste, and sanitary waste. You must also include the following additional information:

(a) If site constraints prevent you from storing chemical containers 50 feet away from receiving waters or the other site drainage features as required in Part 2.3.3c.ii(b), document in your SWPPP the specific reasons why the 50-foot setback is not feasible, and how you will store containers as far away as the site permits; and

(b) If there are construction wastes that are subject to the exception in Part 2.3.3e.ii, describe the specific wastes that will be stored on your site.

x. Application of fertilizers (see Part 2.3.5). Document any departures from the manufacturer specifications where appropriate.

7.2.7 Procedures for Inspection, Maintenance, and Corrective Action. Describe the procedures you will follow for maintaining your stormwater controls, conducting site inspections, and, where necessary, taking corrective actions, in accordance with Part 2.1.4, Part 4, and Part 5 of this permit, accordingly. Also include:

a. The inspection schedule you will follow, which is based on whether your site is subject to Part 4.2 or Part 4.3, or whether your site qualifies for any of the reduced inspection frequencies in Part 4.4;

b. If you will be conducting inspections in accordance with the inspection schedule in Part 4.2.2, Part 4.3, or Part 4.4.1b, the location of the rain gauge or the address of the weather station you will be using to obtain rainfall data;

c. If you will be reducing your inspection frequency in accordance with Part 4.4.1b, the beginning and ending dates of the seasonally defined arid period for your area or the valid period of drought;

d. If you will be reducing your inspection frequency in accordance with Part 4.4.3, the beginning and ending dates of frozen conditions on your site; and

e. Any maintenance or inspection checklists or other forms that will be used.

7.2.8 Procedures for Turbidity Benchmark Monitoring from Dewatering Discharges (if applicable). If you are required to comply with the Part 3.3 turbidity benchmark

[90] Even if you already have an SPCC or other spill prevention plan in existence, your plans will only be considered adequate if they meet all of the requirements of this Part, either as part of your existing plan or supplemented as part of the SWPPP.

monitoring requirements, describe the procedures you will follow to collect and evaluate samples, report results to EPA and keep records of monitoring information, and take corrective action when necessary. Include the specific type of turbidity meter you will use for monitoring, as well as any manuals or manufacturer instructions on how to operate and calibrate the meter. Describe any coordinating arrangement you may have with any other permitted operators on the same site with respect to compliance with the turbidity monitoring requirements, including which parties are tasked with specific responsibilities. If EPA has approved of an alternate turbidity benchmark pursuant to Part 3.3.2b, include any data and other documentation you relied on to request use of the specific alternative benchmark.

7.2.9 Compliance with Other Requirements.

a. Threatened and Endangered Species Protection. Include documentation required in the Endangered Species Protection section of the NOI in NeT, or the ESA worksheet in Appendix D, supporting your eligibility with regard to the protection of threatened and endangered species and designated critical habitat.

b. Historic Properties. Include documentation required in Appendix E supporting your eligibility with regard to the protection of historic properties.

c. Safe Drinking Water Act Underground Injection Control (UIC) Requirements for Certain Subsurface Stormwater Controls. If you are using any of the following stormwater controls at your site, document any contact you have had with the applicable State agency[91] or EPA Regional Office responsible for implementing the requirements for underground injection wells in the Safe Drinking Water Act and EPA's implementing regulations at 40 CFR § 144 -147. Such controls would generally be considered Class V UIC wells:

i. Infiltration trenches (if stormwater is directed to any bored, drilled, driven shaft or dug hole that is deeper than its widest surface dimension, or has a subsurface fluid distribution system);

ii. Commercially manufactured pre-cast or pre-built proprietary subsurface detention vaults, chambers, or other devices designed to capture and infiltrate stormwater flow; and

iii. Drywells, seepage pits, or improved sinkholes (if stormwater is directed to any bored, drilled, driven shaft or dug hole that is deeper than its widest surface dimension, or has a subsurface fluid distribution system).

7.2.10 SWPPP Certification. Your signatory must sign and date your SWPPP in accordance with Appendix G, Part G.11.

7.2.11 Post-Authorization Additions to the SWPPP. Once you are authorized for coverage under this permit, you must include the following documents as part of your SWPPP:

a. A copy of your NOI submitted to EPA along with any correspondence exchanged between you and EPA related to coverage under this permit;

b. A copy of the acknowledgment letter you receive from NeT assigning your NPDES ID (i.e.*, permit tracking number*);

[91] For State UIC program contacts, refer to the following EPA website: https://www.epa.gov/uic.

c. A copy of this permit (an electronic copy easily available to the stormwater team is also acceptable).

7.3 ON-SITE AVAILABILITY OF YOUR SWPPP

You must keep a current copy of your SWPPP at the site or at an easily accessible location so that it can be made available at the time of an on-site inspection or upon request by EPA; a State, Tribal, or local agency approving stormwater management plans; the operator of a storm sewer system receiving discharges from the site; or representatives of the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS).[92]

EPA may provide access to portions of your SWPPP to a member of the public upon request. Confidential Business Information (CBI) will be withheld from the public, but may not be withheld from EPA, USFWS, or NMFS.[93]

If an on-site location is unavailable to keep the SWPPP when no personnel are present, notice of the plan's location must be posted near the main entrance of your construction site.

7.4 SWPPP MODIFICATIONS

7.4.1 You must modify your SWPPP, including the site map(s), within seven (7) days of any of the following conditions:

a. Whenever new operators become active in construction activities on your site, or you make changes to your construction plans, stormwater controls, or other activities at your site that are no longer accurately reflected in your SWPPP. This includes changes made in response to corrective actions triggered under Part 5. You do not need to modify your SWPPP if the estimated dates in Part 7.2.3f change during the course of construction;

b. To reflect areas on your site map where operational control has been transferred (and the date of transfer) since initiating permit coverage;

c. If inspections or investigations by EPA or its authorized representatives determine that SWPPP modifications are necessary for compliance with this permit;

d. Where EPA determines it is necessary to install and/or implement additional controls at your site in order to meet the requirements of this permit, the following must be included in your SWPPP:

i. A copy of any correspondence describing such measures and requirements; and

[92] The SWPPP may be prepared, signed, and kept electronically, rather than in paper form, if the records are: (a) in a format that can be read in a similar manner as a paper record; (b) legally dependable with no less evidentiary value than their paper equivalent; and (c) immediately accessible to the inspector during an inspection to the same extent as a paper copy stored at the site would be, if the records were stored in paper form. For additional guidance on the proper practices to follow for the electronic retention of the SWPPP, refer to the Fact Sheet discussion related to Part 4.7.3.

[93] Information covered by a claim of confidentiality will be disclosed by EPA only to the extent of, and by means of, the procedures set forth in 40 CFR part 2, Subpart B. In general, submitted information protected by a business confidentiality claim may be disclosed to other employees, officers, or authorized representatives of the United States concerned with implementing the CWA. The authorized representatives, including employees of other executive branch agencies, may review CBI during the course of reviewing draft regulations.

ii. A description of the controls that will be used to meet such requirements.

e. To reflect any revisions to applicable Federal, State, Tribal, or local requirements that affect the stormwater controls implemented at the site; and

f. If applicable, if a change in chemical treatment systems or chemically enhanced stormwater control is made, including use of a different treatment chemical, different dosage rate, or different area of application.

7.4.2 You must maintain records showing the dates of all SWPPP modifications. The records must include the name of the person authorizing each change (see Part 7.2.9 above) and a brief summary of all changes.

7.4.3 All modifications made to the SWPPP consistent with Part 7.4 must be authorized by a person identified in Appendix G, Part G.11.b.

7.4.4 Upon determining that a modification to your SWPPP is required, if there are multiple operators covered under this permit, you must immediately notify any operators who may be impacted by the change to the SWPPP.

8 HOW TO TERMINATE COVERAGE

Until you terminate coverage under this permit, you must comply with all conditions and effluent limitations in the permit. To terminate permit coverage, you must submit to EPA a complete and accurate Notice of Termination (NOT), which certifies that you have met the requirements for terminating in Part 8.

8.1 MINIMUM INFORMATION REQUIRED IN NOT

8.1.1 NPDES ID (i.e*., permit tracking number)* provided by EPA when you received coverage under this permit;

8.1.2 Basis for submission of the NOT (see Part 8.2);

8.1.3 Operator contact information;

8.1.4 Name of site and address (or a description of location if no street address is available); and

8.1.5 NOT certification.

8.2 CONDITIONS FOR TERMINATING CGP COVERAGE

You may terminate CGP coverage only if one or more of the conditions in Parts 8.2.1, 8.2.2, or 8.2.3 has occurred. Until your termination is effective consistent with Part 8.5, you must continue to comply with the conditions of this permit.

8.2.1 You have completed all construction activities at your site and, if applicable, construction support activities covered by this permit (see Part 1.2.1c), and you have met all of the following requirements:

a. For any areas that (1) were disturbed during construction, (2) are not covered by permanent structures, and (3) over which you had control during the construction activities, you have met the requirements for final vegetative or non-vegetative stabilization in Part 2.2.14c.

To document that you have met these stabilization requirements, you must take either ground or aerial photographs that show your site's compliance with the Part 2.2.14 stabilization requirements and submit them with your NOT. If any portion of your

site is covered by one of the exceptions in Part 2.2.14c.iii, indicate which exception applies and include a supplementary explanation with your photographs that provides the necessary context for why this portion of the site is in compliance with the final stabilization criteria even though it appears to be unstabilized. You are not required to take photographs of every distinct part of your site that is being stabilized, however, the conditions of the site portrayed in any photographs that are submitted must be substantially similar[94] to those of the areas that are not photographed. You must also comply with the following related to these photographs:

i. Take photographs both before and after the site has met the final stabilization criteria in Part 2.2.14c;

ii. All photographs must be clear and in focus, and in the original format and resolution; and

iii. Include the date each photograph was taken, and a brief description of the area of the site captured by the photograph (e.g., photo shows application of seed and erosion control mats to remaining exposed surfaces on northeast corner of site).

b. You have removed and properly disposed of all construction materials, waste and waste handling devices, and have removed all equipment and vehicles that were used during construction, unless intended for long-term use following your termination of permit coverage;

c. You have removed all stormwater controls that were installed and maintained during construction, except those that are intended for long-term use following your termination of permit coverage or those that are biodegradable (as defined in Appendix A); and

d. You have removed all potential pollutants and pollutant-generating activities associated with construction, unless needed for long-term use following your termination of permit coverage; or

8.2.2 You have transferred control of all areas of the site for which you are responsible under this permit to another operator, and that operator has submitted an NOI and obtained coverage under this permit; or

8.2.3 Coverage under an individual or alternative general NPDES permit has been obtained.

8.3 HOW TO SUBMIT YOUR NOT

You must use EPA's NPDES eReporting Tool (NeT) to electronically prepare and submit an NOT for the 2022 CGP.

To access NeT, go to https://cdx.epa.gov/cdx.

Waivers from electronic reporting may be granted as specified in Part 1.4.2. If the EPA Regional Office grants you approval to use a paper NOT, and you elect to use it, you must complete the form in Appendix I.

[94] Stabilization conditions that are substantially similar would include areas that are using the same type of stabilization measures and that have similar slopes, soils, and topography, and have achieved the same level of stabilization.

8.4 DEADLINE FOR SUBMITTING THE NOT

You must submit an NOT within 30 calendar days after any one of the conditions in Part 8.2 occurs.

8.5 EFFECTIVE DATE OF TERMINATION OF COVERAGE

Your authorization to discharge under this permit terminates at midnight of the calendar day that a complete NOT is submitted to EPA.

9 PERMIT CONDITIONS APPLICABLE TO SPECIFIC STATES, INDIAN COUNTRY LANDS, OR TERRITORIES

The provisions in this Part provide additions to the applicable conditions of this permit to reflect specific additional conditions required as part of the State or Tribal CWA Section 401 certification process, or the Coastal Zone Management Act (CZMA) certification process, or as otherwise established by the permitting authority. The specific additional revisions and requirements only apply to activities in those specific States, Indian country, and areas in certain States with Federal Facilities or areas subject to construction projects by Federal Operators. States, Indian country, and other areas not included in this Part do not have any additions to the applicable conditions of this permit.

9.1 EPA REGION 1

9.1.1 NHR100000 State of New Hampshire

a. Should the permit coverage for an individual applicant be insufficient to achieve water quality standards, the New Hampshire Department of Environmental Services (NHDES) may prepare additional 401 certification conditions for that applicant. Any additional 401 certification conditions will follow all required NHDES public participation requirements.

b. If you disturb 100,000 square feet or more of contiguous area, you must also comply with RSA 485-A:17 and Env-Wq 1500, and, unless exempt, apply for an Alteration of Terrain (AoT) permit from NHDES. This requirement also applies to a lower disturbance threshold of 50,000 square feet or more when construction occurs within the protected shoreline under the Shoreland Water Quality Protection Act (see RSA 483-B and Env-Wq 1400). A permit application must also be filed if your project disturbs an area of greater than 2,500 square feet, is within 50 feet of any surface water, and has a flow path of 50 feet or longer disturbing a grade of 25 percent or greater. Project sites with disturbances smaller than those discussed above, that have the potential to adversely affect state surface waters, are subject to the conditions of an AoT General Permit by Rule (Env-Wq 1503.03).

c. You must determine that any excavation dewatering discharges are not contaminated before they will be authorized as an allowable non-stormwater discharge under this permit (see Part 1.2.2 of the Construction General Permit or CGP). In the absence of information demonstrating otherwise, the water is considered uncontaminated if there is no groundwater contamination within 1,000 feet of the groundwater dewatering location. Information on groundwater contamination can be generated over the Internet via the NHDES web site http:// des.nh.gov/ by using the One Stop Data Mapper. For a toxic substance included in the New Hampshire surface water quality standards, see Env-Wq 1703.21 (see https://www.des.nh.gov/sites/g/fi1es/ehbemt 341/files/documents/2020-01/Env-Wg

1700.pdf). If it is determined that the groundwater to be dewatered is near a remediation or other waste site, you must apply for the Remediation General Permit (see https://www3.epa.gov/region1/npdes/rgp.html)

d. As a minimum, you must treat any uncontaminated excavation "dewatering" discharges and "stormwater" discharges, as those terms are defined in Appendix A of the CGP, as necessary, to remove suspended solids and turbidity so that the surface waters receiving the construction discharges[95] meet New Hampshire surface water quality standards for turbidity (Env-Wq 1703.11 and Env-Wq 1703.03(c)(1)c), benthic deposits (Env-Wq 1703.03(c)(1)a), and Env-Wq 1703.08) and foam, debris, scum or other visible substances (i.e., plumes or visual turbidity)[96] (Env-Wq 1703.03(c)(1)b).

i. For all Construction Activities covered under this CGP, the following shall apply to ensure compliance with the aforementioned regulations for turbidity, benthic deposits and visible substances:

Unless otherwise specified, site inspection requirements shall comply with Part 4 of the CGP. As a minimum site inspection frequency shall be in accordance with Part 4.2.2 of the CGP (and Part 4.3.2 of the CGP for sites discharging dewatering water). Site inspection frequency may be reduced in accordance with Part 4.4 of the CGP (Reductions in Inspection Frequency). Monitoring of the receiving water for visible turbidity and benthic sediment deposits shall be conducted each site inspection and results reported in the Inspection Report required in Part 4.7 of the CGP. Should visible turbidity or benthic sediment deposits attributable or partly attributable to your construction activities be present in the receiving water, the "Corrective Actions" specified in Part 5 shall be immediately implemented to correct the water quality standard violations. In addition, daily monitoring (including photographs) of the receiving water shall be conducted until there is no visible turbidity or benthic deposits. Inspection Reports required in Part 4.7 of the CGP shall include, but not be limited to, the distance downstream and the percent of the river width[97] where visible turbidity was observed, and the period of time that the visible turbidity persisted. A copy of the Inspection Report(s) shall be made available to NHDES within 24 hours of receiving a written request from NHDES.

ii. For Construction Activities, disturbing 5 acres or more of land at any one time (excluding areas that have been completely stabilized in accordance with the final stabilization criteria specified in Part 2.2.14.c of the CGP), the following shall

[95] Construction Discharges include uncontaminated "dewatering" and "stormwater" discharges as those terms are defined in Appendix A of the CGP. Controlled construction discharges are construction discharges where the rate of flow can be regulated such as from a construction settling basin or NHDES approved flocculation system.

[96] For the definition of visual turbidity, see the definition for "Non-Turbid" in Appendix A of the CGP, which states the following:" "Non-Turbid" - a discharge that is free from visual turbidity. For the purposes of this permit, visual turbidity refers to a sediment plume or other cloudiness in the water caused by sediment that can be identified by an observer." *[EPA interprets the text of this footnote as intending to reference the Appendix A definitions of "visual turbidity" and "non-turbid" in the final permit.]*

[97] The distance downstream and the percent of river width where visible turbidity (i.e., plume) is observed is required to determine the extent of the river affected and to determine if there was a "zone of passage" (i.e., a portion of the receiving water where there was no visible turbidity where mobile organisms could pass without being adversely impacted). The percent of river width affected is equal 100 multiplied by the width of the plume (in feet) divided by the width of the receiving water (in feet).

apply to ensure compliance with the aforementioned regulations for turbidity, benthic deposits and visible substances.

Item 9.1.1.d.i) above shall apply to all construction discharges and the minimum site inspection frequency shall comply with Part 4.3.1 of the CGP (and Part 4.3.2 of the CGP for sites discharging dewatering water). Site inspection frequency may be reduced in accordance with Part 4.4 of the CGP (Reductions in Inspection Frequency).

With regards to controlled construction discharges, if there is no visible turbidity (i.e., plumes) or benthic deposits, and, in the absence of information demonstrating otherwise, turbidity measurements of less than or equal to 50 nephelometric turbidity units (NTU) in the controlled construction discharges at the outlet prior to mixing with the receiving surface waters, shall be presumed to meet New Hampshire surface water quality standards for the parameters listed above. As a minimum, the controlled construction discharges must be sampled at each site inspection.

If any controlled construction discharge exceeds 50 NTU, or if visible turbidity or benthic sediment deposits attributable or partly attributable to any construction discharge are observed in the receiving water, then the "Corrective Actions" specified in Part 5 of the CGP shall be immediately implemented.

In addition, should such violation occur, and, in order to determine compliance with surface water quality standards for turbidity (Env-Wq 1703.11 and Env-Wq 1703.03(c)(1)c), benthic deposits (Env-Wq 1703.03(c)(1)a), and Env-Wq 1703.08) and foam, debris, scum or other visible substances (Env-Wq 1703.03(c)(1)b)), turbidity monitoring shall be immediately implemented as specified below:

Turbidity samples of the receiving water shall be immediately taken in the receiving water upstream and beyond the influence of the construction activity, and, unless a mixing zone[98] is approved by NHDES, no more than 75 feet downstream of each controlled construction discharge that exceeded 50 NTU and no more than 75 feet downstream of each construction discharge that caused visible turbidity.

Downstream samples shall be taken at locations in the receiving water that are most likely influenced by the discharge (e.g., if visible turbidity (i.e., a plume) is present, the sample shall be taken in the plume). Samples shall be collected a minimum of 2 times per day during the daylight hours at times when construction activities are most likely to cause turbidity in the receiving water and shall continue until the turbidity water quality standards are met in the receiving water (i.e., the difference between the upstream and downstream turbidity level is no greater than 10 NTU).

[98] Permittees may request a distance greater than 75 feet downstream of a construction discharge for determining compliance with turbidity standards in Class B surface waters, by submitting a mixing zone request to NHDES that complies with Env-Wq 1707.02. If a mixing zone is approved, NHDES is required to include conditions to ensure that the criteria on which the approval is based are met (Env-Wq 1707.03).

If water quality standards are not met during daylight hours on any day, sampling shall resume the next day and continue no fewer than 2 times per day until water quality standards are met. The date, time, location and results of turbidity measurements, as well as a summary identifying the cause of the violations, corrective actions that were implemented, the period of time that the receiving water exceeded turbidity standards and the distance downstream and the percent of the river width where visible turbidity was observed, and the period of time that the visible turbidity persisted, shall be recorded and included in the Inspection Report required in Part 4.7 of the CGP. Turbidity measurements shall be conducted via a field meter in accordance with the requirements for turbidity specified in Table 1B in 40 CFR 136.3 (see 40 CFR §136.3 Identification of test procedures - Code of Federal Regulations ecfr.io). Field meters shall be calibrated every day sampling is conducted and prior to the first sample.

e. Construction site owners and operators are encouraged to consider opportunities for post- construction groundwater recharge using infiltration best management practices (BMPs) during site design and preparation of the SWPPP in order to assure compliance with Env-Wq 1703.03 and Env-Wq 1703.11. If your construction site is in a town that is required to obtain coverage under the NPDES General Permit for discharges from Municipal Separate Storm Sewer Systems (MS4) you may be required to use such practices. The SWPPP must include a description of any on-site infiltration that will be installed as a post-construction stormwater management measure or reasons for not employing such measures such as 1) The facility is located in a wellhead protection area as defined in RSA 485- C:2; or 2) The facility is located in an area where groundwater has been reclassified to GAA, GA1 or GA2 pursuant to RSA 485-C and Env-DW 901; or 3) Any areas that would be exempt from the groundwater recharge requirements contained in Env-Wq 1507.04, including all land uses or activities considered to be a "High-load Area" (see Env-Wq 1502.30). For design considerations for infiltration measures see Env-Wq 1508.06. Note that there may be additional local requirements that fall under the NH MS4 permittee's Authorization to Discharge Permit for those regulated areas.

f. Appendix F of the CGP contains information regarding Tier 2, or high quality waters in the various states. ***[EPA notes that this information has now been moved to https://www.epa.gov/npdes/construction-general-permit-resources-tools-and-templates]*** Although there is no official list of tier 2 waters for New Hampshire, it can be assumed that all New Hampshire surface waters are tier 2 for turbidity unless 1) the surface water that you are proposing to discharge into is listed as impaired for turbidity in the states listing of impaired waters (see https://nhdes-surface-water-quality-assessment-site-nhdes.hub.arcgis.com/) or 2) sampling upstream of the proposed discharge location shows turbidity values greater than 10 NTU (Env-Wq 1703.11). A single grab sample collected during dry weather (no precipitation within 48 hours) is acceptable.

g. To ensure compliance with RSA 485-C, RSA 485-A, RSA 485-A:13, I(a), Env-Wq 1700 and Env-Wq 302, the following information may be requested by NHDES. This information must be kept on site unless you receive a written request from NHDES that it be sent to the address shown below in 9.1.1.h.

i. A list of all non-stormwater discharges that occur at the facility, including their source locations and the control measures being used (see Part 1.2.2 of the CGP).

ii. Records of sampling and analysis required for construction dewatering and stormwater discharges (see 9.1.1.d above).

h. All required or requested documents must be sent to: NH Department of Environmental Services, Watershed Management Bureau, P.O. Box 95 Concord, NH 03302-0095.

9.1.2 MAR100000 Commonwealth of Massachusetts (except Indian country)

a. All discharges covered by the Construction General Permit shall comply with the provisions pursuant to 314 CMR 3.00, 314 CMR 4.00, 314 CMR 9.00, including applicable construction stormwater standards and 310 CMR 10.00.

b. Pursuant to 314 CMR 3.11 (2)(a)6., and in accordance with MassDEP's obligation under 314 CMR 4.05(5)(e) to maintain surface waters free from pollutants in concentrations or combinations that are toxic to humans, aquatic life, or wildlife, permittees are prohibited from discharging dewatering water under the CGP from sites that are designated as Superfund/CERCLA or RCRA, and must make accommodations to dispose of the dewatering discharges appropriately, such as coverage under the Remediation General Permit (RGP).

c. Pursuant to 314 CMR 3.11 (2)(a), and in accordance with MassDEP's obligation to protect Outstanding Resource Waters under 314 CMR 4.04(3), applicants seeking coverage under the 2022 CGP that propose to carry out construction activities near Outstanding Resource Waters as identified in 314 CMR 4.06, shall submit to MassDEP for review:

i. a copy of the Stormwater Pollution Prevention Plan (SWPPP),

ii. a copy of the EPA NOI, and

iii. MassDEP's Stormwater BMP Checklist.

For purposes of this review, the permittee shall submit these documents to MassDEP at the same time they are submitted to EPA. Instructions on how to submit these documents to MassDEP and where to find the MassDEP Stormwater BMP Checklist and obtain authorization to discharge can be found here: https://www.mass.gov/how-to/wm-15-npdes-general-permit-notice-of- intent.

d. Pursuant to 314 CMR 3.11 (2)(a)6., and in accordance with MassDEP's obligation under 314 CMR 4.05(5)(e) to maintain surface waters free from pollutants in concentrations or combinations that are toxic to humans, aquatic life, or wildlife, applicants that propose to dewater under the 2022 CGP and plan to discharge to certain waters as described below, shall determine that any dewatering discharges are not contaminated by testing the proposed discharge as described below as part of the application for WM15 authorization. Unless otherwise specified, testing described in this section should be conducted using the methods in 40 CFR 136.

i. Applicants for sites that plan to discharge to Outstanding Resource Waters as identified in 314 CMR 4.06 shall test one sample of the proposed dewatering discharge water for pH, E. Coli (for discharges to freshwater), fecal coliform (for

discharges to salt water), Enterococci (for discharges to salt water), total suspended solids, oil and grease, total nitrogen, total phosphorus, and all parameters with numeric criteria listed in the Massachusetts Surface Water Quality Standards at 314 CMR 4.05(e). Results shall be reported to MassDEP as part of the WM15 application. To determine if the dewatering discharge could be covered under the 2022 CGP, the effluent at zero dilution must meet numeric water quality criteria. If the effluent does not meet numeric water quality criteria, the applicant shall contact EPA Region 1 to discuss coverage under the Remediation General Permit.

ii. Applicants for sites that propose to discharge to Public Water Supplies (314 CMR 4.06(1)(d)1) shall also test one sample of the proposed dewatering discharge water for per- and polyfluoroalkyl substances (PFAS), as outlined in the table below. Results shall be reported to MassDEP as part of the WM15 application. If any PFAS compounds are detected, the applicant shall apply for coverage under the NPDES Remediation General Permit for Massachusetts if required.

PFAS Testing Parameters for Discharges to Public Drinking Water Supplies[99]	
Perfluorohexanesulfonic acid (PFHxS), grab	Report ng/L
Perfluoroheptanoic acid (PFHpA), grab	Report ng/L
Perfluorononanoic acid (PFNA), grab	Report ng/L
Perfluorooctanesulfonic acid (PFOS), grab	Report ng/L
Perfluorooctanoic acid (PFOA), grab	Report ng/L
Perfluorodecanoic acid (PFDA), grab	Report ng/L

iii. Applicants for sites that propose to discharge to an impaired water as identified in the most recent final Massachusetts Integrated List of Waters,shall test one sample of the proposed dewatering discharge water for the parameter(s) for which the waterbody is impaired. To determine if the dewatering discharge could be covered under the 2022 CGP, the effluent at zero dilution must meet numeric water quality criteria. If the effluent does not meet numeric water quality criteria, the applicant shall contact EPA Region 1 to discuss coverage under the Remediation GeneralPermit and shall apply for RGP coverage if required.

iv. For dewatering discharges to all other waters, if any pollutants are knownor believed present in the proposed dewatering discharge water, the applicant shall apply for coverage under the NPDES Remediation General Permit for Massachusetts if required. For the purposes of this condition, a pollutant is "known present" if measured above the analytical detection limit using a sufficiently sensitive test method in an environmental sample, and "believed present" if a pollutant has not been measured in an environmental sample but will be added or generated prior to discharge, such as through a treatment process. Consequently, a pollutant is "known absent" if measured as non-detect relative to the analytical detection limit using a sufficiently sensitive test method in an environmental sample, and "believed absent" if a pollutant has not been measured in an environmentalsample but will not be added or generated prior to discharge and is not a parameter that applies to the applicable activity category for a site. If any pollutants are known or believed present in the

[99] PFAS testing shall follow established EPA methods 537 or 537.1 for drinking water until EPA Method 3512 for non-potable water becomes available.

proposed dewatering discharge water, the applicant shall test one sample of the proposed dewatering discharge water for the pollutants known or believed to be present. To determine if the dewatering discharge could be covered under the 2022 CGP, the effluent at zero dilution must meet numeric water quality criteria. If the effluent does not meet numeric water quality criteria, the applicant shall contact EPA Region 1 to discuss coverage under the Remediation General Permit.

e. Pursuant to 314 CMR 3.11 (2)(a), and in accordance with MassDEP's obligation to protect Outstanding Resource Waters under 314 CMR 4.04(3), applicants that propose to dewater under the 2022 CGP and discharge to Outstanding Resource Waters as identified in 314 CMR 4.06, shall submit the SWPPP and associated documents to MassDEP to review. MassDEP shall complete review within 30 daysof receipt.

f. Pursuant to 314 CMR 3.11 (2)(a)6., and in accordance with MassDEP's obligation under 314 CMR 4.05 to maintain surface waters free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use assigned to the waterbody, permittees that have been authorized to dewater under the 2022 CGP and that discharge to Outstanding Resource Waters as identified in 314 CMR 4.06 shall carry out daily benchmark monitoring for turbidity[100] for the duration of dewatering. Permittees shall compare the weekly average of the turbidity monitoring results with the established benchmark turbidity value of 25 Nephelometric Turbidity Units (NTU). If a permittee's weekly average turbidity results exceed the benchmark, the operator shall conduct follow-up corrective action to determine the source of the problem and to make any necessary repairs or upgrades to the dewatering controls to lower the turbidity levels. The permittee shall document any corrective action taken in its corrective action log. Furthermore, permittees at these sites shall carry out inspections at higher frequency, specifically, daily inspections of the dewatering discharge treatment for the duration of the discharge. The permittee shall inspect the site for sediment plume or whether a hydrocarbon sheen is visible at the point of discharge, estimate the flow rate at the point of discharge, and inspect the site downstream to assess whether sedimentation is attributable to the dewatering discharges.

g. Pursuant to 314 CMR 3.11 (2)(a)6., and in accordance with MassDEP's obligation under 314 CMR 4.05 to maintain surface waters free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use assigned to the waterbody, permittees shall store materials outside the Base Flood Elevation[101] when feasible to prevent displacing runoff and erosion.

h. Pursuant to 314 CMR 3.11 (2)(a), and in accordance with MassDEP's obligation to maintain surface waters free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses under 314 CMR 4.05(5)(c), all applicants who apply for coverage under the 2022 CGP shall follow guidelines on fertilizer application, including use of fertilizer containing no phosphorus, in accordance with 330 CMR 31.00 Plant Nutrient Application Requirements for

[100] Applicants shall follow EPA Method 180.1 to monitor for turbidity

[101] Base Flood Elevation (BFE) is the elevation of surface water resulting from a flood that has a 1% chance of equaling or exceeding that level in any given year. The BFE is shown on the Flood Insurance Rate Map (FIRM) for zones AE, AH, A1–A30, AR, AR/A, AR/AE, AR/A1– A30, AR/AH, AR/AO, V1–V30 and VE. (Source: https://www.fema.gov/node/404233).

Agricultural Land and Non-Agricultural Turf and Lawns. Further, fertilizer shall never be applied to a site when a rain event greater than 0.5 inches is forecast in the next 48 hours.

i. Pursuant to 314 CMR 3.11 (2)(a), all applicants who apply for coverage under the 2022 CGP and elect to carry out site inspections every 14 days shall also inspect sites within 24 hours of 0.25 inches of precipitation events or greater over 24 hours,or within 24 hours of a discharge that occurred due to snowmelt from 3.25 inches or greater of snow accumulation.[102] During the high flow periods in spring (i.e., months of April to June), inspection frequency shall be increased to once per week for all sites.

  i. To determine whether 3.25 inches or greater of snow accumulation has occurred at a site, snowfall measurements can be taken at the site,[103] or theoperator can rely on similar information from a local weather forecast.

j. Implementing structural improvements, enhanced/resilient pollution prevention measures, and other mitigation measures can help to minimize impacts from stormwater discharges from major storm events such as hurricanes, storm surge, extreme/heavy precipitation,[104] and flood events. Pursuant to 314 CMR 3.11 (2)(a), if such stormwater control measures are already in place due to existing requirements mandated by other state, local or federal agencies, the SWPPP shall include a brief description of the controls and a reference to the existing requirement(s). If the site may be exposed to or has previously experienced suchmajor storm events[105], additional stormwater control measures that may be considered, and implemented as necessary, include, but are not limited to:

  i. Reinforce materials storage structures to withstand flooding and additional exertion of force;

  ii. Prevent floating of semi-stationary structures by elevating to the Base Flood Elevation (BFE) level or securing with non-corrosive device;

  iii. When a delivery of exposed materials is expected, and a storm is anticipated within 48 hours, delay delivery until after the storm or storematerials as appropriate (refer to emergency procedures);

[102] This is the amount of snow that is equivalent to 0.25 inches of rain, based on information from the National Oceanic and Atmospheric Administration (NOAA) indicating that 13 inches of snow is, on average, equivalent to 1 inch of rain. See https://www.nssl.noaa.gov/education/svrwx101/winter/faq/.

[103] NOAA's National Weather Service has guidelines on snowfall measurements at https://www.weather.gov/jkl/snow_measurement. These guidelines recommend use of a "snowboard" (a piece of wood about 16 inches by 16 inches) that is placed in an unobstructed part of the site on a hard surface.

[104] Heavy precipitation refers to instances during which the amount of rain or snow experienced in a location substantially exceeds what is normal. What constitutes a period of heavy precipitation varies according to location and season. Heavy precipitation does not necessarily mean the total amount of precipitation at a location has increased— just that precipitation is occurring in more intense or more frequent events.

[105] To determine if your facility is susceptible to an increased frequency of major storm events that could impact the discharge of pollutants in stormwater, you may reference FEMA, NOAA, or USGS flood map products at https://www.usgs.gov/faqs/where-can-i-find-flood-maps?qt-news_science_products=0#qtnews_science_products.

iv. Temporarily store materials and waste above the Base Flood Elevation ***[EPA notes that it has deleted a footnote reference to the term "Base Flood Elevation" since the same footnote is already included in Part 9.1.2.g, above.]*** level;

v. Temporarily reduce or eliminate outdoor storage;

vi. Temporarily relocate any mobile vehicles and equipment to higher ground;

vii. Develop scenario-based emergency procedures for major storms that are complementary to regular stormwater pollution prevention planning andidentify emergency contacts for staff and contractors; and

viii. Conduct staff training for implementing your emergency procedures atregular intervals.

k. Pursuant to 314 CMR 3.11 (2)(a)6., and in accordance with MassDEP's obligation under 314 CMR 4.05(5)(e) to maintain surface waters free from pollutants in concentrations or combinations that are toxic to humans, aquatic life, or wildlife, permittees who seek coverage under the 2022 CGP and anticipate to carry out dust control shall limit their dust control methodology to using water only and specifically avoid using other techniques, such as solutions containing calcium chloride.

l. If MassDEP requests a copy of the Stormwater Pollution Prevention Plan (SWPPP) for any construction site at any time, the permittee shall submit the SWPPP to MassDEP within 14 days of such a request. MassDEP may conduct an inspection of any site covered by this permit to ensure compliance with state lawrequirements, including state water quality standards.

9.1.3 MTR10F000 Areas in the State of Vermont located at a federal facility

a. Earth disturbance at any one time is limited to five acres.

b. All areas of earth disturbance must have temporary or final stabilization within 14 days of the initial disturbance. After this time, disturbed areas must be temporarily or permanently stabilized in advance of any runoff producing event. A runoff producing event is an event that produces runoff from the construction site. Temporary stabilization is not required if precipitation is not forecast and work is to continue in the next 24-hours or if the work is occurring in a self-contained excavation (i.e. no outlet) with a depth of two feet or greater (e.g. house foundation excavation, utility trenches). Areas of a construction site that drain to sediment basins are not considered eligible for this exemption, and the exemption applies only to the excavated area itself.

c. Site inspections on active construction sites shall be conducted daily during the period from October 15 through April 15.

d. The use of chemical treatments (e.g. polymers, flocculants, and coagulants) for the settling and/or removal of sediment from stormwater runoff associated with construction and construction-related activities requires prior written approval and an approved site and project-specific plan, from the Vermont Agency of Natural Resources. In addition, the use of cationic polymers is prohibited unless approved by the Vermont Agency of Natural Resources under a site and project-specific plan.

e. Any applicant under EPA's CGP shall allow authorized Vermont Agency of Natural Resources representatives, at reasonable times and upon presentation of credentials, to enter upon the project site for purposes of inspecting the project and determining

compliance with this Certification.

f. The Vermont Agency of Natural Resources may reopen and alter or amend the conditions of this Certification over the life of the EPA 2022 Construction General Permit when such action is necessary to assure compliance with the VWQS.

9.2 EPA REGION 2

9.2.1 NYR10I000 Indian country within the State of New York

a. Saint Regis Mohawk Tribe

i. Any Responsible-Person/Decision-Maker required under the CGP to submit a Notice of Intent (NOI) to EPA for coverage under the CGP, must concurrently submit an electronic copy of the NOI to the SRMT Environmental Division, Water Resource Program Manager. Additionally, an electronic copy of the Notice of Termination (NOT) must be provided within three business days after electronic confirmation is received from EPA that the NOT has been accepted. The NOI and NOT must be electronically provided to the following addresses:

Mr. Tieman W. Smith
Water Resources Program Manager Saint Regis Mohawk Tribe
449 Frogtown Road
Akwesasne, NY 13655 Tiernan.Smith@srmt-nsn.gov 518.358.2272 ext. 5073

ii. Any Responsible-Person/Decision-Maker that is required as part of the CGP to prepare a Discharge Management Plan (OMP) or Storm Water Management Plan (SWMP) and/or Storm Water Pollution Prevention Plan (SWPPP) must submit an electronic copy of the DMP, SWMP and/or SWPPP to the SRMT Environment Division, Water Resources Program Manager IO business days prior to the start of construction of any work to be conducted under the CGP. The applicable documents must be provided to the electronic address listed above.

iii. Any Responsible-Person/Decision-Maker that is required under the CGP to submit an annual report to EPA must submit an electronic copy of the annual report concurrently to the SRMT Water Resource Program. Additionally, any correspondences between the applicant and EPA related to analytical data, written reports, corrective action, enforcement, monitoring, or an adverse incident must likewise be routed to the SRMT Water Resources Program at the above electronic address.

iv. An "Authorization to Proceed Letter" with site-specific mitigation requirements may be sent out to the permittee when a review of the NOI and OMP, SWMP and /or SWPPP on a case-by-case basis, is completed by the SRMT Environment Division, Water Resource Program. This approval will allow the application to proceed if all mitigation requirements are met.

b. Seneca Nation

i. Under Part 1.1.5 of the CGP, the Seneca Nation requests that an applicant must demonstrate that they meet the eligibility criteria listed in Appendix D (certify in your Notice of Intent (NOI) that you meet one of the eligibility criteria [Criterion A-F]) as well as species and critical habitats that are listed under the Seneca Nation's "Fishing and Conservation Laws" and the "Seneca Nation of Indians Comprehensive Conservation Law".

ii. The Tribal Historic Preservation Office (THPO) was established in 2000 after the Seneca Nation received a recognition letter from the National Park Service (NPS); therefore under Part 1.1.6 of the CGP (Appendix E) and prior to submitting a Notice of Intent (NOI) operators must complete the Nation's TPHO, Project Review Form (https://sni.org/media/246603/sni-thpo-project-review-form.pdf) and submit the completed form with associated information to the Tribal Historic Preservation Officer at 90 Ohi:yo' Way, Salamanca, NY 14779. Federal agencies engaging in construction activities must provide for construction review by a certified construction reviewer in accordance with 7 Del. C. §§4010 & 4013 and 7 DE Admin. Code 5101, subsection 6.1.6.

iii. Under Part 1.2 of the CGP, discharges must also follow the Section 13 of the Guide for Construction (Seneca Nation of Indians Source Water Code) and respectively, Council Resolution, dated April 13, 2013 (CN: R-04-13-13-11) to ensure that the health, safety and welfare of the citizens of the Seneca Nation, and all other within the Lands and Territories of the Seneca Nation of Indians, and to facilitate the adequate provisions of water through the elimination or prevention of ground water contamination in the vicinity of wells that supply drinking water for the Nation. The area is known as the Source Water Protection Area (SWPA) and specified activities are regulated within this SWPA, as cited in Section 13 of the Guide for Construction and Section VI, of CN: R-04-13-13-11.

iv. Under Part 1.4, any operator who seeks coverage of the CGP, and is required to submit a notice of intent NOI and Notice of Termination (NOT) (as necessary) to the EPA for coverage, under Part 1.4.2 must also submit a copy of the NOI to the Seneca Nation's Environmental Protection Department (EPD) within three business days of submittal to the EPA, (address shown below). Respectively, a copy of the NOT (as described under Part 8.3 of the CGP), which certifies that you have met the requirements of Part 8, must be provided within three business days after electronic confirmation is received from the EPA that the NOT has been accepted. In addition to a NOI and NOT, the Seneca Nation (Environmental Protection Department [EPD]) would require an Environmental Impact Assessment (EA) (Long Form), as shown in Section 2 of the Seneca Nation of Indians Laws, Ordinances & Policies (Guide for Construction), to be completed and submitted to the EPD prior to any project to determine whether the impacts from a project would create significant and detrimental effects to the Nation's lands, water (violate WQS), and environment. The NOI, NOT, and EA must be submitted electronically to epd@sni.org and provided to the following address:

Seneca Nation
Environmental Protection Department (EPD) Attn: Director of EPD
12837 Route 438
Irving, NY 14081

v. Under Part 3.0 of the CGP, discharges must be controlled as necessary to meet applicable WQS. The Seneca Nation is working actively towards finalizing and implementing the; therefore, the EPD would require an applicant to submit or grant access to the permit to obtain information on the impact of effluents on receiving waters, including the capability of receiving waters to support future designated uses and achieve the WQS of the Nation; and to advise prospective dischargers of discharge requirements, and coordinate with the appropriate

permitting agencies. As stated in the Decision Document, under Section 303(c) of the CWA, 33 U.S.C. § 1313(c), states develop, review, and revise (as appropriate) water quality standards for surface waters of the United States. At a minimum, such standards are to include designated water uses, water quality criteria to protect such uses, and an antidegradation policy. 40 C.F.R. § 131.6. In addition, under Section 401 of the CWA states may grant, condition, or deny "certification" for federally permitted or licensed activities that may result in a discharge to the waters of the United States 33 U.S.C. § 1341.

vi. Under Part 7.2.8(a)(b)(c) and for Part 9 of the CGP, the following Sections of the Seneca Nation's Guide for Construction shall be considered, in conjunction with the CGP:

(a) Section 1. Executive Order - To Establish a Policy for Governing Access to Nation Territories and Facilities by Officials of Foreign Government, dated March 31, 2011

(b) Section 3. Natural Resources Committee, Sand and Gravel Law (CN: R-06-24-05-08)

(c) Section 4. Fishing and Conservation Laws - Part 1.1.5 of the CGP

(d) Section 5. Seneca Nation of Indians Comprehensive Conservation Law, adopted January 14, 2012

(e) Section 9. Food is Our Medicine (FIOM) Program/Native Planting Policy (CN: R-03- 08-14-14)

(f) Section 10. Forestry Management Plan (CN: R-08-14-10-23)

(g) Section 11. Timber Ordinance #411-092, dated May 8, 1982

(h) Section 14. Flood Damage Prevention Local Law, dated September 27, 1988

(i) Section 16. Utilities Ordinance No. 87-100

(j) Authorizing Emergency Action and Contingency Plan to Restrain Pollution of Nations Waters, (Council Resolution: R-03-01-18-10), dated March 10, 2018 Seneca Nation of Indians Permit Application for Construction within Waterways Permit, Form NR98-01.00

9.3 EPA REGION 3

9.3.1 DCR100000 District of Columbia

a. Discharges authorized by this permit shall comply with the District of Columbia Water Pollution Control Act of 1984, as amended (DC Official Code § 8-103.01 and § 8-103.06, et seq.) to ensure that District of Columbia waters, waters in adjacent and downstream states, and the beneficial uses of these waters will not be harmed or degraded by the discharges.

b. Discharges authorized by this permit must comply with §§ 1104.1 and 1104.8 of Chapter 11 and the provisions of Chapter 19 of Title 21of District of Columbia Municipal Regulations in order to attain and maintain designated uses of the District of Columbia waters.

c. The permittee shall comply with the District of Columbia Stormwater Management and Soil Erosion and Sediment Control regulations in Chapter 5 of Title 21 of the District of Columbia Municipal Regulations.

d. The permittee shall comply with the District of Columbia Flood Management Control regulations in Chapter 31 of Title 20 of the District of Columbia Municipal Regulations.

e. The permittee shall submit a copy of the Stormwater Pollution Prevention Plan (SWPPP) to the Regulatory Review Division, Department of Energy & Environment, Government of the District of Columbia, 1200 First Street, NE, 5th Floor, Washington, DC 20002, during the review and approval of the permittee's DOEE Erosion and Sediment Control Plan in accordance with the provisions of Chapter 542 of Title 21 of the District of Columbia Municipal Regulations.

f. Upon request, the permittee shall submit all inspection and monitoring reports as required by this permit and 40 CFR § 122.41 to the Associate Director, Inspection and Enforcement Division, Department of Energy & Environment, Government of the District of Columbia, 1200 First Street, NE, 5th Floor, Washington, DC 20002; telephone (202) 535-2226, or by email at Joshua.Rodriguez@dc.gov.

g. In the event the permittee intends to discharge dewatering water, groundwater, or groundwater comingled with stormwater from a known contaminated site, the permittee shall contact the Regulatory Review Division, Department of Energy & Environment, Government of the District of Columbia, 1200 First Street, NE, 5th Floor, Washington, DC 20002; telephone (202) 535-2600, or by email at MS4DischargeAuthorization@dc.gov to request authorization to discharge dewatering water, groundwater, or groundwater comingled with stormwater to the District's Municipal Separate Storm Sewer System (MS4) or to a surface water body pursuant to §§ 8-103.02, 8-103.06, and 8-103.07 of the District of Columbia Water Pollution Control Act of 1984, as amended.

9.3.2 DER10F000 Areas in the State of Delaware located at a federal facility (as defined in Appendix A)

a. Federal agencies must submit a sediment and stormwater management plan (SSMP) and receive Department approval prior to undertaking any land clearing, soil movement or construction activity unless conducting an exempt activity.

b. Federal construction activities are required to have a third-party Certified Construction Reviewer (CCR) perform weekly reviews to ensure the adequacy of construction activities pursuant to the approved SSMP and regulations.

Implementation of approved SSMPs requires the daily oversight of construction activity by certified responsible personnel.

c. Implementation of approved SSMPs requires the daily oversight of construction activity by certified responsible personnel.

d. A current copy of the SSMP must be maintained at the construction site.

e. Unless authorized by the Department, not more than 20 acres may be disturbed at any one time.

9.4 EPA REGION 4

No additional conditions

9.5 EPA REGION 5

9.5.1 MIR10I000 Indian country within the State of Minnesota

a. Fond du Lac Reservation

i. New dischargers wishing to discharge to an Outstanding Reservation Resource Water (ORRW)[106] must obtain an individual permit from EPA for storm water discharges from large and small construction activities.

ii. A copy of the Storm Water Pollution Prevention Plan (SWPPP) must be submitted to the Office of Water Protection at least fifteen (15) days in advance of sending the Notice of Intent to EPA. The SWPPP can be submitted electronically to richardgitar@FDLREZ.com or by hardcopy sent to:

Fond du Lac Reservation
Office of Water Protection
1720 Big Lake Road
Cloquet, MN 55720

iii. Copies of the Notice of Intent (NOI) and the Notice of Termination (NOT) must be sent to the Fond du Lac Office of Water Protection at the same time they are submitted to EPA. [The condition helps the Office of Water Protection keep track of when a project is about to start and when it has ended. FDL Water Quality Certification Ordinance, Section 204 (a) (2)).

iv. If the project will entail a discharge to any watercourse or open water body, the turbidity limit shall NOT exceed 10% of natural background within the receiving water(s) as determined by Office of Water Protection staff. For such discharges, turbidity sampling must take place within 24 hours of a ½-inch or greater rainfall event. The results of the sampling must be reported to the Office of Water Protection within 7 days of the sample collection. All sample reporting must include the date and time, location (GPS: UTM/Zone 15), and NTU. CGP applicants are encouraged to work with the Office of Water Protection in determining the most appropriate location(s) for sampling. [This condition helps both the Office of Water Protection and the project proponent in knowing whether or not their erosion control efforts are effective. FDL Water Quality Certification, Section 204 (b) (1)).

v. Receiving waters with open water must be sampled for turbidity prior to any authorized discharge as determined by Office of Water Protection staff. This requirement only applies to receiving waters which no ambient turbidity data exists. [This condition allows the Office of Water Protection to obtain a baseline turbidity sample in which to compare to other samples. FDL Water Quality Certification Ordinance, Section 204 (b) (2)].

vi. All work shall be carried out in such a manner as will prevent violations of water quality criteria as stated in the Water Quality Standards of the Fond du Lac Reservation, Ordinance #12/98, as amended. This includes, but is not limited to, the prevention of any discharge that causes a condition in which visible solids, bottom deposits, or turbidity impairs the usefulness of water of the Fond du Lac

[106] Although additional waters may be designated in the future, currently Perch Lake, Rice Portage Lake, Miller Lake, Deadfish Lake, and Jaskari Lake are designated as ORRWs.

Reservation for any of the uses designated in the Water Quality Standards of the Fond du Lac Reservation. These uses include wildlife, aquatic life, warm water fisheries, cold water fisheries, subsistence fishing (netting), primary contact recreation, secondary contact recreation, cultural, wild rice areas, aesthetic waters, agriculture, navigation, commercial and wetlands. It also includes the designated uses of wetlands including, but not limited to, baseflow discharge, cultural opportunities, flood flow attenuation, groundwater recharge, indigenous floral and fauna) diversity and abundance, nutrient cycling, organic carbon export/cycling, protection of downstream water quality, recreation, resilience against climactic effects, sediment/shoreline stabilization, surface water storage, wild rice, and water dependent wildlife. [In addition to listing the designated uses of waters of the Fond du Lac Reservation, this condition also limits the project proponent to discharges that will not violate our Water Quality Standards. FDL Water Quality Certification Ordinance, Section 204 (a) (7)).

vii. Appropriate steps shall be taken to ensure that petroleum products or other chemical pollutants are prevented from entering waters of the Fond du Lac Reservation. All spills must be reported to the appropriate emergency management Agency (National Response Center AND the State Duty Officer), and measures shall be taken immediately to prevent the pollution of waters of the Fond du Lac Reservation, including groundwater. The Fond du Lac Office of Water Protection must also be notified immediately of any spill regardless of size. [This condition helps protect water quality and also reminds project proponents of their responsibility in reporting spill events. FDL Water Quality Certification Ordinance, Section 204 (b) (3)).

viii. All seed mixes, whether used for temporary stabilization or permanent seeding, shall NOT contain any annual ryegrass (Lolium species). Wild rye (Elymus species) or Oats (Avena species) may be used as a replacement in seed mixes. [This condition prevents the use of annual ryegrass on the Reservation. Annual ryegrass is allelopathic, which means it produces biochemical in its roots that inhibit the growth of native plants. If used in seed mixes, annual ryegrass could contribute to erosion, especially on slopes. However, the condition also specifies substitute grasses that germinate almost as fast as annual ryegrass for use as a cover crop to help prevent erosion. FDL Water Quality Certification Ordinance, Section 204 (t) (1)).

ix. To prevent the introduction of invasive species, ALL contractors and subcontractors MUST disclose information stating prior equipment location(s) and ALL known invasive species potentially being transported from said location(s). All equipment MUST undergo a high pressure wash (including any equipment mats) BEFORE ENTERING the Fond du Lac Reservation. Personal equipment such as work boots, gloves, vest, etc. MUST be clean of debris, dirt and plant and animal material BEFORE ENTERING the Fond du Lac Reservation. Equipment being transported from known infested areas MUST undergo a high pressure wash as soon as possible after leaving the infested site and again BEFORE ENTERING the Fond du Lac Reservation, to avoid transport of invasive species into areas surrounding the Reservation. Written certification of equipment cleaning MUST be provided to the Fond du Lac Office of Water Protection. Upon arrival, ALL contractor and subcontractor equipment will be inspected by appointed Fond du Lac staff. If equipment is deemed unsatisfactory, the equipment MUST

undergo a high pressure washing until the equipment is cleared by the inspector, until such time, minimal travel will be allowed through the Reservation. The contractor shall be held responsible for the control of any invasive species introduced as a result of their project. [This condition requires the project proponent to prevent the inadvertent introduction of invasive species by taking an active role in cleaning all vehicles, equipment, and equipment mats before entering the Reservation. This condition has been placed in certifications since 2012, due to the introduction of Wild Parsnip in 2011 from a pipeline contractor. It is much easier to prevent the introduction of an invasive species than it is to eradicate it once it has been introduced. Many invasive plant species form monocultures, preventing native plants from growing. This situation often leads to cases of erosion, which in turn effects water quality. FOL Water Quality Certification Ordinance, Section 204 (g) (1)].

x. A copy of this certification MUST be kept by the contractor on-site at all times and be available for viewing by all personnel, including inspectors. [This condition ensures that the information contained in the certification, especially the conditions, is readily available onsite for reference. FOL Water Quality Certification Ordinance, Section 204 (a) (9)].

b. The Grand Portage Band of Lake Superior Chippewa

i. The CGP authorization is for construction activities that may occur within the exterior boundaries of the Grand Portage Reservation in accordance to the Grand Portage Land Use Ordinance. The CGP regulates stormwater discharges associated with construction sites of one acre or more in size. Only those activities specifically authorized by the CGP are authorized by this certification (the "Certification").

ii. All construction stormwater discharges authorized by the CGP must comply with the Water Quality Standards and Water Resources Ordinance, as well as Applicable Federal Standards (as defined in the Water Resources Ordinance).

iii. All appropriate steps must be taken to ensure that petroleum products or other chemical pollutants are prevented from entering the Waters of the Reservation. All spills must be reported to the appropriate emergency-management agency, and measures must be taken to prevent the pollution of the Waters of the Reservation, including groundwater.

iv. The 2022 CGP requires inspections and monitoring reports of the construction site stormwater discharges by a qualified person. Monitoring and inspection reports must comply with the minimum requirements contained in the 2022 CGP. The monitoring plan must be prepared and incorporated into the Storm Water Pollution Prevention Plan (the "SWPP"). A copy of the SWPP must be submitted to the Board at least 30 days in advance of sending the requisite Notice of Intent to EPA. The SWPP should be sent to:

Grand Portage Environmental Resources Board

P.O. Box 428

Grand Portage, MN 55605

Copies of the Notice of Intent and Notice of Termination required under the General Permit must be submitted to the Board at the address above at the same time they are submitted to the EPA.

v. If requested by the Grand Portage Environmental Department, the permittee must provide additional information necessary for a case-by-case eligibility determination to assure compliance with the Water Quality Standards and any Applicable Federal Standards. The burden is on the applicant to demonstrate compliance with the Water Quality Standards, the Water Resources Ordinance, and Applicable Federal Standards whether or not the application is ultimately eligible for the CGP.

vi. CGP discharges must not cause nuisance conditions as defined in Grand Portage Water Quality Standards.

vii. The Board retains full authority to ensure compliance with and to enforce the provisions of the Water Resource Ordinance and Water Quality Standards, Applicable Federal Standards, and these Certification conditions. Nothing herein affects the scope or applicability of other controlling tribal or federal requirements, including but not limited to impacts to cultural, historical, or archeological features or sites, or properties that may be eligible for listing on the National Register of Historic Places under the National Historic Preservation Act, 54 U.S.C. §§ 300101 et seq.

viii. Appeals related to Board actions taken in accordance with any of the preceding conditions may be heard by the Grand Portage Tribal Court.

c. Leech Lake Band of Ojibwe

i. The water quality standards that apply to the construction site are the standards at the time the operator submits its Notice of Intent (NOI) to EPA and the LLBO WRP (see conditions # 2 and # 3).

ii. A copy of the Stormwater Pollution Prevention Plan (SWPPP) must be submitted to the LLBO WRP at least 30 days in advance of sending the NOI for the project to EPA. See attached LLBO 401 Water Quality Certification Ordinance. Section 304(a)(1). The SWPPP should be submitted electronically to Jeff.Harper@llojibwe.net and by hardcopy sent to:

Leech Lake Band of Ojibwe
ATTN: Water Resources Program - 401 Cert
Division of Resource Management
190 Sailstar Drive NW
Cass Lake, Minnesota 56633

iii. Copies of the NOI and the Notice of Termination (NOT) must be submitted to the LLBO WRP at the same time they are submitted to EPA. See attached LLBO 401 Water Quality Certification Ordinance, Section 304(a)(2). The NOI and NOT should be submitted electronically to Jeff.Harper@llojibwe.net and sent by hardcopy to the address cited in condition # 2.

iv. Any and all other conditions listed in Section 304 of the attached LLBO 401 Water Quality Certification Ordinance shall be observed unless the LLBO WRP deems that certain conditions therein are not applicable to the project in need of a permit under this certification.

v. A copy of this certification MUST be kept by the contractor on-site at all times and be available for viewing by all personnel, including inspectors.

vi. Upon consideration of the NOI, if the LLBO WRP finds that the discharge will not be controlled as necessary to meet applicable water quality standards, the LLBO WRP may insist, consistent with Part 3.1 of the CGP, that additional controls are installed to meet applicable water quality standards, or recommend to EPA that the operator obtain coverage under an individual permit.

9.5.2 WIR10I000 Indian country within the State of Wisconsin

a. Bad River Band of Lake Superior Tribe of Chippewa Indians

i. Only those activities specifically authorized by the CGP are authorized by this Certification. This Certification does not authorize impacts to cultural properties, orhistorical sites, or properties that may be eligible for listing as such.

ii. All projects which are eligible for coverage under the CGP and are located within the exterior boundaries of the Bad River Reservation shall be implemented in such a manner that is consistent with the Tribe's Water Quality Standards (WQS). The Tribe's WQS can be viewed at: http://www.badriver-nsn.gov/wp-content/uploads/2020/01/NRD_WaterQualityStandards_2011.pdf

iii. Operators are not eligible to obtain authorization under the CGP for all new discharges to an Outstanding Tribal Resource Water (OTRW or Tier 3 water). OTRWs, or Tier 3 waters, include the following: Kakagon Slough and the lower wetland reaches of its tributaries that support wild rice, Kakagon River, Bad River Slough, Honest John Lake, Bog Lake, a portion of Bad River, from where it enters the Reservation through the confluence with the White River, and Potato River. OTRWs can be viewed at: https://www.arcgis.com/apps/View/index.html?appid=6f44c371217e4ee8b5f1c2c705c 7c7c5

iv. An operator proposing to discharge to an Outstanding Resource Water (ORW or Tier 2.5 water) under the CGP must comply with the antidegradation provisions of the Tribe's WQS. ORWs, or Tier 2.5 waters, include the following: a portion of Bad River, from downstream the confluence with the White River to Lake Superior, White River, Marengo River, Graveyard Creek, Bear Trap Creek, Wood Creek, Brunsweiler River, Tyler Forks, Bell Creek, and Vaughn Creek. ORWs can be viewed at: https://www.arcgis.com/apps/View/index.html?appid=6f44c371217e4ee8b5f1c2c705c 7c7c5. The antidegradation demonstration materials described in provision E.4.iii., and included on the antidegradation demonstration template found at: https://www.badriver-nsn.gov/natural-resources/projectreviews/, must be submitted to the following address:

Bad River Tribe's Natural Resources Department

Attn: Water Regulatory Specialist

P.O. Box 39 Odanah, WI 54861

WaterReg@badriver-nsn.gov

v. An operator proposing to discharge to an Exceptional Resource Water (ERW or Tier 2 water) under the CGP must comply with the antidegradation provisions of the Tribe's WQS. ERWs, or Tier 2 waters, include the following: any surface water within the exterior boundaries of the Reservation that is not specifically classified as an Outstanding Resource Water (Tier 2.5 water) or an Outstanding Tribal Resource Water (Tier 3 water). ERWs can be viewed at:

https://www.arcgis.com/apps/View/index.html?appid=6f44c371217e4ee8b5f1c2c705c 7c7c5. The antidegradation demonstration materials described in provision E.4.ii., and included on the antidegradation demonstration template found at: https://www.badriver-nsn.gov/natural-resources/projectreviews/, must be submitted to the following address:

Bad River Tribe's Natural Resources Department
Attn: Water Regulatory Specialist
P.O. Box 39 Odanah, WI 54861
WaterReg@badriver-nsn.gov

vi. Projects utilizing cationic treatment chemicals within the Bad River Reservation boundaries are not eligible for coverage under the CGP.

vii. A discharge to a surface water within the Bad River Reservation boundaries shall not cause or contribute to an exceedance of the turbidity criterion included in the Tribe's WQS, which states: Turbidity shall not exceed 5 NTU over natural background turbidity when the background turbidity is 50 NTU or less, or turbidity shall not increase more than 10% when the background turbidity is more than 50 NTU.

viii. All projects which are eligible for coverage under the CGP within the exterior boundaries of the Bad River Reservation must comply with the Bad River Reservation Wetland and Watercourse Protection Ordinance, or Chapter 323 of the Bad River Tribal Ordinances, including the erosion and sedimentation control, natural buffer, and stabilization requirements. Questions regarding Chapter 323 and requests for permit applications can be directed to the Wetlands Specialist in the Tribe's Natural Resources Department at (715) 682-7123 or wetlands@badriver-nsn.gov.

ix. An operator of a project, which is eligible for coverage under the CGP, that would result in an allowable discharge under the CGP occurring within the exterior boundaries of the Bad River Reservation must notify the Tribe prior to the commencing earth-disturbing activities. The operator must submit a copy of the Notice of Intent (NOI) to the following addresses at the same time it is submitted to the U.S. EPA:

Bad River Tribe's Natural Resources Department
Attn: Water Regulatory Specialist
P.O. Box 39 Odanah, WI 54861
WaterReg@badriver-nsn.gov

Bad River Tribe's Natural Resources Department
Attn: Tribal Historic Preservation Officer (THPO)
P.O. Box 39 Odanah, WI 54861
THPO@badriver-nsn.gov

The operator must also submit a copy of the Notice of Termination (NOT) to the above addresses at the same time it is submitted to the U.S. EPA. Photographs showing the current site conditions must be included as part of the NOT to document the stabilization requirements have been met.

x. The THPO must be provided 30 days to comment on the project.

xi. The operator must obtain THPO concurrence in writing. This written concurrence will outline measures to be taken to prevent or mitigate effects to historic properties. For more information regarding the specifics of the cultural resources process, see 36 CFR Part 800. A best practice for an operator is to consult with the THPO during the planning stages of an undertaking.

xii. An operator of a project, which is eligible for coverage under the CGP, that would result in an allowable discharge under the CGP occurring within the exterior boundaries of the Bad River Reservation must submit a copy of the Stormwater Pollution Prevention Plan (SWPPP) to the following address at the same time as submitting the NOI:

Bad River Tribe's Natural Resources Department
Attn: Water Regulatory Specialist
P.O. Box 39 Odanah, WI 54861
WaterReg@badriver-nsn.gov

xiii. Any corrective action reports that are required under the CGP must be submitted to the following address within one (1) working day of the report completion:

Bad River Tribe's Natural Resources Department
P.O. Box 39 Odanah, WI 54861
WaterReg@badriver-nsn.gov

xiv. An operator of a project, which is eligible for coverage under the CGP, that would result in an allowable discharge under the CGP occurring within the exterior boundaries of the Bad River Reservation must submit a copies of the inspection reports (including photographs) to the following address within 24 hours of completing any site inspection required:

Bad River Tribe's Natural Resources Department Attn: Water Regulatory Specialist
P.O. Box 39 Odanah, WI 54861
WaterReg@badriver-nsn.gov

xv. An operator shall be responsible for meeting any additional permit requirements imposed by the U.S. EPA necessary to comply with the Tribe's antidegradation policies if the discharge point is located upstream of waters designated by the Tribe.

9.6 EPA REGION 6

9.6.1 NMR100000 State of New Mexico, except Indian country

a. In Outstanding National Resource Waters (ONRWs) in New Mexico, no degradation is permitted except in limited, specifically defined instances. Therefore, Operators are not eligible to obtain authorization under this general permit for stormwater discharges to waters classified as ONRWs listed in Paragraph D of 20.6.4.9 New Mexico Administrative Code (NMAC), also referred to as "Tier 3 waters" as defined in Appendix A of this permit. Exception: When construction activities are in response to a public emergency (e.g., wildfire, extreme flooding, etc.) and the related work requires immediate authorization to avoid a threat to public health or safety.

i. Operators who conduct construction activities in response to a public emergency to mitigate an immediate threat to public health or safety shall

adhere to the requirements in 20.6.4.8(A)(3)(c) NMAC, including notifying the New Mexico Environment Department (NMED) within seven days of initiation of the emergency action and providing NMED with a summary of the action taken within 30 days of initiation of the emergency action.

ii. For all other scenarios, Operators with proposed discharges to ONRWs in New Mexico shall obtain coverage from EPA under an NPDES Individual Permit and will comply with the additional standards and regulations related to discharges to ONRWs in 20.6.4.8(A) NMAC. Additional information is available from:

New Mexico Environment Department Surface Water Quality Bureau
P.O. Box 5469
Santa Fe, NM 87502-5469 Telephone: 505-827-0187
https://www.env.nm.gov/surface-water-quality/wqs/
https://gis.web.env.nm.gov/oem/?map=swqb

b. If construction dewatering activities are anticipated at a construction site and non-stormwater discharges of groundwater, subsurface water, spring water, and/or other dewatering water are anticipated, the Operators/Permittees must complete the following steps:

1. Review the state's Ground Water Quality Bureau Mapper (https://gis.web.env.nm.gov/GWQB/) and Petroleum Storage Tank Bureau Mapper (https://gis.web.env.nm.gov/GWQB/).

   Check if the following sources are located within the noted distance from the anticipated construction dewatering activity. At a minimum, a list of the following potential sources of contaminants and pollutants at the noted distance is to be kept in the SWPPP.

Source of Potential Contamination or Pollutants*	Constituents likely to be required for testing*
Within 0.5 mile of an open Leaking Underground Storage Tank (LUST) site	BTEX (Benzene, Toluene, Ethylbenzene, and Xylene) plus additional parameters depending on site conditions**
Within 0.5 mile of an open Voluntary Remediation site	All applicable parameters or pollutants listed in 20.6.4.13, 20.6.4.52, 20.6.4.54, 20.6.4.97 thru 20.6.4.99, 20.6.4.101 through 20.6.4.899, and 20.6.4.900 NMAC (or an alternate list approved by the NMED-SWQB)*
Within 0.5 mile of an open RCRA Corrective Action Site	
Within 0.5 mile of an open Abatement Site	
Within 0.5 mile of an open Brownfield Site	
Within 1.0 mile or more of a Superfund site or National Priorities List (NPL) site with associated groundwater contamination.	
Construction activity contaminants and/or natural water pollutants	Additional parameters depending on site activities and conditions (Contact NMED- SWQB for an alternate list)*

*For further assistance determining whether dewatering may encounter contaminated sources, please contact the NMED Ground Water Quality Bureau at 505-827-2965 or NMED Surface Water Quality Bureau (SWQB) at 505-827-0187.

** EPA approved sufficiently sensitive methods must be used. For known PCB sources and analysis, EPA Method 1668C must be used (see https://www.epa.gov/cwa-methods).

2. If dewatering activities are anticipated, information on the flow rate and potential to encounter contaminated groundwater, subsurface water, spring water, or dewatering water must be provideddirectly to NMED at the following address:

   NMED Surface Water Quality Bureau

   Program Manager, Point Source Regulation
   SectionPO Box 5469, Santa Fe, NM 87502

   Please call the SWQB to obtain the appropriate email address (505-827-0187).

3. In addition, the Operator/Permittee must characterize the quality of the groundwater and subsurface water, spring water, or dewatering water being considered for discharge according to the table above and including dissolved hardness and pH. Considering the contaminant sources listed in the table above, water quality data may already be available. For further assistance, contactthe

NMED Surface Water Quality Bureau (505-827-0187), Ground Water Quality Bureau (505-827- 2965), Petroleum Storage Tank Bureau (505-476-4397), or Hazardous Waste Bureau (505-476- 6000).

i. The Operator/Permittee must submit recent analytical test results (i.e., within the past 5 years) according to the table above, and including dissolved hardness and pH, to the EPA Region 6 Stormwater Permit Contact and the NMED Surface Water Quality Bureau (see contact information in #2 above). If the test data exceed applicable water quality standards, then the groundwater, subsurface water, spring water, or dewatering water cannot be discharged into surface waters under this general permit. Operators/Permittees may submit an NPDES Individual Permit application to treat and discharge to waters of the U.S. or find alternative disposal measures. No discharges to surface waters are allowed until authorized.

ii. If the discharge has the potential to affect groundwater (e.g., land application), the Operator/Permittee must submit an NOI to the NMED Ground Water Quality Bureau (see 20.6.2.1201 NMAC – Notice of Intent to Discharge).

4. The Operator/Permittee must document any findings and all correspondence with NMED and EPA in the SWPPP.

c. Operators who intend to obtain authorization under this permit for new and existing storm water dischargesfrom construction sites must satisfy the following condition:

i. The SWPPP must include site-specific interim and permanent stabilization, managerial, and structural solids, erosion and sediment control best management practices (BMPs) and/or other controls that are designed to prevent to the maximum extent practicable an increase in the sediment yield and flow velocity from pre-construction, pre-development conditions to assure thatapplicable standards in 20.6.4 NMAC, including the antidegradation policy, and TMDL waste load allocations (WLAs) are met. This requirement applies to discharges both during construction and after construction operations have been completed. The SWPPP must identify and document the rationale for selecting these BMPs and/or other controls. The SWPPP must also describe design specifications, construction specifications, maintenance schedules (including a long-term maintenance plan), criteria for inspections, and expected performance and longevity of these BMPs.For sites greater than 5 acres in size, BMP selection must be made based on the use of appropriatesoil loss prediction models (i.e. SEDCAD, RUSLE, SEDIMOT, MULTISED, etc.) OR equivalent generallyaccepted (by professional erosion control specialists) soil loss prediction tools.

ii. For all sites, the Operator(s) must demonstrate, and include documentation in the SWPPP, that implementation of the site-specific practices will ensure that the applicable standards and TMDL WLAs are met, and will result in sediment yields and flow velocities that, to the maximum extent practicable, will not be greater than the sediment yield levels and flow velocities from preconstruction, pre-development conditions.

iii. All SWPPPs must be prepared in accordance with good engineering practices by qualified (e.g., CPESC certified, engineers with appropriate training) erosion control specialists familiar with the use of soil loss prediction models and design of erosion and sediment control systems based on these models (or equivalent soil

loss prediction tools). Qualifications of the preparer (e.g., professional certifications, description of appropriate training) must be documented in the SWPPP.The Operator(s) must design, implement, and maintain BMPs in the manner specified in the SWPPP.

NMED supports the use of EPA's small residential lot template if a site qualifies to use it as explained inthe permit, as long as it is consistent with the above requirements. NMED's requirement does not preclude small residential sites from using the template, but it may require an additional short paragraphto justify the selection of specific BMPs for the site.

d. Operators must notify NMED when discharges of toxic or hazardous substances or oil from a spill or other release occurs - see Emergency Spill Notification Requirements, Part 2.3.6 of the permit. For emergencies, Operators can call 505-827-9329 at any time. For non-emergencies, Operators can call 866-428-6535 (voice mail 24-hours per day) or 505-476-6000 during business hours from 8am-5pm, Monday through Friday. Operators can also call the NMED Surface Water Quality Bureau directly at 505-827-0187.

e. Operators of small construction activities (i.e., 1-5 acres) are not eligible to qualify for a waiver in lieu of needing to obtain coverage under this general permit based on Item C.3 of Appendix C (Equivalent Analysis Waiver) in the State of New Mexico.

9.6.2 NMR10I000 Indian country within the State of New Mexico, except Navajo Reservation Lands that are covered under Arizona permit AZR10000I and Ute Mountain Reservation Lands that are covered under Colorado permit COR10000I.

a. Nambe Pueblo

i. The operator must provide a copy of the Notice of Intent (NOI) and Notice of Termination (NOT) to the Nambe Pueblo Governor's Office at the same time it is provided to the US Environmental Protection Agency. The NOI and NOT should be provided to the following address:

Office of the Governor Nambe Pueblo

!SA NPI02 WEST

Nambe Pueblo, New Mexico 87506

ii. The operator must provide a copy of the Storm Water Pollution Prevention Plan (SWPPP) to Nambe Pueblo at the same time it is submitted to the EPA, either by email to governor@nambepueblo.org or mailed to the above address.

iii. The operator must provide copies of inspection reports, a copy of the corrective action log, and modifications made to the SWPPP as a result of inspection findings, upon request by the Nambe Pueblo Department of Environmental and Natural Resources or Nam be Governor.

b. Ohkay Owingeh Tribe

i. All operators obtaining permit coverage under the EPA CGP, must submit a copy of the certified (signed) Notice of Intent (NOI) to the Ohkay Owingeh Office of Environmental Affairs, a copy of NOI modifications and the Notice of Termination (NOT), must be provided within three business days after EPA provides electronic confirmation that the submission has been received. The NOI and NOT must be provided to the following address:

Naomi L. Archuleta - Environmental Programs Manager Ohkay Owingeh Office of Environmental Affairs
P.O. Box 717
Ohkay Owingeh, NM 87566
naomi.archuleta@ohkay.org

Noah Kaniatobe - Environmental Specialist Ohkay Owingeh, Office of Environmental Affairs
P.O. Box 717
Ohkay Owingeh, NM 87566
noah.kaniatohe@ohkay.org

ii. All operators obtaining permit coverage under the EPA CGP, must submit an electronic copy of the Storm Water Pollution Prevention Plan (SWPPP) to Ohkay Owingeh Office of Environmental Affairsat the same time that the NOI is submitted to the tribe (see contact information listed above).

iii. Following each incident where the operator takes a corrective action the operator must provide thecorrective action log to the Ohkay Owingeh Office of Environmental Affairs.

iv. The operator must notify Ohkay Owingeh Office of Environmental Affairs within 24 hours, in the event of an emergency spill in addition to the notification requirements at Part 2.3.6 of the CGP. Please contact: Ohkay Owingeh Tribal Police Department at 505.852.2757.

Please contact:
Ohkay Owingeh
Tribal Police Department
505.852.2757

c. Pueblo of Isleta

i. All operators obtaining permit coverage under the EPA CGP must submit a copy of the certified Notice ofIntent (NOI) to the Pueblo of Isleta at the same time it is submitted to EPA for projects occurring within the exterior boundaries of the Pueblo of Isleta. Additionally, a copy of NOI modifications and the Notice of Termination (NOT), must be provided within three business days after EPA provides electronic confirmation that the submission has been received. The Notices must be provided to the following address:

Water Quality Control OfficerPueblo of Isleta
Environment DepartmentPO Box 1270
Isleta NM 87022
505-869-7565
WQCO@isletapueblo.com

ii. The operator must notify the Pueblo of Isleta's Dispatch at 505-869-3030 as soon as possible and thePueblo of Isleta Water Quality Control Officer within 10 hours, in the event of a spill of hazardous ortoxic substances or if health or the

environment become endangered in addition to the notification requirements at Part 2.3.6 and at I.12.6.1 of the CGP.

iii. All operators obtaining permit coverage under the EPA CGP must submit an electronic copy of the Stormwater Pollution Prevention Plan (SWPPP) to the Pueblo of Isleta Water Quality Control Officer atthe above address, 30 days prior to submitting the certified NOI to EPA. If the electronic file is too largeto send through e-mail, a zip file or flash drive may be submitted.

iv. All operators obtaining permit coverage under the EPA CGP must give 2 days advance notice to the Pueblo of Isleta Water Quality Control Officer of any planned changes in the permitted activity whichmay result in noncompliance with permit requirements.

v. All operators obtaining permit coverage under the EPA CGP must post a sign or other notice of permit coverage at a safe, publicly accessible location in close proximity to the construction site. The notice mustbe located so that it is visible from the public road or tribal road that is nearest to the active part of the construction site. The sign must be maintained on-site from the time construction activities begin until final stabilization is met.

vi. Erosion and sediment controls shall be designed to retain sediment on-site and project-generatedwaste materials that have the potential to discharge pollutants shall not be placed on open soil oron a surface that is not stabilized. Volumes of sediment over five (5) cubic yards must be removed from the active construction site; additionally, if sediment is placed for disposal withinthe exterior boundaries of the Pueblo of Isleta, disposal must be within a tribally approved sediment disposal site.

d. Pueblo of Laguna

i. All operators obtaining permit coverage under the EPA CGP must submit an electronic copy of the certified (signed) Notice of Intent (NOI) to the Pueblo of Laguna's Environmental & Natural Resources Department (ENRD) within three business days of submittal to the EPA. Additionally, a copy of NOI modifications and the Notice of Termination (NOT), must be provided within three business days after the EPA provides electronic confirmation that the submission has been received. The NOI and NOT must be electronically submitted to info.environmental@pol-nsn.gov.

ii. All operators obtaining permit coverage under the EPA CGP must submit an electronic copy of the Stormwater Pollution Prevention Plan (SWPPP) to the Pueblo of Laguna's ENRD 14 days prior to the submittal of the NOI (see contact information listed above).

iii. The operator must provide copies of corrective actions logs and modifications made to the SWPPP as a result of inspection findings to the Pueblo of Laguna ENRD (see contact information above).

iv. In addition to the notification requirements of Part 2.3.6 of the CPG ***[EPA interprets this intending to refer to the CGP]***, the operator must notify the Pueblo of Laguna ENRD at 505-552-7512 in the event of an emergency spill as soon as possible.

e. Pueblo of Sandia. The following conditions apply only to discharges on the Pueblo of Sandia Reservation:

i. All operators obtaining permit coverage under the EPA CGP, must submit a copy of the certified (signed) Notice of Intent (NOI) to the Pueblo of Sandia Environment Department concurrently with submittal to the EPA. Additionally, a copy of NOI modifications and the Notice of Termination (NOT), must be provided concurrently with submittal to the EPA. The NOI and NOT must be provided electronically to the following addresses:

Electronic Addresses:

Amy Rosebrough (Water Quality Manager): rosebrough@sanidapueblo.nsn.us
Greg Kaufman (Environment Director):gkaufman@sandiapueblo.nsn.us

ii. All operators obtaining permit coverage under the EPA CGP, must submit an electronic copy of the Stormwater Pollution Prevention Plan (SWPPP) to the Pueblo of Sandia Environment. Department at least 14 days prior to submittal of the NOI to the Pueblo (see contact information listed above).

iii. If requested by the Pueblo of Sandia Environment Department, the permittee must provide additional information necessary on a case-by-case basis to assure compliance with the Pueblo of Sandia Water Quality Standards and/or applicable Federal Standards.

iv. An "Authorization to Proceed Letter" with site specific mitigation requirements may be sent out to the permittee when a review of the NOI and SWPPP, on a case-by-case basis, is completed by the Pueblo of Sandia Environment Department. This approval will allow the application to proceed if all mitigation requirements are met.

v. The Pueblo of Sandia will not allow Small Construction Waivers (Appendix C) to be granted for any small construction activities.

vi. The operator must provide copies of inspection reports, a copy of the corrective action log, and modifications made to the SWPPP as a result of inspection findings to the Pueblo of Sandia Environment Department upon request. An inspection report and corrective action log must be submitted to the Pueblo within 3 days of any inspection that results in corrective action (see contact information listed above).

vii. The operator must notify the Pueblo of Sandia within 24 hours in the event of an emergency spill, in addition to the notification requirements at Part 2.3.6 of the COP (see contact information listed above).

viii. Before submitting a Notice of Termination (NOT) to the EPA, permittees must clearly demonstrate to the Pueblo of Sandia Environment Department through a site visit or documentation that requirements for site stabilization have been met and any temporary erosion control structures have been removed. A short letter stating that the NOT is acceptable and all requirements have been met will be sent to the permittee to add to the permittee's NOT submission to the EPA.

f. Pueblo of Santa Ana. The following conditions apply only to discharges on the Pueblo of Santa Ana Reservation:

i. All operators obtaining permit coverage under the EPA CGP, must submit a copy of the certified (signed) Notice of Intent (NOI) to the Pueblo's Department of Natural Resources within three business days of submittal to EPA. Additionally, a copy of NOI modifications and the Notice of Termination (NOT), must be

provided within three business days after EPA provides electronic confirmation that the submission has been received. The NOI and NOT must be provided to the following address:

Regular U.S. Delivery Mail:
Pueblo of Santa Ana
Department of Natural Resources Water Resources Division
Attn: Andrew Sweetman 02 Dove Rd
Santa Ana Pueblo, NM 87004

Electronically:
Andrew Sweetman
Water Resources Division Manager Andrew.Sweetman@santaana-nsn.gov
Tammy Montoya Hydrologist
Tammy.Montoya@santaana-nsn.gov

ii. All operators obtaining permit coverage under the EPA CGP, must submit an electronic copyof the Stormwater Pollution Prevention Plan (SWPPP) to the to the Pueblo's Department of Natural Resources at the same time that the NOI is submitted to the tribe (see contact information listed above).

iii. The operator must provide copies of inspection reports, a copy of the corrective action log, and modifications made to the SWPPP as a result of inspection findings, upon request by the Pueblo's Department of Natural Resources.

iv. The operator must notify the Pueblo's Department of Natural Resources within 24 hours in the event of an emergency spill, in addition to the notification requirements at Part 2.3.6 of the CGP.

g. Pueblo of Taos

i. All operators obtaining permit coverage under the EPA CGP, must submit a copy of the certified (signed) Notice of Intent (NOi) to the Taos Pueblo Environmental Office and Taos Pueblo Governor's Office within three business days of submittal to EPA. Additionally, a copy of NOi modifications and the Notice of Termination (NOT), must be provided within three business days after EPA provides electronic confirmation that the submission has been received. The NOi and NOTmust be provided to the following addresses:

Honorable Governor of Taos Pueblo PO Box 1846
Taos, New Mexico 87571

Taos Pueblo Environmental Office PO Box 1846
Taos, New Mexico 87571

ii. All operators obtaining permit coverage under the EPA CGP, must submit an electronic copy of theStormwater Pollution Prevention Plan (SWPPP) to the Taos Pueblo Environmental Office when the NOI is submitted to the tribe. Electronic copy of SWPPP downloaded on flash drive may be sent to the above address for the Taos Pueblo Environmental Office.

iii. The operator must provide a copy of the corrective action log following each corrective action undertaken and modifications made to the SWPPP as a result of

a corrective action to the Taos Pueblo Environmental Office at address listed above.

h. Pueblo of Tesuque.

i. All operators obtaining permit coverage under the EPA CGP, must submit a copy of the certified (signed) Notice of Intent (NOI) to the Pueblo of Tesuque Department of Environment and Natural Resources (DENR) and the Pueblo's Governor within three business days of submittal to EPA. Additionally, a copy of any NOi modifications and the Notice of Termination (NOT), must be provided within three business days after EPA provides electronic confirmation that the submission has been received. The NOI and NOT must be provided to the following address:

Governor Mark Mitchell Pueblo of Tesuque
20 TP 828
Santa Fe, NM 87506 governor@puebloftesuque.org

Sage Mountain.flower Pueblo of Tesuque
Department of Environment and Natural Resources Director
20 TP 828

ii. All operators obtaining permit coverage under the EPA CGP, must submit an electronic copyof the Stormwater Pollution Prevention Plan (SWPPP) to Pueblo of Tesuque DENR and the Pueblo's Governor at the same time that the NO! is submitted to the EPA (see contact information listed above).

iii. The operator must provide a copy of the corrective action log, and any modifications made tothe SWPPP as a result of inspection findings, or upon request by the Pueblo of Tesuque DENR.

iv. The operator must notify the Pueblo of Tesuque DENR within 24 hours in the event of an emergency spill, in addition to the notification requirements at Part 2.3.6 of the CGP (seecontact information listed above).

i. Santa Clara Indian Pueblo.

i. All operators obtaining permit coverage under the EPA CGP, must submit a copy of the certified (signed) Notice of Intent (NOI) to the Santa Clara Pueblo Office of Environmental Affairs at the same time the NOI is submitted to the U.S. EPA. Additionally, a copy of the NOI modifications and the Notice of Termination (NOT), must be provided at the same time after electronic confirmation is received from EPA that the NOT has been accepted. The NOI and NOT shall be provided to the following address in electronic format:

Dino Chavarria,
Santa Clara Pueblo
Office of Environmental Affairs
dinoc@santaclarapueblo.org

ii. All operators obtaining permit coverage under the EPA CGP, must submit an electronic copy of the Stormwater Pollution Prevention Plan to the Santa Clara Pueblo Office of Environmental Affairs at the same time the NOI is submitted to the U.S. EPA (see contact information listed above).

iii. The operator must notify the Santa Clara Pueblo Office of Environmental Affairs at the address above within 24 hours, in the event of an emergency spill, in addition to the notification requirements at Part 2.3.6 of the CGP

9.6.3 OKR10I000 Indian country within the State of Oklahoma, except areas of Indian country covered by an extension of state program authority pursuant to Section 10211 of the Safe, Accountable, Flexible, Efficient Transportation Equity Act (SAFETEA).

a. Pawnee Nation. The following conditions apply only to discharges within Pawnee Indian country:

i. Copies of the Notice of Intent (NOI) and Notice of Termination (NOT) must be provided to the Pawnee Nation at the same time it is submitted to the Environmental Protection Agency to the following address:

Pawnee Nation Department of Environmental Conservation and Safety
P.O. Box 470
Pawnee, OK 74058
Or email to dnrs@pawneenation.org

ii. An electronic copy of the Storm Water Pollution Prevention Plan (SWPPP) must be submitted to the Pawnee Nation Department of Environmental Conservation and Safety at the same time the NOI is submitted.

iii. The operator must provide access to the site for inspections and for copies of inspection reports, copy of the corrective action log and modifications, made to the SWPPP because of inspection findings, upon request by the Pawnee Nation DECS.

iv. The Pawnee Nation Department of Environmental Conservation and Safety must be notified at 918.762.3655 immediately upon discovery of any noncompliance with any provision of the permit conditions.

9.6.4 OKR10F000 Discharges in the State of Oklahoma that are not under the authority of the Oklahoma Department of Environmental Quality, or the Oklahoma Department of Agriculture and Forestry including activities associated with oil and gas exploration, drilling, operations, and pipelines (includes SIC Groups 13 and 46, and SIC codes 492 and 5171), and point source discharges associated with agricultural production, services, and silviculture (includes SIC Groups 01, 02, 07, 08, 09).

a. For activities located within the watershed of any Oklahoma Scenic River, including the Illinois River, Flint Creek, Barren Fork Creek, Upper Mountain Fork, Little Lee Creek, and Lee Creek or any water or watershed designated "ORW" in Oklahoma's Water Quality Standards, this permit may only be used to authorize discharges from temporary construction activities. Certification is denied for any on-going activities such as sand and gravel mining or any other mineral mining.

b. For activities located within the watershed of any Oklahoma Scenic River, including the Illinois River, Flint Creek, Barren Fork Creek, Upper Mountain Fork, Little Lee Creek, and Lee Creek or any water or watershed designated "ORW" in Oklahoma's Water Quality Standards, certification is denied for any discharges originating from support activities, including, but not limited to, concrete or asphalt batch plants, equipment staging yards, material storage areas, excavated material disposal areas, or borrow areas.

c. Dewatering discharges into sediment or nutrient-impaired waters, and waters identified as Tier 2, Tier 2.5, or Tier 3 (OAC 785:46-13) shall be controlled to meet water quality standards for turbidity in those waters as follows:

i. Cool Water Aquatic Community/Trout Fisheries: 10 NTUs (OAC 785: 45-5-12(f)(7)(A)(i)

ii. Lakes: 25 NTUs (OAC 785: 45-5-12(f)(7)(A)(ii)

iii. In waters where background turbidity exceeds these values, turbidity from dewatering discharges should be restricted to not exceed ambient levels (OAC 785: 45-5-12(f)(7)(B)

9.7 EPA REGION 7

No additional conditions.

9.8 EPA REGION 8

9.8.1 MTR10I000 Indian country within the State of Montana

a. Blackfeet Nation.

i. The Applicant and applicants for projects authorized under the NWPs should obtain all other permits, licenses, and certifications that may be required by federal, state, or tribal authority. Primary relevant tribal permit will be ALPO (Ordinance 117). Others may apply. It is the applicant's responsibility to know the tribal and local ordinances and complete all necessary permissions before they can commence work.

ii. If a project is unable to meet the enclosed conditions, or if certification is denied for an applicable NWP, the Applicant may request an individual certification from Blackfeet. An individual certification request must follow the requirements outlined in 40 CFR 121.5 of EPA's CWA § 401 Certification Rule, effective September 11, 2020.

iii. Copies of this certification should be kept on the job site and readily available for reference.

iv. If the project is constructed and/or operated in a manner not consistent with the applicable NWP, general conditions, or regional conditions, the permittee may be in violation of this certification.

v. Blackfeet and EPA representatives may inspect the authorized activity and any mitigation areas to determine compliance with the terms and conditions of the NWP.

vi. This NWP Reissuance does not reduce Tribal authority under any other rule.

vii. The project, including any stream relocations and restoration, must be built as shown and as otherwise described in the application, the construction plans, cross sections, mitigation plans and other supporting documents submitted to this office. Impacts to aquatic systems and restoration efforts will be monitored by an appropriate aquatic resource professional to ensure that disturbed areas are restored to at least their original condition.

viii. All existing water uses will be fully maintained during and after the completion of the project. (If applicable)

ix. Where practicable, perform all in-channel and wetland work during periods of low flow or drawn—down or when dry

x. Equipment staging areas must be located out of all delineated wetlands

xi. Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during and immediately after construction, and all exposed soil and other fills, as well as any work below the ordinary high-water mark or in a wetland, must be permanently stabilized as soon as possible

xii. Materials such as piling, culverts, sandbags, fabric, mats, timbers used for temporary facilities in wetlands or below the high- water mark of Waters of the US must be free from oil, gas, excess dirt, loose paint and other pollutants.

xiii. Equipment staging areas in wetlands or in stream or river channels must be placed on mats, or other measures must be taken to minimize soil disturbance and compaction.

xiv. Clearing of riparian or wetland vegetation for the sole purpose of constructing work bridges, detours, staging areas or other temporary facilities must be limited to the absolute minimum necessary. When temporary impacts to native riparian or wetland vegetation are unavoidable, it must be mowed or cut above ground with the topsoil and root mass left intact.

xv. Remove all temporary fills and structures in the entirety when they are no longer needed. Restore affected areas to the appropriate original and planned contours where possible. Re-vegetate disturbed areas with appropriate native species when native species are impacted.

xvi. Construction methods and best management practices (BMPs) must minimize aquatic resource impacts to the maximum extent possible. Any BMPs described in the Joint Application must be followed. BMPs should include installation and maintenance of sediment control measures; separation, storage and reuse of any topsoil; and recovery of all disturbed areas where possible. All best management practices must in place prior to the onset of construction or as soon as practicable during the construction process.

xvii. Best available technology and/or best management practices must be utilized to protect existing water uses and maintain turbidity and sedimentation at the lowest practical level.

xviii. Applicant/contractor should manage disturbed streambank topsoil in a manner that optimizes plant establishment for the site.

xix. When operating equipment or otherwise undertaking construction in wetlands and water bodies the following conditions apply:

(a) Work should be done in dry conditions if possible.

(b) All equipment is to be inspected for oil, gas, diesel, anti-freeze, hydraulic fluid or other petroleum leaks. All such leaks will be properly repaired and equipment cleaned prior to being allowed on the project site. Leaks that occur after the equipment is moved to the project site will be fixed the same day or the next day or removed from the project area. The equipment is not allowed to continue operation once a leak is discovered.

(c) All equipment is to be inspected and cleaned before and after use to minimize the spread or introduction of invasive or undesirable species.

(d) Construction equipment shall not operate below the existing water surface except as follows:

- Impacts from construction should be minimized through the use of best management practices submitted in the permit application.
- Essential work below the waterline shall be done in a manner to minimize impacts to aquatic system and water quality.

(e) Containment booms and/or absorbent material must be available onsite. Any spills of petroleum products must be reported to the Army Corps, Blackfeet Nation BEO Office and the US EPA within 24 hours.

xx. Upland, riparian and in-stream vegetation should be protected except where its removal is necessary for completion of work. Revegetation should be completed as soon as possible. Applicant/contractor should revegetate disturbed soil in a manner that optimizes plant establishment for the site. Revegetation must include topsoil replacement, planting, seeding, fertilization, liming and weed-free mulching as necessary. Applicant must use native plant material and soils where appropriate and feasible. This certification does not allow for the introduction of non-native flora and fauna. All disturbed surface areas must be restored to pre-construction contours and elevation.

xxi. Spoils piles should not be placed or stored within the delineated wetlands or streams unless protected by a temporary structure designed to divert and handle high flows that can be anticipated during permit activity. Spoils piles should be placed on landscaping fabric or some other material to separate spoils material and allow retrieval of spoils material with minimal impact.

xxii. Impacts to wetlands shall not exceed 4.92 acres.

xxiii. Any unexpected and additional impacts to waters of the US should be reported to the

xxiv. Army Corps, Blackfeet Environmental Office Water Quality Coordinator and the US EPA.

xxv. All instream and stream channel reconstruction work must be completed before the stream is diverted into the new channel.

xxvi. Any temporary crossings, bridge supports, cofferdams, or other structures that are necessary during permit activity should be designed to handle high flows that can be anticipated during permit activity. All temporary structures should be completely removed from the water body at the conclusion of the permitted activity and the area restored to a natural function and appearance.

xxvii. The certification does not authorize any unconfined discharge of liquid cement into the waters of the United States. Grouting riprap must occur under dry conditions with no exposure of wet concrete to the water body.

xxviii. BMPs shall include application of certified weed-free straw or hay across all disturbed wetland areas that are temporarily impacted; installation and maintenance of sediment control measures during construction and if necessary, after construction is completed; use of heavy mud mats if necessary; separation,

storage and reuse of all streambank topsoil and wetland topsoil, as appropriate; and recovery of all disturbed wetland and streambank areas where possible. All conditions set by the Blackfeet Tribe and US Army Corps must be followed.

xxix. All applicants, including federal agencies, must notify EPA and the Blackfeet Environmental Office of the use of all NWPs for which certification has been granted prior to commencing work on the project. Notifications must include:

(a) project location (lat. Long., exact point on map);

(b) NWP that will be used and the specific activity that will be authorized under the NWP;

(c) amount of permanent and temporary fills;

(d) a short summary of the proposed activity, and all other federal, state, tribal or local permits or licenses required for the project;

(e) complete contact information of both the applicant and contractor (name, name of the company or property if applicable, telephone, mobile, and email); and,

(f) Summary of best management practices that will be used.

(g) A summary of communications with the affected Tribe's water quality staff regarding the project, including any concerns or issues.

(h) Notify Blackfeet and EPA at least 7 days before the completion of construction and operations begin.

xxx. Point source discharges may not occur: (1) in fens, bogs or other peatlands; (2) within 100 feet of the point of discharge of a known natural spring source; or (3) hanging gardens.

xxxi. Except as specified in the application, no debris, silt, sand, cement, concrete, oil or petroleum, organic material, or other construction related materials or wastes shall be allowed to enter into or be stored where it may enter into waters of the U.S.

xxxii. Silt fences, straw wattles, and other techniques shall be employed as appropriate to protect waters of the U.S. from sedimentation and other pollutants.

xxxiii. Water used in dust suppression shall not contain contaminants that could violate water quality standards.

xxxiv. Erosion control matting that is either biodegradable blankets or loose-weave mesh must be used to the maximum extent practicable.

xxxv. All equipment used in waters of the U.S. must be inspected for fluid leaks and invasive species prior to use on a project. All fluid leaks shall be repaired and cleaned prior to use or when discovered, or if the fluid leak can't be repaired, the equipment shall not be used on site. Equipment used in waters with the possibility of aquatic nuisance species infestation must be thoroughly cleaned and effectively decontaminated before they are used on the project.

xxxvi. Vegetation should be protected except where its removal is necessary for completion of the work. Locations disturbed by construction activities should be revegetated with appropriate native vegetation in a manner that optimizes plant establishment for the specific site.

xxxvii. Revegetation may include topsoil replacement, planting, seeding, fertilization, liming, and weed-free mulching, as necessary. Where practical, stockpile weed- seed-free topsoil and replace it on disturbed areas. All revegetation materials, including plants and plant seed shall be on site or scheduled for delivery prior to or upon completion of the earth moving activities.

xxxviii. Activities may not result in any unconfined discharge of liquid cement into waters of the U.S. Grouting riprap must occur under dry conditions with no exposure of wet concrete to the waterbody.

xxxix. Activities that may result in a point source discharge shall occur during seasonal low flow or no flow periods to the extent practicable.

xl. The placement of material (discharge) for the construction of new dams is not certified, except for stream restoration projects.

xli. Any decision-maker that is required under 7.0 of the CGP to prepare a Stormwater Pollution Prevention Plan (SWPPP), must submit an electronic copy of the SWPPP to the Blackfeet Environmental Office at least 30 days before construction starts for review and approval. Any modifications to the SWPPP should be submitted to the Blackfeet Environmental Office.

xlii. Any Decision-maker required under Part 1.4 of the CGP to submit a Notice of Intent (NOI) to EPA for coverage under the CGP, must submit a copy of the NOI to the Blackfeet Environmental Office within three business days of submittal to EPA. Additionally, a copy of the Notice of Termination (NOT) must be provided within three business days after electronic confirmation is received from EPA that the NOT has been accepted. The NOI and NOT must be provided to the following address Gerald Wagner, Blackfeet Environmental Office Director.

62 Hospital Drive, Browning, MT 59417

beo.director@gmail.com

b. Fort Peck Tribes.

i. Any Decision-maker required under Part 1.4 of the CGP to submit a Notice of Intent (NOI) to EPA for coverage under the CGP, must submit a copy of the NOI to the Fort Peck Tribes Office of Environmental Protection within three business days of submittal to EPA. Additionally, a copy of the Notice of Termination (NOT) must be provided within three business days after electronic confirmation is received from EPA that the NOT has been accepted. The NOI and NOT must be provided to the following address:

Martina Wilson, Office of Environmental Protection Director

501 Medicine Bear Rd Poplar, MT 59255

martinawilson@fortpecktribes.net

ii. Any Decision-maker that is required under Part 7.0 of the CGP to prepare a Stormwater Pollution Prevention Plan (SWPPP), must submit an electronic copy of the SWPPP to the Fort Peck Tribes Office of Environmental Protection at least 30 days before construction starts for review and approval. Any modifications to the

SWPPP should be submitted to the Fort Peck Tribes Office of Environmental Protection.

iii. Any Decision-maker that is required under Part 8.0 of the CGP to submit a weekly, bi-weekly, and/or annual report to EPA, must submit an electronic copy of the annual report to the Fort Peck Tribes Office of Environmental Protection within three business days after submittal to EPA.

9.9 EPA REGION 9

9.9.1 CAR10I000 Indian country within the State of California

a. Morongo Band of Mission Indians

i. A copy of the Stormwater Pollution Prevention Plan (SWPPP) must be submitted (either mailed or electronically) to the MEPD no less than thirty (30) days before commencing construction activities:

Morongo Band of Mission Indians
Environmental Protection Department
12700 Pumarra Road
Banning, CA 92220
Email: epd@morongo-nsn.gov

ii. Copies of the Notice of Intent (NOI) and the Notice of Termination (NOT) must be sent to the MEPD at the same time they are submitted to EPA.

iii. Operators of an "emergency-related project" must submit notice to the MEPD within twenty- four (24) hours after commencing construction activities.

iv. Spills, leaks, or unpermitted discharges must be reported to the MEPD within twenty-four (24) hours of the incident, in addition to the reporting requirements of the CGP.

v. Projects utilizing cationic treatment chemicals (as defined in Appendix A of the CGP) within the Morongo Reservation are not eligible for coverage under this certification of the CGP.

vi. Facilities covered under the CGP will be subject to compliance inspections by MEPD staff, including compliance with final site stabilization criteria prior to submitting an NOI ***[EPA assumes this intended to refer to an NOT]***.

9.9.2 GUR100000 Island of Guam

a. For purposes of this Order, the term "Project Proponent" shall mean U.S. Environmental Protection Agency, and its agents, assignees, and contractors.

b. For purposes of this Order, the permit "Operator" shall mean any party associated with a construction project that meets either of the following two criteria:

i. The party has operational control over construction plans and specifications, including the ability to make modifications to those plans and specifications (e.g. in most cases this is the owner of the site); or

ii. The party has day-to-day operational control of those activities at a project that are necessary to ensure compliance with the permit conditions (e.g., they are authorized to direct workers at a site to carry out activities required by the permit; in most cases this is the general contractor of the project).

Subcontractors generally are not considered operators for the purposes of this permit.

c. The Project Proponent shall enforce the proposed 2022 CGP and ensure that the Operator complies with the conditions of the permit at all times.[107] (40 CFR §121.11(c))

d. All submittals required by this Order shall be sent to the Guam Environmental Protection Agency Attn: 401 Federal Permit Manager, Non-Point Source Program, EMAS Division, 3304 Mariner Avenue, Bldg. 17-3304, Barrigada, Guam 96913, AND via email to jesse.cruz@epa.guam.gov. The submittals shall be identified with WQC Order #2021- 04 and include the COP Permit Number, certifying representative's name, title, mailing address and phone number. (§51060)(4) 2017 GWQS)

e. A copy of the Operator's signed Stormwater Pollution Prevention Plan (SWPPP) and signed Notice of Intent (NOI) and Notice of Termination (NOT) submitted to EPA for review and approval, shall concurrently be submitted to Guam EPA, consistent with condition A4. Coordination with Guam EPA is encouraged when the receiving water(s) for the proposed discharge is/are being identified. (§10105.B.5.d.) GSESCR; (§51060)(4) 2017 GWQS)

f. The Operator must comply with the conditions and requirements set forth in 22 GAR 10, Guam Soil Erosion and Sediment Control Regulations (GSESCR).

g. Before submitting the NOT to EPA, Operators shall comply with GSESC regulations at §10105.B10. (Stabilization of Affected Areas) and §10107.B. {Final Inspection and Approval)

h. All operators/owners shall comply with the general design criteria for best management practices (BMPs) acceptable for meeting the Construction and Post-construction stormwater criteria in the 2006 CNMI and Guam Stormwater Management Manual. (E.O. 2012-02)

i. Operating reports and monitoring and analytical data (e.g. Discharge Monitoring Reports (DMRs), follow-up monitoring reports, Exceedance Reports for Numerical Effluent Limits, etc.) submitted to EPA shall be concurrently submitted to Guam EPA, consistent with condition A4. §51060)(4) 2017 GWQS

j. The Operators who install a sediment basin or similar impoundment shall maintain the storage capacity of five thousand cubic feet {5,000 cu. ft.) per acre of project area tributary to the basin. (§10105.B.5.i.) GSESCR

k. (1) This Order does not authorize EPA to qualify Rainfall Erosivity Waivers to stormwater discharges associated with small construction activities (i.e. 1-5 acres). Operators are required to apply for an NOI for those projects eligible for coverage under the proposed 2022 CGP. An Erosion and Sediment Control Plan is required for every site that would be covered by the proposed 2022 CGP. (22 GAR §10104) The average annual rainfall for Guam and the CNMI exceeds I00 inches per year in many locations. These climatic conditions combined with the region's unique limestone, volcanic geologic formations, sensitive water resources and significant land

[107] By incorporating this condition into the permit, EPA acknowledges receipt of Guam's certification conditions.

development forces make stormwater discharges a very significant environmental and economic issue. (2006 CNMJ/Guam Stormwater Management Manual) E.O. 2012-02

(2) This Order does not authorize EPA to approve a Sediment TMDL Waiver for the Ugum River. Operators of construction activities eligible for a TMDL Waiver in lieu of coverage under the proposed 2022 CGP, shall submit a complete and accurate waiver certification as described in C.2., Appendix C - (Small Construction Waivers) to Guam EPA per condition A4., prior to notifying EPA of its intention to obtain a waiver. §51060)(4) 2017 GWQS

l. The Project Proponent shall submit to Guam EPA a signed Statement of Understanding of Water Quality Certification Conditions.[108] (see Attachment A for an example) per condition A4. §51060)(4) 2017 GWQS

m. The Operator shall comply with applicable provisions of the Guam Pesticides Act of2007 (10 GCA Chapter 50) and implementing regulations at Title 22 GAR Chapter 15 for any use and application of pesticides.

n. Point source discharge(s) to waterbodies under the jurisdiction of Guam EPA must be consistent with the antidegradation policy in 22 GAR §510l(b).

o. The operator shall carry out construction activities in such a manner that will not violate Guam Water Quality Standards (GWQS). Proposed 2022 CGP discharges are prohibited as follows:

- **i.** In Marine Waters, Category M-1 Excellent 22 GAR Chapter 5 §5102(b)(I); and
- **ii.** In Surface Waters, Category S-1 High 22 GAR Chapter 5 §5102(c)(I)

p. In addition to complying with construction dewatering requirements in Part 2.4 and site inspection requirements for all areas where construction dewatering is taking place in Part 4 of the proposed 2022 CGP, Operators shall comply with all dewatering conditions and requirements set forth in 22 GAR 7, Water Resources Development and Operating Regulations, to include securing Guam EPA permits prior to any dewatering activities.

q. The Operator shall develop and implement a Spill Prevention and Containment Plan.

r. The Operator shall have adequate and appropriate spill response materials on hand to respond to emergency release of oil, petroleum or any other material into waters of the territory.

s. Any unpermitted discharge into territorial waters or onto land with a potential for entry into territorial waters, is prohibited. If this occurs, the Operator shall immediately take the following actions:

- **i.** Cease operations at the location of the violation or spill.
- **ii.** Assess the cause of the water quality problem and take appropriate measures to correct the problem and/or prevent further environmental damage.
- **iii.** Notify Guam EPA of the failure to comply. All petroleum spills shall be reported immediately to:

[108] By incorporating this condition into the permit, EPA acknowledges receipt of Guam's certification conditions.

(a) Guam's Emergency 911 system

(b) Guam EPA's 24-Hour Spill Response Team at (671) 888-6488 or during working hours (671) 300-4751

(c) US Coast Guard Sector Guam (671) 355-4824

(d) National Response Center 1-800-424-8802

iv. Submit a detailed written report to Guam EPA within five days of noncompliance that describes the nature of the event corrective action taken and/or planned, steps to be taken to prevent a recurrence, results of any samples taken, and any other pertinent information.

t. Compliance with this condition does not relieve the Operator from responsibility to maintain continuous compliance with the terms and conditions of this Order or the resulting liability from failure to comply.

u. Submittal or reporting of any of this information does not provide relief from any subsequent enforcement actions for unpermitted discharges to waters of the United States.

v. This Order is valid for five (5) Years from Date of Certification, unless otherwise approved by the Guam EPA Administrator.

w. The Operator shall be required to adhere to the current Guam Coral Spawning Moratorium dates for both hard and soft corals where in-water activities and/or construction activity in close proximity with marine waters may impair water quality. These dates can be obtained from the Guam Department of Agriculture, Division of Aquatic and Wildlife Resources, or the NOAA NMFS Pacific Islands Regional Office Habitat Conservation Division.

x. The Operator shall provide notice to Guam EPA consistent with Condition A4:

(a) Immediately upon discovery of noncompliance with the provisions of this Order.

y. A Notice of Violation/Work Stop Order will be issued if certification conditions are not adhered to or when significant or sustained water quality degradation occurs. Work or discharge shall be suspended or halted until the Operator addresses environmental problems/concerns to Guam EPA's satisfaction. Guam EPA may also levy penalties and fines (10 GCA §47111). Invalidity or enforceability of one or more provisions of this certification shall not affect any other provision of this certification.

9.10 EPA REGION 10

9.10.1 IDR10I000 Indian country within the State of Idaho, except Duck Valley Reservation lands (see Region 9)

a. Shoshone-Bannock Tribes

i. Copies of the following information must be sent to the SBT-WRD:

(a) Notice of Intents (NOI)

The Notice of Intent shall be forwarded to the SBT-WRD within thirty (30) days of receipt of submitting NOI to the USEPA.

Shoshone-Bannock Tribes Water Resources Department
PO Box 306 Pima Drive
Fort Hall, ID 83203 Phone: (208) 239-4582
Fax: (208) 239-4592
Or Email ctanaka@sbtribes.com

b. If requested by the SBT-WRD, the permittee must submit a copy of the SWPPP to SBT-WRD within fourteen (14) days of the request.

9.10.2 ORR10I000 Indian country within the State of Oregon, except Fort McDermitt Reservation lands (see Region 9)

a. Confederated Tribes of Coos, Lower Umpqua, and Siuslaw

i. No activities allowed under the CGP shall result in the degradation of any Tribal waters or affect resident aquatic communities or resident or migratory wildlife species at any life stage.

ii. The operator shall be responsible for achieving compliance with CTCLUSI Water Quality Standards and all other tribal codes, regulations, and laws as they exist at the time that the permit is submitted.

iii. The operator shall submit a copy of the Notice of Intent (NOI) to be covered by the general permit to the CTCLUSI Water Quality Program before, or at the same time as, it is submitted to EPA.

iv. The operator shall be responsible for submitting all Stormwater Pollution Prevention Plans (SWPPP) required under this general permit to the CTCLUSI Water Quality Program for review and determination that the SWPPP is sufficient to meet Tribal Water Quality Standards, prior to the beginning of any discharge activities taking place.

v. The operator shall be responsible for reporting an exceedance to Tribal Water Quality Standards to the CTCLUSI Water Quality Program at the same time it is reported to EPA.

vi. The THPO will be provided 30 days to comment on the APE as defined in the permit application.

vii. If the project is an undertaking, a cultural resource assessment must occur. All fieldwork must be permitted by the THPO (as appropriate), conducted by qualified personnel (as outlined by the Secretary of Interior's Standards and Guidelines; http://www.nps.gov/history/local-law/arch_stnds_O.htm) and documented according to Oregon Reporting Standards (Reporting_Guidelines.pdf) (oregon.gov). The resulting report must be submitted to the THPO and the THPO must concur with the finding of effect and recommendations before any ground disturbing work can occur. The THPO requires 30 days to review all reports.

viii. The operator must obtain THPO concurrence in writing. If historic properties are present, this written concurrence will outline measures to be taken to prevent or mitigate adverse effects to historic properties.

b. Confederated Tribes of the Umatilla Indian Reservation

i. The operator shall be responsible for achieving compliance with the

Confederated Tribes of the Umatilla Indian Reservation's (CTUIR) Water Quality Standards.

ii. The operator shall submit a copy of the Notice of Intent (NOI) to be covered by the general permit to the CTUIR Water Resources Program at the address below, at the same time it is submitted to EPA.

iii. The operator shall be responsible for submitting all Stormwater Pollution Prevention Plans (SWPPP) required under this general permit to the CTUIR Water Resources Program for review and determination that the SWPPP is sufficient to meet Tribal Water Quality Standards, prior to the beginning of any discharge activities taking place.

iv. The operator shall be responsible for reporting an exceedance to Tribal Water QualityStandards to the CTUIR Water Resources Program at the same time it is reported to EPA.

Confederated Tribes of the Umatilla Indian Reservation
Water Resources Program
46411 Timíne Way
Pendleton, OR 97801
(541) 429-7200

v. The THPO will be provided 30 days to comment on the APE as defined in the permit application.

vi. If the project is an undertaking, a cultural resource assessment must occur. All fieldwork must be permitted by the Tribal Historic Preservation Office (as appropriate), conducted by qualified personnel (as outlined by the Secretary of Interior's Standards and Guidelines; http://www.nps.gov/history/local-law/arch_stnds_0.htm) and documented according to Oregon Reporting Standards (Reporting_Guidelines.pdf (oregon.gov). The resulting report must be submitted to the THPO and the THPO must concur with the finding of effect and recommendations before any ground disturbing work can occur. The THPO requires 30 days to review all reports.

vii. The operator must obtain THPO concurrence in writing. If historic properties are present, this written concurrence will outline measures to be taken to prevent or mitigate adverse effects to historic properties.

9.10.3 WAR10F000 Areas in the State of Washington, except those located on Indian country, subject to construction activity by a Federal Operator

a. For purposes of this Order, the term "Project Proponent" shall mean those that are seeking coverage under this permit, and its agents, assignees and contractors.

b. The Federal Agency shall mean the US Environmental Protection Agency. The Federal Agency shall enforce the permit and ensure that the Project Proponent complies with the conditions of the permits at all times.

c. Failure of any person or entity to comply with this Certification may result in the issuance of civil penalties or other actions, whether administrative or judicial, to enforce the terms of this Certification.

d. The Certification conditions within this Order must be incorporated into EPA's final NPDES permit. Per 40 CFR 121.10(a), all certification conditions herein that satisfy the

requirements of 40 CFR 121.7(d) must be incorporated into the permit. Per 40 CFR 121.10(b), the permit must clearly identify all certification conditions.

e. This Certification does not authorize exceedances of water quality standards established in chapter 173-201A WAC.

f. Discharges from construction activity must not cause or contribute to violations of the Water Quality Standards for Surface Water of the State of Washington (chapter 173-201A WAC), Ground Water Quality Standards (chapter 173- 200 WAC), Sediment Management Standards (chapter 173-204 WAC), and standards in the EPA's Revision of certain Federal water quality criteria applicable to Washington (40 CFR 131.45). Discharges that do not comply with these standards are prohibited.

g. Prior to discharge of stormwater and non-stormwater to waters of the State, the Permittee must apply all known, available, and reasonable methods of prevention, control, and treatment (AKART). This includes the preparation and implementation of an adequate Stormwater Pollution Prevention Plan (SWPPP), with all appropriate Best Management Practices (BMPs) installed and maintained in accordance with the SWPPP and the terms and conditions of the permit.

i. BMPs must be consistent with:

(a) The Stormwater Management Manual for Western Washington (most current approved edition at the time this permit was issued), for sites west of the crest of the Cascade Mountains; or

(b) The Stormwater Management Manual for Eastern Washington (most current approved edition at the time this permit was issued), for sites east of the crest of the Cascade Mountains; or

(c) Revisions to either manual, or other stormwater management guidance documents or manuals which provide equivalent level of pollution prevention, that are approved by Ecology and incorporated into this permit in accordance with the permit modification requirements of WAC 173-226-230. (For purposes of this section, the stormwater manuals listed in Appendix 10 of the Phase I Municipal Stormwater Permit are approved by Ecology); or

(d) Documentation in the SWPPP that the BMPs selected provided an equivalent level of pollution prevention, compared to the applicable stormwater management manuals, including:

- The technical basis for the selection of all stormwater BMPs (scientific, technical studies, and/or modeling) that support the performance claims for the BMPs being selected.
- An assessment of how the selected BMP will satisfy AKART requirements and the applicable federal technology-based treatment requirements under 40 CFR part 125.3.

The Stormwater Management Manuals for Eastern and Western Washington can be found at: https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Stormwater-permittee-guidance-resources/Stormwater-manuals.

ii. An adequate SWPPP must include a narrative and drawings. All BMPs must be clearly referenced in the narrative and marked on the drawings. The SWPPP

narrative must include documentation to explain and justify the pollution prevention decisions made for the project. Documentation must include:

(a) Information about existing site conditions (topography, drainage, soils, vegetation, etc.).

(b) Potential erosion problem areas.

(c) The 13 elements of a SWPPP, including BMPs used to address each element. Unless site conditions render the element unnecessary and the exemption is clearly justified in the SWPPP, the 13 elements are as follows:

- Preserve Vegetation/Mark Clearing Limits
- Establish Construction Access
- Control Flow Rates
- Install Sediment Controls
- Stabilize Soils
- Protect Slopes
- Protect Drain Inlets
- Stabilize Channels and Outlets
- Control Pollutants
- Control Dewatering
- Maintain BMPs
- Manage the Project
- Protect Low Impact Development (LID) BMPs

h. Discharges of stormwater and authorized non-stormwater must be monitored for turbidity (or transparency) and, in the event of significant concrete work or engineered soils, pH must also be monitored. As applicable based on project specifics, monitoring, benchmarks, and reporting requirements contained in Condition S.4. (pp.10-16) of the Washington State Construction Stormwater General Permit, effective January 1, 2021, shall apply.

i. Discharges to segments of waterbodies listed as impaired by the State of Washington under Section 303(d) of the Clean Water Act for turbidity, fine sediment, phosphorus, or pH must comply with the following numeric effluent limits:

Parameter identified in 303(d) listing	Parameter Sampled	Unit	Analytical Method	Numeric Effluent Limit
• Turbidity • Fine Sediment • Phosphorus	Turbidity	NTU	SM2130	25 NTUs at the point where the stormwater is discharged from the site.
High pH	pH	su	pH meter	In the range of 6.5 – 8.5

All references and requirements associated with Section 303(d) of the Clean Water Act mean the most current EPA-approved listing of impaired waters that exists on the

effective date of the permit, or the date when the operator's complete permit application is received by EPA, whichever is later.

The EPA approved WQ Assessment can be found at: https://ecology.wa.gov/Water-Shorelines/Water-quality/Water-improvement/Assessment-of-state-waters-303d

j. Discharges to a waterbody that is subject to a Total Maximum Daily Load (TMDL) for turbidity, fine sediment, high pH, or phosphorus must be consistent with the TMDL.

- **i.** Where an applicable TMDL sets specific waste load allocations or requirements for discharges covered by this permit, discharges shall be consistent with any specific waste load allocations or requirements established by the applicable TMDL.
- **ii.** Where an applicable TMDL has established a general waste load allocation for construction stormwater discharges, but no specific requirements have been identified, compliance with this permit will be assumed to be consistent with the approved TMDL.
- **iii.** Where an applicable TMDL has not specified a waste load allocation for construction stormwater discharges, but has not excluded these discharges, compliance with this permit will be assumed to be consistent with the approved TMDL.
- **iv.** Where an applicable TMDL specifically precludes or prohibits discharges from construction activity, the operator is not eligible for coverage under this permit.

Applicable TMDL means a TMDL for turbidity, fine sediment, high pH, or phosphorus which has been completed and approved by EPA as of the effective date of the permit, or prior to the date of the operator's complete application for permit coverage is received by EPA, whichever is later.

k. Discharges to waters of the state from the following activities are prohibited:

- **i.** Concrete wastewater.
- **ii.** Wastewater from washout and clean-up of stucco, paint, form release oils, curing compounds and other construction materials.
- **iii.** Process wastewater as defined by 40 Code of Federal Regulations (CFR) 122.2.
- **iv.** Slurry materials and waste from shaft drilling, including process wastewater from shaft drilling for construction of building, road, and bridge foundations unless managed to prevent discharge to surface water.
- **v.** Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance.
- **vi.** Soaps or solvents used in vehicle and equipment washing.
- **vii.** Wheel wash wastewater, unless managed to prevent discharge to surface water.
- **viii.** Discharges from dewatering activities, including discharges from dewatering of trenches and excavations, unless managed according to appropriate controls described within the permit.

l. This Certification is valid until the expiration date including any administrative extension or termination date of the NPDES 2022 Construction General Permit. (40 CFR § 122.46)

m. The Federal Agency shall enforce and the Project Proponent must comply with all the reporting and notification conditions of the NPDES 2022 Construction General Permit in order to comply with this Order and the certification conditions herein (40 CFR § 121.11).

n. You have a right to appeal this Order to the Pollution Control Hearing Board (PCHB) within 30 days of the date of receipt of this Order. The appeal process is governed by chapter 43.21B RCW and chapter 371-08 WAC. "Date of receipt" is defined in RCW 43.21B.001(2).

To appeal you must do all of the following within 30 days of the date of receipt of this Order:

- File your appeal and a copy of this Order with the PCHB (see addresses below). Filing means actual receipt by the PCHB during regular business hours.
- Serve a copy of your appeal and this Order on Ecology in paper form - by mail or in person (see addresses below). E-mail is not accepted.

You must also comply with other applicable requirements in chapter 43.21B RCW and chapter 371-08 WAC.

ADDRESS AND LOCATION INFORMATION

Street Addresses	Mailing Addresses
Department of Ecology Attn: Appeals Processing Desk 300 Desmond Drive SE Lacey, WA 98503 **Pollution Control Hearings Board** 1111 Israel RD SW STE 301 Tumwater, WA 98501	**Department of Ecology** Attn: Appeals Processing Desk PO Box 47608 Olympia, WA 98504-7608 **Pollution Control Hearings Board** PO Box 40903 Olympia, WA 98504-0903

CONTACT INFORMATION

Please direct all questions about this Order to:

Noel Tamboer
Department of Ecology
P.O. Box 47600
Olympia, WA 98503-7600

(360) 701-6171
noel.tamboer@ecy.wa.gov

9.10.4 WAR10I000 Indian country within the State of Washington

a. Lummi Nation

i. This certification does not exempt and is provisional upon compliance with other applicable statutes and codes administered by federal and Lummi tribal agencies. Pursuant to Lummi Code of Laws (LCL) 17.05.020(a), the operator must also obtaina land use permit from the Lummi Planning Department as provided in Title 15 of theLummi Code of Laws and regulations adopted thereunder.

ii. Pursuant to LCL 17.05.020(a), each operator shall develop and submit a Storm WaterPollution Prevention Plan to the Lummi Water Resources Division for review and approval by the Water Resources Manager prior to beginning any discharge activities.

iii. Pursuant to LCL Title 17, each operator shall be responsible for achieving compliance with the Water Quality Standards for Surface Waters of the Lummi

iv. Indian Reservation (Lummi Administrative Regulations [LAR] 17 LAR 07.010 through 17 LAR 07.210 together with supplements and amendments thereto).

v. Each operator shall submit a signed copy of the Notice of Intent (NOI) to the Lummi Water Resources Division at the same time it is submitted electronically to the Environmental Protection Agency (EPA) and shall provide the Lummi Water Resources Division the acknowledgement of receipt of the NOI from the EPA and the associated NPDES tracking number provided by the EPA within 7 calendar days of receipt from the EPA.

vi. Each operator shall submit a signed copy of the Notice of Termination (NOT) to the Lummi Water Resources Division at the same time it is submitted electronically to the EPA and shall provide the Lummi Water Resources Division the EPA acknowledgement of receipt of the NOT.

vii. Storm Water Pollution Prevention Plans, Notice of Intent, Notice of Termination and associated correspondence with the EPA shall be submitted to:

Lummi Natural Resources Department
ATTN: Water Resources Manager 2665 Kwina Road
Bellingham, WA 98226-9298

b. Port Gamble S'Klallam Tribe

i. No discharge from the project site shall cause exceedances of Port Gamble S'KlallamSurface Water Quality Standards narrative or numeric criteria in Tribal waters. This includes activities outside of Tribal lands that occur upstream of Tribal waters.

(a) If any exceedance of these water quality standards occurred, the Natural Resources Department shall be notified immediately.

- The Department shall additionally be provided a complete draft of the proposed corrective action within a reasonable timeframe and its approval will be required before any corrective action may be taken.

ii. Operators performing activities under the CGP that may affect Tribal waters will requirea permit and shall submit their plans to the Port Gamble S'Klallam Natural Resources Department for review.

- The Department has the right to require conditions outside of this Water QualityCertification prior to permit approval.

iii. No activities allowed under the CGP shall result in the degradation of any Tribal watersor change in designated uses.

iv. No activities allowed under the CGP shall affect resident aquatic communities or resident/migratory wildlife species at any life stage.

- Biological assessment methods used to determine the effect of an activity allowedunder the CGP shall be approved by the PGST Natural Resources Department.

v. No activities allowed under the CGP shall be conducted within wetland and stream bufferzones, nor shall said activities affect in any way wetland or stream buffers, as defined by *PGST Law and Order Code 24.08.01(c)*.

vi. Concentrations for substances listed within the table in *Water Quality Standards for Surface Waters* sec. 7(7) shall not be exceeded by activities allowed under the CGP.

c. Spokane Tribe of Indians

i. Pursuant to Tribal Law and Order Code (TLOC) Chapter 30 each operator shall be responsible for achieving compliance with the Surface Water Quality Standards of the Spokane Tribe. The operator shall notify the Spokane Tribe, Water Control Board (WCB) of any spills of hazardous material and;

ii. Each operator shall submit a signed hard copy of the Notice of Intent (NOI) to the WCB at the same time it is submitted to EPA.

iii. The permittee shall allow the Tribal Water Control Board or its designee to inspect and sample at the construction site as needed.

iv. Each operator shall submit a signed copy of the Notice of Termination (NOT) to the WCB at the same time it is submitted to EPA

The correspondence address for the Spokane Tribe Water Control Board is:

Water Control Board c/o Brian Crossley PO Box480
Wellpinit WA 99040
(509)626-4409
crossley@spokanetribe.com

d. Swinomish Tribe

i. Owners and operators seeking coverage under this permit must submit a copy of the Notice of Intent (NOI) to the DEP at the same time the NOI is submitted to EPA.

ii. Owners and operators must also submit to the DEP changes in NOI and/or Notices of Termination at the same time they are submitted to EPA.

iii. Owners and operators seeking coverage under this permit must also submit a Stormwater Pollution Prevention Plan to the DEP for review and approval by DEP prior to beginning any discharge activities.

e. Tulalip Tribes

i. Submission of NOI: Copies of the Notice of Intent (NOI),) Certification shall be submitted to the Tribe's Natural Resources Department to notify the Tribes of the

pending project and in order for the Tribes to review the projects potential impacts to endangered or threatened species.

ii. Submission of SWPPP: A copy of the Stormwater Pollution Plans (SWPPPs) shall be submitted to the Tribe's Natural Resources Department along with the NOI during the 30 day waiting period.

iii. Submission of Monitoring Data and Reports: The results of any monitoring required by this permit and reports must be sent to the Tribe's Natural Resources Depa1tment,

iv. The Tulalip Tribes are federally recognized successors in the interest to the Snohomish, Snoqualmie, Skykomish, and other allied tribes and bands signatory to the Treaty of Point Elliott.

v. including a description of the corrective actions required and undertaken to meet effluent limits or benchmarks (as applicable).

vi. Authorization to Inspect: The Tribe's Natural Resources Department may conduct an inspection of any facility covered by this permit to ensure compliance with tribal water quality standards. The Department may enforce its certification conditions.

vii. Submission of Inspection Reports: Inspection reports must be sent to the Tribe's Natural Resources Department, including a description of the corrective actions required and undertaken to meet effluent limits or benchmarks (as applicable).

viii. Permits on-site: A copy of the pe1mit shall be kept on the job site and readily available for reference by the construction supervisor, construction managers and foreman, and Tribal inspectors.

ix. Project Management: The applicant shall ensure that project managers, construction managers and foreman, and other responsible parties have read and understand conditions of the permit, this certification, and other relevant documents, to avoid violations or noncompliance with this certification.

x. Emergency Spill Notification Requirements: In the event of a spill or the contractor shall immediately take action to stop the violation and correct the problem, and immediately repo1t spill to the Tulalip Tribes Police Department (425) 508-1565. Compliance with this condition does not relieve the applicant from responsibility to maintain continuous compliance with the tem1S and conditions of this certification or the resulting liability from failure to comply.

xi. Discharges to CERCLA Sites: This permit does not autho1ize direct stormwater discharges to certain sites undergoing remedial cleanup actions pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) unless first approved by the appropriate EPA Regional office. In the case of the Tulalip Landfill site (WAD980639256), the Tulalip Tribes also requests notification by the facility and consultation with EPA prior to discharge. Contaminants at this site may include but are not limited to: dioxins, furans, arsenic, copper, lead, zinc, 4- methyl-phenol, Hex-CB, HPAHs, PCBs, PCE, cadmium, mercury, and LPAHs.

xii. Discharge-related Activities that have Potential to Cause an Adverse Effect on Historic Properties: Installation of stormwater controls that involve subsurface disturbances may potentially have an adverse impact on historic properties.

xiii. Procedures detailed in the permit shall be completed. Richard Young, of the Tulalip Tribe's Cultural Resources Department shall be contacted prior to initiating discharge- related activities that may have an impact on historic properties. His contact information is (360) 716-2652, ryoung@tulaliptribes-nsn.gov.

xiv. Invalidation: This certification will cease to be valid if the project is constructed and/or operated in a manner not consistent with the project description contained in

xv. the permit. This certification will also cease to be valid and the applicant must reapply with an updated application if info1mation contained in the permit is voided by subsequent submittals.

xvi. Modification: Nothing in this certification waives the Tulalip Tribes of Washington's authority to issue modifications to this ce1iification if additional impacts due to operational changes are identified, or if additional conditions are necessary to protect water quality or further protect the Tribal Communities interest.

xvii. incorporation by reference: TI1is certification does not exempt the applicant from compliance with other statues and codes administered by the Tribes, county, state and federal agencies.

xviii. Compliance with Tribe's I996 Water Quality Standards: Each permittee shall be responsible for controlling discharges and achieving compliance with the T1ibe's Water Quality Standards.

xix. Compliant with Tulalip Tribes Tidelands Management Policy: Permittee shall be responsible for achieving compliance with applicable sections of the Tulalip Tribe's Tidelands Management Policy. (Tulalip Tribal Code Title 8 Chapter 8.30).

xx. Compliant with Tulalip Tribes Environmental Infractions: Permittee shall be responsible for achieving compliance with applicable sections of the Tulalip Tribe's Environmental Infractions. (Tulalip Tribal Code Title 8 Chapter 8.20).

xxi. Where to Submit information and for further Coordination: All requested documents should be sent to the: Tulalip Tribes Natural Resources Environmental Department c/o Kurt Nelson and Valerie Streeter, 6704 Marine Drive, Tulalip, Washington 98271. For further 40 I Certification coordination with the Tulalip Tribes Natural Resources Department, please contact Mr. Kurt Nelson (360) 716-4617 knelson@tu1aliptribes- nsn.gov. 6406 Marine Dr., Tulalip WA 98271.

f. Makah Tribe

i. The permittee shall be responsible for meeting any additional permit requirements imposed by EPA necessary to comply with the Makah Tribe's Water Quality Standards if the discharge point is located within the Makah's U&A treaty reserved areas.

ii. Each permittee shall submit a copy of the Notice of Intent (NOI) to be covered by the general permit to Makah Fisheries Management, Water Quality Department at the address listed below at the same time it is submitted to the EPA.

Makah Water Quality
Makah Fisheries Management (MFM)
ray.colby@makah.com

PO Box 115
Neah bay, WA 98357

iii. All supporting documentation and certifications in the NOI related to coverage under the general permit for Endangered Species Act purposes shall be submitted to the Tribe's Habitat programs for their review.

iv. If EPA requires coverage under an individual or alternative permit, the permittee shall submit a copy of the permit to Assistant Fisheries Director, ray.colby@makah.com.

v. The permittee shall submit all Stormwater Pollution Prevention plan (SWPP) to MFM for review and approval prior to beginning any activities resulting in a discharge to Makah tribal waters.

vi. The permittee shall notify Ray Colby, ray.colby@makah.com (360) 645-3150 prior to conducting inspections at construction sites generating stormwater discharges to tribal waters.

vii. The operator shall treat dewatering discharges with controls necessary to minimize discharges of pollutants to surface waters, or ground waters, and from stormwater runoff onsite from excavations, trenches, foundations, or storage areas. To the extent feasible, at all points where dewatering is discharged, comply with the velocity dissipation using check dams, sediment traps, and grouted outlets.

g. Puyallup Tribe of Indians

i. The permittee shall be responsible for meeting any additional permit requirements imposed by EPA necessary to comply with the Puyallup Tribe's antidegradation procedures.

ii. Each permittee shall submit a copy of the Notice of Intent (NOI) to be covered by the general permit to Char Naylor, Tribal Water Quality Manager at the following e-mail address: (char.naylor@puyalluptribe-nsn.gov) at the same time it is submitted to EPA.

iii. All supporting documentation and certifications in the NOI related to coverage under the general permit for Endangered Species Act purposes shall be submitted to Char Naylor, Tribal Water Quality Manager/Assistant Fisheries Director (char.naylor@puyalluptribe-nsn.gov) for review.

iv. If EPA requires coverage under an individual or alternative permit, the permittee shall submit a copy of the permit to Char Naylor at the email address listed above.

v. The permittee shall submit all stormwater pollution prevention plans to Char Naylor for review and approval prior to beginning any activities resulting in a discharge to Puyallup tribal waters.

vi. The permittee shall contact Brandon Reynon (Brandon.reynon@puyalluptribe-nsn-gov), Tribe's Historic Preservation Officer or Jennifer Keating (Jennifer.keating@puyalluptribe-nsn.gov), Tribe's Assistant Historic Preservation Officer regarding historic properties and cultural resources.

vii. To minimize the discharge of pollutants to groundwater or surface waters from stormwater that is removed from excavations, trenches, foundations, vaults, or

other storage areas, treat dewatering discharges with controls necessary to minimize discharges of pollutants. Examples of appropriate controls include sediment basins or sediment traps, sediment socks, dewatering tanks, tube settlers, weir tanks, and filtration systems (e.g., bag or sand filters) that are designed to remove sediment.

To the extent feasible, utilize vegetated, upland areas of the site to infiltrate dewatering water before discharge. At all points where dewatering water is discharged, utilize velocity dissipation controls. Examples of velocity dissipation devices include check dams, sediment traps, riprap, and grouted riprap at outlets.

viii. The permittee shall provide and maintain natural buffers to the maximum extent possible (and/or equivalent erosion and sediment controls) when tribal waters are located within 100 feet of the boundaries. If infeasible to provide and maintain an undisturbed 100 foot natural buffer, erosion and sediment controls to achieve the sediment load reduction equivalent to a 100-foot undisturbed natural buffer shall be required.

Appendix A - Definitions and Acronyms

1. Definitions

"Action Area" – all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. See 50 CFR 402. For the purposes of this permit and for application of the threatened and endangered species protection eligibility requirements, the following areas are included in the definition of action area:

- The areas on the construction site where stormwater discharges originate and flow toward the point of discharge into the receiving waters. This includes:
    - areas on the construction site where excavation, site development, or other ground disturbance activities occur, and
    - areas where stormwater controls will be constructed and operated, including any areas where stormwater flows to and from the stormwater controls.
- The areas in the vicinity of the construction site where stormwater discharges flow from the construction site to one or more points of discharge into receiving waters. (Example: Where stormwater flows into an off-site ditch, swale, or gully that leads to receiving waters.
- The extent of the receiving water potentially affected by stormwater discharges from your construction site through alteration of water chemistry, turbidity, temperature, or bank structure (i.e., erosive flow), regardless of whether the construction site is adjacent to the receiving water.

"Agricultural Land" - cropland, grassland, rangeland, pasture, and other agricultural land, on which agricultural and forest-related products or livestock are produced and resource concerns may be addressed. Agricultural lands include cropped woodland, marshes, incidental areas included in the agricultural operation, and other types of agricultural land used for the production of livestock.

"Antidegradation Policy" or "Antidegradation Requirements" - the water quality standards regulation that requires States and Tribes to establish a three-tiered antidegradation program:

1. Tier 1 maintains and protects existing uses and water quality conditions necessary to support such uses. An existing use can be established by demonstrating that fishing, swimming, or other uses have actually occurred since November 28, 1975, or that the water quality is suitable to allow such uses to occur. Where an existing use is established, it must be protected even if it is not listed in the water quality standards as a designated use. Tier 1 requirements are applicable to all surface waters.
2. Tier 2 maintains and protects "high quality" waters -- waterbodies where existing conditions are better than necessary to support CWA § 101(a)(2) "fishable/swimmable" uses. Water quality can be lowered in such waters. However, State and Tribal Tier 2 programs identify procedures that must be followed and questions that must be answered before a reduction in water quality can be allowed. In no case may water quality be lowered to a level which would interfere with existing or designated uses.
3. Tier 3 maintains and protects water quality in outstanding national resource waters (ONRWs). Except for certain temporary changes, water quality cannot be lowered in such waters. ONRWs generally include the highest quality waters of the United States. However, the ONRW classification also offers special protection for waters of exceptional ecological significance, i.e., those which are important, unique, or sensitive ecologically.

Decisions regarding which water bodies qualify to be ONRWs are made by States and authorized Indian Tribes.

"Arid Areas" – areas with an average annual rainfall of 0 to 10 inches. For assistance in determining average annual rainfall in specific locations, refer to the NOAA National Mapping webpage (https://www.ncdc.noaa.gov/cag/national/mapping), the PRISM Climate Group's Time Series Values for individual locations (https://prism.oregonstate.edu/explorer/), or EPA's US EPA EnviroAtlas (https://www.epa.gov/enviroatlas).

"Bank" (e.g., stream bank or river bank) – the rising ground bordering the channel of a water of the U.S.

"Biodegradable" – capable of decomposing under ambient soil conditions into naturally occurring materials over a period of time (e.g., one year).

"Bluff" – a steep headland, promontory, riverbank, or cliff.

"Borrow Areas" – the areas where materials are dug for use as fill, either onsite or off-site.

"Business day" – for the purposes of this permit, a business day is a calendar day on which construction activities will take place.

"Bypass" – the intentional diversion of waste streams from any portion of a treatment facility. See 40 CFR 122.41(m)(1)(i).

"Cationic Treatment Chemical" – polymers, flocculants, or other chemicals that contain an overall positive charge. Among other things, they are used to reduce turbidity in stormwater discharges by chemically bonding to the overall negative charge of suspended silts and other soil materials and causing them to bind together and settle out. Common examples of cationic treatment chemicals are chitosan and cationic PAM.

"Commencement of Construction Activities" – the initial disturbance of soils (or 'breaking ground') associated with clearing, grading, or excavating activities or other construction-related activities (e.g., grubbing; stockpiling of fill material; placement of raw materials at the site).

"Common Plan of Development or Sale" – A contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under one common plan. The "common plan" of development or sale is broadly defined as any announcement or piece of documentation (including a sign, public notice or hearing, sales pitch, advertisement, drawing, permit application, zoning request, computer design, etc.) or physical demarcation (including boundary signs, lot stakes, surveyor markings, etc.) indicating construction activities may occur on a specific plot.

"Construction Activities" – earth-disturbing activities, such as the clearing, grading, and excavation of land, and other construction-related activities (e.g., grubbing; stockpiling of fill material; placement of raw materials at the site) that could lead to the generation of pollutants. Some of the types of pollutants that are typically found at construction sites are:

- sediment;
- nutrients;
- heavy metals;
- pesticides and herbicides;
- oil and grease;
- bacteria and viruses;
- trash, debris, and solids;

- treatment polymers; and
- any other toxic chemicals.

"Construction and Development Effluent Limitations and New Source Performance Standards" (C&D Rule) – as published in 40 CFR § 450, the regulation requiring effluent limitations guidelines (ELGs) and new source performance standards (NSPS) for controlling the discharge of pollutants from construction sites.

"Construction Site" or "Site" – the land or water area where construction activities will occur and where stormwater controls will be installed and maintained. The construction site includes construction support activities, which may be located at a different part of the property from where the primary construction activity will take place, or on a different piece of property altogether.

"Construction Support Activity" – a construction-related activity that specifically supports the construction activity and involves earth disturbance or pollutant-generating activities of its own, and can include activities associated with concrete or asphalt batch plants, equipment staging yards, materials storage areas, excavated material disposal areas, and borrow areas.

"Construction Waste" – discarded material (such as packaging materials; scrap construction materials; masonry products; timber, steel, pipe, and electrical cuttings; plastics; and styrofoam).

"Conveyance Channel" – a temporary or permanent waterway designed and installed to safely convey stormwater flow within and out of a construction site.

"Critical Habitat" – as defined in the Endangered Species Act at 16 U.S.C. 1531 for a threatened or endangered species, (i) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of the Endangered Species Act, on which are found those physical or biological features essential to the conservation of the species and which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of the Endangered Species Act, upon a determination by the Secretary that such areas are essential for the conservation of the species.

"CWA" – the Clean Water Act or the Federal Water Pollution Control Act, 33 U.S.C. section 1251 et seq.

"Dewatering" – the act of draining accumulated stormwater and/or ground water from building foundations, vaults, and trenches, or other similar points of accumulation. Examples can include, but are not limited to:

- Surface area dewatering: water pumped from disturbed surface areas (e.g., trenches, sumps, excavation pits, or other excavations associated with construction where sediment-laden ground water or surface water/storm inflow must be removed) or from sediment basins or similar impoundments for maintenance or decommissioning purposes.
- Ground water dewatering: water discharged from well development, well pump tests, or pumping of ground water from a construction area. Common methods of ground water dewatering from a construction area include sumps and wells, generally described as follows:
  - Sumps: lowers ground water levels near the construction area. Dewatering using sumps consists of pumping ground water out of a lower collection point(s) typically gravity-fed by local ground water.
  - Wells: drilled wells, including bored/augured, driven, or jetted, which use vacuum or pumping to lower the ground water at greater depths than sumps. The two most common types of wells used for dewatering ground water are:

- Wellpoints: small-diameter shallow wells which are connected via a header pipe. A pump creates a vacuum in the header pipe.
- Deep Wells: larger-diameter holes, drilled relatively deep (typically greater than 10 feet), pumped by submersible electric pumps.

"Dewatering Water" – as used in this permit, water discharged from dewatering operations.

"Discharge" – when used without qualification, means the "discharge of a pollutant."

"Discharge of a Pollutant" – any addition of any "pollutant" or combination of pollutants to "waters of the United States" from any "point source," or any addition of any pollutant or combination of pollutants to the waters of the "contiguous zone" or the ocean from any point source other than a vessel or other floating craft which is being used as a means of transportation. This includes additions of pollutants into waters of the United States from: surface runoff which is collected or channeled by man; discharges through pipes, sewers, or other conveyances, leading into privately owned treatment works. See 40 CFR 122.2.

"Discharge Point" – for the purposes of this permit, the location where collected and concentrated stormwater flows or dewatering water are discharged from the construction site.

"Discharge-Related Activity" – activities that cause, contribute to, or result in stormwater and allowable non-stormwater point source discharges, and measures such as the siting, construction, and operation of stormwater controls to control, reduce, or prevent pollutants from being discharged.

"Discharge to an Impaired Water" – for the purposes of this permit, a discharge to an impaired water occurs if the first water of the U.S. to which you discharge is identified by a State, Tribe, or EPA pursuant to Section 303(d) of the Clean Water Act as not meeting an applicable water quality standard and (1) requires development of a total maximum daily load (TMDL) (pursuant to section 303(d) of the CWA; or (2) is addressed by an EPA-approved or established TMDL; or (3) is not in either of the above categories but the waterbody is covered by a pollution control program that meets the requirements of 40 CFR 130.7(b)(1). For discharges that enter a storm sewer system prior to discharge, the water of the U.S. to which you discharge is the first water of the U.S. that receives the stormwater discharge from the storm sewer system.

"Domestic Waste" – for the purposes of this permit, typical household trash, garbage or rubbish items generated by construction activities.

"Drainageway" – an open linear depression, whether constructed or natural, that functions for the collection and drainage of surface water.

"Drought-Stricken Area" – for the purposes of this permit, an area in which the National Oceanic and Atmospheric Administration's U.S. Seasonal Drought Outlook indicates for the period during which the construction will occur that any of the following conditions are likely: (1) "Drought to persist or intensify", (2) "Drought ongoing, some improvement", (3) "Drought likely to improve, impacts ease", or (4) "Drought development likely". See http://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php.

"Earth-Disturbing Activity"– actions taken to alter the existing vegetation and/or underlying soil of a site, such as clearing, grading, site preparation (e.g., excavating, grubbing, cutting, and filling), soil compaction, and movement and stockpiling of top soils.

"Earth-Disturbing Activities Conducted Prior to Active Mining Activities" – Consists of two classes of earth-disturbing (i.e., clearing, grading and excavation) activities:

a. activities performed for purposes of mine site preparation, including: cutting new rights of way (except when related to access road construction); providing access to a mine site for vehicles and equipment (except when related to access road construction); other earth disturbances associated with site preparation activities on any areas where active mining

activities have not yet commenced (e.g., for heap leach pads, waste rock facilities, tailings impoundments, wastewater treatment plants); and

b. construction of staging areas to prepare for erecting structures such as to house project personnel and equipment, mill buildings, etc., and construction of access roads.

Note: only earth-disturbing activities associated with the construction of staging areas and the construction of access roads conducted prior to active mining (see (b) above) are considered to be "construction" and therefore stormwater discharges from these activities are eligible for coverage under this permit. See Part 1.2.1.b. The activities described in (a) above are not considered to be "construction" and therefore stormwater discharges associated with this activity are not eligible for coverage under this permit.

"Effective Operating Condition" – for the purposes of this permit, a stormwater control is kept in effective operating condition if it has been implemented and maintained in such a manner that it is working as designed to minimize pollutant discharges.

"Effluent Limitations" – for the purposes of this permit, any of the Part 2 or Part 3 requirements.

"Effluent Limitations Guideline" (ELG) – defined in 40 CFR § 122.2 as a regulation published by the Administrator under section 304(b) of the CWA to adopt or revise effluent limitations.

"Eligible" – for the purposes of this permit, refers to stormwater and allowable non-stormwater discharges that are authorized for coverage under this general permit.

"Emergency-Related Project" – a project initiated in response to a public emergency (e.g., mud slides, earthquake, extreme flooding conditions, disruption in essential public services), for which the related work requires immediate authorization to avoid imminent endangerment to human health or the environment, or to reestablish essential public services.

"Endangered Species" – defined in the Endangered Species Act at 16 U.S.C. 1531 as any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary to constitute a pest whose protection under the provisions of this Act would present an overwhelming and overriding risk to man.

"Excursion" – a measured value that exceeds a specified limit.

"Existing Site" – a site where construction activities commenced prior to February 16, 2017.

"Exit Points" – any points of egress from the construction site to be used by vehicles and equipment during construction activities.

"Exposed Soils" – for the purposes of this permit, soils that as a result of earth-disturbing activities are left open to the elements.

"Federal Facility" – any buildings, installations, structures, land, public works, equipment, aircraft, vessels, and other vehicles and property, owned by, or constructed or manufactured for the purpose of leasing to, the Federal government.

"Federal Operator" – an entity that meets the definition of "Operator" in this permit and is either any department, agency or instrumentality of the executive, legislative, and judicial branches of the Federal government of the United States, or another entity, such as a private contractor, performing construction activity for any such department, agency, or instrumentality.

"Final Stabilization" – on areas not covered by permanent structures, either (1) uniform, perennial vegetation *(e.g., evenly distributed, without large bare areas)* has been established, or for arid or semi-arid areas, will be established that provides 70 percent or more of the cover that is provided by vegetation native to local undisturbed areas, and/or (2) permanent non-

vegetative stabilization measures (e.g., riprap, gravel, gabions, and geotextiles) have been implemented to provide effective cover for exposed portions of the site

"General Contractor" – for the purposes of this permit, the primary individual or company solely accountable to perform a contract. The general contractor typically supervises activities, coordinates the use of subcontractors, and is authorized to direct workers at a site to carry out activities required by the permit.

"Hazardous Substances" or "Hazardous or Toxic Waste" – for the purposes of this permit, any liquid, solid, or contained gas that contain properties that are dangerous or potentially harmful to human health or the environment. See also 40 CFR §261.2.

"Historic Property" – as defined in the National Historic Preservation Act regulations, means any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian Tribe or Native Hawaiian organization and that meet the National Register criteria.

"Impaired Water"– a water identified by the State, Tribe, or EPA as not meeting an applicable water quality standard and (1) requires development of a TMDL (pursuant to section 303(d) of the CWA; or (2) is addressed by an EPA-approved or established TMDL; or (3) is not in either of the above categories but the waterbody is covered by a pollution control program that meets the requirements of 40 CFR 130.7(b)(1).

"Impervious Surface" – for the purpose of this permit, any land surface with a low or no capacity for soil infiltration including, but not limited to, pavement, sidewalks, parking areas and driveways, packed gravel or soil, or rooftops.

"Indian Country" or "Indian Country Lands" – defined at 40 CFR §122.2 as:

1. All land within the limits of any Indian reservation under the jurisdiction of the United States Government, notwithstanding the issuance of any patent, and, including rights-of-way running through the reservation;
2. All dependent Indian communities with the borders of the United States whether within the originally or subsequently acquired territory thereof, and whether within or without the limits of a State; and
3. All Indian allotments, the Indian titles to which have not been extinguished, including rights-of-ways running through the same.

"Infeasible" – for the purpose of this permit, infeasible means not technologically possible or not economically practicable and achievable in light of best industry practices. EPA notes that it does not intend for any permit requirement to conflict with State water rights law.

"Install" or "Installation" – when used in connection with stormwater controls, to connect or set in position stormwater controls to make them operational.

"Jar test" – a test designed to simulate full-scale coagulation/flocculation/sedimentation water treatment processes by taking into account the possible conditions.

"Landward" – positioned or located away from a waterbody, and towards the land.

"Large Construction Activity" – defined at 40 CFR § 122.26(b)(14)(x) and incorporated here by reference. Large construction activity includes clearing, grading, and excavating resulting in a land disturbance that will disturb equal to or greater than five acres of land or will disturb less than five acres of total land area but is part of a larger common plan of development or sale that will ultimately disturb equal to or greater than five acres. Large construction activity does

not include routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or original purpose of the site.

"Linear Construction Site" – includes the construction of roads, bridges, conduits, substructures, pipelines, sewer lines, towers, poles, cables, wires, connectors, switching, regulating and transforming equipment and associated ancillary facilities in a long, narrow area.

"Minimize" – to reduce and/or eliminate to the extent achievable using stormwater controls that are technologically available and economically practicable and achievable in light of best industry practices.

"Mining Activity" – for the purposes of this permit, includes mining-related construction activities defined at 40 CFR 122.26(b)(14)(x) and 122.26(b)(15)(i), and active mining activities defined at 40 CFR 122.26(b)(14)(iii). Both of these sub categories of activities include earth-disturbing activities, with the latter also including such activities as: extraction, removal or recovery, and beneficiation of mined material from the earth; removal of overburden and waste rock to expose mineable material; and site reclamation and closure activities.

"Mining Operations" – for the purposes of this permit, mining operations are grouped into two distinct categories, with distinct effluent limits and requirements applicable to each: 1) earth-disturbing activities conducted prior to active mining activities; and 2) active mining activities, which includes reclamation.

"Municipal Separate Storm Sewer System" or "MS4" – defined at 40 CFR §122.26(b)(8) as a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains):

1. Owned and operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law) having jurisdiction over disposal of sewage, industrial wastes, stormwater, or other wastes, including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian Tribe or an authorized Indian Tribal organization, or a designated and approved management agency under section 208 of the CWA that discharges to waters of the United States;
2. Designed or used for collecting or conveying stormwater;
3. Which is not a combined sewer; and
4. Which is not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR §122.2.

"National Pollutant Discharge Elimination System" (NPDES) – defined at 40 CFR §122.2 as the national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements, under sections 307, 402, 318, and 405 of CWA. The term includes an 'approved program.'

"Native Topsoil" – the uppermost layer of naturally occurring soil for a particular area, and is often rich in organic matter, biological activity, and nutrients.

"Natural Buffer" – for the purposes of this permit, an area of undisturbed natural cover surrounding waters of the United States within which construction activities are restricted. Natural cover includes the vegetation, exposed rock, or barren ground that exists prior to commencement of earth-disturbing activities.

"Natural Vegetation" – vegetation that occurs spontaneously without regular management, maintenance, or species introductions or removals, and that generally has a strong component of native species..

"New Operator of a Permitted Site" – an operator that through transfer of ownership and/or operation replaces the operator of an already permitted construction site that is either a "new site" or an "existing site".

"New Site" – a site where construction activities commenced on or after February 16, 2017.

"New Source" – for the purposes of this permit, a construction project that commenced construction activities after February 1, 2010.

"New Source Performance Standards (NSPS)" – for the purposes of this permit, NSPS are technology-based standards that apply to construction sites that are new sources under 40 CFR 450.24.

"Non-Stormwater Discharges" – discharges that do not originate from storm events. They can include, but are not limited to, discharges of process water, air conditioner condensate, non-contact cooling water, vehicle wash water, sanitary wastes, concrete washout water, paint wash water, irrigation water, or pipe testing water.

"Non-Turbid" – a discharge that is free from visual turbidity.

"Notice of Intent" (NOI) – the form (electronic or paper) required for authorization of coverage under the Construction General Permit.

"Notice of Termination" (NOT) – the form (electronic or paper) required for terminating coverage under the Construction General Permit.

"NPDES eReporting Tool" (NeT) – EPA's online system for submitting electronic Construction General Permit forms.

"Operational" – for the purposes of this permit, stormwater controls are made "operational" when they have been installed and implemented, are functioning as designed, and are properly maintained.

"Operator" – for the purposes of this permit and in the context of stormwater discharges associated with construction activity, any party associated with a construction project that meets either of the following two criteria:

1. The party has operational control over construction plans and specifications, including the ability to make modifications to those plans and specifications *(*e.g. *in most cases this is the owner of the site)*; or
2. The party has day-to-day operational control of those activities at a project that are necessary to ensure compliance with the permit conditions (e.g.*, they are authorized to direct workers at a site to carry out activities required by the permit; in most cases this is the general contractor of the project)*.

This definition is provided to inform permittees of EPA's interpretation of how the regulatory definitions of "owner or operator" and "facility or activity" are applied to discharges of stormwater associated with construction activity. Subcontractors generally are not considered operators for the purposes of this permit.

"Ordinary High Water Mark" – the line on the shore established by fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, and/or the presence of litter and debris.

"Permitting Authority" – for the purposes of this permit, EPA, a Regional Administrator of EPA, or an authorized representative.

"Point(s) of Discharge" – see "Discharge Point."

"Point Source" – any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural stormwater runoff.

"Pollutant" – defined at 40 CFR §122.2. A partial listing from this definition includes: dredged spoil, solid waste, sewage, garbage, sewage sludge, chemical wastes, biological materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial or municipal waste.

"Pollution Prevention Controls" – stormwater controls designed to reduce or eliminate the addition of pollutants to construction site discharges through analysis of pollutant sources, implementation of proper handling/disposal practices, employee education, and other actions.

"Polymers" – for the purposes of this permit, coagulants and flocculants used to control erosion on soil or to enhance the sediment removal capabilities of sediment traps or basins. Common construction site polymers include polyacrylamide (PAM), chitosan, alum, polyaluminum chloride, and gypsum.

"Prohibited Discharges" – discharges that are not allowed under this permit, including:

1. Wastewater from washout of concrete;
2. Wastewater from washout and cleanout of stucco, paint, form release oils, curing compounds and other construction materials;
3. Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance;
4. Soaps or solvents used in vehicle and equipment washing;
5. Toxic or hazardous substances from a spill or other release; and
6. Waste, garbage, floatable debris, construction debris, and sanitary waste.

"Provisionally Covered Under this Permit" – for the purposes of this permit, EPA provides temporary coverage under this permit for emergency-related projects prior to receipt of a complete and accurate NOI. Discharges from earth-disturbing activities associated with the emergency-related projects are subject to the terms and conditions of the permit during the period of temporary coverage.

"Qualified Person" – a person knowledgeable in the principles and practice 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.

"Receiving Water" – a "Water of the United States" as defined in 40 CFR §122.2 into which the regulated stormwater discharges.

"Run-On" – sources of stormwater that drain from land located upslope or upstream from the regulated site in question.

"Seasonally Dry Period" – a month in which the long-term average total precipitation is less than or equal to 0.5 inches. Refer to EPA's Seasonally Dry Period Locator and supporting maps for assistance in determining whether a site is operating during a seasonally dry period for the area, located at https://www.epa.gov/npdes/construction-general-permit-resources-tools-and-templates.

"Sediment-Related parameter" – for the purposes of this permit, a pollutant parameter that is closely related to sediment such as turbidity, total suspended solids (TSS), total suspended sediment, transparency, sedimentation, and siltation.

"Semi-Arid Areas" – areas with an average annual rainfall of 10 to 20 inches. For assistance in determining average annual rainfall in specific locations, refer to the NOAA National Mapping webpage (https://www.ncdc.noaa.gov/cag/national/mapping), the PRISM Climate Group's Time Series Values for individual locations (https://prism.oregonstate.edu/explorer/), or EPA's US EPA EnviroAtlas (https://www.epa.gov/enviroatlas).

"Shared Control" - for the purposes of this permit, a stormwater control, such as a sediment basin or pond, used by two or more operators that is installed and maintained for the purpose of minimizing and controlling pollutant discharges from a construction site with multiple operators associated with a common plan of development or sale. Any operators that are contributing stormwater from their construction activities to a shared control are considered to rely upon a shared control.

"Small Construction Activity" – defined at 40 CFR §122.26(b)(15) and incorporated here by reference. A small construction activity includes clearing, grading, and excavating resulting in a land disturbance that will disturb equal to or greater than one (1) acre and less than five (5) acres of land or will disturb less than one (1) acre of total land area but is part of a larger common plan of development or sale that will ultimately disturb equal to or greater than one (1) acre and less than five (5) acres. Small construction activity does not include routine maintenance that is performed to maintain the original line and grade, hydraulic capacity, or original purpose of the site.

"Small Residential Lot" – for the purpose of this permit, a lot being developed for residential purposes that will disturb less than 1 acre of land, but is part of a larger residential project that will ultimately disturb greater than or equal to 1 acre.

"Snowmelt" – the conversion of snow into overland stormwater and ground water flow as a result of warmer temperatures.

"Spill" – for the purpose of this permit, the release of a hazardous or toxic substance from its container or containment.

"Stabilization" – the use of vegetative and/or non-vegetative cover to prevent erosion and sediment loss in areas exposed through the construction process.

"Steep Slopes" – where a State, Tribe, local government, or industry technical manual (e.g., stormwater BMP manual) has defined what is to be considered a "steep slope", this permit's definition automatically adopts that definition. Where no such definition exists, steep slopes are automatically defined as those that are 15 percent or greater in grade.

"Storm Sewer System" – a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains) designed or used for collecting or conveying stormwater.

"Stormwater" – stormwater runoff, snowmelt runoff, and surface runoff and drainage.

"Stormwater Control" - refers to any best management practice or other method (including narrative effluent limitations) used to prevent or reduce the discharge of pollutants to waters of the United States.

"Stormwater Discharge Associated with Construction Activity" – as used in this permit, a discharge of pollutants in stormwater to waters of the United States from areas where earth-disturbing activities (e.g., clearing, grubbing, grading, or excavation) occur, or where construction materials or equipment storage or maintenance (e.g., fill piles, borrow area,

concrete truck chute washdown, fueling), or other industrial stormwater directly related to the construction process (e.g., concrete or asphalt batch plants), are located.

"Stormwater Inlet" – a structure placed below grade to conduct water used to collect stormwater runoff for conveyance purposes.

"Stormwater Team" – the group of individuals responsible for oversight of the development and modifications of the SWPPP, and oversight of compliance with the permit requirements. The individuals on the "Stormwater Team" must be identified in the SWPPP.

"Storm Event" – a precipitation event that results in a measurable amount of precipitation.

"Storm Sewer" – a system of pipes (separate from sanitary sewers) that carries stormwater runoff from buildings and land surfaces.

"Subcontractor" – for the purposes of this permit, an individual or company that takes a portion of a contract from the general contractor or from another subcontractor.

"SWPPP" (Stormwater Pollution Prevention Plan) – a site-specific, written document that, among other things: (1) identifies potential sources of stormwater pollution at the construction site; (2) describes stormwater controls to reduce or eliminate pollutants in stormwater discharges from the construction site; and (3) identifies procedures the operator will implement to comply with the terms and conditions of this general permit.

"Temporary Stabilization" – a condition where exposed soils or disturbed areas are provided temporary vegetative and/or non-vegetative protective cover to prevent erosion and sediment loss. Temporary stabilization may include temporary seeding, geotextiles, mulches, and other techniques to reduce or eliminate erosion until either final stabilization can be achieved or until further construction activities take place to re-disturb this area.

"Thawing Conditions" – for the purposes of this permit, thawing conditions are expected based on the historical likelihood of two or more days with daytime temperatures greater than 32˚F. This date can be determined by looking at historical weather data. Note: the estimation of thawing conditions is for planning purposes only. During construction the permittee will be required to conduct site inspections based upon actual conditions (i.e., if thawing conditions occur sooner than expected, the permittee will be required to conduct inspections at the regular frequency).

"Threatened Species" – defined in the Endangered Species Act at 16 U.S.C. 1531 as any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

"Tier 2 Waters" – for antidegradation purposes, pursuant to 40 CFR 131.12(a)(2), those waters that are characterized as having water quality that exceeds the levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water.

"Tier 2.5 Waters" – for antidegradation purposes, those waters designated by States or Tribes as requiring a level of protection equal to and above that given to Tier 2 waters, but less than that given Tier 3 waters. Some States have special requirements for these waters.

"Tier 3 Waters" – for antidegradation purposes, pursuant to 40 CFR 131.12(a)(3), Tier 3 waters are identified by States as having high quality waters constituting an Outstanding National Resource Water (ONRW), such as waters of National Parks and State Parks, wildlife refuges, and waters of exceptional recreational or ecological significance.

"Total Maximum Daily Load" or "TMDL" – the sum of the individual wasteload allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background. If receiving water has only one point source discharger, the TMDL is the sum of that point source WLA plus the LAs for any nonpoint sources of pollution and natural background sources,

tributaries, or adjacent segments. TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measure.

"Toxic Waste" – see "Hazardous Substances."

"Treatment Chemicals" – polymers, flocculants, or other chemicals used to reduce turbidity in stormwater.

"Turbidity" – a condition of water quality characterized by the presence of suspended solids and/or organic material.

"Uncontaminated Discharge" – in the context of authorized non-stormwater discharges, a discharge that meets applicable water quality standards.

"Upland" – the dry land area above and 'landward' of the ordinary high water mark.

"Upset" – Upset means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond your reasonable control. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation. See 40 CFR 122.41(n)(1).

"Visual Turbidity" – for the purposes of this permit, visual turbidity is present when there is a sediment plume in the discharge or the discharge appears cloudy, opaque, or has a visible contrast that can be visually identified by an observer.

"Water-Dependent Structures" – structures or facilities that are required to be located directly adjacent to a waterbody or wetland, such as a marina, pier, boat ramp, etc.

"Water Quality Standards" – defined in 40 CFR § 131.3, and are provisions of State (including Tribal) or Federal law which consist of a designated use or uses for the waters of the United States, water quality criteria for such waters based upon such uses, and an antidegradation policy to protect high-quality waters. Water quality standards protect the public health or welfare, enhance the quality of water and serve the purposes of the Act.

"Waters of the United States" – see definition at 40 CFR 122.2.

"Wetland" – those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. On-site evaluations are typically required to confirm the presence and boundaries of wetlands.

2. Acronyms

ACHP – Advisory Council on Historic Preservation

BMP – Best Management Practice

CBI – Confidential Business Information

CGP – Construction General Permit

CFR – Code of Federal Regulations

CWA – Clean Water Act

CZMA – Coastal Zone Management Act

ECHO – EPA Enforcement and Compliance History Online

ELG – Effluent Limitations Guideline

EPA – United States Environmental Protection Agency
ESA – Endangered Species Act
FR – Federal Register
MS4 – Municipal Separate Storm Sewer System
MSGP – Multi-Sector General Permit
NEPA – National Environmental Policy Act
NeT – NPDES eReporting Tool
NTU - Nephelometric turbidity units
NHPA – National Historic Preservation Act
NMFS – United States National Marine Fisheries Service
NPDES – National Pollutant Discharge Elimination System
NOI – Notice of Intent
NOT – Notice of Termination
NPDES – National Pollutant Discharge Elimination System
NRC – National Response Center
NRCS – National Resources Conservation Service
NSPS – New Source Performance Standards
ONRW – Outstanding National Resource Water
PAM – Polyacrylamide
POTW – Publicly Owned Treatment Works
RUSLE – Revised Universal Soil Loss Equation
SDS – Safety Data Sheet
SHPO – State Historic Preservation Office
SPCC – Spill Prevention Control and Countermeasure
SWPPP – Stormwater Pollution Prevention Plan
THPO – Tribal Historic Preservation Office
TMDL – Total Maximum Daily Load
TSS – Total Suspended Solids
UIC – Underground Injection Control
USDA – United States Department of Agriculture
USFWS – United States Fish and Wildlife Service
USGS – United States Geological Survey
WQS – Water Quality Standard

Appendix B - Permit Areas Eligible for Coverage and EPA Regional Addresses

Permit coverage for stormwater discharges from construction activity occurring within the following areas is provided by legally separate and distinctly numbered permits. For assistance in determining whether your construction activities are located within Indian country, refer to the Bureau of Indian Affairs' digital map of the land areas of Federally-recognized Tribes at https://biamaps.doi.gov/indianlands/#.

B.1 EPA Region 1

The permit offers coverage for stormwater discharges from construction activity from the following areas in EPA Region 1:

Permit No.	Areas of Coverage/Where EPA is Permitting Authority
CTR10I000	Indian country within the State of Connecticut
MAR100000	Commonwealth of Massachusetts (except Indian country)
MAR10I000	Indian country within the State of Massachusetts
NHR100000	State of New Hampshire
RIR10I000	Indian country within the State of Rhode Island
VTR10F000	Areas in the State of Vermont located at a Federal Facility (as defined in Appendix A)
1R10I000	All areas of Indian country not identified above that are not already covered by an EPA-approved permitting program with authorization to issue permits in Indian country

For stormwater discharges in EPA Region 1 outside the areas of coverage identified above, please contact your State NPDES permitting authority to obtain coverage under a State-issued NPDES permit.

EPA Region 1 Address:
U.S. EPA Region 1
Office of Ecosystem Protection
Stormwater and Construction Permits Section
5 Post Office Square, Suite 100
(OEP 06-1)
Boston, MA 02109-3912

B.2 EPA Region 2

The permit offers coverage for stormwater discharges from construction activity from the following areas in EPA Region 2:

Permit No.	Areas of Coverage/Where EPA is Permitting Authority
NYR10I000	Indian country within the State of New York
PRR100000	Commonwealth of Puerto Rico
02R10I000	All areas of Indian country not identified above that are not already covered by an EPA-approved permitting program with authorization to issue permits in Indian country

For stormwater discharges in EPA Region 2 outside the areas of coverage identified above, please contact your State NPDES permitting authority to obtain coverage under a State-issued NPDES permit.

EPA Region 2 Address:
For Puerto Rico:
U.S. EPA Region 2
Caribbean Environmental Protection Division
NPDES Stormwater Program
City View Plaza II – Suite 7000
48 Rd. 165 Km 1.2
Guaynabo, PR 00968-8069

For New York:
U.S. EPA Region 2
NPDES Stormwater Program
290 Broadway, 24th Floor
New York, NY 10007-1866

B.3 EPA Region 3

The permit offers coverage for stormwater discharges from construction activity from the following areas in EPA Region 3:

Permit No.	Areas of Coverage/Where EPA is Permitting Authority
DCR100000	District of Columbia
DER10F000	Areas in the State of Delaware located at a Federal Facility (as defined in Appendix A)
VAR10I000	Indian country within the State of Virginia
03R10I000	All areas of Indian country not identified above that are not already covered by an EPA-approved permitting program with authorization to issue permits in Indian country

For stormwater discharges in EPA Region 3 outside the areas of coverage identified above, please contact your State NPDES permitting authority to obtain coverage under a State-issued NPDES permit.

EPA Region 3 Address:
U.S. EPA Region 3
Office of NPDES Permits and Enforcement
NPDES Permits Branch, Mailcode 3WP41
1650 Arch Street
Philadelphia, PA 19103

B.4 EPA Region 4

The permit offers coverage for stormwater discharges from construction activity from the following areas in EPA Region 4:

Permit No.	Areas of Coverage/Where EPA is Permitting Authority
ALR10I000	Indian country within the State of Alabama
FLR10I00E	Indian country within the State of Florida
MSR10I000	Indian country within the State of Mississippi
NCR10I000	Indian country within the State of North Carolina
04R10I000	All areas of Indian country not identified above that are not already covered by an EPA-approved permitting program with authorization to issue permits in Indian country (except Catawba lands in South Carolina)

For stormwater discharges in EPA Region 4 outside the areas of coverage identified above, please contact your State NPDES permitting authority to obtain coverage under a State-issued NPDES permit.

EPA Region 4 Address:
U.S. EPA Region 4
Water Protection Division
NPDES Stormwater Program
Atlanta Federal Center
61 Forsyth Street SW
Atlanta, GA 30303-3104

B.5 EPA Region 5

The permit offers coverage for stormwater discharges from construction activity from the following areas in EPA Region 5:

Permit No.	Areas of Coverage/Where EPA is Permitting Authority
MIR10I000	Indian country within the State of Michigan, except the L'Anse Reservation of the Keweenaw Bay Indian Community
MNR10I000	Indian country within the State of Minnesota, except sites located in the Fond du Lac Reservation discharging to Outstanding Reservation Resources Waters (ORRWs)[1]
WIR10I000	Indian country within the State of Wisconsin, except sites located in the Bad River Band of Lake Superior Tribe of Chippewa Indians discharging to Outstanding Tribal Resource Waters (OTRWs) or Tier 3 waters[2]
05R10I000	All areas of Indian country not identified above that are not already covered by an EPA-approved permitting program with authorization to issue permits in Indian country

[1] The Tribe has identified Perch Lake, Rice Portage Lake, Miller Lake, Deadfish Lake, and Jaskari Lake as ORRWs.
[2] The Tribe has identified the following as OTRWs or Tier 3 waters: Kakagon Slough and the lower wetland reaches of its tributaries that support wild rice, Kakagon River, Bad River Slough, Honest John Lake, Bog Lake, a portion of Bad River, from where it enters the Reservation through the confluence with the White River, and Potato River.

For stormwater discharges in EPA Region 5 outside the areas of coverage identified above, please contact your State NPDES permitting authority to obtain coverage under a State-issued NPDES permit.

EPA Region 5 Address:
U.S. EPA Region 5
NPDES Program Branch
77 W. Jackson Blvd.
Mail Code WN16J
Chicago, IL 60604-3507

B.6 EPA Region 6

The permit offers coverage for stormwater discharges from construction activity from the following areas in EPA Region 6:

Permit No.	Areas of Coverage/Where EPA is Permitting Authority
LAR10I000	Indian country within the State of Louisiana
NMR100000	State of New Mexico, except Indian country
NMR10I000	Indian country within the State of New Mexico, except Navajo Reservation Lands that are covered under Arizona permit AZR10000I and Ute Mountain Reservation Lands that are covered under Colorado permit COR10000I.
OKR10I000	Indian country within the State of Oklahoma, except areas of Indian country covered by an extension of state program authority pursuant to Section 10211 of the Safe, Accountable, Flexible, Efficient Transportation Equity Act (SAFETEA).
OKR10F000	Discharges in the State of Oklahoma that are not under the authority of the Oklahoma Department of Environmental Quality, or the Oklahoma Department of Agriculture and Forestry including activities associated with oil and gas exploration, drilling, operations, and pipelines (includes SIC Groups 13 and 46, and SIC codes 492 and 5171), and point source discharges associated with agricultural production, services, and silviculture (includes SIC Groups 01, 02, 07, 08, 09).
TXR10I000	Indian country within the State of Texas
06R10I000	All areas of Indian country not identified above that are not already covered by an EPA-approved permitting program with authorization to issue permits in Indian country

For stormwater discharges in EPA Region 6 outside the areas of coverage identified above, please contact your State NPDES permitting authority to obtain coverage under a State-issued NPDES permit.

EPA Region 6 Address:
U.S. EPA Region 6
NPDES Stormwater Program (WQ-PP)
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

B.7 EPA Region 7

The permit offers coverage for stormwater discharges from construction activity from the following areas in EPA Region 7:

Permit No.	Areas of Coverage/Where EPA is Permitting Authority
IAR10I000	Indian country within the State of Iowa
KSR10I000	Indian country within the State of Kansas
NER10I000	Indian country within the State of Nebraska, except Pine Ridge Reservation lands (see Region 8)
07R10I000	All areas of Indian country not identified above that are not already covered by an EPA-approved permitting program with authorization to issue permits in Indian country

For stormwater discharges in EPA Region 7 outside the areas of coverage identified above, please contact your State NPDES permitting authority to obtain coverage under a State-issued NPDES permit.

EPA Region 7 Address:
U.S. EPA Region 7
NPDES Stormwater Program
11201 Renner Blvd
Lenexa, KS 66219

B.8 EPA Region 8

The permit offers coverage for stormwater discharges from construction activity from the following areas in EPA Region 8:

Permit No.	Areas of Coverage/Where EPA is Permitting Authority
COR10F000	Areas in the State of Colorado located at a Federal Facility (as defined in Appendix A), except those located on Indian country
COR10I000	Indian country within the State of Colorado, as well as the portion of the Ute Mountain Reservation located in New Mexico
MTR10I000	Indian country within the State of Montana
NDR10I000	Indian country within the State of North Dakota, as well as that portion of the Standing Rock Reservation located in South Dakota (except for the portion of the lands within the former boundaries of the Lake Traverse Reservation which is covered under South Dakota permit SDR10000I listed below)
SDR10I000	Indian country within the State of South Dakota, as well as the portion of the Pine Ridge Reservation located in Nebraska and the portion of the lands within the former boundaries of the Lake Traverse Reservation located in North Dakota (except for the Standing Rock Reservation which is covered under North Dakota permit NDR10000I listed above)
UTR10I000	Indian country within the State of Utah, except Goshute and Navajo Reservation lands (see Region 9)
WYR10I000	Indian country within the State of Wyoming
08R10I000	All areas of Indian country not identified above that are not already covered by an EPA-approved permitting program with authorization to issue permits in Indian country

For stormwater discharges in EPA Region 8 outside the areas of coverage identified above, please contact your State NPDES permitting authority to obtain coverage under a State-issued NPDES permit.

EPA Region 8 Address:
EPA Region 8 Storm Water Program
Mailcode: 8P-W-WW
1595 Wynkoop Street
Denver, CO 80202-1129

B.9 EPA Region 9

The permit offers coverage for stormwater discharges from construction activity from the following areas in EPA Region 9:

Permit No.	Areas of Coverage/Where EPA is Permitting Authority
ASR100000	Island of American Samoa
AZR10I000	Indian country within the State of Arizona, as well as Navajo Reservation lands in New Mexico and Utah
CAR10I000	Indian country within the State of California
GUR100000	Island of Guam
JAR100000	Johnston Atoll
MPR100000	Commonwealth of the Northern Mariana Islands
MWR100000	Midway Island and Wake Island
NVR10000I	Indian country within the State of Nevada, as well as the Duck Valley Reservation in Idaho, the Fort McDermitt Reservation in Oregon and the Goshute Reservation in Utah
09R10I000	All areas of Indian country not identified above that are not already covered by an EPA-approved permitting program with authorization to issue permits in Indian country

For stormwater discharges in EPA Region 9 outside the areas of coverage identified above, please contact your State NPDES permitting authority to obtain coverage under a State-issued NPDES permit.

EPA Region 9 Address:
U.S. EPA Region 9
Water Division
NPDES Stormwater Program (WTR-2-3)
75 Hawthorne Street
San Francisco, CA 94105-3901

B.10 EPA Region 10

The permit offers coverage for stormwater discharges from construction activity from the following areas in EPA Region 10:

Permit No.	Areas of Coverage/Where EPA is Permitting Authority
AKR10I000	Indian country lands as defined in 18 U.S.C. 1151 within the State of Alaska
AKR10F000	Denali National Park and Preserve
IDR10I000	Indian country within the State of Idaho, except Duck Valley Reservation lands (see Region 9)
ORR10I000	Indian country within the State of Oregon, except Fort McDermitt Reservation lands (see Region 9)
WAR10F000	Areas in the State of Washington, except those located on Indian country, subject to construction activity by a Federal Operator
WAR10I000	Indian country within the State of Washington
010R10I000	All areas of Indian country not identified above that are not already covered by an EPA-approved permitting program with authorization to issue permits in Indian country

For stormwater discharges in EPA Region 10 outside the areas of coverage identified above, please contact your State NPDES permitting authority to obtain coverage under a State-issued NPDES permit.

EPA Region 10 Address:
U.S. EPA Region 10
NPDES Stormwater Program
1200 6th Avenue (OWW-191)
Seattle, WA 98101-3140

Appendix C - Small Construction Waivers and Instructions

These waivers are only available to stormwater discharges associated with small construction activities (i.e., 1-5 acres). As the operator of a small construction activity, you may be able to qualify for a waiver in lieu of needing to obtain coverage under this general permit based on: (A) a low rainfall erosivity factor, (B) a TMDL analysis, or (C) an equivalent analysis that determines allocations for small construction sites are not needed. Each operator, otherwise needing permit coverage, must notify EPA of its intention for a waiver. It is the responsibility of those individuals wishing to obtain a waiver from coverage under this general permit to submit a complete and accurate waiver certification as described below. Where the operator changes or another is added during the construction project, the new operator must also submit a waiver certification to be waived.

C.1 Rainfall Erosivity Waiver

Under this scenario the small construction project's rainfall erosivity factor calculation ("R" in the Revised Universal Soil Loss Equation) is less than five during the period of construction activity. The operator must certify to EPA that construction activity will occur only when the rainfall erosivity factor is less than five. The period of construction activity begins at initial earth disturbance and ends with final stabilization. Where vegetation will be used for final stabilization, the date of installation of a stabilization practice that will provide interim non-vegetative stabilization can be used for the end of the construction period, provided the operator commits (as a condition of waiver eligibility) to periodically inspect and properly maintain the area until the criteria for final stabilization as defined in the CGP have been met. If use of this interim stabilization eligibility condition was relied on to qualify for the waiver, signature on the waiver with its certification statement constitutes acceptance of and commitment to complete the final stabilization process. The operator must submit a waiver certification to EPA prior to commencing construction activities.

> *Note: The rainfall erosivity factor "R" is determined in accordance with Chapter 2 of Agriculture Handbook Number 703, Predicting Soil Erosion by Water: A Guide to Conservation Planning With the Revised Universal Soil Loss Equation (RUSLE), pages 21–64, dated January 1997; United States Department of Agriculture (USDA), Agricultural Research Service.*

EPA has developed an online rainfall erosivity calculator to help small construction sites determine potential eligibility for the rainfall erosivity waiver. You can access the calculator from EPA's website at: https://www.epa.gov/npdes/rainfall-erosivity-factor-calculator-small-construction-sites. The R factor can easily be calculated by using the construction site latitude/longitude or address and estimated start and end dates of construction. This calculator may also be useful in determining the time periods during which construction activity could be waived from permit coverage. You may find that moving your construction activity by a few weeks or expediting site stabilization will allow you to qualify for the waiver. Use this online calculator or the Construction Rainfall Erosivity Waiver Fact Sheet (https://www.epa.gov/sites/production/files/2015-10/documents/fact3-1.pdf) to assist in determining the R Factor for your small construction site.

If you are the operator of the construction activity and eligible for a waiver based on low erosivity potential, you can submit a rainfall erosivity waiver electronically via EPA's NPDES eReporting Tool (NeT) (https://www.epa.gov/npdes/stormwater-discharges-construction-activities#ereporting), unless you received a waiver from your EPA Regional Office (see Part 1.4.1 of the CGP for information about receiving a waiver from electronic reporting).

Note: If the R factor is five or greater, you do not qualify for the rainfall erosivity waiver, and must obtain coverage under an NPDES permit (e.g., the CGP), unless you qualify for the Water Quality Waiver as described in section B below.

If your small construction project continues beyond the projected completion date given on the waiver certification, you must recalculate the rainfall erosivity factor for the new project duration. If the R factor is below five, you must update all applicable information on the waiver certification and retain a copy of the revised waiver as part of your records. The new waiver certification must be submitted prior to the projected completion date listed on the original waiver form to assure your exemption from permitting requirements is uninterrupted. If the new R factor is five or above, you must obtain NPDES permit coverage.

C.2 TMDL Waiver

This waiver is available if EPA has established or approved a TMDL that addresses the pollutant(s) of concern for the impaired water and has determined that controls on stormwater discharges from small construction activity are not needed to protect water quality. The pollutant(s) of concern include sediment (such as total suspended solids, turbidity or siltation) and any other pollutant that has been identified as a cause of impairment of any waterbody that will receive a discharge from the construction activity. Information on TMDLs that have been established or approved by EPA is available from EPA online at https://www.epa.gov/tmdl and from State and Tribal water quality agencies.

If you are the operator of the construction activity and eligible for a waiver based on compliance with an EPA-established or approved TMDL, you must provide the following information in order to be waived from permitting requirements:

1. Name, address and telephone number of the construction site operator(s);
2. Name (or other identifier), address, county or similar governmental subdivision, and latitude/longitude of the construction project or site;
3. Estimated construction start and completion (i.e., final stabilization) dates, and total acreage (to the nearest quarter acre) to be disturbed;
4. The name of the waterbody(s) that would be receiving stormwater discharges from your construction project;
5. The name and approval date of the TMDL;
6. A statement, signed and dated by an authorized representative as provided in Appendix G, Subsection G.11, that certifies that the construction activity will take place and that the stormwater discharges will occur, within the drainage area addressed by the TMDL.

C.3 Equivalent Analysis Waiver

This waiver is available for discharges to non-impaired waters only. The operator can develop an equivalent analysis that determines allocations for his/her small construction site for the pollutant(s) of concern or determines that such allocations are not needed to protect water quality. This waiver requires a small construction operator to develop an equivalent analysis based on existing in-stream concentrations, expected growth in pollutant concentrations from all sources, and a margin of safety.

If you are a construction operator who wants to use this waiver, you must develop your equivalent analysis and provide the following information to be waived from permitting requirements:

1. Name, address and telephone number of the construction site operator(s);

2. Name (or other identifier), address, county or similar governmental subdivision, and latitude/longitude of the construction project or site;
3. Estimated construction start and completion (i.e., final stabilization) dates, and total acreage (to the nearest quarter acre) to be disturbed;
4. The name of the waterbody(s) that would be receiving stormwater discharges from your construction project;
5. Your equivalent analysis;
6. A statement, signed and dated by an authorized representative as provided in Appendix G, Subsection G.11, that certifies that the construction activity will take place and that the stormwater discharges will occur, within the drainage area addressed by the equivalent analysis.

C.4 Waiver Deadlines and Submissions

1. Waiver certifications must be submitted prior to commencement of construction activities.
2. If you submit a TMDL or equivalent analysis waiver request, you are not waived until EPA approves your request. As such, you may not commence construction activities until receipt of approval from EPA.
3. Late Notifications: Operators are not prohibited from submitting waiver certifications after initiating clearing, grading, excavation activities, or other construction activities. The Agency reserves the right to take enforcement for any unpermitted discharges that occur between the time construction commenced and waiver authorization is granted.

Submittal of a waiver certification is an optional alternative to obtaining permit coverage for discharges of stormwater associated with small construction activity, provided you qualify for the waiver. Any discharge of stormwater associated with small construction activity not covered by either a permit or a waiver may be considered an unpermitted discharge under the Clean Water Act. As mentioned above, EPA reserves the right to take enforcement for any unpermitted discharges that occur between the time construction commenced and either discharge authorization is granted or a complete and accurate waiver certification is submitted. EPA may notify any operator covered by a waiver that they must obtain NPDES permit coverage. EPA may notify any operator who has been in non-compliance with a waiver that they may no longer use the waiver for future projects. Any member of the public may petition EPA to take action under this provision by submitting written notice along with supporting justification.

Complete and accurate TMDL or equivalent analysis waiver requests must be sent to the applicable EPA Regional Office address specified in Appendix B.

Appendix D - Eligibility Worksheet Relating to Threatened and Endangered Species Protection

D.1 Introduction

This appendix provides a printable worksheet that can be helpful in selecting and documenting your eligibility criteria with respect to the protection of Federally listed threatened or endangered species and Federally designated "critical habitat" under the Endangered Species Act (ESA) [hereinafter "ESA-listed species and designated critical habitat(s)"] from discharges and discharge-related activities authorized under this permit. This is important because Section 9 of the ESA prohibits all persons and agencies from "taking" threatened and endangered species (16 U.S.C. § 1532(19)).

While coordination between you and the U.S. Fish and Wildlife Service (USFWS) and/or the National Marine Fisheries Service (NMFS) (together, referred to as the "Services") may not be required in all cases, EPA encourages you to coordinate with the Services, to document that coordination, and to do so early in the planning process prior to submitting your NOI.

D.2 Certifying ESA Eligibility Criterion for the CGP

To be eligible for coverage under the CGP, you must certify that you meet one of the criteria listed in this worksheet (Section D.5), which is then submitted with your NOI for coverage under this permit. If you do not meet one of the ESA eligibility criteria outlined in the worksheet below, you are not eligible for coverage under this permit. These criteria ensure that coverage is available only for discharges and discharge-related activities that (1) avoid or eliminate any short- or long-term adverse effects to ESA-listed species and designated critical habitat(s), or (2) may result in any short- or long-term adverse effects that result in incidental take addressed under the incidental take statement of a biological opinion or permit for take issued under Section 10 of the ESA.

As part of your determination of eligibility, EPA has developed a worksheet that assists operators in arriving at the correct criterion. The following requirements apply to the completion of the worksheet depending on how you are submitting your NOI for permit coverage:

1. If the EPA Regional Office grants you a waiver from electronic reporting, in accordance with Part 1.1.5 of the CGP, you must complete the worksheet in section D.4 of this appendix to provide all information as required on your NOI that supports the eligibility criterion you qualify under per Part 1.1.5 of the permit. **You must submit the worksheet with your NOI. If you do not submit the worksheet with your NOI, your NOI will be considered incomplete.**
2. If you do not have a waiver from electronic reporting, you must **complete your eligibility criteria selection outlined in the Endangered Species Protection section of the NOI in the NPDES eReporting Tool (NeT-CGP)** and provide all information as required on your NOI that supports the eligibility criterion you qualify under per Part 1.1.5 of the permit. The printable worksheet in this appendix may be helpful to you in preparing to submit your NOI, but you do not have to use it.

D.3 What to Expect Once you Submit your NOI

After you submit your NOI and before your NOI is authorized, EPA may notify you if any additional controls are necessary to ensure your discharges are not likely to result in any short- or long-term adverse effects on ESA-listed species and critical habitat.

The Services have the opportunity, within 14 days of submission of the NOI, to advise EPA whether either agency believes the planned discharges meet the selected eligibility criterion; whether the eligibility criterion could be met with additional conditions; or whether the eligibility criterion is not met. With respect to ESA issues, EPA recognizes the Services' expertise and will carefully consider their conclusion(s) in identifying eligibility for authorization, either with or without additional conditions. In the event EPA has placed a hold on your NOI based on NMFS or USFWS' recommendation, EPA will notify you as to whether your discharges are authorized or whether an individual permit will be required. If you do not hear from EPA within 14 days, you may assume that your discharge is authorized without further conditions.

D.4 Worksheet Instructions

Follow the instructions within the worksheet below to determine which criterion you are eligible for coverage under this permit. Check only 1 criterion, answer the required questions, and include the required information.

Please keep the following in mind as you complete the worksheet:

- The worksheet requires that you answer questions in a sequential order so that you can select the correct eligibility criterion. The worksheet does not go through each criterion alphabetically, but rather is organized in a way that allows you to eliminate those criteria that do not apply to your site. For instance, Step 1 of the worksheet requires you to determine whether criterion B, E, or F applies first, in that order, before proceeding to determining whether criterion A applies in Step 2.
- You must consider ESA-listed species and/or designated critical habitat(s) under the jurisdiction of both the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) and select the criterion that best applies to your site. You must comply with any applicable terms, conditions, or other requirements developed in theprocess of meeting one of the eligibility criteria in this section to remain eligible for coverage under this permit.
- When evaluating the potential effects of your activities, you must consider effects to listed species or critical habitats within the "action area" of your construction activity, as identified by the USFWS IPaC and/or the NOAA website resources on page D-10 through D-11 of this appendix. Please Note: *NMFS' jurisdiction includes ESA-listed marine and estuarine species that spawn in inland rivers.* The definition of "action area," which is contained in Appendix A, is repeated below forconvenience.

"Action Area" – all areas to be affected directly or indirectly by the federal action and not merely theimmediate area involved in the action. See 50 CFR part 402. For the purposes of this permit and for application of the Endangered Species Act requirements, the following areas are included in the definition of action area:

- The **areas on the construction site** where stormwater discharges originate and flow toward the point of discharge into the receiving waters. This includes:
  - areas on the construction site where excavation, site development, or other ground disturbance activities occur, and
  - areas where stormwater controls will be constructed and operated, including any areas where stormwater flows to and from the stormwater controls.
- The areas **in the vicinity of the construction site** where stormwater discharges flow from the construction site to one or more points of discharge into receiving waters. (Example: Where stormwater flows into an off-site ditch, swale, or gully that leads to receiving waters.)
- **The extent of the receiving water** potentially affected by stormwater discharges from your construction site through alteration of water chemistry, turbidity, temperature, or bank structure (i.e., erosive flow), regardless of whether the construction site is adjacent to the receiving water.

D.5 Worksheet

Step 1 – Determine if You Meet the Eligibility Requirements of Criterion B, E, or F

Instructions

- First determine whether you are eligible under Criterion B by reviewing the eligibility requirements below.
- If you determine that your facility does not meet Criterion B (e.g., due to difference in action area described, lack of analysis of appropriate effects, new listings or designation of critical habitat), proceed to check if you meet the requirements for Criterion E or F.

Criterion B Eligibility Requirements

If your discharges and discharge-related activities were already addressed in another operator's valid certification of eligibility under the current 2022 CGP that included your action area (e.g., a general contractor or developer may have completed and filed an NOI for the entire action area with the necessary ESA certifications (Criterion A, C, D, E, or F)), you may be eligible under Criterion B. In order to be eligible for coverage, you must confirm that **all** three of the following are true (**check all that apply**):

☐ I have confirmed that the other operator's certification of eligibility accounted for my action area and that the eligibility certification was valid.

☐ There has been no lapse of NPDES permit coverage in the other operator's certification.

☐ I will comply with all measures that formed the basis of the other operator's valid certification of eligibility.

Instructions

- **If all three of the above are true, you may check Criterion B below and answer questions B1-B5, and if applicable, B6-B7.**
- **If any of the above are not true** (for example, if there are any listed species in your action area that were not addressed in the other operator's certification, you are not eligible under Criterion B), **you may not select Criterion B and must proceed to check if you meet the requirements for Criterion E or F.**

☐ **B Eligibility requirements met by another operator under the 2022 CGP.** The construction site's discharges and discharge-related activities were already addressed in another operator's valid certification of eligibility for your "action area" under eligibility Criterion A, C, D, E, or F of the 2022 CGP and you have confirmed that no additional ESA-listed species and/or designated critical habitat under the jurisdiction of USFWS and/or NMFS not considered in the

that certification may be present or located in the "action area." To certify your eligibility under this criterion, there must be no lapse of NPDES permit coverage in the other CGP operator's certification. By certifying eligibility under this criterion, you agree to comply with any conditions upon which the other CGP operator's certification was based. You must include below the NPDES ID from the other 2022 CGP operator's notification of authorization under this permit and list any measures that you must comply with). If your certification is based on another 2022 CGP operator's certification under Criterion C, you must provide EPA with the relevant supporting information required of existing dischargers in Criterion C.

B1. Provide the NPDES ID from the other CGP operator's NOI authorized under this permit:

_ _ _ _ _ _ _ _ _ _

B2. Identify the eligibility criterion of the other CGP operator's NOI? (check only one)

☐ A ☐ C ☐ D ☐ E ☐ F

B3. Provide the authorization date of the other CGP operator's NOI (MM/DD/YYYY):

_ _ / _ _ / _ _ _ _

By certifying eligibility under Criterion B, you must comply with any terms and conditions imposed under the eligibility requirements of the criterion for which the other operator has established eligibility (either Criterion A, C, D, E, or F) to ensure that your discharges and discharge-related activities are protective of listed species and/or critical habitat. *Note: If you are unable to meet these eligibility requirements, then you may either establish eligibility under one of the other criteria, or you may consider applying to EPA for an individual permit.*

B4. List any measures that formed the basis of the other operator's valid certification of eligibility that you will comply with (or enter "N/A" if none exist):

B5. Check to confirm you have provided documentation in your SWPPP supporting your eligibility under Criterion B, including any of the terms and conditions, as well as the other operator's basis for establishing eligibility. Yes ☐

If your certification is based on another operator's certification under Criterion C, you must provide the following:

B6. What Federally listed species and/or designated habitat are located in your "action area"? (attached separate sheet if necessary)

B7. What is the distance between your site and the listed species or designated critical habitat (in miles)? _____

Instructions

- **If you selected Criterion B above and answered questions B1-B5, and if applicable, B6-B7, you are done with this worksheet. If you are *not* filing electronically, you must submit this worksheet with your NOI.**
- If you are not eligible under Criterion B, proceed to check if you meet the requirements for Criterion E or F.





Criterion E Eligibility Requirements

If consultation under ESA section 7 has concluded, you may be eligible for coverage under Criterion E. In order to be eligible for coverage under Criterion E, **you must confirm that both of the following are true (check all that apply)**:

☐ A consultation between a Federal agency and USFWS and/or the NMFS under section 7 of the ESA has concluded**.** Consultations can be either formal or informal, and would have occurred only as a result of a separate Federal action (e.g., during application for an individual wastewater discharge permit or the issuance of a wetlands dredge and fill permit), and the consultation must have addressed the effects of your construction activity's discharges and discharge-related activities on all ESA-listed threatened or endangered species and all designated critical habitat under the jurisdiction of each Service, as appropriate, in your action area. The result of this consultation must be either:

i. A biological opinion currently in effect that determined that the action in question (taking into account the effects of your facility's discharges and discharge-related activities) is likely to adversely affect, but is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. The biological opinion must have included the effects of your facility's discharges[1] and discharge-related activities on all the listed species and designated

[1] Effects of discharge include, but are not limited to, the analysis of the hydrological, chemical, and biological effects of the discharge on listed species, their prey, and their habitat, as well as critical habitat, where designated. For example, the

critical habitat in your action area under the jurisdiction of each Service, as appropriate. To be eligible under (i), any reasonable and prudent measures specified in the incidental take statement must be implemented;

ii. Written concurrence (e.g., letter of concurrence) from the applicable Service(s) with a determination that your facility's discharges and discharge-related activities are not likely to adversely affect ESA-listed species and/or designated critical habitat. The concurrence letter must have included the effects of your facility's discharges and discharge-related activities on all the ESA-listed species and/or designated critical habitat on your species list(s) acquired from USFWS and/or NMFS as part of this worksheet.

☐ The consultation does not warrant reinitiation under 50 CFR §402.16; or, if reinitiation of consultation is required (e.g., due to a new species listing, critical habitat designation, or new information), the Federal action agency has reinitiated the consultation and the result of the consultation is consistent with the statements above. Include any reinitiation documentation from the Services or consulting Federal agency with your NOI.

Instructions

- **If both of the above are true, you may check Criterion E below and answer questions E1-E6.**
  - For more information on section 7 consultation, see 50 CFR part 402. If you receive a "jeopardy opinion," you may continue to work with USFWS and/or NMFS and your permitting authority to modify your project so that it will not jeopardize listed species or designated critical habitat.
  - Note that most consultations are accomplished through informal consultation. When conducting informal ESA section 7 consultation as a non-Federal representative, you must follow the procedures found in 50 CFR Part 402 of the ESA regulations. You must notify the Services of your intention and agreement to conduct consultation as a non-Federal representative.
  - Consultation may also occur in the context of another Federal action at the construction site (e.g., where ESA section 7 consultation was performed for issuance of a wetlands dredge and fill permit for the project or where a NEPA review is performed for the project that incorporates a section 7 consultation).
  - Any terms and conditions developed through consultations to protect listed species and critical habitat must be incorporated into the SWPPP. As noted above, a Federal operator may, if they wish, initiate consultation with the Services at Step Four. Non-Federal operators may seek technical assistance from the Services at Step 5.
  - Whether ESA section 7 consultation must be performed with either USFWS, NMFS, or both Services depends on the listed species that may be affected by the operator's stormwater discharges. In general, NMFS has jurisdiction over marine, estuarine, and anadromous species. Operators should also be aware that while formal section 7 consultation provides protection from incidental takings liability, informal consultation does not.

- **If not, proceed to check if you meet the requirements for Criterion F.**

effects analysis would have evaluated whether the various pollutants in the discharge (e.g., TSS, metals) would adversely affect listed species through exposure to the pollutants, or to their prey or habitat. Effects that look only at short-term effects unrelated to the stormwater discharge effects to listed species are not sufficient for these purposes.

☐ **E** **ESA Section 7 consultation has successfully concluded.** Consultation between a Federal Agency and the USFWS and/or NMFS under section 7 of the ESA has concluded. The consultation must have addressed the effects of the construction site's discharges and discharge-related activities on ESA-listed species and/or designated critical habitat under the jurisdiction of USFWS and/or NMFS. To certify eligibility under this criterion, **Indicate the result of the consultation**:

☐ Biological opinion and/or conference opinion and incidental take statement currently in effect currently in effect from USFWS and/or NMFS that concludes that the action in question (taking into account the effects of your site's discharges and discharge-related activities) is not likely to jeopardize the continued existence of ESA-listed species, nor the destruction or adverse modification of critical habitat;

Or

☐ Written concurrence from USFWS and/or NMFS with a finding that the site's discharges and discharge-related activities are not likely to adversely affect ESA-listed species and/or designated critical habitat.

E1. Identify the federal action agency or agencies involved:

E2. Identify the Service(s) field or regional offices providing the consultation:

E3. Identify any tracking numbers associated with the consultation (e.g., IPaC number, ECO number):

E4. What is the date the consultation was completed? (MM/DD/YYYY) __ __ / __ __ / __ __ __ __

E5. Check to confirm that correspondence with USFWS and/or NMFS documenting the Biological Opinion, conference opinion (IPaC or ECO tracking number) or concurrence is attached. Yes ☐

E6. Check to confirm you have provided documentation in your SWPPP supporting your eligibility under Criterion E, including copies of the correspondence between yourself and the Services. Yes ☐

Instructions

- **If you selected Criterion E above and answered questions E1-E6, you are done with this worksheet. If you are not filing electronically, you must submit this worksheet with your NOI.**
- If you are not eligible under Criterion E, proceed to check if you meet the requirements for Criterion F.

Criterion F Eligibility Requirements

If your construction activities are the subject of a permit under ESA section 10, and this authorization addresses the effects of your site's discharges and discharge-related activities on ESA-listed species and designated critical habitat in your action area, you may be eligible for coverage under Criterion F. In order to be eligible or coverage under Criterion F, **you must confirm that the following is true:**

☐ A permit or permits issued under section 10 of the ESA specifically address the effects of your facility's discharges and discharge-related activities (if applicable) on all federally-listed species and designated critical habitat in your action area.

Note: You must follow USFWS and/or NMFS procedures when applying for an ESA section 10 permit (see 50 CFR §17.22(b)(1) for USFWS and §222.22 for NMFS). Application instructions for section 10 permits can be obtained from http://www.fws.gov and http://www.nmfs.noaa.gov or by contacting the appropriate Service office.

Instructions

- **If the above is true, you may check Criterion F below and answer questions F1-F6.**
- If you are not eligible under criterion F, proceed to Step 2.

☐ **F** **Issuance of section 10 permit**. Potential take is authorized through the issuance of a permit under section 10 of the ESA by the USFWS and/or NMFS, and this authorization addresses the effects of the site's discharges and discharge-related activities on ESA-listed species and designated critical habitat. You must include copies of the correspondence between yourself and the participating agencies in your SWPPP and your NOI.

F1. Which Service provided the section 10 permit? (check all that apply)

USFWS ☐ NMFS ☐

F2. Identify the field or regional offices providing the permit(s):

F3. Identify any tracking numbers associated with the consultation (e.g., IPaC number, ECO number):

F4. What is the date the permit(s) was granted? (MM/DD/YYY) __ __ / __ __ / __ __ __ __
(2nd permit date, if applicable: __ __ / __ __ / __ __ __ __)

F5. Check to confirm that correspondence with USFWS and/or NMFS and a copy of the section 10 permit or relevant tracking number(s) (IPaC and/or ECO number) is attached. Yes ☐

F6. Check to confirm you have provided documentation in your SWPPP supporting your eligibility under Criterion F, including a copy of the section 10 permit and copies of the correspondence between yourself and the Services. Yes ☐

Instructions

- **If you selected Criterion F above and answered questions F1-F6, you are done with this worksheet. If you are not filing electronically, you must submit this worksheet with your NOI.**
- If you are not eligible under Criterion F, proceed to Step 2.

Step 2 – Determine if Listed Threatened or Endangered Species or their Designated Critical Habitat(s) are Likely to Occur in your Site's Action Area

Instructions

- **First, determine the extent of your action area.** You must determine whether species listed as either threatened or endangered, or their critical habitat(s) are located in your site's action area (i.e., all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action, including areas beyond the footprint of the site that are likely to be affected by stormwater discharges, discharge-related activities, and authorized non-stormwater discharges).

You must consider the following in determining the action area for your site, and **confirm that all the following are true**:

☐ In determining my "action area", I have considered that discharges of pollutants from the project site can expand the action area well beyond the footprint of my site and the discharge point(s). I have taken into account the controls I will be implementing to minimize pollutants and the receiving waterbody characteristics (e.g., perennial, intermittent, ephemeral) in determining the extent of physical, chemical, and/or biotic effects of the

discharges. I confirm that all receiving waterbodies that could receive pollutants from my site are included in my action area.

☐ In determining my "action area", I have considered that discharge-related activities must also be accounted for in determining my action area. I understand that discharge-related activities are any activities that cause, contribute to, or result in stormwater and authorized non-stormwater point source discharges, and measures such as the siting, construction, timing,[2] and operation of stormwater controls to control, reduce, or prevent pollutants from being discharged. I understand that any new or modified stormwater controls that will have noise or other similar effects, and any disturbances associated with construction of controls, are part of my action area.

If you have any questions about determining the extent of your action area, you may contact EPA or the Services for assistance. https://www.epa.gov/npdes/contact-us-stormwater#regional

Instructions

- **Next, you must identify, to the best of your ability, any species listed as either threatened or endangered, or their critical habitat(s), that are located in your site's action area (see definitions of these terms in Appendix A).** You must follow the instructions on the https://www.epa.gov/npdes/construction-general-permit-threatened-and-endangered-species to obtain lists of any ESA-protected species and/or critical habitat that are expected to exist in your county, township, or the receiving water for your discharge.
- If ESA-protected resources occur within your action area, keep a copy of the species and critical habitat list(s) from the Service(s) with your SWPPP and use the list(s) to complete your NOI. For USFWS species, attach to this worksheet the full printout from your IPaC query/Official Species List. You can include the map from your IPaC query. For NMFS species, attach to this worksheet the full printout of the report from your query of the mapping resource you used (either the National or Greater Atlantic Region Mapper). The printed report from NMFS mappers will include a map of your query.

[2] Timing considerations could be related to, for example, a time of the year where a migratory bird species is present in the action area and the operator might want to consider that in terms of their construction sequencing; there are other times of the year where this consideration might not be relevant.

Instructions

- **After completing Step 2 above, if there are <u>no</u> listed species and <u>no</u> critical habitat areas in your action area,** you may be eligible for criterion A.

Criterion A Eligibility Requirements

In order to be eligible for coverage under criterion A, you must confirm that all the following are true (**check all that apply**):

☐ I confirm that I have used the species location resources of **BOTH** NMFS and USFWS to identify any ESA-listed species within my action area.

☐ I have confirmed there to be no ESA-listed species and no critical habitat in my action area.

Instructions

- **If all of the above are true, you may check criterion A below and answer questions A1-A5.** 
- **If any of the above is not true, you may not select criterion A and must proceed to Step 3** to determine if you can become eligible under criterion C.

Note: For existing dischargers that have previously obtained coverage under criterion A, you must verify whether ESA-protected species and/or critical habitat are expected to exist in your action area, as described above. Please note that if you now find that your action area overlaps with ESA-protected species or critical habitat, you must proceed to Step 3.

☐ **A <u>No ESA-listed species and/or designated critical habitat present in action area</u>**. You certify that ESA-listed species and designated critical habitat(s) under the jurisdiction of the USFWS or NMFS are not likely to occur in your site's "action area" as defined in Appendix A of this permit.. *Please Note: NMFS' jurisdiction includes ESA-listed marine and estuarine species that spawn in inland rivers.*

A1. USFWS information sources used (reliance on State resources is not acceptable):

Note: If your Official Species List from USFWS indicated no species or critical habitat were present in your action area, include the full consultation tracking code at the top of your Official Species List in your NOI in the basis statement for Criterion A. If an Official Species List was not available on IPaC, list the contact date and name of the Service staff with whom you corresponded to verify no USFWS species or critical habitat were present in your action area.

A2. NMFS information sources used (reliance on State resources is not acceptable):

A3. I confirm that aerial image(s) of the site is attached. Yes ☐

A4. I confirm that a printout of the species' list(s) showing no ESA-listed species or critical habitat in my action area is attached. Yes ☐

A5. Check to confirm you have provided documentation in your SWPPP supporting your eligibility under Criterion A. For USFWS species, include the full printout from your IPaC query/Official Species List. You can include the map from your IPaC query. For NMFS species, include the full printout from the appropriate NMFS website resources on page X with the correct Region selected. Yes ☐

Instructions

- **If you selected Criterion A above and answered questions A1-A5, you are done with this worksheet. If you are not filing electronically, you must submit this worksheet with your NOI.**



- **If listed species and/or critical habitat may exist in your action area, you must do one or more of the following**:



  - **Conduct visual inspections.** This method may be particularly suitable for construction sites that are smaller in size or located in non-natural settings such as highly urbanized areas or industrial parks where there is little or no natural habitat, or for construction activities that discharge directly into municipal stormwater collection systems.
  - **Conduct a formal biological survey**. In some cases, particularly for larger construction sites with extensive stormwater discharges, biological surveys may be an appropriate way to assess whether species are located in the action area and whether there are likely to be short- or long-term adverse effects to such species. Biological surveys are frequently performed by environmental consulting firms.
  - **If required, conduct an environmental assessment under the National Environmental Policy Act (NEPA).** Some construction activities might require review under NEPA for specific reasons, such as Federal funding or other Federal involvement in the project. Note: Coverage under the CGP does not trigger such a review for individual projects/sites. EPA has complied with NEPA in the issuance of the CGP.

    and

  - **Follow the instructions in Steps 3 – 5 below, as applicable.** Note that many but not all measures imposed to protect listed species under these steps will also protect critical habitat. Thus, meeting the eligibility requirements of this CGP may require measures to protect critical habitat that are separate from those to protect listed species.

Step 3 – Assess if the Construction Activity's Discharges or Discharge-Related Activities Are Likely to Result in Short- or Long-Term Adverse Effects to Listed Threatened or Endangered Species or Designated Critical Habitat

Instructions

- If in Step 2 you identified that listed species and/or designated critical habitat could exist in your action area**, you must next assess whether your discharges or discharge-related activities are likely to result in short- or long-term adverse effects to ESA-listed threatened or endangered species or designated critical habitat**.

Potential short- or long-term adverse effects from discharges and discharge-related activities include:

- **Hydrological**. Stormwater discharges may cause siltation, sedimentation, or induce other changes in receiving waters such as temperature, salinity, or pH. These effects will vary with the amount of stormwater discharged and the volume and condition of the receiving water. Where a stormwater discharge constitutes a minute portion of the total volume of the receiving water, adverse hydrological effects are less likely. Construction activity itself may also alter drainage patterns on a site where construction occurs that can impact listed species or critical habitat.
- **Habitat**. Excavation, site development, grading, and other surface disturbance activities from construction activities, including the installation or placement of stormwater controls, may result in adverse effects to listed species or their habitat. Stormwater may drain or inundate listed species habitat.
- **Toxicity**. In some cases, pollutants in construction stormwater may have toxic effects on listed species. For example: Stormwater discharges from construction on or adjacent to agricultural property may contain pesticides. Stormwater discharges from projects involving pavement and roofing could include tar and asphalt.

The scope of effects to consider will vary with each site. If you are having difficulty determining whether your project is likely to result in short- or long-term adverse effects to listed species or critical habitat, or one of the Services has already raised concerns to you, you should contact the appropriate Services office for assistance.

Instructions

- **If any short- or long-term adverse effects to listed threatened or endangered species or their critical habitat <u>are not</u> likely, then you may check Criterion C below and answer questions C1-C8.**
- **If any short- or long-term adverse effects to listed threatened or endangered species or their critical habitat <u>are</u> likely, you must follow Step 4 below.** You may still be eligible for Criterion C if you are able to install and implement appropriate measures to avoid the likelihood of adverse effects.

Criterion C Eligibility Requirements

☐ **C** **Discharges not likely to result in any short- or long-term adverse effects to ESA-listed species and/or designated critical habitat.** ESA-listed species and/or designated critical habitat(s) under the jurisdiction of the USFWS and/or NMFS are likely to occur in or near your site's "action area," and you certify to EPA that your site's discharges and discharge-related activities are not likely to result in any short- or long-term adverse effects to ESA-listed threatened or endangered species and/or designated critical habitat. This certification may include consideration of any stormwater controls and/or management practices you will adopt to ensure that your discharges and discharge-related activities are not likely to result in any short- or long-term adverse effects to ESA-listed species and/or designated critical habitat. To certify your eligibility under this criterion, you must indicate below1) the ESA-listed species and/or designated habitat located in your "action area" using the process outlined in this Appendix; 2) the distance between the site and the listed species and/or designated critical habitat in the action area (in miles); and 3) a rationale describing specifically how short- or long-term adverse effects to ESA-listed species will be avoided from the discharges and discharge-related activities. You must also include a copy of your site map from your SWPPP showing the upland and in-water extent of your "action area" with your NOI.

C1. I confirm that both ESA-listed species and designated critical habitat under the jurisdiction of the USFWS and/or NMFS were considered in my evaluation. Yes ☐

C2. Provide the USFWS information resources and expertise used to arrive at this criterion selection:

C3. Provide the NMFS information resources and expertise used to arrive at this criterion selection:

C4. What ESA-listed species and/or designated critical habitat are located in your "action area?" (or attach a printout of the species' list(s))

C5. What is the distance between your site and the ESA-listed species and/or designated critical habitat within the action area (in miles, state "on site" if the ESA-listed species and/or designated critical habitat is within the area to be disturbed)? _____

C6. Provide the rationale describing specifically how any short- or long-term adverse effects to ESA-listed species will be avoided from the discharge and discharge-related activities.

C7. I confirm that a site map from my SWPPP showing the upland and in-water extent of my "action area" is attached. Yes ☐

C8. Check to confirm you have provided documentation in your SWPPP supporting your eligibility under Criterion C. Yes ☐

Instructions

- **If you selected Criterion C above and answered questions C1-C8, you are done with this worksheet. If you are not filing electronically, you must submit this worksheet with your NOI.** 

- If not, please proceed to step 4. 

Step 4 - Determine if Measures Can Be Implemented to Avoid Adverse Effects

Instructions

If you make a preliminary decision in Step 3 that short- or long-term adverse effects from your construction activity's discharges or discharge-related activities are likely to occur, you can still receive coverage under eligibility Criterion C of the CGP if appropriate measures are undertaken to avoid or eliminate the likelihood of short- or long-term adverse effects prior to applying for CGP coverage.

These measures may involve relatively simple changes to construction activities such as re-routing a stormwater discharge to bypass an area where species are located, relocating stormwater controls, or by modifying the "footprint" of the construction activity. If you are unable to ascertain which measures to implement to avoid the likelihood of short- or long-term adverse effects, you must coordinate with USFWS and/or NMFS, in which case you would not be eligible for coverage under eligibility Criterion C, but may instead be eligible for coverage under eligibility criterion D (described in more detail in Step 5).

- **If you are able to install and implement appropriate measures to avoid the likelihood of short- or long-term adverse effects, then <u>you</u> <u>may go back</u> and check eligibility Criterion C above and answer questions C1-C8 above, <u>and</u> C9-C10 below.** The measures you adopt to avoid or eliminate short- or long-term adverse effects must be implemented for the duration of the construction project and your coverage under the CGP.
- **If you cannot ascertain which measures to implement to avoid the likelihood of adverse effects,** you must follow the procedures in Step 5.

C9. I confirm that I have or will install and implement appropriate measures to avoid the likelihood of any short- or long-term adverse effects to ESA-listed threatened or endangered species or their critical habitat. Yes ☐

C10. Provide a description of the measures installed/to be installed and implemented to avoid likelihood of any short- or long-term adverse effects.

Instructions

- **If you selected Criterion C above and answered questions C1-C10, you are done with this worksheet. If you are not filing you NOI electronically, you must submit this worksheet with your NOI.**
- If you are not eligible for Criterion C, please proceed to step 5.

Step 5 - Determine if the Eligibility Requirements of Criterion D Can Be Met

Instructions

- If in Step 4 you cannot ascertain which measures to implement to avoid the likelihood of short- or long-term adverse effects, you must contact USFWS and/or NMFS. You may still be eligible for CGP coverage if likely adverse effects can be addressed through meeting criterion D.
- If you meet the requirements of criterion D, **then you may check criterion D below and answer questions D1-D5.**

Criterion D Eligibility Requirements

☐ **D** **Coordination with USFWS and/or NMFS has successfully concluded.** Coordination between you and the USFWS and/or NMFS has concluded. The coordination must have addressed the effects of your site's discharges and discharge-related activities on ESA-listed species and/or designated critical habitat under the jurisdiction of USFWS and/or NMFS, and resulted in a written confirmation from USFWS and/or NMFS that the effects of your site's discharges and discharge-related activities are not likely to result in short- or long-term adverse effects for ESA-listed species and/or designated critical habitat in your action area. By certifying eligibility under this criterion, you agree to comply with any conditions you must meet for your site's discharges and discharge-related activities to not likely result in any short- or long-term adverse effects. You must include copies of the correspondence with the participating agencies in your SWPPP and your NOI.

D1. Which Service participated in coordination? (check all that apply) USFWS ☐ NMFS ☐

D2. Identify the field and/or regional office(s) that provided the coordination?

D3. What is the date the coordination concluded? (MM/DD/YYY) __ __ / __ __ / __ __ __ __

D4. Check to confirm that correspondence with USFWS and/or NMFS documenting concurrence is attached. Yes ☐

D5. Check to confirm you have provided documentation in your SWPPP supporting your eligibility under Criterion D, including copies of the correspondence between yourself and the Services. Yes ☐

Instructions

- **If you selected Criterion D above and answered questions D1-D5, you are done with this worksheet. If you are not filing electronically, you must submit this worksheet with your NOI.** 

Paperwork Reduction Act Notice

This collection of information is approved by OMB under the Paperwork Reduction Act, 44 U.S.C. 3501 et seq. (OMB Control No. 2040-0305). Responses to this collection of information are mandatory (40 CFR 122.26). An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The public reporting and recordkeeping burden for this collection of information is estimated to be 3.3 hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates and any suggested methods for minimizing respondent burden to the Regulatory Support Division Director, U.S. Environmental Protection Agency (2821T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

Appendix E – Historic Property Screening Process

Background

Section 106 of the National Historic Preservation Act (NHPA) requires Federal agencies to take into account the effects of Federal "undertakings", such as the issuance of this permit, on historic properties that are either listed on, or eligible for listing on, the National Register of Historic Places. To address any issues relating to historic properties in connection with the issuance of this permit, EPA developed the screening process in this appendix that enables construction operators to appropriately consider the potential impacts, if any, of their installation of stormwater controls on historic properties and to determine whether actions can be taken, if applicable, to mitigate any such impacts. Although the coverages of individual construction sites under this permit do not constitute separate Federal undertakings, the screening process in this appendix provides an appropriate site-specific means of addressing historic property issues in connection with EPA's issuance of the permit.

Key Terms

Historic property- prehistoric or historic districts, sites, buildings, structures, or objects that are included in or eligible for inclusion in the National Register of Historic Places, including artifacts, records, and remains that are related to and located within such properties

SHPO – The State Historic Preservation Officer for a particular State

THPO or Tribal representative – The Tribal Historic Preservation Officer for a particular Tribe or, if there is no THPO, the representative designated by such Tribe for NHPA purposes

Instructions for All Construction Operators

You are required to follow the screening process in this appendix to determine if your installation of stormwater controls on your site has the potential to cause effects to historic properties, and whether or not you need to contact your SHPO, THPO, or other Tribal representative for further information. **You may not submit your NOI until you have completed this screening process.** The following four steps describe how applicants can meet the historic property requirements under this permit:

Step 1 *Are you installing any stormwater controls that require subsurface earth disturbance?*[1]

The first step of the screening process is to determine if you will install stormwater controls that cause subsurface earth disturbance. The installation of the following types of stormwater controls require subsurface earth disturbance:[2]

- Dikes
- Berms
- Catch Basins
- Ponds
- Ditches
- Trenches
- Culverts
- Channels

[1] You are only required to consider earth-disturbing activities related to the installation of stormwater controls in the NHPA screening process. You are not reqired to consider other earth-disturbing activities at the site. If you are installing one of the above stormwater controls or another type of control that requires subsurface earth disturbance, your stormwater controls have the potential to have an effect on historic properties. If this is the case, then you must proceed to Step 2.

[2] This list is not intended to be exhaustive. Other stormwater controls that are not on this list may involve earth-disturbing activities and must also be examined for the potential to affect historic properties.

- Perimeter Drains
- Swales

If you are not installing one of the above stormwater controls or another type of control that requires subsurface earth disturbance, then you may indicate this on your NOI, and no further screening is necessary. During the 14-day waiting period after submitting your NOI, the SHPO, THPO, or other Tribal representative may request that EPA hold up authorization based on concerns about potential adverse effects to historic properties. EPA will evaluate any such request and notify you if any additional controls to address adverse effects to historic properties are necessary.

Step 2 *Have prior professional cultural resource surveys or other evaluations determined that historic properties do not exist, or have prior disturbances precluded the existence of historic properties?*

If you are installing a stormwater control that requires subsurface earth disturbance, you must next determine if no historic properties exist on your site based on prior professional cultural resource surveys or other evaluations, or if the existence of historic properties has been precluded because of prior earth disturbances.

If prior to your project it has already been determined that no historic properties exist at your site based on available information, including information that may be provided by your applicable SHPO, THPO, or other Tribal representative, then you may indicate this on your NOI, and no further screening steps are necessary. Similarly, if prior earth disturbances have eliminated the possibility that historic properties exist on your site, you may indicate this on your NOI, and no further screening steps are necessary. After submitting your NOI, and during the 14-day waiting period, the SHPO, THPO, or other Tribal representative may request that EPA hold up authorization based on concerns about potential adverse effects to historic properties. EPA will evaluate any such request and notify you if any additional measures to address adverse effects to historic properties are necessary.

If neither of these circumstances exists for your project, you must proceed to Step 3.

Step 3 *If you are installing any stormwater controls that require subsurface earth disturbance, you must determine if these activities will have an effect on historic properties.*

If your answer to the question in Step 2 is "no", then you must assess whether your earth-disturbing activities related to the installation of stormwater controls will have an effect on historic properties. This assessment may be based on historical sources, knowledge of the area, an assessment of the types of earth-disturbing activities you are engaging in, considerations of any controls and/or management practices you will adopt to ensure that your stormwater control-related earth-disturbing activities will not have an effect on historic properties, and any other relevant factors. If you determine based on this assessment that earth disturbances related to the installation of your stormwater controls will have no effect on historic properties, you may indicate this on your NOI, and document the basis for your determination in your SWPPP, and no further screening steps are necessary. After submitting your NOI, and during the 14-day waiting period, the SHPO, THPO, or other Tribal representative may request that EPA hold up authorization based on concerns about potential adverse effects to historic properties. EPA will evaluate any such request and notify you if any further processes are necessary including any additional measures to address adverse effects to historic properties are necessary.

If none of the circumstances in Steps 1 - 3 exist for your project, you must proceed to Step 4.

Step 4: *If you are installing any stormwater controls that require subsurface earth disturbance and you have not satisfied the conditions in Steps 1 - 3, you must contact and consult with the appropriate historic preservation authorities.*

Where you are installing stormwater controls that require subsurface earth disturbance, and you cannot determine in Step 3 that these activities will have no effect on historic properties, then you must contact the relevant SHPO, THPO, or other Tribal representative to request their views as to the likelihood that historic properties are potentially present on your site and may be impacted by the installation of these controls.

> *Note: Addresses for SHPOs may be found at https://ncshpo.org/directory/, and addresses for THPOs may be found at https://grantsdev.cr.nps.gov/THPO_Review/index.cfm. If a Tribe does not have a THPO, you should contact the appropriate Tribal government office designated by the Tribe for this purpose.*

You must submit the following minimum information in order to properly initiate your request for information:

1. Project name (*i.e.*, the name or title most commonly associated with your project);
2. A narrative description of the project;
3. Name, address, phone and fax number, and email address (if available) of the operator;
4. Most recent U.S. Geological Survey (USGS) map section (7.5 minute quadrangle) showing actual project location and boundaries clearly indicated; and
5. Sections of the SWPPP site map (see Part 7.2.4) that show locations where stormwater controls that will cause subsurface earth disturbance will be installed (see Step 1).

Without submitting this minimum information, you will not have been considered to have properly initiated your request. You will need to provide the SHPO, THPO, or other Tribal representative **a minimum of 15 calendar days** after they receive these materials to respond to your request for information about your project.

If you do not receive a response within 15 calendar days after receipt by the SHPO, THPO, or other Tribal representative of your request, then you may indicate this on your NOI, and no further screening steps are necessary. Or, if the applicable SHPO, THPO, or other Tribal representative responds to your request with an indication that no historic properties will be affected by the installation of stormwater controls at your site, then you may indicate this on your NOI, and no further screening steps are necessary. After submitting your NOI, and during the 14-day waiting period, the SHPO, THPO, or other Tribal representative may request that EPA hold up authorization based on concerns about potential adverse effects to historic properties. EPA will evaluate any such request and notify you if any further processes are necessary including any additional measures to address adverse effects to historic properties are necessary.

If within 15 calendar days of receipt of your request the applicable SHPO, THPO, or other Tribal representative responds with a request for additional information or for further consultation regarding appropriate measures for treatment or mitigation of effects on historic properties caused by the installation of stormwater controls on your site, you must comply with this request and proceed to Step 5.

Step 5: *Consultation with applicable consulting parties.*

If, following your discussions with the appropriate historic preservation authorities in Step 4, the applicable SHPO, THPO, Tribal representative, or any other consulting party requests additional information or further consultation, you must respond with such information or consult to determine impacts to historic properties that may be caused by the installation of stormwater controls on your site and appropriate measures for treatment or mitigation of such impacts. If as a result of your discussions with the applicable SHPO, THPO, Tribal representative, or any other

consulting party, you enter into, and comply with, a written agreement regarding treatment and/or mitigation of impacts on your site, then you may indicate this on your NOI, and no further screening steps are necessary.

If, however, agreement on an appropriate treatment or mitigation plan cannot be reached between you and the SHPO, THPO, Tribal representative, or any other consulting party within 30 days of your response to the SHPO, THPO, Tribal representative, or any other consulting party's request for additional information or further consultation, you may submit your NOI, but you must indicate that you have not negotiated measures to avoid or mitigate such effects. You must also include in your SWPPP the following documentation:

1. Copies of any written correspondence between you and the SHPO, THPO, Tribal representative, or any other consulting party; and
2. A description of any significant remaining disagreements as to mitigation measures between you and the SHPO, THPO, Tribal representative, or any other consulting party.

After submitting your NOI, and during the 14-day waiting period, the SHPO, THPO, ACHP, Tribal representative, or any other consulting party may request that EPA place a hold on authorization based upon concerns regarding potential adverse effects to historic properties. EPA, in coordination with the ACHP, will evaluate any such request and notify you if any further processes are necessary including any additional measures to address adverse effects to historic properties are necessary.

Appendix F – Buffer Requirements.

The purpose of this appendix is to assist you in complying with the requirements in Part 2.2.1 of the permit regarding the establishment of natural buffers and/or equivalent sediment controls. This appendix is organized as follows:

F.1 SITES THAT ARE REQUIRED TO PROVIDE AND MAINTAIN NATURAL BUFFERS AND/OR EQUIVALENT EROSION AND SEDIMENT CONTROLS 2
F.2 COMPLIANCE ALTERNATIVES AND EXCEPTIONS 3
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F.1 SITES THAT ARE REQUIRED TO PROVIDE AND MAINTAIN NATURAL BUFFERS AND/OR EQUIVALENT EROSION AND SEDIMENT CONTROLS

The requirement in Part 2.2.1 to provide and maintain natural buffers and/or equivalent erosion and sediment controls applies for any discharges to waters of the U.S. located within 50 feet of your site's earth disturbances. If the receiving water is not located within 50 feet of earth-disturbing activities, Part 2.2.1 does not apply. See Figure F – 1.

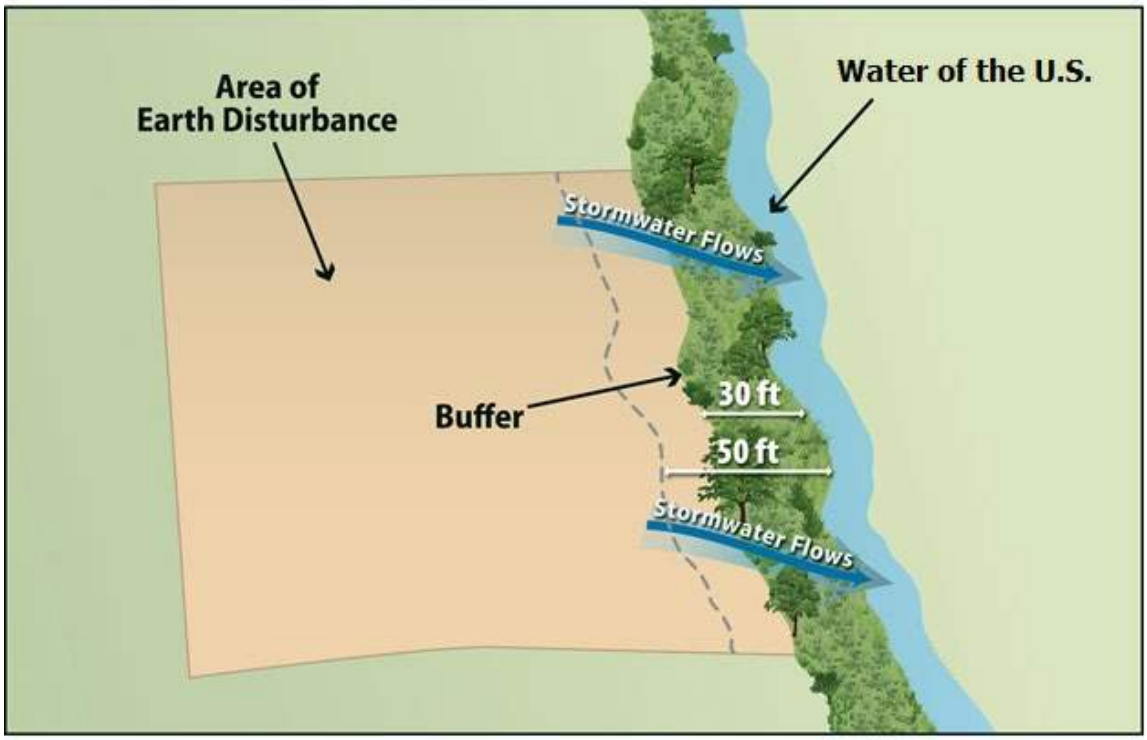


Figure F-1 Example of earth-disturbing activities within 50 feet of a water of the U.S.

F.2 COMPLIANCE ALTERNATIVES AND EXCEPTIONS

F.2.1 Compliance Alternatives

If Part 2.2.1 applies to your site, you have three compliance alternatives from which you can choose, unless you qualify for any of the exceptions (see below and Part 2.2.1.a):

1. Provide and maintain a 50-foot undisturbed natural buffer; or
2. Provide and maintain an undisturbed natural buffer that is less than 50 feet and is supplemented by erosion and sediment controls that achieve the sediment load reduction equivalent to a 50-foot undisturbed natural buffer; or
3. If infeasible to provide and maintain an undisturbed natural buffer of any size, implement erosion and sediment controls to achieve the sediment load reduction equivalent to a 50-foot undisturbed natural buffer.

The compliance alternative selected must be maintained throughout the duration of permit coverage.

See Part F.2.2 below for exceptions to the compliance alternatives.

See Part F.2.3 for requirements applicable to providing and maintaining natural buffers under compliance alternatives 1 and 2 above.

See Part F.2.4 for requirements applicable to providing erosion and sediment controls that achieve the sediment load reduction equivalent to a 50-foot undisturbed natural buffer under compliance alternatives 2 and 3 above.

F.2.2 Exceptions to the Compliance Alternatives

The following exceptions apply to the requirement to implement one of the Part 2.2.1.a compliance alternatives (see also Part 2.2.1.b):

- The following disturbances are exempt from the requirements Part 2.2.1 and this Appendix[1]:
  - Construction approved under a CWA Section 404 permit; or
  - Construction of a water-dependent structure or water access areas *(e.g., pier, boat ramp, trail)*.
- If there is no discharge of stormwater to waters of the U.S. through the area between the disturbed portions of the site and any waters of the U.S. located within 50 feet of your site, you are not required to comply with the requirements in Part 2.2.1 and this Appendix. This includes situations where you have implemented controls measures, such as a berm or other barrier, that will prevent such discharges.
- Where no natural buffer exists due to preexisting development disturbances *(e.g., structures, impervious surfaces)* that occurred prior to the initiation of planning for the current development of the site, you are not required to comply with the requirements in Part 2.2.1 and this Appendix.
  Where some natural buffer exists but portions of the area within 50 feet of the receiving water are occupied by preexisting development disturbances, you are

[1] This exemption does not apply, however, to disturbances within 50 feet of a receiving water that are adjacent to the disturbances listed here (i.e., construction permitted under CWA Section 404, or construction of a water-dependent structure or water access area) and that are covered by this permit.

required to comply with the requirements in Part 2.2.1 and this Appendix. For the purposes of calculating the sediment load reduction for either compliance alternative 2 or 3, you are not expected to compensate for the reduction in buffer function that would have resulted from the area covered by these preexisting disturbances. Clarity about how to implement the compliance alternatives for these situations is provided in F.2.3 and F.2.4 below.

If during your project, you will disturb any portion of these preexisting disturbances, the area removed will be deducted from the area treated as a "natural buffer."

- For "linear construction sites" (see Appendix A), you are not required to comply with this requirement if site constraints *(e.g., limited right-of-way)* make it infeasible to implement one of the Part 2.2.1.a compliance alternatives, provided that, to the extent feasible, you limit disturbances within 50 feet of any waters of the U.S. and/or you provide supplemental erosion and sediment controls to treat stormwater discharges from earth disturbances within 50 feet of the receiving water You must also document in your SWPPP your rationale for why it is infeasible for you to implement one of the Part 2.2.1.a compliance alternatives, and describe any buffer width retained and supplemental erosion and sediment controls installed.
- For "small residential lot" construction *(i.e., a lot being developed for residential purposes that will disturb less than 1 acre of land, but is part of a larger residential project that will ultimately disturb greater than or equal to 1 acre),* you have the option of complying with one of the "small residential lot" compliance alternatives in Part F.3 of this appendix.

Note that you must document in your SWPPP if any disturbances related to any of the above exceptions occurs within the buffer area on your site.

F.2.3 Requirements for Providing and Maintaining Natural Buffers

This part of the appendix applies to you if you choose compliance alternative 1 (50-foot buffer), compliance alternative 2 (a buffer of < 50 feet supplemented by additional erosion and sediment controls that achieve the equivalent sediment load reduction as the 50-foot buffer), or if you are providing a buffer in compliance with one of the "small residential lot" compliance alternatives in Part F.3.

Buffer Width Measurement

Where you are retaining a buffer of any size, the buffer should be measured perpendicularly from any of the following points, whichever is further landward from the water:

1. The ordinary high water mark of the water body, defined as the line on the shore established by fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, and/or the presence of litter and debris; or
2. The edge of the stream or river bank, bluff, or cliff, whichever is applicable.

Refer to Figures F – 2 and F - 3. You may find that specifically measuring these points is challenging if the flow path of the receiving water changes frequently, thereby causing the measurement line for the buffer to fluctuate continuously along the path of the waterbody. Where this is the case, EPA suggests that rather than measuring each change or deviation along the water's edge, it may be easier to select regular intervals

from which to conduct your measurement. For instance, you may elect to conduct your buffer measurement every 5 to 10 feet along the length of the water.

Additionally, note that if earth-disturbing activities will take place on both sides of a receiving water that flows through your site, to the extent that you are establishing a buffer around this water, it must be established on both sides. For example, if you choose compliance alternative 1, and your project calls for disturbances on both sides of a small stream, you would need to retain the full 50 feet of buffer on both sides of the water. However, if your construction activities will only occur on one side of the stream, you would only need to retain the 50-foot buffer on the side of the stream where the earth-disturbance will occur.

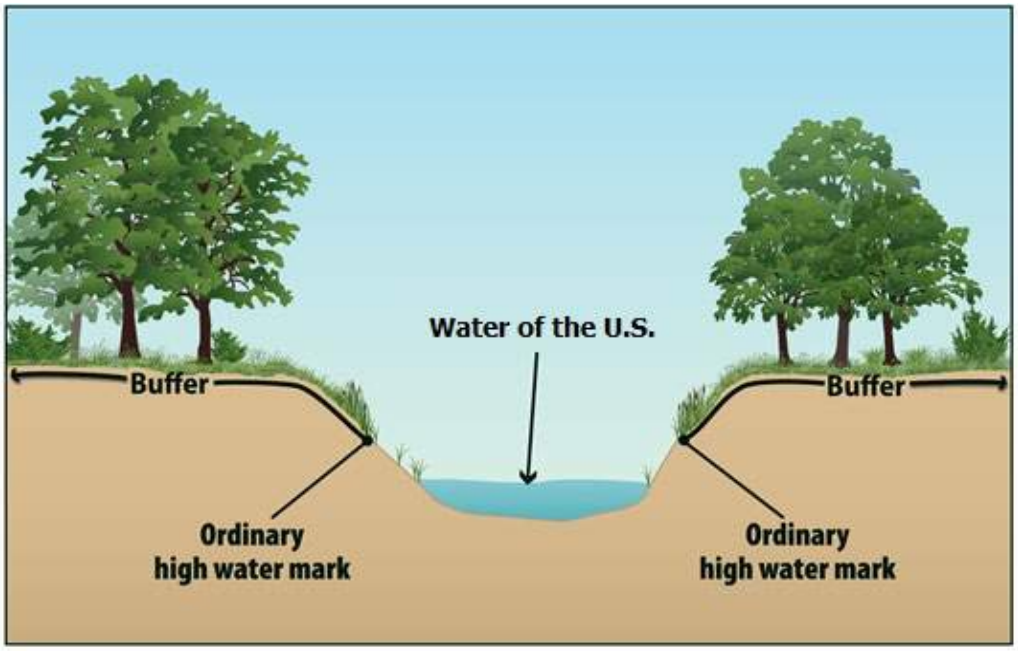


Figure F-2 Buffer measurement from the ordinary high water mark of the water body, as indicated by a clear natural line impressed on the bank, shelving, changes in the character of the soil, destruction of terrestrial vegetation, and/or the presence of litter/debris.

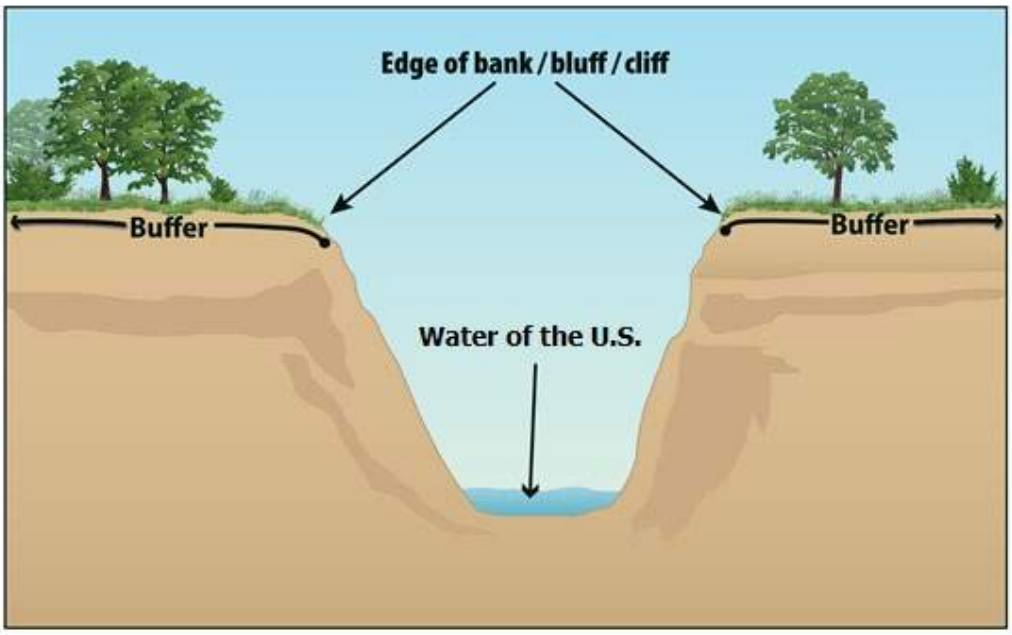


Figure F-3 Buffer measurement from the edge of the bank, bluff, or cliff, whichever is applicable.

Limits to Disturbance Within the Buffer

You are considered to be in compliance with the requirement to provide and maintain a natural buffer if you retain and protect from construction activities the natural buffer that existed prior to the commencement of construction. If the buffer area contains no vegetation prior to the commencement of construction (e.g., sand or rocky surface), you are not required to plant vegetation. As noted above, any preexisting structures or impervious surfaces may occur in the natural buffer provided you retain and protect from disturbance the buffer areas outside of the preexisting disturbance.

To ensure that the water quality protection benefits of the buffer are retained during construction, you are prohibited from conducting any earth-disturbing activities within the buffer during permit coverage. In furtherance of this requirement, **prior to commencing earth-disturbing activities on your site, you must delineate, and clearly mark off, with flags, tape, or a similar marking device, the buffer area on your site.** The purpose of this requirement is to make the buffer area clearly visible to the people working on your site so that unintended disturbances are avoided.

While you are not required to enhance the quality of the vegetation that already exists within the buffer, you are encouraged to do so where such improvements will enhance the water quality protection benefits of the buffer. (Note that any disturbances within the buffer related to buffer enhancement are permitted and do not constitute construction disturbances.) For instance, you may want to target plantings where limited vegetation exists, or replace existing vegetation where invasive or noxious plant species (see http://plants.usda.gov/java/noxiousDriver) have taken over. In the case of invasive or noxious species, you may want to remove and replace them with a diversity of native trees, shrubs, and herbaceous plants that are well-adapted to the climatic, soil, and hydrologic conditions on the site. You are also encouraged to limit the removal of naturally deposited leaf litter, woody debris, and other biomass, as this material contributes to the ability of the buffer to retain water and filter pollutants.

If a portion of the buffer area adjacent to the receiving water is owned by another party and is not under your control, you are only required to retain and protect from construction activities the portion of the buffer area that is under your control. For example, if you comply with compliance alternative 1 (provide and maintain a 50-foot buffer), but 10 feet of land immediately adjacent to the receiving water is owned by a different party than the land on which your construction activities are taking place and you do not have control over that land, you must only retain and protect from construction activities the 40-foot buffer area that occurs adjacent to the property on which your construction activities are taking place. EPA would consider you to be in compliance with this requirement regardless of the activities that are taking place in the 10-foot area that is owned by a different party than the land on which your construction activities are taking place that you have no control over.

Discharges to the Buffer

You must ensure that all discharges from the area of earth disturbance to the natural buffer are first treated by the site's erosion and sediment controls (*for example, you must comply with the Part 2.2.3 requirement to install sediment controls along any perimeter areas of the site that will receive pollutant discharges*), **and if necessary to prevent erosion caused by stormwater flows within the buffer, you must use velocity dissipation devices**. The purpose of this requirement is to decrease the rate of stormwater flow and encourage infiltration so that the pollutant filtering functions of the buffer will be achieved. To comply with this requirement, construction operators typically will use devices that physically dissipate stormwater flows so that the discharge entering the buffer is spread out and slowed down.

SWPPP Documentation

You are required to document in your SWPPP the natural buffer width that is retained. For example, if you are complying with alternative 1, you must specify in your SWPPP that you are providing a 50-foot buffer. Or, if you will be complying with alternative 2, you must document the reduced width of the buffer you will be retaining (and you must also describe the erosion and sediment controls you will use to achieve an equivalent sediment reduction, as required in Part F.2.4 below). Note that you must also show any buffers on your site map in your SWPPP consistent with Part 7.2.4.j. Additionally, if any disturbances related to the exceptions in Part F.2.2 occur within the buffer area, you must document this in the SWPPP.

F.2.4 Guidance for Providing the Equivalent Sediment Reduction as a 50-foot Buffer

This part of the appendix applies to you if you choose compliance alternative 2 (provide and maintain a buffer that is less than 50 feet that is supplemented by erosion and sediment controls that achieve the sediment load reduction equivalent to a 50-foot buffer) or compliance alternative 3 (implement erosion and sediment controls to achieve the sediment load reduction equivalent to a 50-foot buffer).

Determine Whether it is Feasible to Provide a Reduced Buffer

EPA recognizes that there will be a number of situations in which it will be infeasible to provide and maintain a buffer of any width. While some of these situations may exempt you from the buffer requirement entirely (see F.2.2), if you do not qualify for one of these exemptions, there still may be conditions or circumstances at your site that make it infeasible to provide a natural buffer. For example, there may be sites where a significant portion of the property on which the earth-disturbing activities will occur is located within the buffer area, thereby precluding the retention of natural buffer areas.

Therefore, you should choose compliance alternative 2 if it is feasible for you to retain some natural buffer on your site. (Note: For any buffer width retained, you are required to comply with the requirements in Part F.2.3, above, concerning the retention of vegetation and restricting earth disturbances.) Similarly, if you determine that it is infeasible to provide a natural buffer of any size during construction, you should choose alternative 3.

Design Controls That Provide Equivalent Sediment Reduction as 50-foot Buffer

You must next determine what additional controls must be implemented on your site that, alone or in combination with any retained natural buffer, achieve a reduction in sediment equivalent to that achieved by a 50-foot buffer.

Note that if only a portion of the natural buffer is less than 50 feet, you are only required to implement erosion and sediment controls that achieve the sediment load reduction equivalent to the 50-foot buffer for discharges through that area. You would not be required to provide additional treatment of stormwater discharges that flow through 50 feet or more of natural buffer. See Figure F-4.

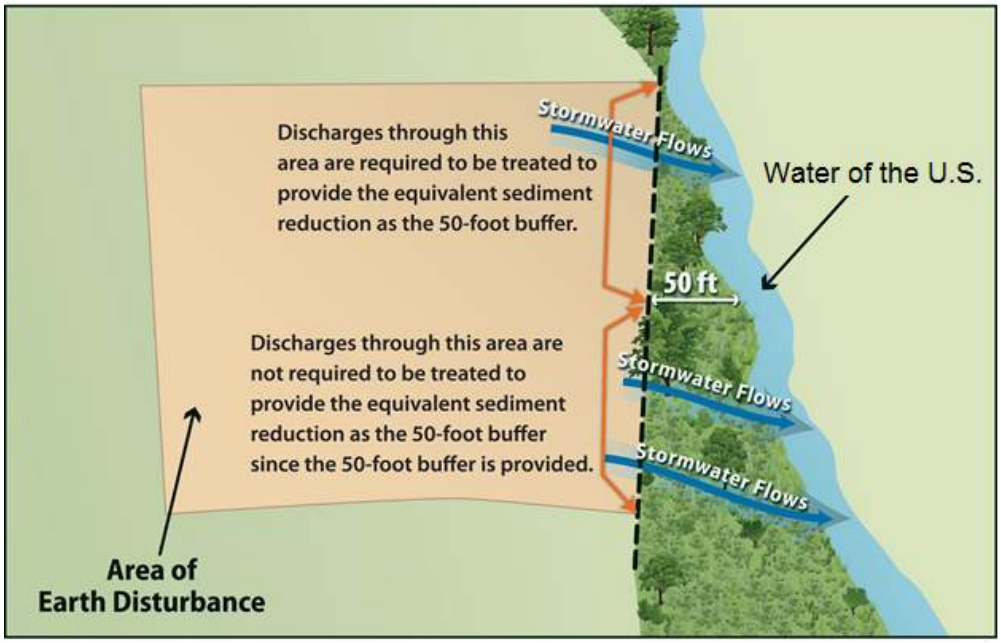


Figure F-4 Example of how to comply with the requirement to provide the equivalent sediment reduction when only a portion of your earth-disturbances discharge to a buffer of less than 50-feet.

Steps to help you meet compliance alternative 2 and 3 requirements are provided below.

Step 1 - Estimate the Sediment Reduction from the 50-foot Buffer

In order to design controls that match the sediment removal efficiency of a 50-foot buffer, you first need to know what this efficiency is for your site. The sediment removal efficiencies of natural buffers vary according to a number of site-specific factors, including precipitation, soil type, land cover, slope length, width, steepness, and the types of erosion and sediment controls used to reduce the discharge of sediment prior to the buffer. EPA has simplified this calculation by developing buffer performance tables covering a range of vegetation and soil types for the areas covered by the CGP. See

Attachment 1 of this Appendix, Tables F-8 through F-15. Note: buffer performance values in Tables F-8 through F-15 represent the percent of sediment captured through the use of perimeter controls (e.g., silt fences) and 50-foot buffers at disturbed sites of fixed proportions and slopes.[2]

Using Tables F-8 through F-15 (see Attachment 1 of this Appendix), you can determine the sediment removal efficiency of a 50-foot buffer for your geographic area by matching the vegetative cover type that best describes your buffer area and the type of soils that predominate at your site. For example, if your site is located in Massachusetts (Table F-9), and your buffer vegetation corresponds most closely with that of tall fescue grass, and the soil type at your site is best typified as sand, your site's sediment removal efficiency would be 81 percent.

In this step, you should choose the vegetation type in the tables that most closely matches the vegetation that would exist naturally in the buffer area on your site regardless of the condition of the buffer. However, because you are not required to plant any additional vegetation in the buffer area, in determining what controls are necessary to meet this sediment removal equivalency in Step 2 below, you will be able to take credit for this area as a fully vegetated "natural buffer."

Similarly, if a portion of the buffer area adjacent to the receiving water is owned by another party and is not under your control, you can treat the area of land not under your control as having the equivalent vegetative cover and soil type that predominates on the portion of the property on which your construction activities are occurring.

For example, if your earth-disturbances occur within 50 feet of a receiving water, but the 10 feet of land immediately adjacent to the receiving water is owned by a different party than the land on which your construction activities are taking place and you do not have control over that land, you can treat the 10 foot area adjacent to the stream as having the equivalent soil and vegetation type that predominates in

[2] EPA used the following when developing the buffer performance tables:

- The sediment removal efficiencies are based on the U.S. Department of Agriculture's RUSLE2 ("Revised Universal Soil Loss Equation 2") model for slope profiles using a 100-foot long denuded slopes.
- Sediment removal was defined as the annual sediment delivered at the downstream end of the 50-foot natural buffer (tons/yr/acre) divided by the annual yield from denuded area (tons/yr/acre).
- As perimeter controls are also required by the CGP, sediment removal is in part a function of the reduction due to a perimeter control (i.e., silt fence) located between the disturbed portion of the site and the upstream edge of the natural buffer and flow traveling through a 50-foot buffer of undisturbed natural vegetation.
- It was assumed that construction sites have a relatively uniform slope without topographic features that accelerate the concentration for erosive flows.
- It was assumed that vegetation has been removed from the disturbed portion of the site and a combination of cuts and fills have resulted in a smooth soil surface with limited retention of near-surface root mass.

To represent the influence of soil, EPA analyzed 11 general soil texture classifications in its evaluation of buffer performance. To represent different types of buffer vegetation, EPA evaluated 4 or more common vegetative types for each State/Territory covered under the permit. For each vegetation type evaluated, EPA considered only permanent, non-grazed, and non-harvested vegetation, on the assumption that a natural buffer adjacent to the receiving water will typically be undisturbed. EPA also evaluated slope steepness and found that sediment removal efficiencies present in Tables G-8 through G-15 are achievable for slopes that are less than nine percent.

the 40 foot area under your control. You would then make the same assumption in Step 2 for purposes of determining the equivalent sediment removal.

Alternatively, you may do your own calculation of the effectiveness of the 50-foot buffer based upon your site-specific conditions, and may use this number as your sediment removal equivalency standard to meet instead of using Tables F-8 through F-15. This calculation must be documented in your SWPPP.

Step 2 - Design Controls That Match the Sediment Removal Efficiency of the 50-foot Buffer

Once you determine the estimated sediment removal efficiency of a 50-foot buffer for your site in Step 1, you must next select stormwater controls that will provide an equivalent sediment load reduction. These controls can include the installation of a single control, such as a sediment pond or additional perimeter controls, or a combination of stormwater controls. Whichever control(s) you select, you must demonstrate in your SWPPP that the controls will provide at a minimum the same sediment removal capabilities as a 50-foot natural buffer (Step 1). You may take credit for the removal efficiencies of your required perimeter controls in your calculation of equivalency, because these were included in calculating the buffer removal efficiencies in Tables F-8 through F-15. (Note: You are reminded that the controls must be kept in effective operating condition until you complete final stabilization on the disturbed portions of the site discharging to the receiving water)

To make the determination that your controls and/or buffer area achieve an equivalent sediment load reduction as a 50-foot buffer, you should use a model or other type of calculation. As mentioned above, there are a variety of models available that can be used to support your calculation, including USDA's RUSLE-series programs and the WEPP erosion model, SEDCAD, SEDIMOT, or other models. A couple of examples are provided in Attachment 3 to help illustrate how this determination could be made.

If you retain a buffer of less than 50 feet, you may take credit for the removal that will occur from the reduced buffer and only need to provide additional controls to make up the difference between the removal efficiency of a 50 foot buffer and the removal efficiency of the narrower buffer. For example, if you retain a 30 foot buffer, you can account for the sediment removal provided by the 30 foot buffer retained, and you will only need to design controls to make up for the additional removal provided by the 20 feet of buffer that is not being provided. To do this, you would plug the width of the buffer that is retained into RUSLE or another model, along with other stormwater controls that will together achieve a sediment reduction equivalent to a natural 50-foot buffer.

As described in Step 1 above, you can take credit for the area you retained as a "natural buffer" as being fully vegetated, regardless of the condition of the buffer area.

For example, if your earth-disturbances occur 30 feet from a receiving water, but the 10 feet of land immediately adjacent to the receiving water is owned by a different party than the land on which your construction activities are taking place and you do not have control over that land, you can treat the 10-foot area as a natural buffer, regardless of the activities that are taking place in the area. Therefore, you can assume (for purposes of your equivalency calculation) that your site is providing the sediment removal equivalent of a 30-foot buffer, and you will only need to design controls to make up for the additional removal provided by the 20-foot of buffer that is not being provided.

Step 3 - Document How Site-Specific Controls Will Achieve the Sediment Removal Efficiency of the 50-foot Buffer

In Steps 1 and 2, you determined both the expected sediment removal efficiency of a 50-foot buffer at your site, and you used this number as a performance standard to design controls to be installed at your site, which alone or in combination with any retained natural buffer, achieves the expected sediment removal efficiency of a 50-foot buffer at your site. The final step is to document in your SWPPP the information you relied on to calculate the equivalent sediment reduction as an undisturbed natural buffer.

EPA will consider your documentation to be sufficient if it generally meets the following:

- For Step 1, refer to the table in Attachment 1 that you used to derive your estimated 50-foot buffer sediment removal efficiency performance. Include information about the buffer vegetation and soil type that predominate at your site, which you used to select the sediment load reduction value in Tables F-8 through F-15. Or, if you conducted a site-specific calculation for sediment removal efficiency, provide the specific removal efficiency, and the information you relied on to make your site-specific calculation.
- For Step 2, (1) Specify the model you used to estimate sediment load reductions from your site; and (2) the results of calculations showing how your controls will meet or exceed the sediment removal efficiency from Step 1.

If you choose compliance alternative 3, you must also include in your SWPPP a description of why it is infeasible for you to provide and maintain an undisturbed natural buffer of any size.

F.3 SMALL RESIDENTIAL LOT COMPLIANCE ALTERNATIVES

EPA has developed two additional compliance alternatives applicable only to "small residential lots" that are unable to provide and maintain a 50 foot buffer.

A **small residential lot** is a lot or grouping of lots being developed for residential purposes that will disturb less than 1 acre of land, but that is part of a larger residential project that will ultimately disturb greater than or equal to 1 acre.

The following steps describe how a small residential lot operator would achieve compliance with one these 2 alternatives.

F.3.1 Small Residential Lot Compliance Alternative Eligibility

In order to be eligible for the small residential lot compliance alternatives, the following conditions must be met:

a. The lot or grouping of lots meets the definition of "small residential lot"; and

b. The operator must follow the guidance for providing and maintaining a natural buffer in Part F.2.3 of this Appendix, including:

i. Ensure that all discharges from the area of earth disturbance to the natural buffer are first treated by the site's erosion and sediment controls, and use velocity dissipation devices if necessary to prevent erosion caused by stormwater within the buffer;

ii. Document in the SWPPP the natural buffer width retained on the property, and show the buffer boundary on your site plan; and

iii. Delineate, and clearly mark off, with flags, tape, or other similar marking device, all natural buffer areas.

F.3.2 Small Residential Lot Compliance Alternatives

You must next choose from one of two small residential lot compliance alternatives and implement the stormwater control practices associated with that alternative.

Note: The compliance alternatives provided below are not mandatory. Operators of small residential lots can alternatively choose to comply with the any of the options that are available to other sites in Part 2.2.1.a and F.2.1 of this Appendix.

Small Residential Lot Compliance Alternative 1

Alternative 1 is a straightforward tiered-technology approach that specifies the controls that a small residential lot must implement based on the buffer width retained. To meet the requirements of small residential lot compliance alternative 1, you must implement the controls specified in Table F–1 based on the buffer width to be retained. See footnote 3, below, for a description of the controls you must implement.

For example, if you are an operator of a small residential lot that will be retaining a 35-foot buffer and you choose Small Residential Lot Compliance Alternative 1, you must implement double perimeter controls between earth disturbances and the receiving water

In addition to implementing the applicable control, you must also document in your SWPPP how you will comply with small residential lot compliance alternative 1.

Table F-1 Alternative 1 Requirements[3]

Retain 50-foot Buffer	Retain <50 and >30 foot Buffer	Retain ≤ 30 foot Buffer
No Additional Requirements	Double Perimeter Controls	Double Perimeter Controls and 7-Day Site Stabilization

Small Residential Lot Compliance Alternative 2

Alternative 2 specifies the controls that a builder of a small residential lot must implement based on both the buffer width retained and the site's sediment discharge risk. By incorporating the sediment risk, this approach may result in the implementation of controls that are more appropriate for the site's specific conditions.

Step 1 – Determine Your Site's Sediment Risk Level

To meet the requirements of Alternative 2, you must first determine your site's sediment discharge "risk level" based on the site's slope, location, and soil type. To help you to determine your site's sediment risk level, EPA developed five different tables for different slope conditions. You should select the table that most closely corresponds to your site's average slope.

For example, if your site's average slope is 7 percent, you should use Table G–4 to determine your site's sediment risk.

After you determine which table applies to your site, you must then use the table to determine the "risk level" (e.g., "low", "moderate", or "high") that corresponds to your site's location and predominant soil type.[4]

For example, based on Table F-3, a site located in New Hampshire with a 4 percent average slope and with predominately sandy clay loam soils would fall into the "moderate" risk level.

[3] **Description of Additional Controls Applicable to Small Residential Lot Compliance Alternatives 1 and 2:**

- **No Additional Requirements:** If you implement a buffer of 50 feet or greater, then you are not subject to any additional requirements. Note that you are required to install perimeter controls between the disturbed portions of your site and the buffer in accordance with Part 2.2.3.
- **Double Perimeter Control:** In addition to the reduced buffer width retained on your site, you must provide a double row of perimeter controls between the disturbed portion of your site and the receiving water spaced a minimum of 5 feet apart.
- **Double Perimeter Control and 7-Day Site Stabilization:** In addition to the reduced buffer width retained on your site and the perimeter control implemented in accordance with Part 2.2.3, you must provide a double row of perimeter controls between the disturbed portion of your site and the receiving water spaced a minimum of 5 feet apart, and you are required to complete the stabilization activities specified in Parts 2.2.14 within 7 calendar days of the temporary or permanent cessation of earth-disturbing activities.

[4] One source for determining your site's predominant soil type is the USDA's Web Soil Survey located at http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx.

Table F-2 Risk Levels for Sites with Average Slopes of ≤ 3 Percent

Soil Type / Location	Clay	Silty Clay Loam or Clay-Loam	Sand	Sandy Clay Loam, Loamy Sand or Silty Clay	Loam, Silt, Sandy Loam or Silt Loam
CNMI / Guam	Moderate	Moderate	Moderate	Moderate	High
Puerto Rico	Moderate	Moderate	Moderate	Moderate	High
Virgin Islands	Low	Moderate	Low	Moderate	Moderate
American Samoa	Moderate	Moderate	Moderate	Moderate	High
Massachusetts and New Hampshire	Low	Moderate	Low	Low	Moderate
Idaho	Low	Low	Low	Low	Low
New Mexico	Low	Low	Low	Low	Low
Washington D.C.	Low	Moderate	Low	Low	Moderate

Table F-3 Risk Levels for Sites with Average Slopes of > 3 Percent and ≤ 6 Percent

Soil Type / Location	Clay	Silty Clay Loam or Clay-Loam	Sand	Sandy Clay Loam, Loamy Sand or Silty Clay	Loam, Silt, Sandy Loam or Silt Loam
CNMI / Guam	Moderate	Moderate	Moderate	Moderate	High
Puerto Rico	Moderate	Moderate	Moderate	Moderate	High
Virgin Islands	Moderate	Moderate	Moderate	Moderate	High
American Samoa	High	High	Moderate	High	High
Massachusetts and New Hampshire	Moderate	Moderate	Low	Moderate	High
Idaho	Low	Low	Low	Low	Low
New Mexico	Low	Low	Low	Low	Moderate
Washington D.C.	Moderate	Moderate	Moderate	Moderate	High

Table F-4 Risk Levels for Sites with Average Slopes of > 6 Percent and ≤ 9 Percent

Soil Type / Location	Clay	Silty Clay Loam or Clay-Loam	Sand	Sandy Clay Loam, Loamy Sand or Silty Clay	Loam, Silt, Sandy Loam or Silt Loam
CNMI / Guam	Moderate	High	Moderate	High	High
Puerto Rico	Moderate	High	Moderate	Moderate	High
Virgin Islands	Moderate	Moderate	Moderate	Moderate	High
American Samoa	High	High	High	High	High
Massachusetts and New Hampshire	Moderate	Moderate	Moderate	Moderate	High
Idaho	Low	Low	Low	Low	Low
New Mexico	Low	Low	Low	Low	Moderate
Washington D.C.	Moderate	Moderate	Moderate	Moderate	High

Table F-5 Risk Levels for Sites with Average Slopes of > 9 Percent and ≤ 15 Percent

Soil Type / Location	Clay	Silty Clay Loam or Clay-Loam	Sand	Sandy Clay Loam, Loamy Sand or Silty Clay	Loam, Silt, Sandy Loam or Silt Loam
CNMI / Guam	High	High	High	High	High
Puerto Rico	High	High	High	High	High
Virgin Islands	Moderate	High	Moderate	High	High
American Samoa	High	High	High	High	High
Massachusetts and New Hampshire	Moderate	Moderate	Moderate	Moderate	High
Idaho	Low	Low	Low	Low	Low
New Mexico	Low	Moderate	Low	Moderate	Moderate
Washington D.C.	Moderate	High	Moderate	Moderate	High

Table F-6 Risk Levels for Sites with Average Slopes of > 15 Percent

Soil Type / Location	Clay	Silty Clay Loam or Clay-Loam	Sand	Sandy Clay Loam, Loamy Sand or Silty Clay	Loam, Silt, Sandy Loam or Silt Loam
CNMI / Guam	High	High	High	High	High
Puerto Rico	High	High	High	High	High
Virgin Islands	High	High	High	High	High
American Samoa	High	High	High	High	High
Massachusetts and New Hampshire	High	High	Moderate	High	High
Idaho	Low	Low	Low	Low	Moderate
New Mexico	Moderate	Moderate	Moderate	Moderate	High
Washington D.C.	High	High	Moderate	High	High

Step 2 – Determine Which Additional Controls Apply

Once you determine your site's "risk level", you must next determine the additional controls you need to implement on your site, based on the width of buffer you plan to retain. Table F-7 specifies the requirements that apply based on the "risk level" and buffer width retained. See footnote 3, above, for a description of the additional controls that are required.

For example, if you are the operator of a small residential lot that falls into the "moderate" risk level, and you decide to retain a 20-foot buffer, using Table F-7 you would determine that you need to implement double perimeter controls to achieve compliance with small residential lot compliance alternative 2.

You must also document in your SWPPP your compliance with small residential lot compliance alternative 2.

Table F-7. Alternative 2 Requirements[2]

Risk Level Based on Estimated Soil Erosion	Retain ≥ 50' Buffer	Retain <50' and >30' Buffer	Retain ≤30' and >10' Buffer	Retain ≤ 10' Buffer
Low Risk	No Additional Requirements	No Additional Requirements	Double Perimeter Control	Double Perimeter Control
Moderate Risk	No Additional Requirements	Double Perimeter Control	Double Perimeter Control	Double Perimeter Control and 7-Day Site Stabilization
High Risk	No Additional Requirements	Double Perimeter Control	Double Perimeter Control and 7-Day Site Stabilization	Double Perimeter Control and 7-Day Site Stabilization

ATTACHMENT 1

Sediment Removal Efficiency Tables[5]

EPA recognizes that very high removal efficiencies, even where theoretically achievable by a 50-foot buffer, may be very difficult to achieve in practice using alternative controls. Therefore in the tables below, EPA has limited the removal efficiencies to a maximum of 90%. Efficiencies that were calculated at greater than 90% are shown as 90%, and this is the minimum percent removal that must be achieved by alternative controls.

Table F-8 Estimated 50-foot Buffer Performance in Idaho*

	Estimated % Sediment Removal				
Type of Buffer Vegetation**	**Clay**	**Silty Clay Loam or Clay-Loam**	**Sand**	**Sandy Clay Loam, Loamy Sand or Silty Clay**	**Loam, Silt, Sandy Loam or Silt Loam**
Tall Fescue Grass	42	52	44	48	85
Medium-density Weeds	28	30	28	26	60
Low-density Warm-season Native Bunchgrass (i.e., Grama Grass)	25	26	24	24	55
Northern Mixed Prairie Grass	28	30	28	26	50
Northern Range Cold Desert Shrubs	28	28	24	26	50

* Applicable for sites with less than nine percent slope
** Characterization focuses on the under-story vegetation

Table F-9 Estimated 50-foot Buffer Performance in Massachusetts and New Hampshire*

	Estimated % Sediment Removal				
Type of Buffer Vegetation**	**Clay**	**Silty Clay Loam or Clay-Loam**	**Sand**	**Sandy Clay Loam, Loamy Sand or Silty Clay**	**Loam, Silt, Sandy Loam or Silt Loam**
Warm-season Grass (i.e., Switchgrass, Lemongrass)	79	90	90	90	90
Cool-season Dense Grass (Kentucky Bluegrass, Smooth Bromegrass, Timothy)	78	90	90	90	90
Tall Fescue Grass	76	90	81	89	90
Medium-density Weeds	66	76	60	72	66

* Applicable for sites with less than nine percent slope
** Characterization focuses on the under-story vegetation

[5] The buffer performances were calculated based on a denuded slope upgradient of a 50-foot buffer and a perimeter controls, as perimeter controls are a standard requirement (see Part 2.2.3).

Table F-10 Estimated 50-foot Buffer Performance in New Mexico*

	Estimated % Sediment Removal				
Type of Buffer Vegetation **	**Clay**	**Silty Clay Loam or Clay-Loam**	**Sand**	**Sandy Clay Loam, Loamy Sand or Silty Clay**	**Loam, Silt, Sandy Loam or Silt Loam**
Tall Fescue grass	71	85	80	86	90
Medium-density Weeds	56	73	55	66	78
Low-density Warm-season Native Bunchgrass (i.e., Grama Grass)	53	70	51	62	67
Southern Mixed Prairie Grass	53	71	52	63	50
Southern Range Cold Desert Shrubs	56	73	55	65	53

* Applicable for sites with less than nine percent slope
** Characterization focuses on the under-story vegetation

Table F-11 Estimated 50-foot Buffer Performance in Washington, DC*

	Estimated % Sediment Removal				
Type of Buffer Vegetation **	**Clay**	**Silty Clay Loam or Clay-Loam**	**Sand**	**Sandy Clay Loam, Loamy Sand or Silty Clay**	**Loam, Silt, Sandy Loam or Silt Loam**
Warm-season Grass (i.e., Switchgrass, Lemongrass)	82	90	90	90	90
Cool-season Dense Grass (Kentucky Bluegrass, Smooth Bromegrass, Timothy)	81	90	90	90	90
Tall Fescue Grass	79	90	83	89	90
Medium-density Weeds	71	79	66	75	74

* Applicable for sites with less than nine percent slope
** Characterization focuses on the under-story vegetation

Table F-12 Estimated 50-foot Buffer Performance in American Samoa*

	Estimated % Sediment Removal				
Type of Buffer Vegetation **	**Clay**	**Silty Clay Loam or Clay-Loam**	**Sand**	**Sandy Clay Loam, Loamy Sand or Silty Clay**	**Loam, Silt, Sandy Loam or Silt Loam**
Bahiagrass (Permanent cover)	82	90	90	90	83
Warm-season Grass (i.e., Switchgrass, Lemongrass)	82	90	90	90	85
Dense Grass	82	90	90	90	83
Tall Fescue Grass	82	89	82	89	79
Medium-density Weeds	70	73	62	75	59

* Applicable for sites with less than nine percent slope
** Characterization focuses on the under-story vegetation

Table F-13 Estimated 50-foot Buffer Performance in CNMI and Guam*

	Estimated % Sediment Removal				
Type of Buffer Vegetation **	**Clay**	**Silty Clay Loam or Clay-Loam**	**Sand**	**Sandy Clay Loam, Loamy Sand or Silty Clay**	**Loam, Silt, Sandy Loam or Silt Loam**
Bahiagrass (Permanent cover)	80	90	90	90	89
Warm-season Grass (i.e., Switchgrass, Lemongrass)	80	90	90	90	90
Dense Grass	79	90	90	90	89
Tall Fescue Grass	76	90	80	88	87
Medium-density Weeds	63	73	53	68	61

* Applicable for sites with less than nine percent slope
** Characterization focuses on the under-story vegetation

Table F-14 Estimated 50-foot Buffer Performance in Puerto Rico*

	Estimated % Sediment Removal				
Type of Buffer Vegetation**	**Clay**	**Silty Clay Loam or Clay-Loam**	**Sand**	**Sandy Clay Loam, Loamy Sand or Silty Clay**	**Loam, Silt, Sandy Loam or Silt Loam**
Bahiagrass (Permanent cover)	83	90	90	90	90
Warm-season Grass (i.e., Switchgrass, Lemongrass)	83	90	90	90	90
Dense Grass	83	90	90	90	90
Tall Fescue Grass	82	90	84	90	89
Medium-density Weeds	72	78	65	76	64

* Applicable for sites with less than nine percent slope
** Characterization focuses on the under-story vegetation

Table F-15 Estimated 50-foot Buffer Performance in Virgin Islands*

Type of Buffer Vegetation**	**Clay**	**Silty Clay Loam or Clay-Loam**	**Sand**	**Sandy Clay Loam, Loamy Sand or Silty Clay**	**Loam, Silt, Sandy Loam or Silt Loam**
Bahiagrass (Permanent cover)	85	90	90	90	90
Warm-season Grass (i.e., Switchgrass, Lemongrass)	86	90	90	90	90
Dense Grass	85	90	90	90	90
Tall Fescue Grass	85	90	88	90	89
Medium-density Weeds	75	77	71	78	63

* Applicable for sites with less than nine percent slope
** Characterization focuses on the under-story vegetation

ATTACHMENT 2

Using the Sediment Removal Efficiency Tables – Questions and Answers

- *What if my specific buffer vegetation is not represented in Tables F-8 through F-15?* Tables F-8 through F-15 provide a wide range of factors affecting buffer performance; however, there are likely instances where the specific buffer vegetation type on your site is not listed. If you do not see a description of the type of vegetation present at your site, you should choose the vegetation type that most closely matches the vegetation type on your site. You can contact your local Cooperative Extension Service Office (http://nifa.usda.gov/partners-and-extension-map) for assistance in determining the vegetation type in Tables F-8 through F-15 that most closely matches your site-specific vegetation.
- *What if there is high variability in local soils?* EPA recognizes that there may be a number of different soil type(s) on any given construction site. General soil information can be obtained from USDA soil survey reports (http://websoilsurvey.nrcs.usda.gov) or from individual site assessments performed by a certified soil expert. Tables F-8 through F-15 present eleven generic soil texture classes, grouping individual textures where EPA has determined that performance is similar. If your site contains different soil texture classes, you should use the soil type that best approximates the predominant soil type at your site.
- *What if my site slope is greater than 9 percent after final grade is reached?* As indicated in the buffer performance tables, the estimated sediment removal efficiencies are associated with disturbed slopes of up to 9 percent grade. Where your graded site has an average slope of greater than 9 percent, you should calculate a site-specific buffer performance.
- *How do I calculate my own estimates for sediment reduction at my specific site?* If you determine that it is necessary to calculate your own sediment removal efficiency using site-specific conditions (e.g., slopes at your site are greater than 9 percent), you can use a range of available models that are available to facilitate this calculation, including USDA's RUSLE-series programs and the WEPP erosion model, SEDCAD, SEDIMOT, or other equivalent models.
- *What is my estimated buffer performance if my site location is not represented by Tables F-8 through F-15?* If your site is located in an area not represented by Tables F-8 through F-15, you should use the table that most closely approximates conditions at your site. You may instead choose to conduct a site-specific calculation of the buffer performance.
- *What if only a portion of my site drains to the buffer area?* If only a portion of your site drains to a receiving water, where that water is within 50 feet of your earth disturbances, you are only required to meet the equivalency requirement for the stormwater flows corresponding to those portions of the site. See Example 2 below for an example of how this is expected to work.

ATTACHMENT 3

Examples of How to Use the Sediment Removal Efficiency Tables

Example 1. Comparatively Wet Location (7.5 acre site located in Massachusetts)

The operator of a 7.5-acre construction site in Massachusetts has determined that it is infeasible to establish a buffer of any size on the site, and is now required to select and install controls that will achieve an equivalent sediment load reduction as that estimated in F-9 for their site conditions. The first step is to identify what percentage of eroded sediment is estimated to be retained from a 50-foot buffer. For this example, it is assumed that the site has a relatively uniform gentle slope (3 percent), so Table F-9 can be used to estimate the 50-foot buffer sediment load reduction. If the site's buffer vegetation is best typified by cool-season dense grass and the underlying soil is of a type best described as loamy sand, the 50-foot buffer is projected to capture 90 percent of eroded sediment from the construction site.

The second step is to determine what sediment controls can be selected and installed in combination with the perimeter controls already required to be implemented at the site (see Part 2.2.3), which will achieve the 90 percent sediment removal efficiency from Table F-9. For this example, using the RUSLE2 profile model, it was determined that installing a pair of shallow-sloped diversion ditches to convey runoff to a well-designed and maintained sediment basin provides 99 percent sediment removal. Because the estimated sediment reduction is greater than the required 90 percent that a 50-foot buffer provides, the operator will have met the buffer requirements. See Figure F-5. The operator could also choose a different set of controls, as long as they achieve at least a 90 percent sediment removal efficiency.

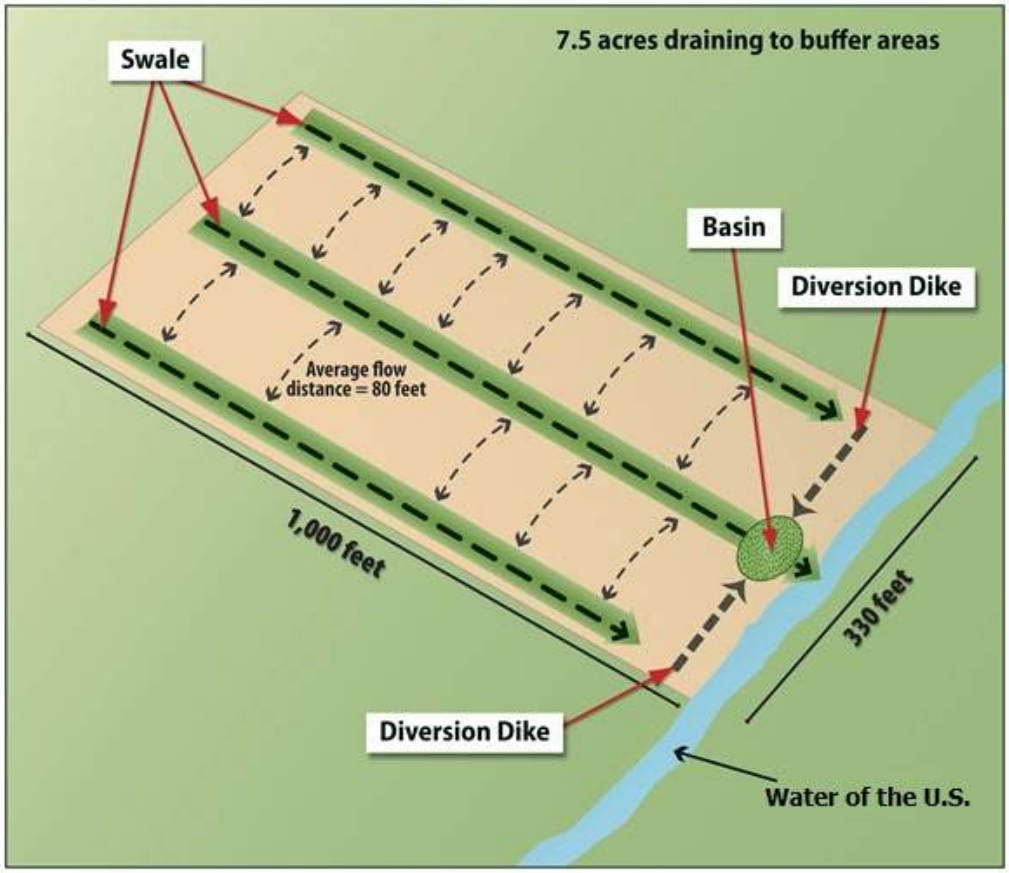


Figure F-5 Example 1 – Equivalent Sediment Load Reductions at a 7.5 ac Site in MA.

Example 2. Arid Location With Pre-existing Disturbances in the Natural Buffer (6.5 acre site located in New Mexico)

An operator of a site in New Mexico determines that it is not feasible to provide a 50-foot buffer, but a 28-foot buffer can be provided. Because the operator will provide a buffer that is less than 50 feet, the operator must determine which controls, in combination with the 28-foot buffer, achieve a sediment load reduction equivalent to the 50-foot buffer. In this example, the project will disturb 6.5 acres of land, but only 1.5 acres of the total disturbed area drains to the buffer area. Within the 28-foot buffer area is a preexisting concrete walkway. Similar to Example 1, the equivalence analysis starts with Step 1 in Part F.2.4 of this Appendix with a review of the New Mexico buffer performance (Table F-10). The operator determines that the predominate vegetation type in the buffer area is prairie grass, the soil type is similar to silt, and the site is of a uniform, shallow slope (e.g., 3 percent grade). Although the operator will take credit for the disturbance caused by the concrete walkway as a natural buffer in Step 2, here the operator can treat the entire buffer area as being naturally vegetated with prairie grass. Based on this information, the operator refers to Table F-10 to estimate that the 50-foot buffer would retain 50 percent of eroded soil.

The second step is to determine, based on the 50 percent sediment removal efficiency found in Table F-10, what sediment controls, in combination with the 28-foot buffer area, can be implemented to reduce sediment loads by 50 percent or more. The operator does not have to account the reduction in buffer function caused by the preexisting walkway, and can take credit for the entire 28-foot buffer being fully vegetated in the analysis. For this example, using the RUSLE2 profile model, the operator determined that installing a fiber roll barrier between the

silt fence (already required by Part 2.2.3) and the 28-foot buffer will achieve an estimated 84 percent sediment removal efficiency. See Figure F-6. Note that this operator is subject to the requirement in Part F.2.3 of this Appendix to ensure that discharges through the silt fence, fiber roll barrier, and 28-foot buffer do not cause erosion within the buffer. The estimated sediment reduction is greater than the required 50 percent; therefore the operator will have met the buffer alternative requirement.

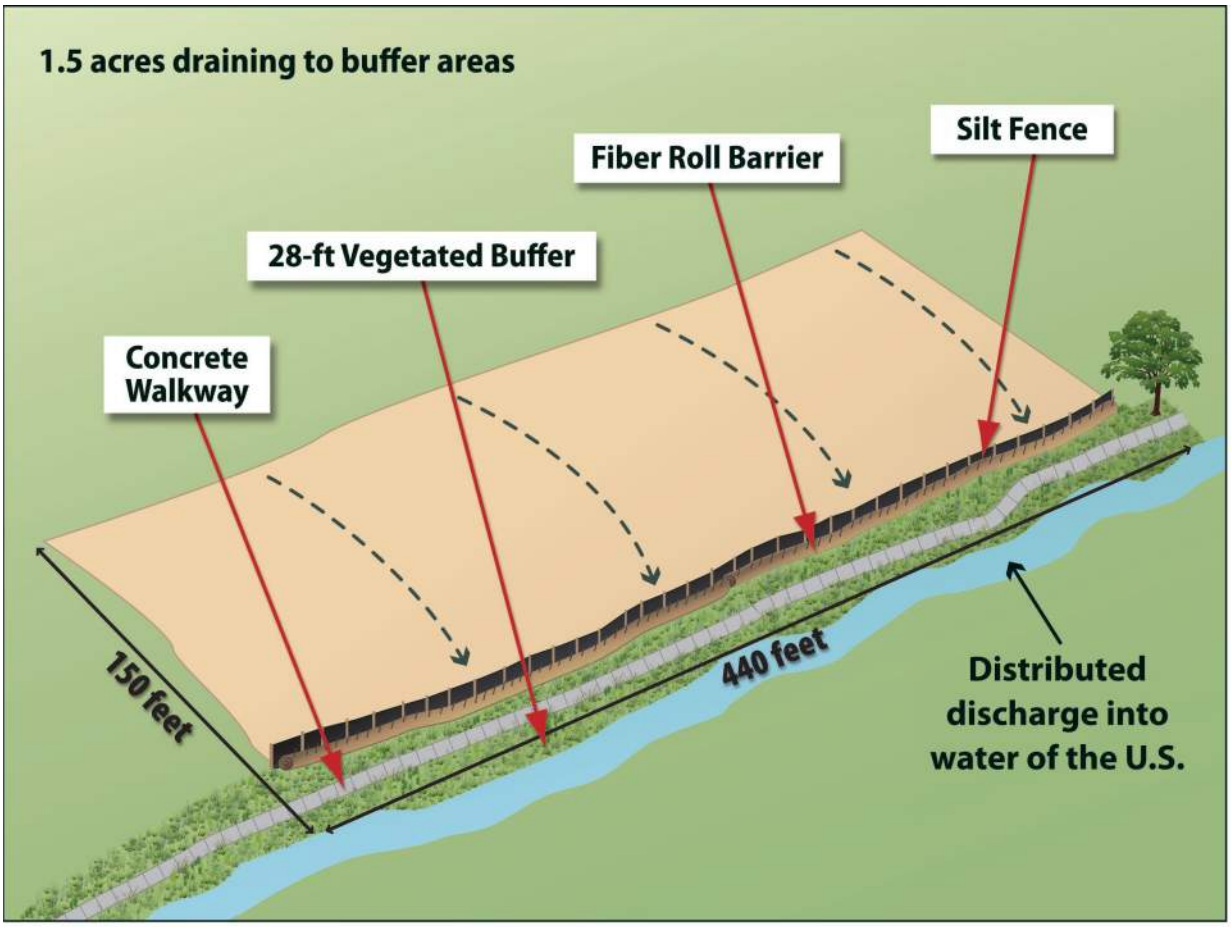


Figure F-6 Example 2 – Equivalent Sediment Load Reductions at a 6.5 ac Site in NM.

Appendix G - Standard Permit Conditions

Standard permit conditions in Appendix G are consistent with the general permit provisions required under 40 CFR 122.41.

G.1 Duty To Comply.

You must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application.

G.1.1 You must comply with effluent standards or prohibitions established under section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish these standards, even if the permit has not yet been modified to incorporate the requirement.

G.1.2 Penalties for Violations of Permit Conditions: EPA and other federal agencies are required to adjust their maximum and minimum statutory civil penalty amounts through rulemaking by January 15 each year to account for inflation. EPA's annual rulemaking adjustments, codified in 40 C.F.R. § 19.4, are mandated by the Federal Civil Penalties Inflation Adjustment Act of 1990, as amended through the Federal Civil Penalties Inflation Adjustment Act Improvements Act of 2015 (28 U.S.C. § 2461 note). As such, the civil penalty amounts below may change in the future due to inflation. See 40 C.F.R. § 19.4 for the most up-to-date civil penalty amounts.

G.1.2.1 *Criminal Penalties.*

a. *Negligent Violations*. The CWA provides that any person who negligently violates permit conditions implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act is subject to criminal penalties of not less than $2,500 nor more than $25,000 per day of violation, or imprisonment of not more than one year, or both. In the case of a second or subsequent conviction for a negligent violation, a person shall be subject to criminal penalties of not more than $50,000 per day of violation or by imprisonment of not more than two years, or both.

b. *Knowing Violations.* The CWA provides that any person who knowingly violates permit conditions implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act is subject to a fine of not less than $5,000 nor morethan $50,000 per day of violation, or by imprisonment for not more than 3 years, or both. In the case of a second or subsequent conviction for a knowing violation, a person shall be subject to criminal penalties of not more than $100,000 per day of violation, or imprisonment of not more than 6 years, or both.

c. *Knowing Endangerment.* The CWA provides that any person who knowingly violates permit conditions implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act and who knows at that time that he or she is placing another person in imminent danger of death or serious bodily injury shall upon conviction be subject to a fine of not more than $250,000 or by imprisonment of not more than 15 years, or both. In the case of a second or subsequent conviction for a knowing endangerment violation, aperson shall be subject to a fine of not more than $500,000 or by imprisonment of not more than 30 years, or both. An organization, as defined in section 309(c)(3)(B)(iii) of the Act, shall, upon conviction of violating the imminent danger provision be subject to a fine of not more than $1,000,000 and can fined up to $2,000,000 for second or subsequent convictions.

d. *False Statement.* The CWA provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000, or by imprisonment for not more than 2 years, or both. If a conviction of a person is for a violation committed after a first conviction of such person under this paragraph, punishment is a fine of not more than $20,000 per day of violation, or by imprisonment of not more than 4 years, or both. The Act further provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

G.1.2.2 *Civil Penalties.* The CWA provides that any person who violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act is subject to a civil penalty not to exceed the maximum amount authorized by Section 309(d) of the Act, as adjusted pursuant to the Federal Civil Penalties Inflation Adjustment Act of 1990 (28 U.S.C. § 2461 note), and codified at 40 CFR § 19.4.

G.1.2.3 *Administrative Penalties.* The CWA provides that any person who violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the Act is subject to an administrative penalty, as follows:

a. *Class I Penalty*. Not to exceed the maximum amounts authorized by Section 309(g)(2)(A) of the Act and the Federal Civil Penalties Inflation Adjustment Act of 1990 as amended by the Federal Civil Penalties Inflation Adjustment Act Improvements Act of 2015 (28 U.S.C. § 2461 note), and codified at 40 CFR § 19.4.

b. *Class II Penalty*. Not to exceed the maximum amounts authorized by Section 309(g)(2)(B) of the Act and the Federal Civil Penalties Inflation Adjustment Act of 1990, as amended by the Federal Civil Penalties Inflation Adjustment Act Improvements Act of 2015 (28 U.S.C. § 2461 note), and codified at 40 CFR § 19.4.

G.2 Duty to Reapply.

If you wish to continue an activity regulated by this permit after the expiration date of this permit, you must apply for and obtain authorization as required by the new permit once EPA issues it.

G.3 Need to Halt or Reduce Activity Not a Defense.

It shall not be a defense for you in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

G.4 Duty to Mitigate.

You must take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

G.5 Proper Operation and Maintenance.

You must at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) that are installed or used by you to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the

operation of backup or auxiliary facilities or similar systems which are installed by you only when the operation is necessary to achieve compliance with the conditions of this permit.

G.6 Permit Actions.

This permit may be modified, revoked and reissued, or terminated for cause. Your filing of a request for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

G.7 Property Rights.

This permit does not convey any property rights of any sort, or any exclusive privileges.

G.8 Duty to Provide Information.

You must furnish to EPA or an authorized representative (including an authorized contractor acting as a representative of EPA), within a reasonable time, any information that EPA may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. You must also furnish to EPA or an authorized representative upon request, copies of records required to be kept by this permit.

G.9 Inspection and Entry.

You must allow EPA or an authorized representative (including an authorized contractor acting as a representative of EPA), upon presentation of credentials and other documents as may be required by law, to:

G.9.1 Enter upon your premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

G.9.2 Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

G.9.3 Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and

G.9.4 Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act, any substances or parameters at any location.

G.10 Monitoring and Records.

G.10.1 Samples and measurements taken for the purpose of monitoring must be representative of the volume and nature of the monitored activity.

G.10.2 You must retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least three years from the date the permit expires or the date the permittee's authorization is terminated. This period may be extended by request of EPA at any time.

G.10.3 Records of monitoring information must include:

G.10.3.1 The date, exact place, and time of sampling or measurements;

G.10.3.2 The individual(s) who performed the sampling or measurements;

G.10.3.3 The date(s) analyses were performed

G.10.3.4 The individual(s) who performed the analyses;

G.10.3.5 The analytical techniques or methods used; and

G.10.3.6 The results of such analyses.

G.10.4 Monitoring must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in the permit.

G.10.5 The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000, or by imprisonment for not more than 2 years, or both. If a conviction of a person is for a violation committed after a first conviction of such person under this paragraph, punishment is a fine of not more than $20,000 per day of violation, or by imprisonment of not more than 4 years, or both.

G.11 Signatory Requirements.

G.11.1 All applications, including NOIs and NOTs, must be signed as follows:

G.11.1.1 For a corporation: By a responsible corporate officer. For the purpose of this subsection, a responsible corporate officer means: (i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (ii) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

G.11.1.2 For a partnership or sole proprietorship: By a general partner or the proprietor, respectively; or

G.11.1.3 For a municipality, state, federal, or other public agency: By either a principal executive officer or ranking elected official. For purposes of this subsection, a principal executive officer of a federal agency includes (i) the chief executive officer of the agency, or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrator of EPA).

G.11.2 Your SWPPP (including changes to your SWPPP inspection reports), corrective action log, turbidity monitoring report, site inspection and dewatering inspection reports, and any other compliance documentation required under this permit, must be signed by a person described in Appendix G, Subsection G.11.1 above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

G.11.2.1 The authorization is made in writing by a person described in Appendix G, Subsection G.11.1;

G.11.2.2 The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental

matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position); and

G.11.2.3 The signed and dated written authorization is included in the SWPPP. A copy must be submitted to EPA, if requested.

G.11.3 Changes to Authorization. If an authorization under this permit is no longer accurate because a different operator has responsibility for the overall operation of the construction site, a new NOI must be submitted to EPA. See Table 1 in Part 1.4.3 of the permit. However, if the only change that is occurring is a change in contact information or a change in the facility's address, the operator need only make a modification to the existing NOI submitted for authorization.

G.11.4 Any person signing documents in accordance with Appendix G, Subsections G.11.1 or G.11.2 above must include the following certification:

> "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 contained therein. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information contained is, to the best of my knowledge and belief, true, accurate, and complete. I have no personal knowledge that the information submitted is other than 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."

G.11.5 For persons signing NOIs electronically, in addition to meeting other applicable requirements in Appendix G, Subsection G.11, such signatures must meet the same signature, authentication, and identity-proofing standards set forth at 40 CFR § 3.2000(b) for electronic reports (including robust second-factor authentication).

G.11.6 The CWA provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or non-compliance shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

G.12 Reporting Requirements.

G.12.1 Planned changes. You must give notice to EPA as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required only when:

G.12.1.1 The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source in 40 CFR 122.29(b); or

G.12.1.2 The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations in the permit, nor to notification requirements under 40 CFR 122.42(a)(1).

G.12.2 Anticipated noncompliance. You must give advance notice to EPA of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

G.12.3 Transfers. This permit is not transferable to any person except after notice to EPA. Where a facility wants to change the name of the permittee, the original permittee (the first owner or operators) must submit a Notice of Termination pursuant to Part 8. The new

owner or operator must submit a Notice of Intent in accordance with Part 1.4 and Table 1. See also requirements in Appendix G, Subsections G.11.1 and G.11.2.

G.12.4 Monitoring reports. Monitoring results must be reported at the intervals specified elsewhere in this permit.

G.12.4.1 Monitoring results must be reported on a Discharge Monitoring Report (DMR) or forms provided or specified by EPA for reporting results of monitoring of sludge use or disposal practices.

G.12.4.2 If you monitor any pollutant more frequently than required by the permit using test procedures approved under 40 CFR Part 136 or, in the case of sludge use or disposal, approved under 40 CFR 136 unless otherwise specified in 40 CFR Part 503, or as specified in the permit, the results of this monitoring must be included in the calculation and reporting of the data submitted in the DMR or sludge reporting form specified by EPA.

G.12.5 Compliance schedules. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit must be submitted no later than 14 days following each schedule date.

G.12.6 Twenty-four hour reporting. In addition to reports required elsewhere in this permit:

G.12.6.1 You must report any noncompliance which may endanger health or the environment directly to the EPA Regional Office (see contacts at https://www2.epa.gov/national-pollutant-discharge-elimination-system-npdes/contact-us-stormwater#regional). Any information must be provided orally within 24 hours from the time you become aware of the circumstances. A written submission must also be provided within five days of the time you become aware of the circumstances. The written submission must contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

G.12.6.2 The following shall be included as information which must be reported within 24 hours under this paragraph.

a. Any unanticipated bypass which exceeds any effluent limitation in the permit. (See 40 CFR 122.41(m)(3)(ii))

b. Any upset which exceeds any effluent limitation in the permit

c. Violation of a maximum daily discharge limit for any numeric effluent limitation. (See 40 CFR 122.44(g).)

G.12.6.3 EPA may waive the written report on a case-by-case basis for reports under Appendix G, Subsection G.12.6.2 if the oral report has been received within 24 hours.

G.12.7 Other noncompliance. You must report all instances of noncompliance not reported under Appendix G, Subsections G.12.4, G.12.5, and G.12.6, at the time monitoring reports are submitted. The reports must contain the information listed in Appendix G, Subsection G.12.6.

G.12.8 Other information. Where you become aware that you failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Permitting Authority, you must promptly submit such facts or information.

G.13 Bypass.

G.13.1 Definitions.

G.13.1.1 Bypass means the intentional diversion of waste streams from any portion of a treatment facility See 40 CFR 122.41(m)(1)(i).

G.13.1.2 Severe property damage means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production. See 40 CFR 122.41(m)(1)(ii).

G.13.2 Bypass not exceeding limitations. You may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of Appendix G, Subsections G.13.3 and G.13.4. See 40 CFR 122.41(m)(2).

G.13.3 Notice.

G.13.3.1 Anticipated bypass. If you know in advance of the need for a bypass, you must submit prior notice, if possible at least ten days before the date of the bypass. See 40 CFR 122.41(m)(3)(i).

G.13.3.2 Unanticipated bypass. You must submit notice of an unanticipated bypass as required in Appendix G, Subsection G.12.6 (24-hour notice). See 40 CFR 122.41(m)(3)(ii).

G.13.4 Prohibition of bypass. See 40 CFR 122.41(m)(4).

G.13.4.1 Bypass is prohibited, and EPA may take enforcement action against you for bypass, unless:

a. Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

b. There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

c. You submitted notices as required under Appendix G, Subsection G.13.3.

G.13.4.2 EPA may approve an anticipated bypass, after considering its adverse effects, if EPA determines that it will meet the three conditions listed above in Appendix G, Subsection G.13.4.1.

G.14 Upset.

G.14.1 Definition. Upset means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond your reasonable control. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation. See 40 CFR 122.41(n)(1).

G.14.2 Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology based permit effluent limitations if the requirements of Appendix G, Subsection G.14.3 are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review. See 40 CFR 122.41(n)(2).

G.14.3 Conditions necessary for a demonstration of upset. See 40 CFR 122.41(n)(3). A permittee who wishes to establish the affirmative defense of upset must demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

G.14.3.1 An upset occurred and that you can identify the cause(s) of the upset;

G.14.3.2 The permitted facility was at the time being properly operated; and

G.14.3.3 You submitted notice of the upset as required in Appendix G, Subsection G.12.6.2.b (24 hour notice).

G.14.3.4 You complied with any remedial measures required under Appendix G, Subsection G.4.

G.14.4 Burden of proof. In any enforcement proceeding, you, as the one seeking to establish the occurrence of an upset, have the burden of proof. See 40 CFR 122.41(n)(4).

G.15 Retention of Records.

Copies of the SWPPP and all documentation required by this permit, including records of all data used to complete the NOI to be covered by this permit, must be retained for at least three years from the date that permit coverage expires or is terminated. This period may be extended by request of EPA at any time.

G.16 Reopener Clause.

G.16.1 Procedures for modification or revocation. Permit modification or revocation will be conducted according to 40 CFR §122.62, §122.63, §122.64 and §124.5.

G.16.2 Water quality protection. If there is evidence indicating that the stormwater discharges authorized by this permit cause, have the reasonable potential to cause or contribute to an excursion above any applicable water quality standard, you may be required to obtain an individual permit, or the permit may be modified to include different limitations and/or requirements.

G.16.3 Timing of permit modification. EPA may elect to modify the permit prior to its expiration (rather than waiting for the new permit cycle) to comply with any new statutory or regulatory requirements, such as for effluent limitation guidelines that may be promulgated in the course of the current permit cycle.

G.17 Severability.

Invalidation of a portion of this permit does not necessarily render the whole permit invalid. EPA's intent is that the permit is to remain in effect to the extent possible; in the event that any part of this permit is invalidated, EPA will advise the regulated community as to the effect of such invalidation.

Appendix H - Notice of Intent (NOI) Form and Instructions

Part 1.4.1 requires you to use the NPDES eReporting Tool, or "NeT" system, to prepare and submit your NOI electronically. However, if the EPA Regional Office grants you a waiver to use a paper NOI form, and you elect to use it, you must complete and submit the following form.

NPDES Form 3510-9	EPA	U.S. Environmental Protection Agency Washington, DC 20460 Notice of Intent for the 2022 NPDES Construction General Permit	OMB No. 2040-0305 Exp. Date 01/31/2025

Submission of this Notice of Intent (NOI) constitutes notice that the operator identified in Section III of this form requests authorization to discharge pursuant to the NPDES Construction General Permit (CGP) permit number identified in Section II of this form. Submission of this NOI also constitutes notice that the operator identified in Section III of this form meets the eligibility requirements of Part 1.1 CGP for the project identified in Section IV of this form. Permit coverage is required prior to commencement of construction activity until you are eligible to terminate coverage as detailed in Part 8 of the CGP. To obtain authorization, you must submit a complete and accurate NOI form. Discharges are not authorized if your NOI is incomplete or inaccurate or if you were never eligible for permit coverage. Refer to the instructions at the end of this form.

SECTION I. APPROVAL TO USE PAPER NOI FORM

Paper NOI Form

Have you been granted a waiver from electronic reporting from the Regional Office*? ☐ Yes ☐ No

If yes, check which waiver you have been granted, the name of the EPA Regional Office staff person who granted the waiver, and the date of approval:

Waiver granted:

☐ The owner/operator's headquarters is physically located in a geographic area (i.e., ZIP code or census tract) that is identified as under-served for broadband Internet access in the most recent report from the Federal Communications Commission.

☐ The owner/operator has issues regarding available computer access or computer capability.

Name of EPA staff person that granted the waiver	Date approval obtained (MM/DD/YYYY)

*** Note: You are required to obtain approval from the applicable Regional Office prior to using this paper NOI form. If you have not obtained a waiver, you must file this form electronically using the NPDES eReporting Tool (NeT).**

SECTION II. PERMIT INFORMATION

Permit

NPDES ID (EPA Use Only)	Master Permit Number (see Appendix B of the CGP for the list of eligible permit numbers)

SECTION III. OPERATOR INFORMATION

Operator Information

Operator Name

Are you requesting coverage under this NOI as a "Federal Operator" or for a "Federal Facility" as defined in Appendix A? ☐ Yes ☐ No

Mailing Address

Street

City	State	ZIP Code

County or Similar Government Division

Operator Point of Contact Information:

First Name	Middle Initial	Last Name

Title

Phone Number	Email Address

NOI Preparer

Complete if NOI was prepared by someone other than the certifier:

First Name	Middle Initial	Last Name

Organization

Phone number	Email address

SECTION IV. PROJECT/SITE INFORMATION

Project/Site Address

Project/Site Name

Street/Location

City	State	ZIP Code

County or Similar Government Division:

For the project/site you are seeking permit coverage, provide the following information:

Latitude (in decimal degrees to four decimal places):	Longitude (in decimal degrees to four decimal places):
° N	° W

Latitude/Longitude Data Source: ☐ Map ☐ GPS ☐ Other (Specify):

Horizontal Reference Datum: ☐ NAD 27 ☐ NAD 83 ☐ WGS 84

Site Information

Is your site located in Indian country lands, or on a property of religious or cultural significance to an Indian Tribe? ☐ Yes ☐ No

If yes, provide the name of the Indian Tribe associated with the area of Indian country (including name of Indian reservation, if applicable), or if not in Indian country, provide the name of the Indian Tribe associated with the property:

Project Information

Estimated Project Start Date (MM/DD/YYYY)	Estimated Project Completion Date (MM/DD/YYYY)

Estimated Area to be Disturbed (to the nearest quarter acre):

Type of Construction Site (check all that apply):

☐ Single-Family Residential ☐ Multi-Family Residential ☐ Commercial

☐ Industrial ☐ Institutional ☐ Highway or Road

☐ Utility ☐ Other (Specify):

Was the pre-development land use used for agriculture (see Appendix A for definition of "agricultural land")? ☐ Yes ☐ No

Have earth-disturbing activities commenced on your project/site? ☐ Yes ☒ No

If yes, is your project an "emergency-related project" (see Appendix A)? ☒ Yes ☐ No

Project Information

Have stormwater discharges from your project/site been covered previously under an NPDES permit?	☐ Yes	☐ No
If yes, provide the NPDES ID (if you had coverage under EPA's 2017 CGP) or the NPDES permit number (if you had coverage under an EPA individual permit): _____		
Are there other operators that are covered under this permit for the same project site?	☐ Yes	☐ No
If yes, provide the NPDES ID number for all other operators at the site who have coverage under this permit: _____		
Will there be demolition of any structure built or renovated before January 1, 1980?	☐ Yes	☐ No
If yes, do any of the structures being demolished have at least 10,000 square feet of floor space?	☐ Yes	☐ No
Will you be discharging dewatering water from your site?	☐ Yes	☐ No
If yes, will you be discharging dewatering water from a current or former Federal or State remediation site?	☐ Yes	☐ No

SECTION V. DISCHARGE INFORMATION

Project Information

By indicating "Yes," I confirm that I understand that the CGP only authorizes the allowable stormwater discharges in Part 1.2.1 and the allowable non-stormwater discharges listed in Part 1.2.2. Any discharges not expressly authorized in this permit cannot become authorized or shielded from liability under CWA section 402(k) by disclosure to EPA, State, or local authorities after issuance of this permit via any means, including the Notice of Intent (NOI) to be covered by the permit, the Stormwater Pollution Prevention Plan (SWPPP), during an inspection, etc. If any discharges requiring NPDES permit coverage other than the allowable stormwater and non-stormwater discharges listed in Parts 1.2.1 and 1.2.2 will be discharged, they must be covered under another NPDES permit.	☐ Yes	
Does your project/site discharge stormwater into a Municipal Separate Storm Sewer System (MS4)?	☐ Yes	☐ No
Are there any waters of the U.S. within 50 feet of your project's earth disturbances?	☐ Yes	☐ No

Receiving Waters Information

For each point of discharge, provide the following receiving water information. (Attach a separate list if necessary)

Point of Discharge ID	Provide the name of the first water of the U.S. that receives stormwater directly from the point of discharge and/or from the MS4 that the point of discharge discharges to:	If the receiving water is impaired (on the CWA 303(d) list), list the pollutants that are causing the impairment:	If a TMDL been completed for this receiving waterbody, providing the following information:
			TMDL Name and ID:
			Pollutant(s) for which there is a TMDL:
			TMDL Name and ID:
			Pollutant(s) for which there is a TMDL:

Receiving Waters Information

For each point of discharge, provide the following receiving water information. (Attach a separate list if necessary)			
Point of Discharge ID	**Provide the name of the first water of the U.S. that receives stormwater directly from the point of discharge and/or from the MS4 that the point of discharge discharges to:**	**If the receiving water is impaired (on the CWA 303(d) list), list the pollutants that are causing the impairment:**	**If a TMDL been completed for this receiving waterbody, providing the following information:**
			TMDL Name and ID: **Pollutant(s) for which there is a TMDL:**
			TMDL Name and ID: **Pollutant(s) for which there is a TMDL:**
			TMDL Name and ID: **Pollutant(s) for which there is a TMDL:**
			TMDL Name and ID: **Pollutant(s) for which there is a TMDL:**
			TMDL Name and ID: **Pollutant(s) for which there is a TMDL:**

Are any of the waters of the U.S. to which you discharge designated by the State or Tribal authority under its antidegradation policy as a Tier 2 (or Tier 2.5) water (water quality exceeds levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water) or as a Tier 3 water (Outstanding National Resource Water)? (See Appendix F). ☐ Yes ☐ No

If yes, name(s) of receiving water(s) and its designation (Tier 2, Tier 2.5 or Tier 3):

SECTION VI. CHEMICAL TREATMENT INFORMATION

Chemical Treatment

Will you use polymers, flocculants, or other treatment chemicals at your construction site? ☐ Yes ☐ No

If yes, will you use cationic treatment chemicals at your construction site*? ☐ Yes ☐ No

If yes, have you been authorized to use cationic treatment chemicals by your applicable EPA Regional Office in advance of filing your NOI*? ☐ Yes ☐ No

If you have been authorized to use cationic treatment chemicals by your applicable EPA Regional Office, attach a copy of your authorization letter and include documentation of the appropriate controls and implementation procedures designed to ensure that your use of cationic treatment chemicals will not lead to a violation of water quality standards.

Please indicate the treatment chemicals that you will use:

* Note: You are ineligible for coverage under this permit unless you notify your applicable EPA Regional Office in advance and the EPA office authorizes coverage under this permit after you have included appropriate controls and implementation procedures designed to ensure that your use of cationic treatment chemicals will not lead to a violation of water quality standards.

SECTION VII. STORMWATER POLLUTION PREVENTION PLAN (SWPPP) AND PERSONNEL TRAINING INFORMATION

SWPPP

Has the SWPPP been prepared in advance of filing this NOI, as required? ☐ Yes ☐ No

By indicating "Yes," I confirm that all required personnel, including those conducting inspections at your site, will meet the training requirements in Part 6 of this permit. ☐ Yes

SWPPP Contact Information

First Name	Middle Initial	Last Name

Professional Title

Phone number	Email address

SECTION VIII. ENDANGERED SPECIES PROTECTION

Endangered Species Protection

In accordance with Part 1.1.5, if the EPA Regional Office grants you a waiver from electronic reporting, you must complete the worksheet in Appendix D to select your eligibility criteria with respect to the protection of Federally listed threatened or endangered species and Federally designated "critical habitat" under the Endangered Species Act (ESA) [hereinafter "ESA-listed species and designated critical habitat(s)"] from discharges and discharge-related activities authorized under this permit.

You must submit the ESA worksheet and all required supporting documentation with this NOI. If you do not submit the worksheet and the required supporting documentation with your NOI, your NOI will be considered incomplete. After you submit your NOI and before your NOI is authorized, EPA may notify you if any additional controls are necessary to ensure your discharges are not likely to result in any short- or long-term adverse effects on ESA-listed species and critical habitat.

By indicating "Yes," I confirm that you have included the completed ESA worksheet from Appendix D and all required supporting information for your criterion selection with the submission of this NOI. ☐ Yes

SECTION IX. HISTORIC PRESERVATION

Historic Preservation

Are you installing any stormwater controls as described in Appendix E that require subsurface earth disturbance? (Appendix E, Step 1) ☐ Yes ☐ No

If yes, have prior surveys or evaluations conducted on the site have already determined historic properties do not exist, or that prior disturbances have precluded the existence of historic properties? (Appendix E, Step 2) ☐ Yes ☐ No

If no, have you determined that your installation of subsurface earth-disturbing stormwater controls will have no effect on historic properties? (Appendix E, Step 3) ☐ Yes ☐ No

If no, did the SHPO, THPO, or other Tribal representative (whichever applies) respond to you within the 15 calendar days to indicate whether the subsurface earth disturbances caused by the installation of stormwater controls affect historic properties? (Appendix E, Step 4) ☐ Yes ☐ No

If yes, describe the nature of their response:

- ☐ Written indication that no historic properties will be affected by the installation of stormwater controls.
- ☐ Written indication that adverse effects to historic properties from the installation of stormwater controls can be mitigated by agreed upon actions.
- ☐ No agreement has been reached regarding measures to mitigate effects to historic properties from the installation of stormwater controls.
- ☐ Other (Specify):

SECTION X. CERTIFICATION INFORMATION

Certification Information

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 have no personal knowledge that the information submitted is other than 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.

First Name	Middle Initial	Last Name

Title

Signature	Date (MM/DD/YYYY)

Email Address

General Instructions

Who Must File an NOI Form?

Under the provisions of the Clean Water Act, as amended (33 U.S.C. 1251 et. seq.; the Act), Federal law prohibits stormwater discharges from certain construction activities to waters of the U.S. unless that discharge is covered under a National Pollutant Discharge Elimination System (NPDES) permit. Operators of construction sites where one or more acres are disturbed, smaller sites that are part of a larger common plan of development or sale where there is a cumulative disturbance of at least one acre, or any other site specifically designated by the Director, must obtain coverage under an NPDES general permit. For coverage under the 2022 CGP, each person, firm, public organization, or any other entity that meets either of the following criteria must file a Notice of Intent form: (1) they have operational control over construction plans and specifications, including the ability to make modifications to those plans and specifications; or (2) they have day-to-day operational control of those activities at the project necessary to ensure compliance with the permit conditions. If you have questions about whether you need a NPDES stormwater permit, or if you need information to determine whether EPA or your State agency is the permitting authority, contact your EPA Regional Office.

Completing the Form

Obtain and read a copy of the 2022 CGP, viewable at https://www.epa.gov/npdes/stormwater-discharges-construction-activities#cgp. To complete this form, type or print uppercase letters, in the appropriate areas only. Please place each character between the marks (abbreviate if necessary to stay within the number of characters allowed for each item). Use one space for breaks between words, but not for punctuation marks unless they are needed to clarify your response. If you have any questions on this form, telephone EPA's NOI Processing Center at (866) 352-7755. **Please submit the original document with signature in ink - do not send a photocopied signature.**

Section I. Approval to Use Paper NOI Form

You must indicate whether you have been granted a waiver from electronic reporting from the EPA Regional Office. Note that you are not authorized to use this paper NOI form unless the EPA Regional Office has approved its use. Where you have obtained approval to use this form, indicate the waiver that you have been granted, the name of the EPA staff person who granted the waiver, and the date that approval was provided.

See https://www.epa.gov/npdes/contact-us-stormwater#regional for a list of EPA Regional Office contacts.

Section II. Permit Information

Provide the master permit number of the permit under which you are applying for coverage (see Appendix B of the general permit for the list of eligible master permit numbers)

Section III. Operator Information

Provide the legal name of the person, firm, public organization, or any other entity that operates the project described in this NOI. Refer to Appendix A of the permit for the definition of "operator".

Indicate whether you are seeking coverage under this permit as a "Federal Operator" or "Federal Facility" as defined in Appendix A.

Also provide a point of contact, the operator's mailing address, county, telephone number, and e-mail address (to be notified via e-mail of NOI approval when available). Correspondence for the NOI will be sent to this address.

If the NOI was prepared by someone other than the certifier (for example, if the NOI was prepared by the facility SWPPP contact or a consultant for the certifier's signature), include the full name, organization, phone number, and email address of the NOI preparer.

Section IV. Project/Site Information

Enter the official or legal name and complete street address, including city, State, ZIP code, and county or similar government subdivision of the project or site. If the project or site lacks a street address, indicate the general location of the site (e.g., Intersection of State Highways 61 and 34). Complete site information must be provided for permit coverage to be granted.

Provide the latitude and longitude of your facility in decimal degrees format. The latitude and longitude of your facility can be determined in several different ways, including through the use of global positioning system (GPS) receivers, U.S. Geological Survey (U.S.G.S.) topographic or quadrangle maps, and web-based siting tools, among others. For consistency, EPA requests that measurements be taken from the approximate center of the construction site. For linear construction sites, the measurement should be taken midpoint of the site. If known, enter the horizontal reference datum for your latitude and longitude. The horizontal reference datum is shown on the bottom left corner of USGS topographic maps; it is also available for GPS receivers.

Indicate whether the project is in Indian country lands or located on a property of religious or cultural significance to an Indian Tribe, and if so, provide the name of the Indian Tribe associated with the area of Indian country (including name of Indian reservation, if applicable), or if not in Indian country, provide the name of the Indian Tribe associated with the property.

Enter the estimated construction start and completion dates using four digits for the year (i.e., 10/06/2012). Indicate to the nearest quarter acre the estimated area to be disturbed. Indicate the type of construction site.

Indicate whether the pre-development land use of the site was used for agriculture Appendix A defines "agricultural land" as cropland, grassland, rangeland, pasture, and other agricultural land, on which agricultural and forest-related products or livestock are produced and resource concerns may be addressed. Agricultural lands include cropped woodland, marshes, incidental areas included in the agricultural operation, and other types of agricultural land used for the production of livestock.

Indicate whether earth-disturbing activities have already commenced on your project/site. If earth-disturbing activities have commenced on your site because stormwater discharges from the site have been previously covered under a NPDES permit, you must provide the 2017 CGP NPDES ID or

the NPDES permit number if coverage was under an individual permit.

Indicate if demolition is occurring, and if so, if the structure has at least 10,000 square feet of floor space.

Indicate if there are other operators covered under this permit for the same project site. If there are multiple operators, provide the NPDES ID number for the other operators at the site who have coverage under this permit.

Indicate whether you will be discharging dewatering water, as defined in Appendix A, during the course of the project. If you will be discharging dewatering water, indicate whether the site from which you will be dewatering is located on a current or former Federal or State remediation site. Federal remediation sites include cleanups covered by Superfund (both National Priorities List (NPL) sites and non-NPL sites), Resource Conservation and Recovery Act (RCRA) corrective actions sites, cleanups at Federal Facilities, and Federal, State, or Tribal brownfields sites. State remediation sites could include, for instance, brownfield site cleanups funded by the State, State superfund sites, and petroleum tank release sites. Operators may use online mapping resources, such as EPA's Cleanups in My Community Map, to help determine if they are located on a remediation site. The Cleanups in My Community Map is viewable at:

https://ordspub.epa.gov/ords/cimc/f?p=cimc:map::::71

Section V. Discharge Information

You must confirm that you understand that the CGP only authorizes the allowable stormwater discharges listed in Part 1.2.1 and the allowable non-stormwater discharges listed in Part 1.2.2. Any discharges not expressly authorized under the CGP are not covered by the CGP or the permit shield provision of the CWA Section 402(k) and they cannot become authorized or shielded by disclosure to EPA, State, or local authorities via the NOI to be covered by the permit or by any other means (e.g., in the SWPPP or during an inspection). If any discharges requiring NPDES permit coverage other than the allowable stormwater and non-stormwater discharges listed in Parts 1.2.1 and 1.2.2 will be discharged, they must either be eliminated or covered under another NPDES permit.

Indicate whether discharges from the site will enter into a municipal separate storm sewer system (MS4), as defined in Appendix A.

Also, indicate whether any waters of the U.S. exist within 50 feet from your site. Note that if "yes", you are required to comply with the requirement in Part 2.2.1 of the permit to provide natural buffers or equivalent erosion and sediment controls.

For each unique point of discharge you list, you must specify the name of the first water of the U.S. that receives stormwater directly from the point of discharge and/or from the MS4 that the point of discharge discharges to. You must specify whether any waters of the U.S. that you discharge to are listed as "impaired" as defined in Appendix A, and the pollutants for which the water is impaired. You must identify any Total Maximum Daily Loads (TMDL) that have been completed for any of the waters of the U.S. that you discharge to. Operators may find it useful to use EPA's Discharge Mapping Tool to determine whether the water of the U.S. is impaired, the pollutant causing the impairment, and whether a TMDL exists for the water body. The Discharge Mapping Tool is viewable at https://www.epa.gov/npdes/epas-stormwater-discharge-mapping-tools.

Indicate whether discharges from the site will enter into a water of the U.S. that is designated as a Tier 2, Tier 2.5, or Tier 3 water. A list of Tier 2, 2.5, and 3 waters is provided at https://www.epa.gov/npdes/construction-general-permit-resources-tools-and-templates. If the answer is "yes", name all waters designated as Tier 2, Tier 2.5, or Tier 3 to which the site will discharge.

Section VI. Chemical Treatment Information

Indicate whether the site will use polymers, flocculants, or other treatment chemicals. Indicate whether the site will employ cationic treatment chemicals. If the answer is "yes" to either question, indicate which chemical(s) you will use. Note that you are not eligible for coverage under this permit to use cationic treatment chemicals unless you notify your applicable EPA Regional Office in advance and the EPA office authorizes coverage under this permit after you have included appropriate controls and implementation procedures designed to ensure that your use of cationic treatment chemicals will not lead to a violation of water quality standards. If you have been authorized to use cationic treatment chemicals by your applicable EPA Regional Office, attach a copy of your authorization letter and include documentation of the appropriate controls and implementation procedures designed to ensure that your use of cationic treatment chemicals will not lead to a violation of water quality standards. Examples of cationic treatment chemicals include, but are not limited to, cationic polyacrylamide (C-PAM), PolyDADMAC (POLY DIALLYL DIMETHYL AMMONIUM CHLORIDE), and chitosan.

Section VII. Stormwater Pollution Prevention Plan (SWPPP) and Personnel Training Information

All sites eligible for coverage under this permit are required to prepare a SWPPP in advance of filing the NOI, in accordance with Part 7. Indicate whether the SWPPP has been prepared in advance of filing the NOI.

Confirm that all required personnel, including those conducting inspections at your site, will meet the training requirements in Part 6 of this permit.

Indicate the street, city, State, and ZIP code where the SWPPP can be found. Indicate the contact information (name, organization, phone, and email) for the person who developed the SWPPP for this project.

Section VIII. Endangered Species Information

Confirm that you have included the completed ESA worksheet from Appendix D and all required supporting information for your criterion selection with the submission of this NOI.

Section IX. Historic Preservation

Use the instructions in Appendix E to complete the questions on the NOI form regarding historic preservation.

Section X. Certification Information

The NOI must be signed as follows:

For a corporation: By a responsible corporate officer. For the purpose of this Section, a responsible corporate officer means:

(i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (ii) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making

major capital investment recommendations, and initiating and directing other comprehensive measures to assure long-term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

For a partnership or sole proprietorship: By a general partner or the proprietor, respectively; or

For a municipality, State, Federal, or other public agency: By either a principal executive officer or ranking elected official. For purposes of this Part, a principal executive officer of a Federal agency includes (i) the chief executive officer of the agency, or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrator of EPA). Include the name and title of the person signing the form and the date of signing. An unsigned or undated NOI form will not be considered eligible for permit coverage.

Modifying Your NOI

If you have been granted a waiver from your Regional Office from electronic reporting, and if after submitting your NOI you need to correct or update any fields on this NOI form, you may do so by indicating changes on this same form.

Paperwork Reduction Act Notice

This collection of information is approved by OMB under the Paperwork Reduction Act, 44 U.S.C. 3501 et seq. (OMB Control No. 2040-0305). Responses to this collection of information are mandatory (40 CFR 122.26). An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The public reporting and recordkeeping burden for this collection of information is estimated to be 3.3 hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates and any suggested methods for minimizing respondent burden to the Regulatory Support Division Director, U.S. Environmental Protection Agency (2821T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

Submitting Your Form

Submit your NOI form by mail to one of the following addresses:

For Regular U.S. Mail Delivery:
Stormwater Notice Processing Center
Mail Code 4203M, ATTN: 2022 CGP
U.S. EPA
1200 Pennsylvania Avenue, NW
Washington, DC 20460

For Overnight/Express Mail Delivery:
Stormwater Notice Processing Center
William Jefferson Clinton East Building - Room 7420
ATTN: 2022 CGP
U.S. EPA
1201 Constitution Avenue, NW
Washington, DC 20004

Visit this website for instructions on how to submit electronically:

https://www.epa.gov/npdes/stormwater-discharges-construction-activities#ereporting

Appendix I - Notice of Termination (NOT) Form and Instructions

Part 8.3 requires you to use the NPDES eReporting Tool, or "NeT" system, to prepare and submit your NOT electronically. However, if the EPA Regional Office grants you a waiver to use a paper NOT form, and you elect to use it, you must complete and submit the following form.

NPDES Form 3510-13	EPA	U.S. Environmental Protection Agency Washington, DC 20460 Notice of Termination for the 2022 NPDES Construction General Permit	OMB No. 2040-0305 Exp. Date 01/31/2025

Submission of this Notice of Termination constitutes notice that the operator identified in Section III of this form is no longer authorized discharge pursuant to the NPDES Construction General Permit (CGP) from the site identified in Section IV of this form. All necessary information must be included on this form. Refer to the instructions at the end of this form.

SECTION I. APPROVAL TO USE PAPER NOI FORM

Paper NOI Form

Have you been granted a waiver from electronic reporting from the Regional Office*? ☐ Yes ☐ No

If yes, check which waiver you have been granted, the name of the EPA Regional Office staff person who granted the waiver, and the date of approval:

Waiver granted:

☐ The owner/operator's headquarters is physically located in a geographic area (i.e., ZIP code or census tract) that is identified as under-served for broadband Internet access in the most recent report from the Federal Communications Commission.

☐ The owner/operator has issues regarding available computer access or computer capability.

Name of EPA staff person that granted the waiver	Date approval obtained (MM/DD/YYYY)

*** Note: You are required to obtain approval from the applicable Regional Office prior to using this paper NOI form. If you have not obtained a waiver, you must file this form electronically using the NPDES eReporting Tool (NeT).**

SECTION II. PERMIT INFORMATION

Permit

NPDES ID

Reason for Termination (Check only one):

☒ You have completed all construction activities at your site, and you have met all other requirements in Part 8.2.1.

Check this box to confirm that you have attached photographs as required by Part 8.2.1.a that document your compliance with the permit's final stabilization requirements.

Include the date each photograph was taken, and a brief description of the area of the site captured by the photograph (e.g., photo shows application of seed and erosion control mats to remaining exposed surfaces on northeast corner of site).

☐ If any portion of your site is covered by one of the Part 2.2.14c.iii exceptions to the final stabilization criteria, indicate which exception applies and include a supplementary explanation with your photographs that provides the necessary context for why this portion of the site is in compliance even though it appears to be unstabilized.

☒ Another operator has assumed control over all areas of the site and that operator has submitted an NOI and obtained coverage under the CGP.

☒ You have obtained coverage under an individual permit or another general NPDES permit addressing stormwater discharges from the construction site.

SECTION III. OPERATOR INFORMATION

Operator Information

Operator Name

Mailing Address

Street

City	State	ZIP Code

County or Similar Government Division

Phone Number	Email Address

SECTION IV. PROJECT/SITE INFORMATION

Project/Site Address

Project/Site Name		
Street/Location		
City	State	ZIP Code
County or Similar Government Division:		

SECTION V. CERTIFICATION INFORMATION

Certification Information

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.

First Name	Middle Initial	Last Name
Title		
Signature		Date (MM/DD/YYYY)
Email Address		

General Instructions

Who May File an NOT Form?

Permittees who are presently covered under the EPA-issued 2022 Construction General Permit (CGP) for Stormwater Discharges Associated with Construction Activity may submit an NOT form when: (1) earth-disturbing activities at the site are completed and the conditions in Parts 8.2.1.a through 8.2.1.b are met; or (2) the permittee has transferred all areas under its control to another operator, and that operator has submitted and obtained coverage under this permit; or (3) the permittee has obtained coverage under a different NPDES permit for the same discharges.

Completing the Form

Type or print, using uppercase letters, in the appropriate areas only. Please place each character between the marks. Abbreviate if necessary to stay within the number of characters allowed for each item. Use only one space for breaks between words, but not for punctuation marks unless they are needed to clarify your response. If you have any questions about this form, refer to https://www.epa.gov/npdes/stormwater-discharges-construction-activities#cgp or telephone EPA's NOI Processing Center at (866) 352-7755. **Please submit original document with signature in ink - do not send a photocopied signature.**

Section I. Approval to Use Paper NOI Form

You must indicate whether you have been granted a waiver from electronic reporting from the EPA Regional Office. Note that you are not authorized to use this paper NOT form unless the EPA Regional Office has approved its use. Where you have obtained approval to use this form, indicate the waiver that you have been granted, the name of the EPA staff person who granted the waiver, and the date that approval was provided.

See https://www.epa.gov/npdes/contact-us-stormwater#regional for a list of EPA Regional Office contacts.

Section II. Permit Information

Enter the existing NPDES ID assigned to the project . If you do not know the NPDES ID number, or contact EPA's NOI Processing Center at (866) 352-7755.

Indicate your reason for submitting this Notice of Termination by checking the appropriate box. Check only one. If you selected the first box, confirm that you have attached photographs as required by Part 8.2.1.a. All submitted photographs must: (1) be taken both before and after the site has met the final stabilization criteria in Part 2.2.14.c; (2) be clear and in focus, and in the original format and resolution; and (3) include the date each photograph was taken, and a brief description of the area of the site captured by the photograph (e.g., photo shows application of seed and erosion control mats to remaining exposed surfaces on northeast corner of site).

If any portion of your site is covered by one of the Part 2.2.14c.iii final stabilization exceptions, indicate which exception applies and provide an explanation with your photographs that describes why this portion of the site is in compliance even though it may appear to be unstabilized.

Section III. Operator Information

Provide the legal name of the person, firm, public organization, or any other entity that operates the project described in this NOT and is covered by the NPDES ID identified in Section II. Enter the complete mailing address, telephone number, and email address of the operator.

Section IV. Project/Site Information

Enter the official or legal name and complete street address, including city, State, ZIP code, and county or similar government subdivision of the project or site. If the project or site lacks a street address, indicate the general location of the site (e.g., Intersection of State Highways 61 and 34). Complete site information must be provided for termination of permit coverage to be valid.

Section V. Certification Information

The NOT, must be signed as follows:

For a corporation: By a responsible corporate officer. For the purpose of this Part, a responsible corporate officer means: (i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy-or decision-making functions for the corporation, or (ii) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long-term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

For a partnership or sole proprietorship: By a general partner or the proprietor, respectively; or

For a municipality, State, Federal, or other public agency: By either a principal executive officer or ranking elected official. For purposes of this Part, a principal executive officer of a Federal agency includes (i) the chief executive officer of the agency, or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrator of EPA).

Include the name, title, and email address of the person signing the form and the date of signing. An unsigned or undated NOT form will not be considered valid termination of permit coverage.

Paperwork Reduction Act Notice

This collection of information is approved by OMB under the Paperwork Reduction Act, 44 U.S.C. 3501 et seq. (OMB Control No. 2040-0305). Responses to this collection of information are mandatory (40 CFR 122.26). An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a

currently valid OMB control number. The public reporting and recordkeeping burden for this collection of information is estimated to be 1.2 hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates and any suggested methods for minimizing respondent burden to the Regulatory Support Division Director, U.S. Environmental Protection Agency (2821T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

Submitting Your Form

Submit your NOT form by mail to one of the following addresses:

For Regular U.S. Mail Delivery:
Stormwater Notice Processing Center
Mail Code 4203M, ATTN: 2022 CGP
U.S. EPA
1200 Pennsylvania Avenue, NW
Washington, DC 20460

For Overnight/Express Mail Delivery:
Stormwater Notice Processing Center
William Jefferson Clinton East Building - Room 7420
ATTN: 2022 CGP
U.S. EPA
1201 Constitution Avenue, NW
Washington, DC 20004

Visit this website for instructions on how to submit electronically:

https://www.epa.gov/npdes/stormwater-discharges-construction-activities#ereporting

Appendix J - Suggested Format for Request for Chemical Treatment

If you plan to add "cationic treatment chemicals" (as defined in Appendix A) to stormwater and/or authorized non-stormwater prior to discharge, Part 1.1.9 requires you to notify your applicable EPA Regional Office in advance of submitting your NOI. The EPA Regional Office will authorize coverage under this permit after you have included appropriate controls and implementation procedures designed to ensure that your use of cationic treatment chemicals will result in discharges that meet applicable water quality standards. To notify your EPA Regional Office, you may use following form.

NPDES Form 6100-066	EPA	U.S. Environmental Protection Agency Washington, DC 20460 Suggested Form for Notifying EPA about Proposed Use of Cationic Treatment Chemicals under the 2022 NPDES Construction General Permit	OMB No. 2040-0305 Exp. Date 01/31/2025

Under Part 1.1.9 of the 2022 CGP, if you plan to add "cationic treatment chemicals" (as defined in Appendix A) to stormwater and/or authorized non-stormwater prior to discharge, you may not submit your Notice of Intent (NOI) until you notify your applicable EPA Regional Office in advance and the EPA Regional Office authorizes coverage under this permit after you have included appropriate controls and implementation procedures designed to ensure that your use of cationic treatment chemicals will result in discharges that meet applicable water quality standards. You may use this suggested form to notify your EPA Regional Office about your proposed use of cationic treatment chemicals.

SECTION I. OPERATOR INFORMATION

Operator Information

Operator Name		
Mailing Address		
Street		
City	State	ZIP Code
County or Similar Government Division		
Phone Number	Email Address	

SECTION II. PROJECT/SITE INFORMATION

Project/Site Information

Project/Site Name		
Project/Site Address		
Street/Location		
City	State	ZIP Code
County or Similar Government Division		
Site Contact Information (if different from operator)		
First Name	Middle Initial	Last Name
Phone Number		
Receiving Waterbodies		
Name(s) of Receiving Waterbodies:		

SECTION III. MAP

Map

Attach a map that illustrates the entire site including all of the below items. Include this map in your Stormwater Pollution Prevention Plan (SWPPP).
- All receiving waterbodies
- All proposed location(s) of chemical treatment system(s)
- All proposed point(s) of discharge to receiving waterbodies
- All soil types within areas to be disturbed
- All areas of earth disturbance
- Sufficient indication of topography to indicate where stormwater flows

Attach a schematic drawing of the proposed treatment system(s). Include all components of the treatment train, sample points, and pipe configurations. In addition to sufficient holding capacity upstream of treatment, the system must have the capacity to hold water for testing and to re-treat water that does not meet water quality standards.

SECTION IV. RESPONSIBLE PERSONNEL

Responsible Personnel

Treatment System Operator or Company Name (if subcontracted out):		
Street/Location		
City	State	ZIP Code

Responsible Personnel	
List personnel who will be responsible for operating the chemical treatment systems and application of the chemicals.	Cite the training that the personnel have received in operation and maintenance of the treatment system(s) and use of the specific chemical(s) proposed.

SECTION V. PROPOSED TREATMENT

Proposed Treatment

Check proposed treatment system to be used:	☐ Chitosan enhanced sand filtration with discharge to infiltration (ground water).
	☐ Chitosan enhanced sand filtration with discharge to temporary holding ponds (batch).
	☐ Chitosan enhanced sand filtration with discharge to surface waters (flow-through).
	☐ Other (describe below and submit documentation that the proposed system and chemical(s) demonstrate the ability to remove turbidity and produce non-toxic effluent/discharge):
Check proposed cationic chemical(s) to be used:	☐ FlocClear™ (2% chitosan acetate solution).
	☐ StormKlear™ LiquiFloc™ (1% chitosan acetate solution).
	☐ ChitoVan™ (1% chitosan acetate solution).
	☐ StormKlear™ LiquiFloc™ (3% chitosan acetate solution).
	☐ Other (Specify):

Estimated Treatment Period Start Date (MM/DD/YYYY)	Estimated Treatment Period End Date (MM/DD/YYYY)

Describe sampling and recordkeeping schedule. Attach additional sheets as needed:

Proposed Treatment

Explain why you have selected this proposed treatment system and chemicals. Include an explanation of why the use of cationic treatment chemicals is necessary at the site. Reference how the soil types on your site influenced your choices. Describe or provide an illustration of how the site of the discharge will be stabilized and why the discharge location will not cause erosion of the discharge water's bank or bed (please note that a permit from the Corps and State agencies may be necessary to place rock in the water body for this stabilization). Attach as many additional sheets as needed for a full explanation. If you have a report from a chemical treatment contractor describing their recommended approach you may attach that.

SECTION VI. CERTIFICATION INFORMATION

Certification Information

I have documented and hereby certify that the following information is correct and has been documented in the SWPPP for this project:

- The SWPPP includes a complete site-specific description of the chemical treatment system herein proposed for use, including specifications, design, and Material Safety Data Sheets for all chemicals to be used.
- The controls to be used on the site are compatible with the safe and effective use of cationic chemical treatment.
- I verified through jar tests that the site soil is conducive to chemical treatment.
- I verified that the chemical treatment system operators for this project received training.
- I read, understand, and will follow all conditions and design criteria in the applicable use designation(s).
- If the discharge is to Tribal waters, I notified the appropriate Tribal government of the intent to use chemical treatment on a site located within that jurisdiction.
- I will keep the use level designation, operation and maintenance manual, and training certificate on site prior to and during use of chemical treatment.
- A licensed engineer designed the system for this project including system sizing, pond sizing, and flow requirements.
- I verify that the discharge will not adversely affect downstream conveyance systems or stream channels (e.g., cause erosion).

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.

Authorized Official

First Name	Middle Initial	Last Name

Title

Signature	Date (MM/DD/YYYY)

Email Address

Section I. Operator Information

Provide the legal name of the person, firm, public organization, or any other entity that operates the project. Refer to Appendix A of the permit for the definition of "operator." Provide the operator's mailing address, county, telephone number, and e-mail address.

Section II. Project/Site Information

Enter the official or legal name and complete street address, including city, State, ZIP code, and county or similar government subdivision of the project or site. If the project or site lacks a street address, indicate the general location of the site (e.g., Intersection of State Highways 61 and 34).

Provide site contact information, if different from the operator.

Provide the name of the receiving waterbodies to which your site/project will discharge.

Section III. Map

Attach a map of the entire site that includes the identified items. Attach a schematic of the proposed treatment system(s) that includes the identified items.

Section IV. Responsible Personnel

Provide the legal name of the treatment system operator or company and complete street address, including city, State, including city, State, and ZIP code.

List personnel who will be responsible for operating the chemical treatment systems and application of the chemicals. For each personnel listed, cite the training that the personnel have received in operation and maintenance of the treatment system(s) and use of the specific chemical(s) proposed.

Section V. Proposed Treatment

Indicate the proposed treatment system and proposed cationic chemicals to be used. Indicate the estimated treatment start and end dates. Describe the sampling and recordkeeping schedule. Explain why you have selected the proposed treatment system and chemicals.

Section VI. Certification Information

The form must be signed as follows:

For a corporation: By a responsible corporate officer. For the purpose of this Section, a responsible corporate officer means:

(i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (ii) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long-term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

For a partnership or sole proprietorship: By a general partner or the proprietor, respectively; or

For a municipality, State, Federal, or other public agency: By either a principal executive officer or ranking elected official. For purposes of this Part, a principal executive officer of a Federal agency includes (i) the chief executive officer of the agency, or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrator of EPA). Include the name and title of the person signing the form and the date of signing.

Submitting Your Form

Submit this form to your applicable EPA Regional Office. Contact information can be found at: https://www.epa.gov/npdes/contact-us-stormwater#regional

Appendix K – Turbidity Monitoring Report Form and Instructions

Part 3.3 requires you to use the EPA NPDES eReporting Tool, or "NeT" system, to prepare and submit your report electronically. However, if the EPA Regional Office grants you a waiver to use a paper form, and you elect to use it, you must complete and submit the following form.

NPDES Form 6100-065	EPA	U.S. Environmental Protection Agency Washington, DC 20460 Turbidity Monitoring Report Form for Dewatering Discharges to Sensitive Waters Under the 2022 NPDES Construction General Permit	OMB No. 2040-0305 Exp. Date 01/31/2025

SECTION I. APPROVAL TO USE PAPER FORM

Paper Form

Have you been granted a waiver from electronic reporting from the Regional Office*? ☐ Yes ☐ No

If yes, check which waiver you have been granted, and provide the name of the EPA Regional Office staff person who granted the waiver, and the date of approval:

Waiver granted:

☐ The owner/operator's headquarters is physically located in a geographic area (i.e., ZIP code or census tract) that is identified as under-served for broadband Internet access in the most recent report from the Federal Communications Commission.

☐ The owner/operator has issues regarding available computer access or computer capability.

Name of EPA staff person that granted the waiver	Date approval obtained (MM/DD/YYYY)

*** Note: You are required to obtain approval from the applicable Regional Office prior to using this paper form. If you have not obtained a waiver, you must file this form electronically using the NPDES eReporting Tool (NeT).**

SECTION II. PERMIT INFORMATION

Permit

NPDES ID

Does this report fulfill turbidity monitoring report obligations of other operators that are covered under this permit for the same project site? ☐ Yes ☐ No

If yes, provide the NPDES ID number(s) for all other such operators at the same project site: _____

SECTION III. OPERATOR INFORMATION

Operator Information

Operator Name

Mailing Address

Street

City	State	ZIP Code

County or Similar Government Division:

Phone Number	Email Address

Preparer

Complete if form was prepared by someone other than the certifier:

First Name	Middle Initial	Last Name

Organization

Phone Number	Email Address

SECTION IV. SITE INFORMATION

Site Address

Site Name

Site Address

Street/Location

City	State	ZIP Code

County or Similar Government Division:

SECTION IV. MONITORING QUARTER

Monitoring Quarter

Identify monitoring quarter (select only one):

- ☐ Quarter 1 (January 1 – March 31)
- ☐ Quarter 2 (April 1 – June 30)
- ☐ Quarter 3 (July 1 – September 30)
- ☐ Quarter 4 (October 1 – December 31)

SECTION IVI. TURBIDITY MONITORING DATA

Turbidity Monitoring Data

Discharge Point Description/ Name:

Was dewatering water discharged during the monitoring quarter? ☐ Yes (Enter the data below) ☐ No (Skip to Section VII)

Specific Week within Monitoring Quarter[1]	Weekly Average (NTU)[2]	Benchmark Threshold (NTU)	Alternate Benchmark Threshold (NTU)[3]	Average exceeds Benchmark?[4]
Week 1		50		☐ Yes ☐ No
Week 2		50		☐ Yes ☐ No
Week 3		50		☐ Yes ☐ No
Week 4		50		☐ Yes ☐ No
Week 5		50		☐ Yes ☐ No
Week 6		50		☐ Yes ☐ No
Week 7		50		☐ Yes ☐ No
Week 8		50		☐ Yes ☐ No
Week 9		50		☐ Yes ☐ No
Week 10		50		☐ Yes ☐ No
Week 11		50		☐ Yes ☐ No
Week 12		50		☐ Yes ☐ No
Week 13		50		☐ Yes ☐ No
Week 14		50		☐ Yes ☐ No

[1] Refer to Table K-1 to determine the specific monitoring week number for which you are reporting turbidity data for this quarter.

[2] Report to the nearest whole number. Enter "N/A" if no dewatering discharge occurred during any particular week.

[3] Prior approval from the EPA Regional Office is required pursuant to Part 3.3.2.b. Unless and until EPA approves your request to use an alternate benchmark, you are required to use the standard benchmark of 50 NTU and take any required corrective actions if an exceedance occurs. Enter "N/A" if you have not received approval for an alternate benchmark threshold.

[4] If "Yes," the operator must conduct follow-up corrective action pursuant to Part 5.2.2 and document any corrective action taken in the corrective action log in accordance with Part 5.4.

VII. CERTIFICATION INFORMATION

Certification Information

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.

First Name	Middle Initial	Last Name

Title

Signature	Date (MM/DD/YYYY)

Phone Number	Email Address

General Instructions

Who Must Submit A Turbidity Monitoring Report to EPA?

Sites covered under the Construction General Permit (CGP or permit) that are required to monitor pursuant to Part 3.3 of the permit must submit Turbidity Monitoring Reports consistent with the reporting requirements specified in Part 3.3.4 of the permit.

When Must I Submit A Turbidity Monitoring Report to EPA?

You must submit your report to EPA no later than 30 days following the end of each monitoring quarter. Submit a form for every quarter the site is active.

Monitoring Quarter #	Months	Reporting Deadline
1	January 1 – March 31	April 30
2	April 1 – June 30	July 30
3	July 1 – September 30	October 30
4	October 1 – December 31	January 30

Completing the Form

Obtain and read a copy of the 2022 CGP, viewable at https://www.epa.gov/npdes/stormwater-discharges-construction-activities#cgp. To complete this form, type or print, using uppercase letters, in the appropriate areas only. Please submit the original document with signature in ink - do not send a photocopied signature. **Photocopy your form for your records before you send the completed original form to the appropriate address.**

Section I. Approval to Use Paper Form

You must indicate whether you have been granted a waiver from electronic reporting from the EPA Regional Office. Note that you are not authorized to use this paper form unless the EPA Regional Office has approved its use. Where you have obtained approval to use this form, indicate the waiver that you have been granted, the name of the EPA staff person who granted the waiver, and the date that approval was provided. See https://www.epa.gov/npdes/contact-us-stormwater for a list of EPA Regional Office contacts.

Section II. Permit Information

Provide the NPDES ID (i.e., NOI tracking number) assigned to the site for which this form is being submitted. Submit the form only for sites discharging dewatering water to a sediment-impaired water or a water designated as a Tier 2, Tier 2.5, or Tier 3 water.

Indicate whether this report fulfills turbidity monitoring report obligations of other operators that are covered under this permit for the same project site. If the answer is yes, provide all relevant NPDES ID numbers.

Section III. Operator Information

Provide the legal name of the person, firm, public organization, or any other entity that is considered the operator of the site. See Part 1.1.1 and Appendix A for the definition of "operator." Provide the operator's mailing address, phone number, and e-mail. The operator information in this Section should match the operator information provided on your NOI form.

If this form was prepared by someone other than the certifier, include the name, organization, phone number, and email address of the person who prepared this form.

Section IV. Site Information

Enter the official or legal name and complete street address, including city, State, ZIP code, and county or similar government subdivision of the site. If the site lacks a street address, indicate the general location (e.g., Intersection of State Highways 61 and 34). The site information in this Section should match the site information provided on your NOI form.

Section V. Monitoring Quarter

Indicate the appropriate monitoring quarter (Quarter 1, 2, 3, or 4). The monitoring quarters are specified in the table in the section titled "When Must I Submit A Turbidity Monitoring Report to EPA." Select only one quarter.

Section VI. Turbidity Monitoring Data

Provide the discharge point description/name if you are discharging dewatering water from more than one point at the site. If you are discharging from only one point at the site, leave the spaces blank.

Submit Section VI data for each dewatering discharge point. For example, if you are discharging dewatering water from two points at the site, then submit two Section VIs (one for each discharge point).

Indicate whether dewatering occurred during the monitoring quarter. If "Yes" enter the data in the data table. If "No" skip to Section VII.

For averaging purposes, a monitoring week starts with a Monday and ends on Sunday. A numerical value is assigned for each week, which is called a Week Number (e.g., 1, 2, 3 etc.). The form includes a Week Number for each week of the year. Refer to Table K-1 for the dates that correspond with each Week Number.

Next, calculate the weekly average turbidity value for the corresponding monitoring week. The weekly average is calculated by adding all of the individual turbidity results for that monitoring week and dividing by the total number of samples. The calculation for the weekly average includes only those days when dewatering discharge occurred. Days when no dewatering discharge occurred, and therefore do not have turbidity data associated with them, are not included in the calculation of the weekly average. For example, if turbidity samples from your dewatering discharge in week 1 result in values of 30 NTU on Tuesday, 40 NTU on Wednesday, and 45 NTU on Thursday, your weekly average turbidity value would be 38 NTU ((30+40+45) ÷ 3 = 38 NTU). If in week 2, your turbidity samples resulted in values of 45 NTU on Monday, 30 NTU on Tuesday, 25 NTU on Wednesday, and 15 NTU on Thursday, you would calculate a new average for that week, which would yield an average turbidity value of 29 NTU ((45+30+25+15) ÷ 4 = 29 NTU). By comparison, if your samples on consecutive days from Friday to Monday were 60

NTU, 45 NTU, 40 NTU, and 43 NTU, respectively, and there are no other dewatering discharges for the remainder of the week, you would calculate one weekly average for the Friday to Sunday to be 48 NTU ((60+45+40) ÷ 3 = 48 NTU), and a separate weekly average for the one Monday to be 43 NTU (43 ÷ 1 = 43 NTU).

If you collect and analyze more than one turbidity sample per day from your dewatering discharge, you must include any additional results in the calculation of your weekly average. For example, if during a monitoring week you take two turbidity samples on Tuesday with a value of 30 NTU and 35 NTU, three samples on Wednesday with a value of 40 NTU, 45 NTU, and 48 NTU, and one sample on Thursday with a value of 45 NTU, your weekly average turbidity value for this week would be 41 NTU ((30+35+40+45+48+45) ÷ 6 = 41 NTU).

Enter the weekly average turbidity values for the corresponding week into the table. Enter "N/A" into the table for the turbidity weekly average if no dewatering discharge occurred during the week.

The benchmark threshold for turbidity for this permit is 50 NTUs unless EPA has authorized the use of an alternate benchmark in accordance with Part 3.3.2.b. If you are using an alternate benchmark threshold, enter the number into the table for the corresponding week. Unless and until EPA approves your request to use an alternate benchmark, you are required to use the standard benchmark of 50 NTU and take any required corrective actions if an exceedance occurs. Enter "N/A" if you have not received approval for an alternate benchmark threshold.

For each week with a value for the weekly average, select "Yes" or "No" in the table to indicate whether the weekly average value exceeds the 50 NTU benchmark or the alternate turbidity benchmark (whichever is applicable). If "Yes", the operator must conduct follow-up corrective action pursuant to Part 5.2.2 and document any corrective action taken in the corrective action log in accordance with Part 5.4.

Section VII. Certification Information

Forms must be signed by a person described below, or by a duly authorized representative of that person.

For a corporation: By a responsible corporate officer. For the purpose of this Section, a responsible corporate officer means:

(i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (ii) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long-term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

For a partnership or sole proprietorship: By a general partner or the proprietor, respectively; or

For a municipality, State, Federal, or other public agency: By either a principal executive officer or ranking elected official. For purposes of this Part, a principal executive officer of a Federal agency includes (i) the chief executive officer of the agency, or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrator of EPA). Include the name and title of the person signing the form and the date of signing.

A person is a duly authorized representative only if:

1. The authorization is made in writing by a person described above;

2. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company, (A duly authorized representative may thus be either a named individual or any individual occupying a named position.) and

3. The written authorization is submitted to the Director.

An unsigned or undated form will be considered incomplete.

Submitting Your Form

If you have been granted a waiver from your Regional Office to submit a paper form, you must send your form by mail to one of the following addresses:

For Regular U.S. Mail Delivery:

Stormwater Notice Processing Center
Mail Code 4203M, ATTN: 2022 CGP Reports
U.S. EPA
1200 Pennsylvania Avenue, NW
Washington, DC 20460

For Overnight/Express Mail Delivery:

Stormwater Notice Processing Center
William Jefferson Clinton East Building - Room 7420
ATTN: 2022 CGP Reports
U.S. EPA
1201 Constitution Avenue, NW
Washington, DC 20004

Visit this website for instructions on how to submit electronically:

https://epanet.zendesk.com/hc/en-us/sections/115000949868-CGP-Training-Material

Revisions to a Submitted Form

If you have previously submitted a form with an error, submit a revised form with the correct information. After discovering the error, submit the revised form as soon as possible. Make a notation on the revised form where the correction was made.

Paperwork Reduction Act Notice

This collection of information is approved by OMB under the Paperwork Reduction Act, 44 U.S.C. 3501 et seq. (OMB Control No. 2040-0305). Responses to this collection of information are mandatory (40 CFR 122.26). An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The public reporting and recordkeeping burden for this collection of information is

estimated to be 0.2 hours per response. Send comments on the Agency's need for this information, the accuracy of the provided burden estimates and any suggested methods for minimizing respondent burden to the Regulatory Support Division Director, U.S. Environmental Protection Agency (2821T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460. Include the OMB control number in any correspondence. Do not send the completed form to this address.

Table K-1: 2022 CGP - Dates Corresponding to Monitoring Weeks for Each Monitoring Quarter

2022			
Monitoring Quarter	Week #	*Monday* Start Date	*Sunday* End Date
1	1	1/3/22	1/9/22
	2	1/10/22	1/16/22
	3	1/17/22	1/23/22
	4	1/24/22	1/30/22
	5	1/31/22	2/6/22
	6	2/7/22	2/13/22
	7	2/14/22	2/20/22
	8	2/21/22	2/27/22
	9	2/28/22	3/6/22
	10	3/7/22	3/13/22
	11	3/14/22	3/20/22
	12	3/21/22	3/27/22
	13	3/28/22	4/3/22
2	1	4/4/22	4/10/22
	2	4/11/22	4/17/22
	3	4/18/22	4/24/22
	4	4/25/22	5/1/22
	5	5/2/22	5/8/22
	6	5/9/22	5/15/22
	7	5/16/22	5/22/22
	8	5/23/22	5/29/22
	9	5/30/22	6/5/22
	10	6/6/22	6/12/22
	11	6/13/22	6/19/22
	12	6/20/22	6/26/22
	13	6/27/22	7/3/22
3	1	7/4/22	7/10/22
	2	7/11/22	7/17/22
	3	7/18/22	7/24/22
	4	7/25/22	7/31/22
	5	8/1/22	8/7/22
	6	8/8/22	8/14/22
	7	8/15/22	8/21/22
	8	8/22/22	8/28/22
	9	8/29/22	9/4/22
	10	9/5/22	9/11/22
	11	9/12/22	9/18/22
	12	9/19/22	9/25/22
	13	9/26/22	10/2/22
4	1	10/3/22	10/9/22
	2	10/10/22	10/16/22
	3	10/17/22	10/23/22
	4	10/24/22	10/30/22
	5	10/31/22	11/6/22
	6	11/7/22	11/13/22
	7	11/14/22	11/20/22
	8	11/21/22	11/27/22
	9	11/28/22	12/4/22
	10	12/5/22	12/11/22
	11	12/12/22	12/18/22
	12	12/19/22	12/25/22
	13	12/26/22	1/1/23

2023			
Monitoring Quarter	Week #	*Monday* Start Date	*Sunday* End Date
1	1	1/2/23	1/8/23
	2	1/9/23	1/15/23
	3	1/16/23	1/22/23
	4	1/23/23	1/29/23
	5	1/30/23	2/5/23
	6	2/6/23	2/12/23
	7	2/13/23	2/19/23
	8	2/20/23	2/26/23
	9	2/27/23	3/5/23
	10	3/6/23	3/12/23
	11	3/13/23	3/19/23
	12	3/20/23	3/26/23
	13	3/27/23	4/2/23
2	1	4/3/23	4/9/23
	2	4/10/23	4/16/23
	3	4/17/23	4/23/23
	4	4/24/23	4/30/23
	5	5/1/23	5/7/23
	6	5/8/23	5/14/23
	7	5/15/23	5/21/23
	8	5/22/23	5/28/23
	9	5/29/23	6/4/23
	10	6/5/23	6/11/23
	11	6/12/23	6/18/23
	12	6/19/23	6/25/23
	13	6/26/23	7/2/23
3	1	7/3/23	7/9/23
	2	7/10/23	7/16/23
	3	7/17/23	7/23/23
	4	7/24/23	7/30/23
	5	7/31/23	8/6/23
	6	8/7/23	8/13/23
	7	8/14/23	8/20/23
	8	8/21/23	8/27/23
	9	8/28/23	9/3/23
	10	9/4/23	9/10/23
	11	9/11/23	9/17/23
	12	9/18/23	9/24/23
	13	9/25/23	10/1/23
4	1	10/2/23	10/8/23
	2	10/9/23	10/15/23
	3	10/16/23	10/22/23
	4	10/23/23	10/29/23
	5	10/30/23	11/5/23
	6	11/6/23	11/12/23
	7	11/13/23	11/19/23
	8	11/20/23	11/26/23
	9	11/27/23	12/3/23
	10	12/4/23	12/10/23
	11	12/11/23	12/17/23
	12	12/18/23	12/24/23
	13	12/25/23	12/31/23

2024			
Monitoring Quarter	Week #	*Monday* Start Date	*Sunday* End Date
1	1	1/1/24	1/7/24
	2	1/8/24	1/14/24
	3	1/15/24	1/21/24
	4	1/22/24	1/28/24
	5	1/29/24	2/4/24
	6	2/5/24	2/11/24
	7	2/12/24	2/18/24
	8	2/19/24	2/25/24
	9	2/26/24	3/3/24
	10	3/4/24	3/10/24
	11	3/11/24	3/17/24
	12	3/18/24	3/24/24
	13	3/25/24	3/31/24
2	1	4/1/24	4/7/24
	2	4/8/24	4/14/24
	3	4/15/24	4/21/24
	4	4/22/24	4/28/24
	5	4/29/24	5/5/24
	6	5/6/24	5/12/24
	7	5/13/24	5/19/24
	8	5/20/24	5/26/24
	9	5/27/24	6/2/24
	10	6/3/24	6/9/24
	11	6/10/24	6/16/24
	12	6/17/24	6/23/24
	13	6/24/24	6/30/24
3	1	7/1/24	7/7/24
	2	7/8/24	7/14/24
	3	7/15/24	7/21/24
	4	7/22/24	7/28/24
	5	7/29/24	8/4/24
	6	8/5/24	8/11/24
	7	8/12/24	8/18/24
	8	8/19/24	8/25/24
	9	8/26/24	9/1/24
	10	9/2/24	9/8/24
	11	9/9/24	9/15/24
	12	9/16/24	9/22/24
	13	9/23/24	9/29/24
	14	9/30/24	10/6/24
4	1	10/7/24	10/13/24
	2	10/14/24	10/20/24
	3	10/21/24	10/27/24
	4	10/28/24	11/3/24
	5	11/4/24	11/10/24
	6	11/11/24	11/17/24
	7	11/18/24	11/24/24
	8	11/25/24	12/1/24
	9	12/2/24	12/8/24
	10	12/9/24	12/15/24
	11	12/16/24	12/22/24
	12	12/23/24	12/29/24
	13	12/30/24	1/5/25

2025			
Monitoring Quarter	Week #	*Monday* Start Date	*Sunday* End Date
1	1	1/6/25	1/12/25
	2	1/13/25	1/19/25
	3	1/20/25	1/26/25
	4	1/27/25	2/2/25
	5	2/3/25	2/9/25
	6	2/10/25	2/16/25
	7	2/17/25	2/23/25
	8	2/24/25	3/2/25
	9	3/3/25	3/9/25
	10	3/10/25	3/16/25
	11	3/17/25	3/23/25
	12	3/24/25	3/30/25
	13	3/31/25	4/6/25
2	1	4/7/25	4/13/25
	2	4/14/25	4/20/25
	3	4/21/25	4/27/25
	4	4/28/25	5/4/25
	5	5/5/25	5/11/25
	6	5/12/25	5/18/25
	7	5/19/25	5/25/25
	8	5/26/25	6/1/25
	9	6/2/25	6/8/25
	10	6/9/25	6/15/25
	11	6/16/25	6/22/25
	12	6/23/25	6/29/25
	13	6/30/25	7/6/25
3	1	7/7/25	7/13/25
	2	7/14/25	7/20/25
	3	7/21/25	7/27/25
	4	7/28/25	8/3/25
	5	8/4/25	8/10/25
	6	8/11/25	8/17/25
	7	8/18/25	8/24/25
	8	8/25/25	8/31/25
	9	9/1/25	9/7/25
	10	9/8/25	9/14/25
	11	9/15/25	9/21/25
	12	9/22/25	9/28/25
	13	9/29/25	10/5/25
4	1	10/6/25	10/12/25
	2	10/13/25	10/19/25
	3	10/20/25	10/26/25
	4	10/27/25	11/2/25
	5	11/3/25	11/9/25
	6	11/10/25	11/16/25
	7	11/17/25	11/23/25
	8	11/24/25	11/30/25
	9	12/1/25	12/7/25
	10	12/8/25	12/14/25
	11	12/15/25	12/21/25
	12	12/22/25	12/28/25
	13	12/29/25	1/4/26

2026			
Monitoring Quarter	Week #	*Monday* Start Date	*Sunday* End Date
1	1	1/5/26	1/11/26
	2	1/12/26	1/18/26
	3	1/19/26	1/25/26
	4	1/26/26	2/1/26
	5	2/2/26	2/8/26
	6	2/9/26	2/15/26
	7	2/16/26	2/22/26
	8	2/23/26	3/1/26
	9	3/2/26	3/8/26
	10	3/9/26	3/15/26
	11	3/16/26	3/22/26
	12	3/23/26	3/29/26
	13	3/30/26	4/5/26
2	1	4/6/26	4/12/26
	2	4/13/26	4/19/26
	3	4/20/26	4/26/26
	4	4/27/26	5/3/26
	5	5/4/26	5/10/26
	6	5/11/26	5/17/26
	7	5/18/26	5/24/26
	8	5/25/26	5/31/26
	9	6/1/26	6/7/26
	10	6/8/26	6/14/26
	11	6/15/26	6/21/26
	12	6/22/26	6/28/26
	13	6/29/26	7/5/26
3	1	7/6/26	7/12/26
	2	7/13/26	7/19/26
	3	7/20/26	7/26/26
	4	7/27/26	8/2/26
	5	8/3/26	8/9/26
	6	8/10/26	8/16/26
	7	8/17/26	8/23/26
	8	8/24/26	8/30/26
	9	8/31/26	9/6/26
	10	9/7/26	9/13/26
	11	9/14/26	9/20/26
	12	9/21/26	9/27/26
	13	9/28/26	10/4/26
4	1	10/5/26	10/11/26
	2	10/12/26	10/18/26
	3	10/19/26	10/25/26
	4	10/26/26	11/1/26
	5	11/2/26	11/8/26
	6	11/9/26	11/15/26
	7	11/16/26	11/22/26
	8	11/23/26	11/29/26
	9	11/30/26	12/6/26
	10	12/7/26	12/13/26
	11	12/14/26	12/20/26
	12	12/21/26	12/27/26
	13	12/28/26	1/3/27

2027			
Monitoring Quarter	Week #	*Monday* Start Date	*Sunday* End Date
1	1	1/4/27	1/10/27
	2	1/11/27	1/17/27
	3	1/18/27	1/24/27
	4	1/25/27	1/31/27
	5	2/1/27	2/7/27
	6	2/8/27	2/14/27
	7	2/15/27	2/21/27
	8	2/22/27	2/28/27
	9	3/1/27	3/7/27
	10	3/8/27	3/14/27
	11	3/15/27	3/21/27
	12	3/22/27	3/28/27
	13	3/29/27	4/4/27

Attachment C – NOI and EPA Authorization Email

Attachment D – Site Inspection Form and Dewatering Inspection Form

DRAFT

Project Name: _____
NPDES ID Number: _____

Section A – General Information (If necessary, complete additional inspection reports for each separate inspection location.)	
Inspector Information	
Inspector Name:	**Title:**
Company Name:	**Email:**
Address:	**Phone Number:**
Inspection Details	
Inspection Date:	**Inspection Location:**
Inspection Start Time:	**Inspection End Time:**
Current Phase of Construction:	**Weather Conditions During Inspection:**

Did you determine that any portion of your site was unsafe for inspection per CGP Part 4.5? ☐ Yes ☐ No

If "Yes," provide the following information:

Location of unsafe conditions:

The conditions that prevented you inspecting this location:

Indicate the required inspection frequency: (Check all that apply. You may be subject to different inspection frequencies in different areas of the site.)

Standard Frequency (CGP Part 4.2):

☐ At least once every 7 calendar days; **OR**

☐ Once every 14 calendar days *and* within 24 hours of the occurrence of either:

- A storm event that produces 0.25 inches or more of rain within a 24-hour period, or
- A snowmelt discharge from a storm event that produces 3.25 inches or more of snow within a 24-hour period

Increased Frequency (CGP Part 4.3.1) (If site discharges to sediment or nutrient-impaired waters or to waters designated as Tier 2, Tier 2.5, or Tier 3):

☐ Once every 7 calendar days *and* within 24 hours of the occurrence of either:

- A storm event that produces 0.25 inches or more of rain within a 24-hour period, or
- A snowmelt discharge from a storm event that produces 3.25 inches or more of snow within a 24-hour period

Reduced Frequency (CGP Part 4.4):

- ☐ For stabilized areas: Twice during first month, no more than 14 calendar days apart; then once per month after first month until permit coverage is terminated
- ☐ For stabilized areas on "linear construction sites": Twice during first month, no more than 14 calendar days apart; then once more within 24 hours of the occurrence of either:
  - A storm event that produces 0.25 inches or more of rain within a 24-hour period, or
  - A snowmelt discharge from a storm event that produces 3.25 inches or more of snow within a 24-hour period
- ☐ For arid, semi-arid, or drought-stricken areas during seasonally dry periods or during drought: Once per month and within 24 hours of the occurrence of either:
  - A storm event that produces 0.25 inches or more of rain within a 24-hour period, or
  - A snowmelt discharge from a storm event that produces 3.25 inches or more of snow within a 24-hour period
- ☐ For frozen conditions where construction activities are being conducted: Once per month

Was this inspection triggered by a storm event producing 0.25 inches or more of rain within a 24-hour period? ☐ Yes ☐ No

If "Yes," how did you determine whether the storm produced 0.25 inches or more of rain?

- ☐ On-site rain gauge
- ☐ Weather station representative of site.
  Weather station location:

Total rainfall amount that triggered the inspection (inches):

Was this inspection triggered by a snowmelt discharge from a storm event producing 3.25 inches or more of snow within a 24-hour period? ☐ Yes ☐ No

If "Yes," how did you determine whether the storm produced 3.25 inches or more of snow?

- ☐ On-site rain gauge
- ☐ Weather station representative of site.
  Weather station location:

Total snowfall amount that triggered the inspection (inches):

Section B – Condition and Effectiveness of Erosion and Sediment (E&S) Controls (CGP Part 2.2) (Insert additional rows if needed)					
Type and Location of E&S Control	**Conditions Requiring Routine Maintenance?[1]**	**If "Yes," How Many Times (Including This Occurrence) Has This Condition Been Identified?**	**Conditions Requiring Corrective Action?[2, 3]**	**Date on Which Condition First Observed (If Applicable)?**	**Description of Conditions Observed**
1.	☐ Yes ☐ No		☐ Yes ☐ No		
2.	☐ Yes ☐ No		☐ Yes ☐ No		
3.	☐ Yes ☐ No		☐ Yes ☐ No		
4.	☐ Yes ☐ No		☐ Yes ☐ No		
5.	☐ Yes ☐ No		☐ Yes ☐ No		
If the same routine maintenance was found to be necessary three or more times for the same control at the same location (including this occurrence), follow the corrective action requirements and record the required information in your corrective action log, or describe here why you believe the specific condition should still be addressed as routine maintenance:					

[1] Routine maintenance includes minor repairs or other upkeep performed to ensure that the site's stormwater controls remain in effective operating condition, not including significant repairs or the need to install a new or replacement control. Routine maintenance is also required for specific conditions: (1) for perimeter controls, whenever sediment has accumulated to half or more the above-ground height of the control (CGP Part 2.2.3.c.i); (2) where sediment has been tracked-out from the site onto paved roads, sidewalks, or other paved areas (CGP Part 2.2.4.d); (3) for inlet protection measures, when sediment accumulates, the filter becomes clogged, and/or performance is compromised (CGP Part 2.2.10.b); and (4) for sediment basins, as necessary to maintain at least half of the design capacity of the basin (CGP Part 2.2.12.f)

[2] Corrective actions are triggered only for specific conditions (CGP Part 5.1):

1. A stormwater control needs a significant repair or a new or replacement control is needed, or, in accordance with Part 2.1.4.c, you find it necessary to repeatedly (i.e., three (3) or more times) conduct the same routine maintenance fix to the same control at the same location (unless you document in your inspection report under Part 4.7.1.c that the specific reoccurrence of this same problem should still be addressed as a routine maintenance fix under 2.1.4); or
2. A stormwater control necessary to comply with the requirements of this permit was never installed, or was installed incorrectly; or
3. Your discharges are not meeting applicable water quality standards; or
4. A prohibited discharge has occurred (see CGP Part 1.3); or
5. During the discharge from site dewatering activities:
   a. The weekly average of your turbidity monitoring results exceeds the 50 NTU benchmark (or alternate benchmark if approved by EPA pursuant to Part 3.3.2.b); or
   b. You observe or you are informed by EPA, State, or local authorities of the presence of the conditions specified in Part 4.6.3.e.

[3] If a condition on your site requires a corrective action, you must also fill out a corrective action log found at https://www.epa.gov/npdes/construction-general-permit-resources-tools-and-templates. See CGP Part 5.4 for more information.

Project Name: _____
NPDES ID Number: _____

Section C – Condition and Effectiveness of Pollution Prevention (P2) Practices and Controls (CGP Part 2.3) (Insert additional rows if needed)					
Type and Location of P2 Practices and Controls	**Conditions Requiring Routine Maintenance?[1]**	**If "Yes," How Many Times (Including This Occurrence) Has This Condition Been Identified?**	**Conditions Requiring Corrective Action?[2, 3]**	**Date on Which Condition First Observed (If Applicable)?**	**Description of Conditions Observed**
1.	☐ Yes ☐ No		☐ Yes ☐ No		
2.	☐ Yes ☐ No		☐ Yes ☐ No		
3.	☐ Yes ☐ No		☐ Yes ☐ No		
4.	☐ Yes ☐ No		☐ Yes ☐ No		
5.	☐ Yes ☐ No		☐ Yes ☐ No		
If the same routine maintenance was found to be necessary three or more times for the same control at the same location (including this occurrence), follow the corrective action requirements and record the required information in your corrective action log, or describe here why you believe the specific condition should still be addressed as routine maintenance:					

Section D – Stabilization of Exposed Soil (CGP Part 2.2.14) (Insert additional rows if needed)					
Specific Location That Has Been or Will Be Stabilized	**Stabilization Method and Applicable Deadline**	**Stabilization Initiated?**	**Final Stabilization Criteria Met?**	**Final Stabilization Photos Taken?**	**Notes**
1.		☐ Yes ☐ No If "Yes," date initiated:	☐ Yes ☐ No If "Yes," date criteria met:	☐ Yes ☐ No	
2.		☐ Yes ☐ No If "Yes," date initiated:	☐ Yes ☐ No If "Yes," date criteria met:	☐ Yes ☐ No	
3.		☐ Yes ☐ No If "Yes," date initiated:	☐ Yes ☐ No If "Yes," date criteria met:	☐ Yes ☐ No	
4.		☐ Yes ☐ No If "Yes," date initiated:	☐ Yes ☐ No If "Yes," date criteria met:	☐ Yes ☐ No	
5.		☐ Yes ☐ No If "Yes," date initiated:	☐ Yes ☐ No If "Yes," date criteria met:	☐ Yes ☐ No	

Section E – Description of Discharges (CGP Part 4.6.2) (Insert additional rows if needed)	
Was a discharge (not including dewatering) occurring from any part of your site at the time of the inspection?[4] ☐ Yes ☐ No **If "Yes," for each point of discharge, document the following:** • The visual quality of the discharge. • The characteristics of the discharge, including color; odor; floating, settled, or suspended solids; foam; oil sheen; and other indicators of stormwater pollutants. • Signs of the above pollutant characteristics that are visible from your site and attributable to your discharge in receiving waters or in other constructed or natural site drainage features.	
Discharge Location	**Observations**
1.	
2.	
3.	
4.	
5.	

[4] If a dewatering discharge was occurring, you must conduct a dewatering inspection pursuant to CGP Part 4.3.2 and complete a separate dewatering inspection report.

Section F – Signature and Certification (CGP Part 4.7.2)	
"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 contained therein. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information contained is, to the best of my knowledge and belief, true, accurate, and complete. I have no personal knowledge that the information submitted is other than 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."	
MANDATORY: Signature of Operator or "Duly Authorized Representative:"	
Signature:	**Date:**
Printed Name:	**Affiliation:**
OPTIONAL: Signature of Contractor or Subcontractor	
Signature:	**Date:**
Printed Name:	**Affiliation:**

General Tips for Using This Template

This Site Inspection Report Template is provided to assist you in preparing site inspection reports for EPA's 2022 Construction General Permit (CGP). If you are covered under the 2022 CGP, you can use this template to create a site inspection report form that is customized to the specific circumstances of your site and that complies with the minimum reporting requirements of Part 4.7 of the permit. Note that the use of this form is optional; you may use your own site inspection report form provided it includes the minimum information required in Part 4.7 of the CGP.

This template does not address the CGP's inspection reporting requirements related to dewatering activities. A separate inspection template has been developed specifically for dewatering activities and is available at https://www.epa.gov/npdes/construction-general-permit-resources-tools-and-templates.

Keep in mind that this document is a template and not an "off-the-shelf" inspection report that is ready to use without some modification. You must first customize this form to include the specifics of your project in order for it to be useable for your inspection reports. Once you have entered all of your site-specific information into the blank fields, you may use this form to complete inspection reports.

The following tips for using this template will help you ensure that the minimum permit requirements are met:

- **Review the inspection requirements.** Before you start developing your inspection report form, read the CGP's Part 4 inspection requirements. This will ensure that you have a working understanding of the permit's underlying inspection requirements.
- **Complete all required blank fields.** Fill out all blank fields. Only by filling out all fields will the template be compliant with the requirements of the permit. (Note: Where you do not need the number of rows provided in the template form for your inspection, you may delete these or cross them off as you see fit. Or, if you need more space to document your findings, you may insert additional rows in the electronic version of this form or use the bottom of the page in the field version of this form.)
- **Use your site map to document inspection findings.** In several places in the template, you are directed to specify the location of certain features of your site, including where stormwater controls are installed and where you will be stabilizing exposed soil. You are also asked to fill in location information for unsafe conditions and the locations of any discharges occurring during your inspections. Where you are asked for location information, EPA encourages you to reference the point on your SWPPP site map that corresponds to the requested location on the inspection form. Using the site map as a tool in this way will help you conduct efficient inspections, will assist you in evaluating problems found, and will ensure proper documentation.
- **Complete the inspection report within 24 hours of completing a site inspection.** You must complete an inspection report in accordance with Part 4.7.1 of the CGP.
- **Include the inspection form with your SWPPP.** Once your form is complete, make sure to include a copy of the inspection form in your SWPPP in accordance with Part 7.2.7.e of the CGP.
- **Retain copies of all inspection reports with your records.** You must also retain in your records copies of all inspection reports in accordance with the requirements in Part 4.7.3 of the CGP. These reports must be retained for at least 3 years from the date your permit coverage expires or is terminated in accordance with the requirements in Part 4.7.4 of the CGP.

Instructions for Section A

Inspector Name

Enter the name of the person that conducted the inspection. Include the person's contact information (title, affiliated company name, address, email, and phone number).

Inspection Date and Time

Enter the date you performed the inspection and the time you started and ended the inspection.

Weather Conditions During Inspection

Enter the weather conditions occurring during the inspection, e.g., sunny, overcast, light rain, heavy rain, snowing, icy, windy.

Current Phase of Construction
If this project is being completed in more than one phase, indicate which phase it is currently in.

Inspection Location
If your project has multiple locations where you conduct separate inspections, specify the location where this inspection is being conducted. If only one inspection is conducted for your entire project, enter "Entire Site." If necessary, complete additional inspection report forms for each separate inspection location.

Unsafe Conditions for Inspection (CGP Part 4.5.7)
Inspections are not required where a portion of the site or the entire site is subject to unsafe conditions. These conditions should not regularly occur and should not be consistently present on a site. Generally, unsafe conditions are those that render the site (or a portion of it) inaccessible or that would pose a significant probability of injury to applicable personnel. Examples could include severe storm or flood conditions, high winds, and downed electrical wires.

If your site, or a portion of it, is affected by unsafe conditions during the time of your inspection, provide a description of the conditions that prevented you from conducting the inspection and what parts of the site were affected. If the entire site was considered unsafe, specify the location as "Entire Site."

Inspection Frequency
Check all the inspection frequencies that apply to your project. Note that you may be subject to different inspection frequencies in different areas of your site.

Inspection Triggered by a Storm Event
If you were required to conduct this inspection because of a storm event that produced 0.25 inches or more of rain within a 24-hour period, indicate whether you relied on an on-site rain gauge or a nearby weather station (and where the weather station is located). Also, specify the total amount of rainfall for this specific storm event.

If you were required to conduct this inspection because of a snowmelt discharge from a storm event that produced 3.25 inches or more of snow within a 24-hour period, then indicate whether you relied on an on-site measurement or a nearby weather station (and where the weather station is located). Also, specify the total amount of snowfall for this specific storm event.

Instructions for Section B

Type and Location of Erosion and Sediment (E&S) Controls
Provide a list of all erosion and sediment (E&S) controls that your SWPPP indicates will be installed and implemented at your site. This list must include at a minimum all E&S controls required by CGP Part 2.2. Include also any natural buffers established under CGP Part 2.2.1. Buffer requirements apply if your project's earth-disturbing activities will occur within 50 feet of a discharge to receiving water. You may group your E&S controls on your form if you have several of the same type of controls (e.g., you may group "Inlet Protection Measures," "Perimeter Controls," and "Stockpile Controls" together on one line), but if there are any problems with a specific control, you must separately identify the location of the control, whether routine maintenance or corrective action is necessary, and in the notes section you must describe the specifics about the problem you observed.

Conditions Requiring Routine Maintenance?
Answer "Yes" if the E&S control requires routine maintenance as defined in footnote 1 of this template. Note that in many cases, "Yes" answers are expected and indicate a project with an active operation and maintenance program. You should also answer "Yes" if work to fix the problem is still ongoing from the previous inspection, though necessary work must be initiated immediately and completed by the end of the next business day or within seven calendar days if documented in accordance with CGP Part 2.1.4.b.

If "Yes," How Many Times (Including this Occurrence) Has this Condition Been Identified?
Indicate how many times the routine maintenance has been required for the same control at the same location.

Conditions Requiring Corrective Action?
Answer "Yes" if you found any of the conditions listed in footnote 2 in this template to be present during your inspection (CGP Part 5.1). If you answer "Yes," you must take corrective action and complete a corrective action log, found at https://www.epa.gov/npdes/construction-general-permit-resources-tools-and-templates. You should also answer "Yes" if work to fix the problem from a previous inspection is still ongoing, though the operator must comply with the corrective action deadlines in CGP Part 5.2.

Date on Which Condition First Observed (If Applicable)?
Provide the date on which the condition that triggered the need for routine maintenance or corrective action was first identified. If the condition was just discovered during this inspection, enter the inspection date. If the condition is a carryover from a previous inspection, enter the original date of the condition's discovery.

Description of Conditions Observed
For each E&S control and the area immediately surrounding it, describe whether the control is properly installed and whether it appears to be working to minimize sediment discharge. Indicate also whether a new or modified control is necessary to comply with the permit. Describe any problem condition(s) you observed such as the following:

1. Failure to install or to properly install a required E&S control
2. Damage or destruction to an E&S control caused by vehicles, equipment, or personnel, a storm event, or other event
3. Mud or sediment deposits found downslope from E&S controls, including in receiving waters, or on nearby streets, curbs, or open conveyance channels
4. Sediment tracked out onto paved areas by vehicles leaving construction site
5. Noticeable erosion or sedimentation at discharge outlets or at adjacent streambanks or channels
6. Erosion of the site's sloped areas (e.g., formation of rills or gullies)
7. E&S control is no longer working due to lack of maintenance
8. Other incidents of noncompliance

Describe also why you think the problem condition(s) occurred as well as actions (e.g., routine maintenance or corrective action) you will take or have taken to fix the problem.

For buffer areas, make note of whether they are marked off as required, whether there are signs of construction disturbance within the buffer, which is prohibited under the CGP, and whether there are visible signs of erosion resulting from discharges through the area.

If routine maintenance or corrective action is required, briefly note the reason. If routine maintenance or corrective action has been completed, make a note of the date it was completed and what was done. *If corrective action is required, note that you will need to complete a separate corrective action log describing the condition and your work to fix the problem*.

Routine Maintenance Need Has Been Found to be Necessary Three (3) or More Times for the Same Control at the Same Location (Including this Occurrence)
If routine maintenance has been required three (3) or more times for the same control at the same location, the permit requires (CGP Part 2.1.4.c) you to fix the problem using the corrective action procedures in CGP Part 5 or to document why you believe the reoccurring problem can be addressed as a routine maintenance fix. If you believe the problem can continue to be fixed as routine maintenance, describe why you believe the specific condition should still be addressed as routine maintenance.

Instructions for Section C

Type and Location of Pollution Prevention (P2) Practices and Controls
Provide a list of all pollution prevention (P2) practices and controls that are implemented at your site. This list must include all P2 practices and controls required by CGP Part 2.3 and those that are described in your SWPPP.

Conditions Requiring Routine Maintenance?
Answer "Yes" if the P2 practice or control requires routine maintenance as defined in footnote 1of this template. Note that in many cases, "Yes" answers are expected and indicate a project with an active operation and maintenance program. You should also answer "Yes" if work to fix the problem is still ongoing

from the previous inspection, though necessary work must be initiated immediately and completed by the end of the next business day or within seven calendar days if documented in accordance with CGP Part 2.1.4.b.

If "Yes," How Many Times (Including this Occurrence) Has this Condition Been Identified?
Indicate how many times the routine maintenance has been required for the same practice or control at the same location.

Conditions Requiring Corrective Action?
Answer "Yes" if you found any of the conditions listed in footnote 2 in this template to be present during your inspection (CGP Part 5.1). If you answer "Yes," you must take corrective action and complete a corrective action log, found at https://www.epa.gov/npdes/construction-general-permit-resources-tools-and-templates. You should also answer "Yes" if work to fix the problem from a previous inspection is still ongoing, though the operator must comply with the corrective action deadlines in CGP Part 5.2.

Date on Which Condition First Observed (If Applicable)?
Provide the date on which the condition that triggered the need for maintenance or corrective action was first identified. If the condition was just discovered during this inspection, enter the inspection date. If the condition is a carryover from a previous inspection, enter the original date of the condition's discovery.

Description of Conditions Observed
For each P2 control and the area immediately surrounding it, describe whether the control is properly installed, and whether it appears to be working to minimize or eliminate pollutant discharges. Indicate also whether a new or modified control is necessary to comply with the permit. Describe any problem condition(s) you observed such as the following:

1. Failure to install or to properly install a required P2 control
2. Damage or destruction to a P2 control caused by vehicles, equipment, or personnel, or a storm event
3. Evidence of a spill, leak, or other type of pollutant discharge, or failure to have properly cleaned up a previous spill, leak, or other type of pollutant discharge
4. Spill response supplies are absent, insufficient, or not where they are supposed to be located
5. Improper storage, handling, or disposal of chemicals, building materials or products, fuels, or wastes
6. P2 control is no longer working due to lack of maintenance
7. Other incidents of noncompliance

Describe also why you think the problem condition(s) occurred as well as actions (e.g., routine maintenance or corrective action) you will take or have taken to fix the problem.

If routine maintenance or corrective action is required, briefly note the reason. If routine maintenance or corrective action has been completed, make a note of the date it was completed and what was done. *If corrective action is required, note that you will need to complete a separate corrective action log describing the condition and your work to fix the problem*.

Routine Maintenance Need Was Found to be Necessary Three (3) or More Times for the Same Control at the Same Location (Including this Occurrence)
If routine maintenance has been required three (3) or more times for the same control at the same location, the permit requires (CGP Part 2.1.4.c) you to fix the problem using the corrective action procedures in CGP Part 5 or to document why you believe the reoccurring problem can be addressed as a routine maintenance fix. If you believe the problem can continue to be fixed as routine maintenance, describe why you believe the specific condition should still be addressed as routine maintenance.

Instructions for Section D

Specific Location That Has Been or Will Be Stabilized
List all areas where soil stabilization is required to begin because construction work in that area has permanently stopped or temporarily stopped (i.e., work will stop for 14 or more days), and all areas where stabilization has been implemented (CGP Part 2.2.14).

Stabilization Method and Applicable Deadline
For each area, specify the method of stabilization (e.g., hydroseed, sod, planted vegetation, erosion control blanket, mulch, rock).

Specify also which of the following stabilization deadlines apply to this location:

1. 5 acres or less of land disturbance occurring at any one time at site: Complete no later than 14 calendar days after stabilization initiated.
2. More than 5 acres of land disturbance occurring at any one time at site: Complete no later than 7 calendar days after stabilization initiated.
3. Arid, semi-arid, and drought-stricken areas: See CGP Part 2.2.14.b.i.
4. Unforeseen circumstances: See CGP Part 2.2.14.b.ii.
5. Discharges to a sediment- or nutrient-impaired water or to a water identified as Tier 2, 2.5, or 3 for antidegradation purposes: Complete no later than 7 days after stabilization initiated.

Stabilization Initiated?
For each area, indicate whether stabilization has been initiated. If "Yes," then enter the date stabilization was initiated.

Final Stabilization Criteria Met?
For each area, indicate whether the final stabilization criteria in CGP Part 2.2.14.c have been met. If "Yes," then enter the date final stabilization criteria were met.

Final Stabilization Photos Taken?
Answer "Yes" if you have taken photos before and after meeting the stabilization criteria as required in CGP Part 8.2.1.a.

Notes
For each area where stabilization has been initiated, describe the progress that has been made and what additional actions are necessary to complete stabilization. Note the effectiveness of stabilization in preventing erosion. If stabilization has been initiated but not completed, make a note of the date it is to be completed. If stabilization has been completed, make a note of the date it was completed. If stabilization has not yet been initiated, make a note of the date it is to be initiated and the date it is to be completed.

Instructions for Section E

You are only required to complete this section if a discharge is occurring at the time of the inspection (CGP Part 4.6.2).

Was a discharge (not including dewatering) occurring from any part of your site at the time of the inspection?
During your inspection, examine all points of discharge from your site, and determine whether a discharge is occurring. If a dewatering discharge was occurring, you must conduct a dewatering inspection pursuant to CGP Part 4.3.2. If there is a discharge, answer "Yes" and complete the questions below regarding the specific discharge. If there is not a discharge, answer "No" and skip to the next page.

Discharge Location (Repeat as necessary if there are multiple points of discharge.)
Specify the location on your site where the discharge is occurring. The location may be an outlet from a stormwater control or constructed stormwater channel, a discharge into a storm sewer inlet, or a specific point on the site. Be as specific as possible; it is recommended that you refer to a precise point on your site map.

Observations
Document the visual quality of the discharge and take note of the characteristics of the stormwater discharge, including color; odor; floating, settled, or suspended solids; foam; oily sheen; and other indicators of stormwater pollutants. Also, document signs of these same pollutant characteristics that are visible from your site and attributable to your discharge in receiving waters or in other constructed or natural site drainage features.

Instructions for Section F

Each inspection report must be signed and certified to be considered complete (CGP Part 4.7.2).

Operator or "Duly Authorized Representative" – MANDATORY (CGP Appendix G Part G.11.2 and CGP Appendix H Section X)

At a minimum, the site inspection report must be signed by either (1) the person who signed the NOI, or (2) a duly authorized representative of that person. The following requirements apply:

If the signatory will be the person who signed the NOI for permit coverage, as a reminder, that person must be one of the following types of individuals:

- *For a corporation*: By a responsible corporate officer. For the purpose of this subsection, a responsible corporate officer means: (i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (ii) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.
- *For a partnership or sole proprietorship*: By a general partner or the proprietor, respectively.
- *For a municipality, State, Federal, or other public agency*: By either a principal executive officer or ranking elected official. For purposes of this subsection, a principal executive officer of a Federal agency includes (i) the chief executive officer of the agency, or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrator of EPA).

If the signatory will be a duly authorized representative, the following requirements must be met:

- The authorization is made in writing by the person who signed the NOI (see above);
- The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position); and
- The signed and dated written authorization is included in the SWPPP. A copy must be submitted to EPA, if requested.

Sign, date and print your name and affiliation.

Contractor or Subcontractor - OPTIONAL

Where you rely on a contractor or subcontractor to complete the site inspection report, you should consider requiring the individual(s) to sign and certify each report. Note that this does not relieve you, the permitted operator, of the requirement to sign and certify the site inspection report as well. If applicable, sign, date, and print your name and affiliation.

Note

While EPA has made every effort to ensure the accuracy of all instructions contained in this template, it is the permit, not this template, that determines the actual obligations of regulated construction stormwater discharges. In the event of a conflict between this template and any corresponding provision of the CGP, you must abide by the requirements in the permit. EPA welcomes comments on this Site Inspection Report Template at any time and will consider those comments in any future revision. You may contact EPA for CGP-related inquiries at cgp@epa.gov

Attachment E – Corrective Action Form

2022 CGP Corrective Action Log
Project Name: ___P&G Andover Manufacturing Center Enhancement Project_____
NPDES ID Number: _____

Section A – Individual Completing this Log	
Name:	**Title:**
Company Name:	**Email:**
Address:	**Phone Number:**
Section B – Details of the Problem (CGP Part 5.4.1.a) Complete this section within 24 hours of discovering the condition that triggered corrective action.	
Date problem was first identified:	**Time problem was first identified**:
What site conditions triggered this corrective action? *(Check the box that applies. See instructions for a description of each triggering condition (1 thru 6).)* ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5a ☐ 5b ☐ 6	
Specific location where problem identified:	
Provide a description of the specific condition that triggered the need for corrective action and the cause (if identifiable):	
Section C – Corrective Action Completion (CGP Part 5.4.1.b) Complete this section within 24 hours after completing the corrective action.	
For site condition # 1, 2, 3, 4, or 6 (those not related to a dewatering discharge) confirm that you met the following deadlines (CGP Part 5.2.1):	
☐ Immediately took all reasonable steps to address the condition, including cleaning up any contaminated surfaces so the material will not discharge in subsequent storm events. **AND**	
☐ Completed corrective action by the close of the next business day, unless a new or replacement control, or significant repair, was required. **OR**	
☐ Completed corrective action within seven (7) calendar days from the time of discovery because a new or replacement control, or significant repair, was necessary to complete the installation of the new or modified control or complete the repair. **OR**	
☐ It was infeasible to complete the installation or repair within 7 calendar days from the time of discovery. Provide the following additional information: Explain why 7 calendar days was infeasible to complete the installation or repair:	

Provide your schedule for installing the stormwater control and making it operational as soon as feasible after the 7 calendar days:

For site condition # 5a, 5b, or 6 (those related to a dewatering discharge), confirm that you met the following deadlines:

- ☐ Immediately took all reasonable steps to minimize or prevent the discharge of pollutants until a solution could be implemented, including shutting off the dewatering discharge as soon as possible depending on the severity of the condition taking safety considerations into account.
- ☐ Determined whether the dewatering controls were operating effectively and whether they were causing the conditions.
- ☐ Made any necessary adjustments, repairs, or replacements to the dewatering controls to lower the turbidity levels below the benchmark or remove the visible plume or sheen.

Describe any modification(s) made as part of corrective action: (Insert additional rows below if applicable)	**Date of completion:**	**SWPPP update necessary?**	**If yes, date SWPPP was updated:**
1.		☐ Yes ☐ No	
2.		☐ Yes ☐ No	

Section D - Signature and Certification (CGP Part 5.4.2)

"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 contained therein. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information contained is, to the best of my knowledge and belief, true, accurate, and complete. I have no personal knowledge that the information submitted is other than 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."

MANDATORY: Signature of Operator or "Duly Authorized Representative:"	
Signature:	**Date:**
Printed Name:	**Affiliation:**
OPTIONAL: Signature of Contractor or Subcontractor	
Signature:	**Date:**
Printed Name:	**Affiliation:**

General Instructions

This Corrective Action Log Template is provided to assist you creating a corrective action log that complies with the minimum reporting requirements of Part 5.4 of the EPA's Construction General Permit (CGP). For each triggering condition on your site, you will need to fill out a separate corrective action log.

The entire form must be completed to be compliant with the requirements of the permit. (Note: In Section C, if you do not need the number of rows provided in the corrective action log, you may delete these or cross them off. Alternatively, if you need more space to describe any modifications, you may insert additional rows in the electronic version of this form or use the bottom of the page in the field version of this form.)

If you are covered under a State CGP, this template may be helpful in developing a log that can be used for that permit; however, you will likely need to modify this form to meet the specific requirements of any State-issued permit. If your permitting authority requires you to use a specific corrective action log, you should not use this template.

Instructions for Section A

Individual completing this form Enter the name of the person completing this log. Include the person's contact information (title, affiliated company name, address, email, and phone number).

Instructions for Section B

You must complete Section B within 24 hours of discovering the condition that triggered corrective action. (CGP Part 5.4)

When was the problem first discovered?

Specify the date and time when the triggering condition was first discovered.

What site conditions triggered this corrective action? (CGP Parts 5.1 and 5.3)

Check the box corresponding to the numbered triggering condition below that applies to your site.

1. A stormwater control needs a significant repair or a new or replacement control is needed, or, in accordance with Part Error! Reference source not found., you find it necessary to repeatedly (i.e., 3 or more times) conduct the same routine maintenance fix to the same control at the same location (unless you document in your inspection report under Part Error! Reference source not found. that the specific reoccurrence of this same problem should still be addressed as a routine maintenance fix under Part Error! Reference source not found.);
2. A stormwater control necessary to comply with the requirements of this permit was never installed, or was installed incorrectly;
3. Your discharges are not meeting applicable water quality standards;
4. A prohibited discharge has occurred (see Part 1.3);
5. During discharge from site dewatering activities:
   a. The weekly average of your turbidity monitoring results exceeds the 50 NTU benchmark (or alternate benchmark if approved by EPA pursuant to Part **Error! Reference source not found.**); or
   b. You observe or you are informed by EPA, State, or local authorities of the presence of any of the following at the point of discharge to a receiving water flowing through or immediately adjacent to your site and/or to constructed or natural site drainage features or storm drain inlets:
      - sediment plume
      - suspended solids
      - unusual color
      - presence of odor
      - decreased clarity
      - presence of foam
      - visible sheen on the water surface or visible oily deposits on the bottom or shoreline of the receiving water
6. EPA requires corrective action as a result of permit violations found during an inspection carried out under Part 4.8.

Provide a description of the problem (CGP Part 5.4.1.a)
Provide a summary description of the condition you found that triggered corrective action, the cause of the problem (if identifiable), and the specific location where it was found. Be as specific as possible about the location; it is recommended that you refer to a precise point on your site map.

Instructions for Section C

You must complete Section C within 24 hours after completing the correction action. (CGP Part 5.4)

Deadlines for completing corrective action for condition # 1, 2, 3, 4, or 6 (if not relating to a dewatering discharge) (CGP Part 5.2.1)
Check the box to confirm that you met the deadlines that apply to each triggering condition. You are always required to check the first box (i.e., Immediately took all reasonable steps to address the condition, including cleaning up any contaminated surfaces so the material will not discharge in subsequent storm events.). Only one of the next three boxes should be checked depending on the situation that applies to this corrective action.

Check the second box if the corrective action for this particular triggering condition does not require a new or replacement control, or a significant repair. These actions must be completed by the close of the next business day from the time of discovery of the condition.

Check the third box if the corrective action for this particular triggering condition requires a new or replacement control, or a significant repair. These actions must be completed by no later than seven calendar days from the time of discover of the condition.

Check the fourth box if the corrective action for this particular triggering condition requires a new or replacement control, or a significant repair, and if it is infeasible to complete the work within seven calendar days. Additionally, you will need to fill out the table below the checkbox that requires:

1. An explanation as to why it was infeasible to complete the installation or repair within seven calendar days of discovering the condition.
2. Provide the schedule you will adhere to for installing the stormwater control and making it operational as soon as feasible after the seventh day following discovery.

Note: Per Part 5.2.1.c, where these actions result in changes to any of the stormwater controls or procedures documented in your SWPPP, you must modify your SWPPP accordingly within seven calendar days of completing this work.

Deadlines for completing corrective action for condition # 5a, 5b, or 6 related to a dewatering discharge (CGP Part 5.2.2)
These deadlines apply to conditions relating to construction dewatering activities. Check the box to confirm that you met the deadlines that apply to each triggering condition. You are required to check all of the boxes in this section to indicate your compliance with the corrective action deadlines.

List of modification(s) to correct problem
Provide a list of modifications you completed to correct the problem.

Date of completion
Enter the date you completed the modification. The work must be completed by the deadline you indicated above.

SWPPP update necessary?
Check "Yes" or "No" to indicate if a SWPPP update is necessary consistent with Part 7.4.1.a in order to reflect changes implemented at your site. If "Yes," then enter the date you updated your SWPPP. The SWPPP updates must be made within seven calendar days of completing a corrective action. (CGP Part 5.2.1.c)

Instructions for Section D

Each corrective action log entry must be signed and certified following completion of Section D to be considered complete. (CGP Part 5.4.2)

Operator or "Duly Authorized Representative" – MANDATORY (CGP Appendix G Part G.11.2 and CGP Appendix H Section X)

At a minimum, the corrective action log must be signed by either (1) the person who signed the NOI, or (2) a duly authorized representative of that person. The following requirements apply:

If the signatory will be the person who signed the NOI for permit coverage, as a reminder, that person must be one of the following types of individuals:

- *For a corporation*: By a responsible corporate officer. For the purpose of this subsection, a responsible corporate officer means: (i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (ii) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.
- *For a partnership or sole proprietorship*: By a general partner or the proprietor, respectively.
- *For a municipality, State, Federal, or other public agency*: By either a principal executive officer or ranking elected official. For purposes of this subsection, a principal executive officer of a Federal agency includes (i) the chief executive officer of the agency, or (ii) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrator of EPA).

If the signatory will be a duly authorized representative, the following requirements must be met:

- The authorization is made in writing by the person who signed the NOI (see above);
- The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position); and
- The signed and dated written authorization is included in the SWPPP. A copy must be submitted to EPA, if requested.

Sign, date and print your name and affiliation.

Contractor or Subcontractor - OPTIONAL

Where you rely on a contractor or subcontractor to complete this log and the associated corrective action, you should consider requiring the individual(s) to sign and certify each log entry. Note that this does not relieve you, the permitted operator, of the requirement to sign and certify the log as well. If applicable, sign, date, and print your name and affiliation.

Recordkeeping

Logs must be retained for at least 3 years from the date your permit coverage expires or is terminated. (CGP Part 5.4.4)

Keep copies of your signed corrective action log entries at the site or at an easily accessible location so that it can be made immediately available at the time of an on-site inspection or upon request by EPA. (CGP Part 5.4.3) Include a copy of the corrective action log in your SWPPP. (CGP Part 7.2.7.e)

Note

While EPA has made every effort to ensure the accuracy of all instructions contained in this template, it is the permit, not this template, that determines the actual obligations of regulated construction stormwater discharges. In the event of a conflict between this template and any corresponding provision of the CGP, you must abide by the requirements in the permit. EPA welcomes comments on this Corrective Action Log Template at any time and will consider those comments in any future revision. You may contact EPA for CGP-related inquiries at cgp@epa.gov

Attachment F – SWPPP Amendment Log

DRAFT

No.	Description of the Amendment	Date of Amendment	Amendment Prepared by [Name(s) and Title]

Attachment G –Subcontractor Certifications/Agreements

DRAFT

SUBCONTRACTOR CERTIFICATION
STORMWATER POLLUTION PREVENTION PLAN

Project Number: _____

Project Title: _____

Operator(s): _____

As a subcontractor, you are required to comply with the Stormwater Pollution Prevention Plan (SWPPP) for any work that you perform onsite. Any person or group who violates any condition of the SWPPP may be subject to substantial penalties or loss of contract. You are encouraged to advise each of your employees working on this project of the requirements of the SWPPP. A copy of the SWPPP is available for your review at the office trailer.

Each subcontractor engaged in activities at the construction site that could impact stormwater must be identified and sign the following certification statement:

I certify under the penalty of law that I have read and understand the terms and conditions of the SWPPP for the above designated project and agree to follow the practices described in the SWPPP.

This certification is hereby signed in reference to the above named project:

Company: _____

Address: _____

Telephone Number: _____

Type of construction service to be provided: _____

_____

_____

Signature: _____

Title: _____

Date: _____

Attachment H – Grading and Stabilization Activities Log

DRAFT

Date Grading Activity Initiated	**Description of Grading Activity**	**Description of Stabilization Measure and Location**	**Date Grading Activity Ceased** (Indicate Temporary or Permanent)	**Date When Stabilization Measures Initiated**

Attachment I – SWPPP Training Documentation

DRAFT

Stormwater Pollution Prevention Training Documentation

Project Name:

Project Location:

Instructor's Name(s):

Instructor's Title(s):

Course Location: _____ Date: _____

Course Length (hours): _____

Stormwater Training Topic: (*check as appropriate)*

- ❑ **Sediment and Erosion Controls**
- ❑ **Emergency Procedures**
- ❑ **Stabilization Controls**
- ❑ **Inspections/Corrective Actions**
- ❑ **Pollution Prevention Measures**

Specific Training Objective:_____

_____

Attendee Roster: (*attach additional pages as necessary)*

No.	Name of Attendee	Company
1		
2		
3		
4		
5		
6		
7		
8		

Attachment J – Delegation of Authority Form

Delegation of Authority

I, _____ (name), hereby designate the person or specifically described position below to be a duly authorized representative for the purpose of overseeing compliance with environmental requirements, including the Construction General Permit, at the _____ construction site. The designee is authorized to sign any reports, stormwater pollution prevention plans and all other documents required by the permit.

_____ (name of person or position)
_____ (company)
_____ (address)
_____ (city, state, zip)
_____ (phone)

By signing this authorization, I confirm that I meet the requirements to make such a designation as set forth in Appendix I of EPA's Construction General Permit (CGP), and that the designee above meets the definition of a "duly authorized representative" as set forth in Appendix I.

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.

Name: _____

Company: _____

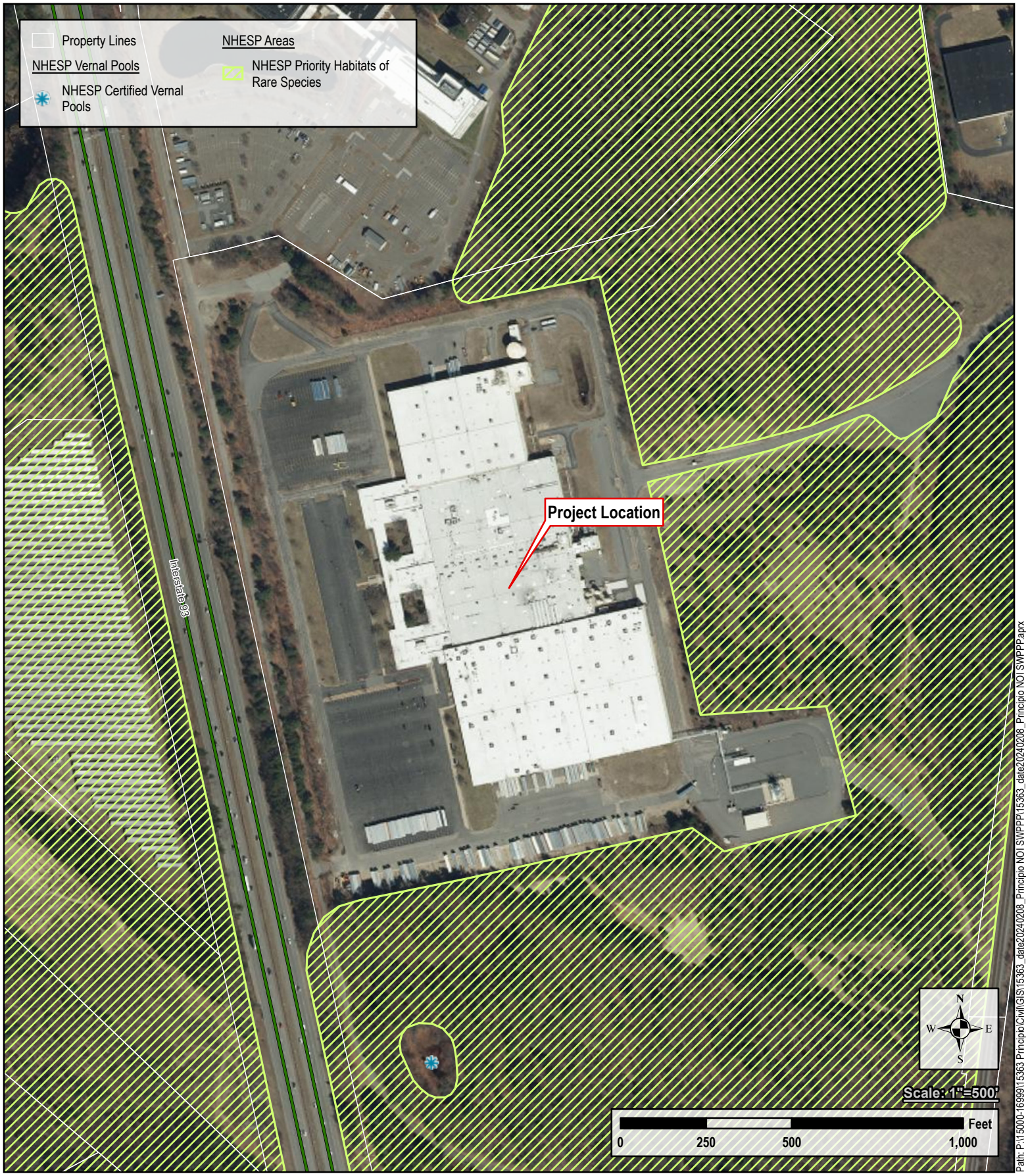
Title: _____

Signature: _____

Date: _____

Attachment K – Endangered Species Documentation

DRAFT



Natural Heritage and Endangered Species Program

2/8/2024

30 Burtt Road
Andover, MA 01810

Data Source: MassGIS
Nitsch Project #15363

Nitsch Engineering

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

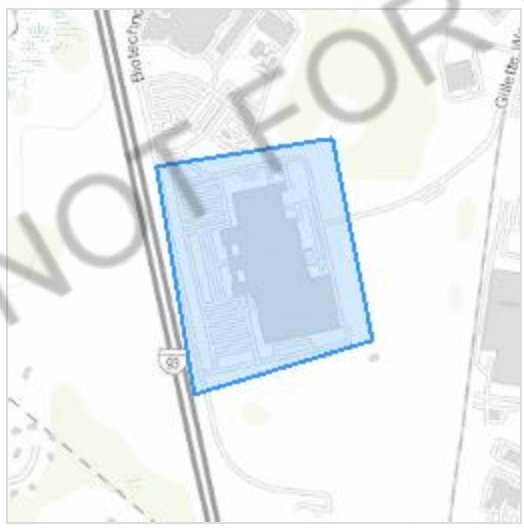
This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

NOT FOR CONSULTATION

Location

Essex County, Massachusetts



Local office

New England Ecological Services Field Office

(603) 223-2541
(603) 223-0104

70 Commercial Street, Suite 300
Concord, NH 03301-5094

NOT FOR CONSULTATION

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

---

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).

NOT FOR CONSULTATION

2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Northern Long-eared Bat Myotis septentrionalis Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9045	Endangered

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

Bald & Golden Eagles

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below.

NOT FOR CONSULTATION

Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

There are bald and/or golden eagles in your project area.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Oct 15 to Aug 31

NOT FOR CONSULTATION

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey

effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

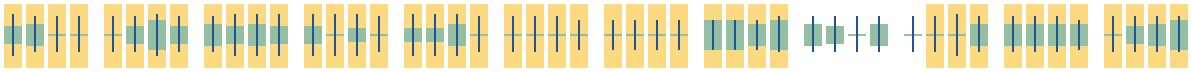
No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

NOT FOR CONSULTATION



Bald Eagle
Non-BCC
Vulnerable



What does IPaC use to generate the potential presence of bald and golden eagles in my specified location?

The potential for eagle presence is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply). To see a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs of bald and golden eagles in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur. Please contact your local Fish and Wildlife Service Field Office if you have questions.

NOT FOR CONSULTATION

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NOT FOR CONSULTATION

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Oct 15 to Aug 31
Black-billed Cuckoo *Coccyzus erythropthalmus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9399	Breeds May 15 to Oct 10

Blue-winged Warbler Vermivora pinus This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds May 1 to Jun 30
Bobolink Dolichonyx oryzivorus This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Jul 31
Canada Warbler Cardellina canadensis This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Aug 10
Chimney Swift Chaetura pelagica This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 15 to Aug 25
Lesser Yellowlegs Tringa flavipes This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere
Prairie Warbler Dendroica discolor This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Jul 31
Rusty Blackbird Euphagus carolinus This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds elsewhere
Wood Thrush Hylocichla mustelina This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 10 to Aug 31

NOT FOR CONSULTATION

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

Breeding Season (▪)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.

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▪ probability of presence ▪ breeding season | survey effort – no data



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Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

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Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

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Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

FRESHWATER EMERGENT WETLAND

PEM1Ex

FRESHWATER FORESTED/SHRUB WETLAND

PFO4/1E

PFO1E

A full description for each wetland code can be found at the National Wetlands Inventory website

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A

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margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

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Attachment L – Historic Preservation Documentation



Path: P:\15000-16999\15363 Principio\Civil\GIS\15363_date20240208_Principio NOI SWPPP\15363_date20240208_Principio NOI SWPPP.aprx

MassHistoric Commission Inventory

30 Burtt Road
Andover, MA 01810

2/8/2024

Data Source: MassGIS
Nitsch Project #15363

Nitsch Engineering

Attachment M – Rainfall and Snowfall Gauge Recording

Use the table below to record the rainfall and snowfall gauge readings at the beginning and end of each work day. An example table follows.

Month/Year			Month/Year			Month/Year		
Day	Start time	End time	Day	Start time	End time	Day	Start time	End time
1			1			1		
2			2			2		
3			3			3		
4			4			4		
5			5			5		
6			6			6		
7			7			7		
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27			27			27		
28			28			28		
29			29			29		
30			30			30		
31			31			31		

DRAFT

Attachment N – Turbidity Meter Manual and Manufacturer's Instructions

Attachment O – Order of Conditions

DRAFT

APPENDIX G

Soil Investigations

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



January 26, 2024

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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How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

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

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

Soil Map

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

Custom Soil Resource Report
Soil Map



Map Scale: 1:3,940 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 19, Sep 10, 2023

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

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
52A	Freetown muck, 0 to 1 percent slopes	2.4	3.6%
255A	Windsor loamy sand, 0 to 3 percent slopes	0.0	0.1%
600	Pits, gravel	0.2	0.4%
602	Urban land	65.1	96.0%
Totals for Area of Interest		**67.8**	**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

52A—Freetown muck, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2t2q9
Elevation: 0 to 1,110 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: Not prime farmland

Map Unit Composition

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

Description of Freetown

Setting

Landform: Depressions, depressions, swamps, kettles, marshes, bogs
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Highly decomposed organic material

Typical profile

Oe - 0 to 2 inches: mucky peat
Oa - 2 to 79 inches: muck

Properties and qualities

Slope: 0 to 1 percent
Surface area covered with cobbles, stones or boulders: 0.0 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
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 0 to 6 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 19.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: F144AY043MA - Acidic Organic Wetlands
Hydric soil rating: Yes

Minor Components

Whitman

Percent of map unit: 5 percent
Landform: Drainageways, depressions

Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Scarboro

Percent of map unit: 5 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Swansea

Percent of map unit: 5 percent
Landform: Bogs, swamps, marshes, depressions, depressions, kettles
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread, dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

255A—Windsor loamy sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2svkg
Elevation: 0 to 990 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

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

Description of Windsor, Loamy Sand

Setting

Landform: Dunes, outwash plains, outwash terraces, deltas
Landform position (three-dimensional): Tread, riser
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Loose sandy glaciofluvial deposits derived from granite and/or loose sandy glaciofluvial deposits derived from schist and/or loose sandy glaciofluvial deposits derived from gneiss

Typical profile

O - 0 to 1 inches: moderately decomposed plant material
A - 1 to 3 inches: loamy sand
Bw - 3 to 25 inches: loamy sand
C - 25 to 65 inches: sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2s
Hydrologic Soil Group: A
Ecological site: F144AY022MA - Dry Outwash
Hydric soil rating: No

Minor Components

Deerfield, loamy sand

Percent of map unit: 10 percent
Landform: Deltas, terraces, outwash plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread, talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Hinckley, loamy sand

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

600—Pits, gravel

Map Unit Setting

National map unit symbol: vjq2
Frost-free period: 125 to 165 days
Farmland classification: Not prime farmland

Map Unit Composition

Pits: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pits

Setting

Parent material: Loose sandy and gravelly glaciofluvial deposits

602—Urban land

Map Unit Setting

National map unit symbol: vjx3
Frost-free period: 125 to 165 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Parent material: Excavated and filled land

Minor Components

Udorthents

Percent of map unit: 10 percent
Hydric soil rating: No

Hinckley

Percent of map unit: 2 percent
Hydric soil rating: No

Paxton

Percent of map unit: 2 percent
Hydric soil rating: No

Windsor

Percent of map unit: 2 percent
Hydric soil rating: No

Charlton

Percent of map unit: 2 percent
Hydric soil rating: No

Merrimac

Percent of map unit: 2 percent
Hydric soil rating: No

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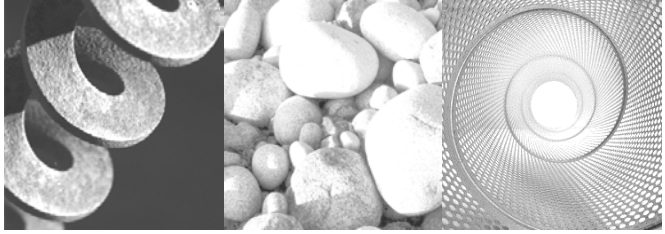
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Foundation Recommendations

Project Principio

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Andover, Massachusetts

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Executive Summary

This report presents our foundation recommendations for the proposed expansion of the existing Gillette manufacturing facility in Andover, Massachusetts.

Project Description

We understand that the Project Principio proposed expansion will consist of a one-story steel-framed manufacturing and warehouse building with a mezzanine level running along portions of the inside perimeter of the building. The proposed overall area is 139,600 square feet. The building will be about 240 feet by 580 feet in plan and will be about 30 feet tall. The proposed building will not have a basement. The elevation of the top of the first-floor slab-on-grade is about El. 103. The elevation of the grade around the outside of the building will be about El. 98.

Subsurface Conditions

Seven borings and thirteen test pits were performed at the site between April 24 and May 8, 2023.

The borings generally encountered between 4 inches to 4.6 feet of granular fill, overlying about 11.8 to 38 feet of loose to medium dense silt and sand, overlying silty sand and gravel, overlying bedrock.

Depth to groundwater was observed in wells in or near the proposed building footprint at elevations generally between about El. 88 and El. 93.

Recommendations

We recommend that the proposed building be supported on spread or strip footings bearing on the natural silt and sand layer, or on compacted Structural Fill extending down to the natural silt and sand layer. The footings should be designed for a maximum allowable bearing pressure of 4 kips per square foot (ksf).

We also recommend that ground improvement be used to reduce the potential for liquefaction or earthquake-induced building settlement. The density of the silt and sand layer was variable, with many of the samples loose enough that they are susceptible to liquefaction. Ground improvement would reduce the risk of significant earthquake-induced building settlement if the design earthquake were to occur.

Based on our review of the boring data, we recommend a seismic site classification of Site Class D. Some of the loose soils at the site are susceptible to liquefaction. However, we understand that the proposed building will have a fundamental period of less than 0.5 seconds.

Therefore, per ASCE 7-16, section 20.3.1, paragraph 1, the site may still be considered Site Class D, and the seismic parameters presented in Section 4.6 are appropriate.

Construction Considerations

Much of the site soil consists primarily of silt, which will be difficult to compact, and will not be suitable for re-use below the building. This soil should be reused in landscaped areas or transported off site.

Near the southern portion of the proposed building, special dewatering techniques such as temporary deep dewatering wells or well points may be needed to maintain the groundwater level at least 2 feet below the bottom of the excavation at all times.

1. Introduction

1.1 Purpose

This report presents our foundation recommendations for the expansion of the existing Gillette Company manufacturing facility located at 30 Burtt Road in Andover, Massachusetts.

1.2 Scope

Our scope of work consisted of the following:

- Performed 7 borings and 13 test pits to observe soil and rock conditions.
- Installed groundwater monitoring wells in two of the completed borings.
- Performed combined mechanical sieve and hydrometer analyses on 22 soil samples collected from test pits to evaluate the soil's suitability for stormwater infiltration.
- Performed mechanical sieve analyses on 29 soil samples collected from the borings to assist in characterizing the site soils and to evaluate shallow soils for suitability for reuse as fill materials during construction and to evaluate liquefaction potential.
- Developed recommendations for foundation design and construction.
- Prepared this report presenting the results of the borings and test pits and our foundation recommendations.

1.3 Authorization

Our work was authorized by Fennick McCredie Subcontract No. 1242 dated March 24, 2023, and Amendment No. 2 to that Subcontract, dated April 12, 2023.

1.4 Project Personnel

The following personnel at GEI were involved with the field explorations, evaluations, and preparation of this report:

Steve Sarandis, P. E.	Project Manager
Michael Paster, P. E.	Senior Consultant
Rihabe Oulal	Geotechnical Engineer
Maria Hernandez-Cabal	Geotechnical Engineer

2. Site and Project Description

2.1 Site Description

The existing building is a one- and two-story building roughly 600 feet by 1200 feet in plan that provides space for offices, manufacturing, and warehouse storage. The area around the existing building is occupied by landscaped areas, a tank farm, parking lots, and driveways. There is a loading dock and a long-term parking area for trailer trucks along the south side of the building. There is also a loading dock on the north side of the building.

The elevation of the paved parking areas and driveways around the facility range from about EL. 97 to El. 100 (NAVD 88). The ground surface elevation over the remainder of the property ranges from a low of about El. 80 in the wetlands located to the northeast of the building up to a high of about El. 118 on high ground on both the north and south sides of the building.

The site for the new building expansion is near the southwest corner of the existing building and is occupied by paved parking areas (Figs. 2 and 3). We understand stormwater structures are proposed at different locations at the site.

Ground surface elevations within the proposed footprint of the new building vary from about El. 98 on the west side of the proposed building in the middle of the existing parking area up to about El. 101 on the east side of the proposed building in the landscaped areas adjacent to the existing building.

Based on original construction plans prepared by Anderson Nichols in 1968, the existing building is supported on shallow spread foundations. Interior columns are supported on square footings ranging in size from about six to nine feet across. The exterior walls are supported on strip footings ranging from about three to six feet wide.

2.2 Project Description

Based on review of the validation drawing set dated March 9, 2023, the Project Principio proposed expansion will consist of a one-story steel-framed manufacturing and warehouse building with a mezzanine level running along portions of the inside perimeter of the building. The proposed overall area is 139,600 square feet. The building will be about 240 feet by 580 feet in plan and will be about 30 feet tall. The proposed building will not have a basement. The elevation of the top of the first-floor slab-on-grade is about El. 103. The elevation of the grade around the outside of the building will be about El. 98.

We understand from the structural engineer that the footing dimensions shown on the validation plans were based on an allowable soil bearing pressure of 4 kips per square foot. The typical footing sizes shown on the validation drawings are 8 by 8 feet and 9 by 9 feet, indicating that the typical column loads in the new building are about 256 to 324 kips.

We also understand from the structural engineer that the building will have a fundamental period of about 0.4 seconds.

The project will include new stormwater infiltration basins. We understand that the new stormwater infiltration basins will be located at various locations around the south and west perimeter of the existing and proposed buildings.

2.3 Elevation Datum

All elevations in this report are referenced to the North American Vertical Datum of 1988 (NAVD 88).

3. Subsurface Conditions

3.1 Site Geology

The USGS surficial geology map of the Wilmington Quadrangle indicates the surface soils in the area of the site consist of coarse deposits of gravel, sand and gravel, and sand. These deposits typically consist of alternating layers of well sorted sands and gravels.

The Bedrock Geologic Map of the Wilmington Quadrangle, Massachusetts (Castle, et al, 2005) indicates the bedrock in the area of the site is pegmatite of the Andover Granite Formation. The pegmatite is described as massive medium to coarse grained rock composed mainly of microcline, plagioclase, quartz, and muscovite.

3.2 2023 Borings and Test Pits

Northern Drill Service of Northborough, Massachusetts drilled 7 borings (B-101 through B-107) and excavated 13 test pits (TP101-TP106 and TP109- TP-115) from April 24 to May 8, 2023. A GEI field engineer observed and logged the drilling and test pit excavations. Boring locations are shown in Figs. 2 and 3. Boring logs are provided in Appendix A. Test pit logs are provided in Appendix B.

Northern Drill Service notified Dig Safe and the appropriate utility agencies prior to performing the borings and test pits. Dig-Safe normally does not mark utilities on private property. Therefore, we took the additional step of engaging Infrasense, Inc. of Woburn, Massachusetts to perform a utility survey at the proposed location of each boring and test pit. Infrasense used ground penetrating radar and electromagnetic induction systems to perform a survey of a 20-foot by 20-foot area around each proposed exploration location to locate utilities or potential obstructions. Based on the results of the utility survey, we adjusted the locations of some of the borings and test pits.

The utility survey indicated the presence of utilities close to boring B-101 and therefore the boring was started with vacuum excavation prior to drilling to check for utilities.

The borings were advanced using flush-jointed casing and rotary-wash drilling techniques. Standard Penetration Tests (SPTs) were performed with an automatic hammer, and split-spoon samples were collected, at two- to five-foot intervals. Northern Drill Service provided the results of a hammer energy measurement test performed in October 2022 on the SPT automatic hammer. The calibration report indicated that the automatic hammer was operating at 85.7% efficiency.

The borings were advanced to depths ranging from 26 to 59 feet below ground surface. Bedrock was encountered in five of the borings at depths ranging between 29 and 47 feet below ground surface. 5- to 10- foot cores were obtained in borings B-101, B-102, B-105 and B-107. Boring B-104 was terminated in the dense sand and gravel and B-105 was terminated in likely weathered rock. After each boing was completed, the holes were backfilled with drill cuttings and all-purpose gravel, except where groundwater wells were installed. The borings located in paved areas were capped with asphalt cold patch, except where groundwater wells were installed.

Groundwater observation wells were installed in borings B-102 and B-103 with a screened length of 15 feet and 5-foot length of solid riser pipe. Wells were completed with flush-mounted road boxes. Groundwater observation well installation logs are provided in Appendix A.

In addition to the borings, Northern Drill Service also excavated 13 test pits using a track mounted excavator. A GEI engineer was on site full time to observe and log the test pit excavations. Test pits were backfilled with the excavated soil placed in lifts, with each lift compacted with the excavator bucket. Test pit logs are provided in Appendix B.

3.3 Previous Boring Data

GEI previously engaged Northern Drill Service to perform a subsurface investigation program at the site between July 28 through August 25, 2020. This program consisted of 18 borings (B1 through B18) and five test pits. The borings were advanced to depths ranging between 20 to 80 feet, using flush-jointed casing and rotary-wash drilling techniques. Standard Penetration Tests (SPTs) were performed, and split-spoon samples were collected, at two- to five-foot intervals. SPTs were performed with an automatic hammer. As part of this exploration program, 5- to 10-foot rock cores were obtained in five of the borings (B-10 to B15) and groundwater motoring wells were installed in five of the borings (B2, B5, B14, B15 and B16) with depths ranging between 15 to 30 feet. A GEI field engineer observed and logged the drilling and test pits excavations. The locations of these previous explorations are shown in Figs. 2 and 3. Logs of the 2020 borings are provided in Appendix D and logs of the 2020 test pits are provided in Appendix E.

3.4 Laboratory Testing

We performed 29 mechanical grain size tests and 22 combined mechanical grain size and hydrometer tests on soil samples collected from the boring and test pits. The test results are summarized in Table 1. The grain-size distribution curves are presented in Appendix C.

3.5 Soil Descriptions, Hydrologic Soil Group, and Rawl's Rate

Soil descriptions on the boring and test pit logs (Appendices A and B, respectively) and on the individual grain-size distribution reports (Appendix C) are based on the Unified Soil Classification System (USCS). Also included in Appendix C is a figure that shows the results of the mechanical sieve and hydrometer analyses based on the United States Department of Agriculture (USDA) Soil Description System.

The USDA soil descriptions were used to obtain the soil texture class, National Resource Conservation Services (NRCS) hydrologic soil group, and estimated infiltration rates (Rawls Rate), as described in the Massachusetts Stormwater Handbook. The soil texture class, hydrologic soil group, and Rawls Rates are provided in Table 4.

3.6 Subsurface Conditions

The soil layers encountered in the borings are described below, starting at the ground surface. Subsurface profiles are shown in Figs. 4 and 5. The soil conditions are known only at boring locations. Conditions between borings may vary significantly from those shown in the subsurface profiles and described below. These variations may not become evident until construction.

As discussed above, Standard Penetration Testing was performed using an automatic hammer. We corrected the Standard Penetration Test N-values for energy (N_{60}) based on energy measurements for the specific automatic hammer system used for the borings. Corrected N-values (N_{60}) are plotted in the subsurface profiles (Figs. 4 and 5) and are used in the discussion of subsurface conditions below. Field (uncorrected) SPT N-values are shown on the boring logs in Appendix A.

Asphalt – B101, and B104-B107 were advanced in the existing parking lot on the west side of the building, which is paved with approximately 2 to 3 inches of asphalt.

Topsoil – B102 was advanced in a landscaped area adjacent to the existing building and encountered 9 inches of topsoil at the ground surface.

Fill – A thin layer of fill was encountered at the ground surface in B-103 and below the pavement in other borings. The fill layer was about 1 to 4 feet thick and consisted of widely graded sand with silt and gravel.

Silt and Sand – A layer of silt, fine sand, and sand, was encountered below the asphalt, topsoil, and fill. This layer ranged from 14 to 38 feet thick. This layer typically consisted of silt and fine sand with occasional layers of widely graded sand. At many depths and locations this layer was mostly silt. Standard Penetration Test N_{60}-values in the upper 10 to 15 feet of this layer ranged from 10 to 46 with most values between 15 and 30, indicating a

medium dense soil. N_{60}-values in the lower 10 to 15 feet of this layer ranged from 3 to 16 with most values between 7 and 12 indicating a loose to medium dense soil.

Sand and Gravel: A layer of silty gravelly sand was encountered below the silt and sand layers in six of the seven of the borings. Two of the borings (B104 and B106) were terminated in this layer. Where fully penetrated, the layer ranged in thickness from 8 to 12.5 feet thick and consisted of fine to coarse sand with varying amounts of fine to coarse gravel and silty fines. Cobbles and boulders were also encountered in this layer. This layer was encountered just above the bedrock. N_{60}-values in this layer ranged from to 21 to 137, with most values between 20 and 40 indicating a medium dense to dense soil. Several SPTs performed in this layer encountered refusal, indicating the presence of cobbles and boulders. B-107 encountered a 12.5-foot layer of numerous cobbles and boulders directly on to top of the bedrock.

Bedrock – Bedrock was encountered in five of the borings (B101, B102, B103, B105, and B107) at depths ranging from 25.6 to 47.0 feet below the ground surface. In borings where bedrock was encountered, 5- to 10-foot rock cores were generally obtained. B103 was advanced 1.0 foot into weathered bedrock with a roller bit, but no rock core was obtained. Core samples of the bedrock consisted of hard, slightly weathered, light gray to dark gray gneiss and pegmatite of the Andover Granite formation. The Rock Quality Designation (RQD) ranged from 42 to 100 percent, and core recovery ranged from 88 to 100 percent. Typically, the driller advanced the boring about 1 to 2 feet into the top of bedrock before starting to core, indicating that the upper 2 to 3 feet of bedrock could be softer or more fractured.

Photographs of the bedrock cores collected as part of this investigation are presented at the end of the boring logs in Appendix A.

3.7 Groundwater Conditions

Between May 5 and June 1, 2023, groundwater levels across the overall site ranged from El. 78.3 to El. 94.1. The groundwater elevations were the highest in the southern end of the site and dropped toward the north. Groundwater level measurements are provided in Table 2.

Within or near the footprint of the proposed building, groundwater elevations from May 5 to June 1, 2023 were:

- B102(OW): El. 87.3 to 87.7.
- B103(OW): El. 92.6 to 93.4.
- B15(OW): El. 90.7 to 91.5.

These groundwater level measurements represent conditions at the times and locations indicated. Significantly different groundwater levels may occur at other times and locations.

4. Foundation Recommendations

4.1 10th Edition Massachusetts Building Code

Our recommendations are based on the Draft 10th Edition of the Massachusetts Building Code, which consists of the 2021 International Building Code (IBC) and Massachusetts Amendments to the IBC. The 2021 IBC references ASCE 7-16 with Supplement 1.

4.2 Foundation Design

We recommend that the proposed building be supported on spread or strip footings bearing on the natural silt and sand layer, or on compacted Structural Fill extending down to the natural silt and sand layer. The footings should be designed for a maximum allowable bearing pressure of 4 kips per square foot (ksf).

We also recommend that ground improvement be used to reduce the potential for liquefaction or earthquake-induced settlement. The density of the silt and sand layer was variable, with many of the samples loose enough that they are susceptible to liquefaction. Ground improvement would reduce the risk of significant earthquake-induced settlement if the design earthquake were to occur. Ground improvement is discussed further in Section 4.5 below.

Footings designed for 4 ksf allowable bearing pressure should be at least 3 feet wide. For relatively light loads, footings 2.5 feet wide may be used with an allowable bearing pressure of 3.3 ksf, and footings 2 feet wide may be used with an allowable bearing pressure of 2.6 ksf.

Exterior footings and footings in unheated portions of the building should bear at least 4 feet below the finished grade for frost protection. Interior footings should bear at least 18 inches below the bottom of the floor slab.

4.3 Floor Slab

We understand that the first floor will be designed as a slab-on-grade, about 5 feet above existing grade. We recommend that the top 9 inches of fill below the floor slab consist of Structural Fill (per Table 5). Recommendations for subgrade preparation and filling below the floor slab are discussed below in Section 5.2.

We recommend that contraction joints be incorporated between the slab-on-grade and the columns and perimeter walls of the proposed building. The bottom of the slab-on-grade should be at least 6 inches above the top of underlying footings.

We recommend that, at a minimum, a vapor retarder be installed below the ground floor slabs-on-grade. We recommend that you consult with the manufacturer of the proposed flooring system regarding vapor transmission and vapor retarder/waterproofing requirements.

We recommend designing the slabs-on-grade using a modulus of subgrade reaction k=250 pounds per cubic inch (assuming a Structural Fill thickness of at least 9 inches). This k value is for a loaded area on the Structural Fill below the slab corresponding to a 30-inch diameter plate. The k value should be reduced for larger loaded areas. This recommended value is for relatively flexible slabs on compacted sandy or gravelly soils and is based on the design guidance provided in "Slab Thickness for Industrial Concrete Floors on Grade" by the Portland Cement Association (PCA), 1996 and "Design of Slabs on Grade" by the American Concrete Institute (ACI) in publication ACI 360R.

4.4 Settlement

We estimate that the total settlement of the proposed building will be less than 1 inch, and differential settlements between adjacent footings will be less than 0.6 inch. We estimate that settlement of the slab-on-grade will be less than 0.75-inch, and differential settlement over a 20-foot span will be less than 0.5 inch. Much of the settlement is expected to occur during construction.

4.5 Ground Improvement

Ground improvement can take many forms, but the most appropriate for this site consists of vertical ground reinforcement elements consisting of columns of crushed stone, concrete, or grout, installed typically at 3- to 10-foot spacing. Typical designs often use a non-uniform spacing with closer spacing below footings and wider spacing below slabs-on-grade. The ground reinforcement elements should extend through the silt and sand layer to denser soil or rock (typically 25 to 45 ft deep). The tops of the reinforcement elements are typically overlain by a layer of compacted sand and gravel (called a load transfer platform) that distributes the bearing loads from the footings and slab-on-grade to the reinforced ground.

The ground improvement is typically designed and installed by specialty contractors using proprietary methods under a performance specification (that we will prepare during final design). Proprietary methods that can be considered include rammed aggregate piers (RAPs) such as "Geopiers" and "Vibro piers," or rigid inclusions such as "Controlled Modulus Columns" (CMCs), and "Vibro concrete columns."

Some of these methods densify the existing soils by installing the inclusions using vibratory methods. Although these methods would provide the most effective ground improvement, procedures would likely need to be modified for use adjacent to the existing footing-supported buildings, as the vibrations could cause settlement of the existing buildings.

A combination of techniques could also be used: one technique near the existing buildings and another technique farther from the existing buildings.

4.6 Seismic Design

Based on our review of the boring data, we recommend a seismic site classification of Site Class D. The earthquake design parameters for the Town of Andover (per Massachusetts amendments (10th Edition) to Chapter 16 of the IBC) are:

S_S = 0.355 g

S_1 = 0.076 g

Our recommended amplification factors are:

F_a = 1.5

F_V = 2.4

Resulting seismic design parameters are:

S_{DS} = 0.355 g

S_{D1} = 0.122 g

Some of the loose soils at the site are susceptible to liquefaction. However, we understand that the proposed building will have a fundamental period of less than 0.5 seconds. Therefore, per ASCE 7-16, section 20.3.1, paragraph 1, the site may still be considered Site Class D, and the seismic parameters above are appropriate.

4.7 Lateral Wall Loads

We recommend that exterior walls where the floor is above exterior grade be designed for the lateral pressures shown in Fig. 6.

5. Construction Recommendations

5.1 Preparation of Subgrades for Footings

Where footing subgrades are sandy or gravelly, footings may bear directly on the subgrade soils. For these sandy or gravelly subgrades, loose or disturbed soil should be removed from the bottom of the footing excavations, and the subgrade should be compacted with at least three coverages of a vibratory compactor weighing at least 200 pounds and imparting an impact load of at least 2.5 tons. Bearing surfaces should be free of standing water, frost, and loose soil before placement of reinforcing steel and concrete. Areas of the subgrade disturbed by traffic or surface water should be re-compacted.

Where footing subgrades are primarily silt, then the final excavation to subgrade should be made with a smooth-bladed bucket, and the subgrade should be covered with a 4-inch-thick concrete mud slab to protect the subgrade from disturbance while constructing the footings.

5.2 Preparation of Subgrades and Filling for Slab-on-Grade

The building slab-on-grade will be constructed on several feet of fill. The top 9 inches below the slab-on-grade should consist of compacted Structural Fill (per Table 5). Below that, Ordinary Fill meeting the gradation requirements in Table 6 may be used, but the Ordinary Fill should meet the same compaction requirements as Structural Fill. (Ordinary Fill may have up to 20% fines making it difficult to compact adequately in wet conditions, and may require special procedures for placement and compaction. Therefore, the contractor should consider providing Ordinary Fill with less than about 12% fines.) Before placing new fill, we recommend that the existing pavement and any existing topsoil be removed, and the subgrade be compacted with at least three coverages of a 5-ton vibratory roller.

Section 1705.6 and Table 1705.6 of the Massachusetts Building Code (IBC 2021) calls for continuous inspection of fill placed within the building limits.

5.3 Excavation and Dewatering

All excavations should be made in accordance with OSHA standards.

Groundwater was encountered about 5 to 10 feet below ground surface, and is not expected to be encountered in footing excavations over most of the building footprint. If footing or utility excavations do encounter groundwater, filtered sumps should be used to maintain groundwater at least 2 feet below the bottom of the excavation. The site should be graded to direct surface runoff away from excavations.

Near the southern portion of the proposed building groundwater was encountered about 5 feet below the ground surface and close to the anticipated subgrade elevation for the perimeter wall footings. In this area, special dewatering techniques such as temporary deep dewatering wells or well points may be needed to maintain the groundwater level at least 2 feet below the bottom of the excavation at all times.

5.4 Filling and Backfilling

Backfill placed outside the building limits should meet the compaction and gradation requirements for Ordinary Fill in Table 4. This includes fill below the pavement box for parking areas and driveways, and backfill for utility trenches. Ordinary Fill may be susceptible to frost heave. The potential for frost heave can be reduced by grading outside areas for proper drainage and by using Structural Fill rather than Ordinary Fill for the top 1 to 2 feet.

5.5 Reuse of On-site Soil

Based on the results of grain size analyses, it appears that some of the existing site soils will be acceptable for reuse as Ordinary Fill. However, much of the site soil consists primarily of silt, which will be difficult to compact, and should be reused in landscaped areas or transported off site. Grain size distribution curves are presented in Appendix C.

Aside from the 9-inch layer of Structural Fill immediately below the slab-on-grade, it is acceptable to use on site soil meeting the requirements of Ordinary Fill below floor slabs within the limits of the buildings, provided it can be compacted to the same requirements as we recommended for Structural Fill. However, Ordinary Fill may have up to 20% fines making it difficult to compact adequately in wet conditions, and may require special procedures for placement and compaction. The decision whether to use the on-site soils within the building limits (even it meets the requirements of Ordinary Fill) should be made during construction. For planning purposes, we recommend assuming that no on-site soils can be reused under the buildings.

5.6 Freezing Conditions

The soils at the site are frost susceptible. Therefore, if construction is performed during freezing weather, special precautions will be required to prevent the subgrade soils from freezing. Freezing of the soil beneath the foundation during construction may result in subsequent settlement of the structure when the soil thaws.

All subgrades should be free of frost before placement of concrete. Frost-susceptible soils that have frozen should be removed and replaced with compacted Structural Fill. The footing and the soil adjacent to the footing should be insulated until they are backfilled.

Soil placed as fill should be free of frost, as should the ground on which it is placed.

If slabs-on-grade or footings are built and left exposed during the winter, precautions should be taken to prevent freezing of the underlying soil.

5.7 Existing Structures and Buried Structures/Utilities

As part of our subsurface explorations, we did review utility plans and engage a utility locating company to clear the locations of our borings and test pits. Through this effort, we are aware that there are numerous existing utilities present within the footprint of the proposed building. All utilities within the footprint of the building should be relocated and the excavations backfilled with Ordinary Fill meeting the gradation and compaction requirements presented in Table 6.

It was not part of our scope to explore for or research the locations of all buried utilities or other buried structures at the site. Before construction of foundations for the proposed structures, a diligent effort should be made to determine the presence and location of any buried structures including utilities. This effort should include a thorough review of available drawings and other records of the site use and facilities. If the presence of such structures is determined to be likely, GEI should be notified so that we may review and revise our recommendations, if appropriate.

6. Limitations

Our recommendations are based on the project information provided to us at the time of this report and may require modification if there are any changes in the nature, design, or location of the proposed structure. We cannot accept responsibility for designs based on our recommendations unless we are engaged to review the final plans and specifications to determine whether any changes in the project affect the validity of our recommendations and whether our recommendations have been properly implemented in the design.

The recommendations in this report are based in part on the data obtained from the subsurface explorations. The nature and extent of variations between explorations may not become evident until construction. If variations from the anticipated conditions are encountered, it may be necessary to revise the recommendations in this report. We, therefore, recommend that GEI be engaged to make site visits during construction to: a) check that the subsurface conditions exposed during construction are in general conformance with our design assumptions and b) ascertain that, in general, the work is being performed in compliance with the contract documents.

Our professional services for this project have been performed in accordance with generally accepted engineering practices; no warranty, express or implied, is made.

This report should be submitted to the building official by the permit applicant at the time of permit application, per Building Code Section 1803.6.

Tables

Table 1. Subsurface Conditions Summary
Project Principio
Andover, Massachusetts

Boring	Elevations of Top of Layer (feet, Datum - NAVD 88)						
	Ground Surface/ Top of Fill	Sand	Silt and Sand/Sand and Silt	Sand and Gravel	Bedrock	Bottom of Boring	Groundwater Elevation
B-101	98.0	NE	96.0	NE	51.0	39.1	NM
B-102 (OW)	101.0	NE	100.3	67.0	57.5	46.0	--
B-103 (OW)	98.5	NE	93.9	NE	55.5	54.5	--
B-104	97.5	96.8	85.5	53.5	NE	51.5	NM
B-105	98.0	NE	97.3	79.0	71.0	59.0	91.9
B-106	97.5	NE	95.3	83.5	NE	71.5	90.9
B-107	98.0	NE	97.7	NE	59.0	54.0	92.0
B1	98.5	98.5	NE	NE	NE	57.5	85.8
B2 (OW)	101.0	73.5	38.5	33.5	NE	22.0	--
B3	102.5	102.5	80.0	NE	NE	61.5	88.7
B4	100.0	100.0	94.0	NE	NE	19.0	90.6
B5 (OW)	101.0	NE	101.0	NE	NE	80.0	--
B6	99.5	97.5	89.5	NE	NE	38.5	86.2
B7	106.5	106.5	94.5	NE	NE	49.5	92.8
B8	101.5	101.5	97.5	NE	NE	40.5	93.4
B9	99.5	98.5	92.0	NE	NE	48.5	89.2
B10	110.0	110.0	103.2	50.0	39.0	32.0	91.6
B11	107.5	107.3	101.5	61.0	46.0	43.5	101.3
B12	100.0	NE	100.0	72.5	62.0	51.0	89.0
B13	111.0	111.0	102.0	56.7	NE	45.0	95.8
B14 (OW)	107.0	106.7	101.0	67.0	55.5	48.0	--
B15 (OW)	99.0	NE	96.0	90.5	84.0	72.0	--
B16 (OW)	99.0	98.0	NE	NE	NE	79.0	--
B17	99.0	99.0	NE	NE	NE	58.0	79.4
B18	101.0	101.0	NE	NE	NE	60.0	90.9

Notes:
1. NE - Not encountered in the boring during drilling; NM - Not measured.
2. "--" indicates an observation well was installed. Refer to Table 2 for groundwater readings.

Table 2. Groundwater Data
Project Principio
Andover, Massachusetts

Observation Well Number	Ground Elevation (feet)	May 5,2023		May 8, 2023		May 23, 2023		June 1, 2023	
		Depth (feet)	Elevation (feet)	Depth (feet)	Elevation (feet)	Depth (feet)	Elevation (feet)	Depth (feet)	Elevation (feet)
B2 (OW)	101.0	17.2	83.8	17.0	84.0	17.1	83.9	17.2	83.8
B5 (OW)	101.0	5.8	95.2	6.2	94.8	6.9	94.1	7.3	93.7
B14 (OW)	107.0	12.1	94.9	12.1	94.9	12.6	94.4	12.9	94.1
B15 (OW)	99.0	7.5	91.5	7.5	91.5	7.8	91.2	8.3	90.7
B16 (OW)	99.0	Dry	<79.0	Dry	<79.0	Dry	<79.0	20.3	78.3
B-102 (OW)	101.0	13.4	87.6	13.4	87.6	13.3	87.7	13.3	87.3
B-103 (OW)	98.5	5.1	93.4	5.1	93.4	5.5	93.0	5.5	92.6

Notes:

1. Elevations are based on the North American Vertical Datum of 1988 (NAVD 88).
2. Depth refers to depth below ground surface.
3. OW = Observation well.
4. "--" indicates no measurement was taken.

Table 3. Laboratory Test Results
Project Principio
Andover, Massachusetts

Boring	Sample	Depth (ft)	USCS Classif'n	Moisture Content	Grain Size Analysis				
					Gravel	Sand	Total Fines	Silt	Clay
				(%)	(%)	(%)	(%)	(%)	(%)
B-101	S1	6-8	ML	12	0.0	11.8	88.2	--	-
	S5	14-16	ML	31	0.0	39.7	60.3	--	-
	S6	19-21	ML	26	0.0	11.5	88.5	--	-
	S7	24-26	ML	25	0.0	39.2	60.8	--	-
	S8	29-31	ML	24	0.0	34.8	65.2	--	-
B-102	S1 (9"-22")	0-2	SM	15	0.0	57.9	42.1	--	-
	S7	19-21	SM	28	0.0	57.7	42.3	--	-
	S8	24-26	ML	25	0.0	45.9	54.1	--	-
	S9	29-31	ML	29	0.0	7.5	92.5	--	-
B-103	S1	0-2	SM	7	6.0	74.9	19.1	--	-
	S5	8-10	SM	30	0.0	86.0	14.0	--	-
	S6	14-16	ML	32	0.0	2.3	97.7	--	-
	S7	19-21	ML	26	0.0	16.1	83.9	--	-
	S8	24-26	ML	26	0.0	8.5	91.5	--	-
B-104	S3	4-6	ML	21	0.0	15.4	84.6	--	-
	S6	14-16	ML	29	0.0	15.5	84.5	--	-
	S7	19-21	ML	33	0.0	29.9	70.1	--	-
	S8	24-26	ML	24	0.0	35.2	64.8	--	-
	S9	29-31	ML	27	0.0	9.9	90.1	--	-
B-105	S2	2-4	ML	16	0.0	10.0	90.0	--	-
	S3	4-6	ML	28	0.0	2.5	97.5	--	-
	S5	8-10	ML	29	0.0	21.1	78.9	--	-
	S6	14-16	ML	27	0.0	3.2	96.8	--	-
B-106	S1	0-2	SM	12	3.1	73.3	23.6	--	-
	S5	8-10	ML	32	0.0	0.4	99.6	--	-
B-107	S2	2-4	SM	10	3.0	78.9	18.1	--	-
	S6	14-16	ML	31	3.5	1.8	94.7	--	-
	S7	19-21	ML	33	0.0	0.7	99.3	--	-
	S8	24-26	ML	34	0.0	2.8	97.2	--	-
TP-101	G1	1-2.5	SM	8	7.9	79.5	12.6	10.9	1.7
	G2	3-4	SM	13	0.8	63.9	35.3	35.0	<1
TP-102	G1	1-2	SP-SM	6	14.4	75.1	10.5	9.6	0.9
	G2	6-7	GP	1	52.2	46.3	1.5	1.2	0.3
TP-103	G2	5-5.5	ML	25	0.0	6.9	93.1	90.1	3.0
	G3	7.5-8	SP	28	0.0	93.8	6.2	4.9	1.3
TP-104	G3	3-4	ML	27	0.0	3.5	96.5	91.6	4.9
TP-105	G2	3-4	SP-SM	11	0.0	89.9	10.1	10.0	<1
	G3	7-8	ML	27	0.0	21.1	78.9	77.4	1.5
TP-106	G1	3-4	SM	13	0.0	84.4	15.6	16.0	<1
	G2	6-8	ML	28	0.0	32.2	67.8	66.8	1.0
TP-109	G2	2.5-2.8	SM	12	2.1	55.5	42.4	41.3	1.1
	G3	8.5-8.7	ML	10	0.0	31.7	68.3	67.3	1.0
TP-110	G1	1-1.5	SP-SM	6	34.4	55.5	10.1	7.2	2.9
	G2	6.5-7.0	ML	10	0.0	29.3	70.7	69.3	1.4
TP-111	G2	3-4	SP-SM	9	3.5	87.9	8.6	9.0	<1
	G4	10-10.5	ML	12	0.0	46.2	53.8	53.8	0.0
TP-112	G2	5.5-6	SM	13	0.1	63.8	36.1	34.9	1.2
	G3	9.8-10	SM	12	0.0	55.2	44.8	45.0	<1
TP-113	G1	7.5-8.5	SM	25	0.0	55.0	45.0	44.2	1
TP-114	G1	3-3.5	ML	21	0.0	28.5	71.5	69.4	2.1
TP-115	G1	0-2	SM	13	4.7	72.4	22.9	18.5	4.4

Table 4. Test Pit Data and Infiltration Rates from Explorations
Project Principio
Andover, Massachusetts

Exploration Number	Approx. Ground Surface Elevation [1,2]	Bottom of Test Pit		Layer Classified for Infiltration Properties		Description of Soil	Observed Mottling	Groundwater[3]		USDA Soil Texture [4]	NRCS Hydrologic Soil Group [5]	Infiltration Rate[5]
	(ft)	Depth (ft)	El. (ft)	Depth (ft)	Elevation (ft)		(Y/N)	Depth (ft)	El. (ft)			(in/hr)
TP-101	99.0	6.5	92.5	1.0 - 2.5	98.0 - 96.5	Silty SAND, tan.	N	Dry >6.5	<92.5	Sand	A	8.27
				3.0 - 4.0	96.0 - 95.0	Silty SAND, gray.				Loamy Sand	A	2.41
TP-102	99.0	7.0	92.0	1.0 - 2.0	98.0 - 97.0	Narrowly graded SAND with silt, tan.	N	Dry >7.0	<92.0	Sand	A	8.27
				6.0 - 7.0	93.0 - 92.0	Narrowly graded GRAVEL with sand, gray				Sand	A	8.27
TP-103	99.0	10.5	88.5	5.0 - 5.5	94.0 - 93.5	SILT, bluish gray and tan.	Y (~7.5 ft)	Dry >10.5	<88.5	Sand	A	8.27
				7.5 - 8.5	91.5 - 90.5	Narrowly graded SAND, tan with orange.				Silt Loam	C	0.27
TP-104	99.0	9.0	90.0	3.0 - 4.0	96.0 - 95.0	SILT, bluish gray and tan.	Y (~6 ft)	Dry >9.0	<90.0	Silt	Note 6	Note 6
TP-105	99.0	8.0	91.0	3.0 - 4.0	96.0 - 95.0	Narrowly graded SAND with silt, tan.	Y (~6 ft)	Dry >8.0	<91.0	Sand	A	8.27
				7.0 - 8.0	92.0 - 91.0	SILT with sand, bluish gray.				Sandy Loam	B	1.02
TP-106	99.0	9.5	89.5	3.0 - 4.0	96.0 - 95.0	Silty SAND, tan.	N	6.0	93.0	Sand	A	8.27
				6.0 - 8.0	93.0 - 91.0	Sandy SILT, bluish gray.				Sandy Loam	B	1.02
TP-109	98.5	9.5	89.0	2.5 - 2.8	96.0 - 95.7	Silty SAND, tan.	Y (~5 ft)	Dry >9.5	<89.0	Loamy Sand	A	2.41
				8.5 - 8.7	90.0 - 89.8	Sandy SILT, tan.				Sandy Loam	B	1.02
TP-110	98.0	9.0	89.0	1.0 - 1.5	97.0 - 96.5	Narrowly graded SAND with silt and gravel, brown.	N	Dry >9.0	<89.0	Sand	A	8.27
				6.5 - 7.0	91.5 - 91.0	Sandy SILT, light tan.				Sandy Loam	B	1.02
TP-111	97.5	10.5	87.0	3.0 - 4.0	94.5 - 93.5	Narrowly graded SAND with silt, tan.	N	Dry >10.5	<87.0	Sand	A	8.27
				10.0 - 10.5	87.5 - 87.0	Sandy SILT, tan and gray.				Sandy Loam	B	1.02
TP-112	99.0	10.5	88.5	5.5 - 6.0	93.5 - 93.0	Silty SAND, gray and tan.	N	Dry >10.5	<88.5	Sandy Loam	B	1.02
				9.8 - 10.0	89.2 - 89.0	Silty SAND, gray and tan.				Loamy Sand	A	2.41
TP-113	100	10.0	90.0	7.5 - 8.5	92.5 - 91.5	Silty SAND, tan and gray.	N	3.0	97.0	Loamy Sand	A	2.41
TP-114	100	11.0	89.0	3.0 - 3.5	97.0 - 96.5	SILT with sand, bluish gray with rust staining.	Y (~3.5 ft)	8.0	92.0	Sandy Loam	B	1.02
TP-115	99.0	7.0	92.0	0.0 - 2.0	99.0 - 97.0	Silty SAND, brown.	N	4.5	94.5	Loamy Sand	A	2.41

Notes:

1. Elevation datum is the North American Vertical Datum (NAVD) of 1988.
2. Ground surface elevations estimated from spot elevation points on base plan provided by Fennick McCredie Architecture.
3. Groundwater depth in test pits is based on depth were water was observed entering the test pit.
4. USDA soil texture is derived from Fig. 2.3.2, of the Massachusetts Stormwater Handbook (Vol 3, Ch. 1) using the results of sieve analyses and hydrometer tests performed on soil samples obtained from the test pits.
5. NRCS Hydrologic Soil Groups and Infiltration rates are derived from Table 2.3.3, of the Massachusetts Stormwater Handbook (Vol. 3, Ch.1) using the USDA Soil Texture classification.
6. The Massachusetts Stormwater Handbook does not provide a NRCS Hydrologic Soils Group or Rawls Infiltration rate for Silt

Table 5. Requirements for Structural Fill
Project Principio
Fennick McCredie
Andover, Massachusetts

Structural Fill shall consist of hard, durable sand and gravel, free of clay, organic matter, surface coatings, and other deleterious materials. Soil finer than the No. 200 sieve (the "fines") shall be non-plastic. Structural Fill shall meet the following gradation requirements:

Sieve Size	Percent Passing by Weight
3 inches	100
½ inch	50 – 100
No. 4	35 – 85
No. 16	20 – 65
No. 50	5 – 40
No. 200 (fines)	0 – 8

Structural Fill shall be compacted in maximum 9-inch-thick, loose lifts to at least 95 percent of the maximum dry density determined in accordance with ASTM D1557 (Modified AASHTO Compaction).

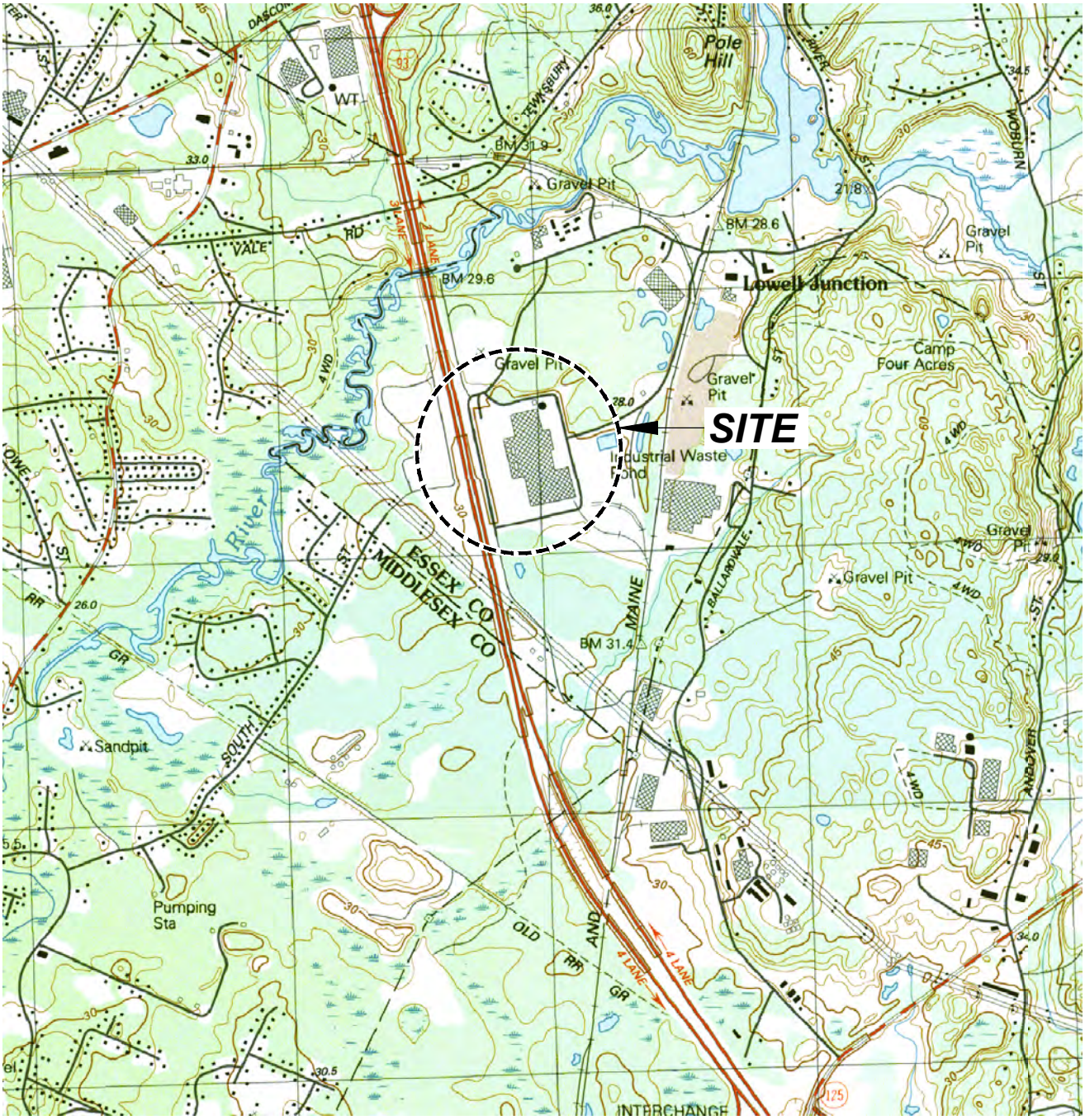
Table 6. Requirements for Ordinary Fill
Project Principio
Fennick McCredie
Andover, Massachusetts

Ordinary Fill shall consist of hard, durable sand and gravel, free of clay, organic matter, surface coatings, and other deleterious materials. Soil finer than the No. 200 sieve (the "fines") shall be nonplastic. Ordinary Fill shall meet the following gradation requirements:

Sieve Size	Percent Passing by Weight
6 inches	100
3 inches	80 – 100
No. 4	20 – 100
No. 200 (fines)	0 - 20

Ordinary Fill shall be compacted in maximum 12-inch-thick, loose lifts to at least 92 percent of the maximum dry density determined in accordance with ASTM D1557 (Modified AASHTO Compaction).

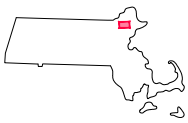
Figures



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SCALE, FEET

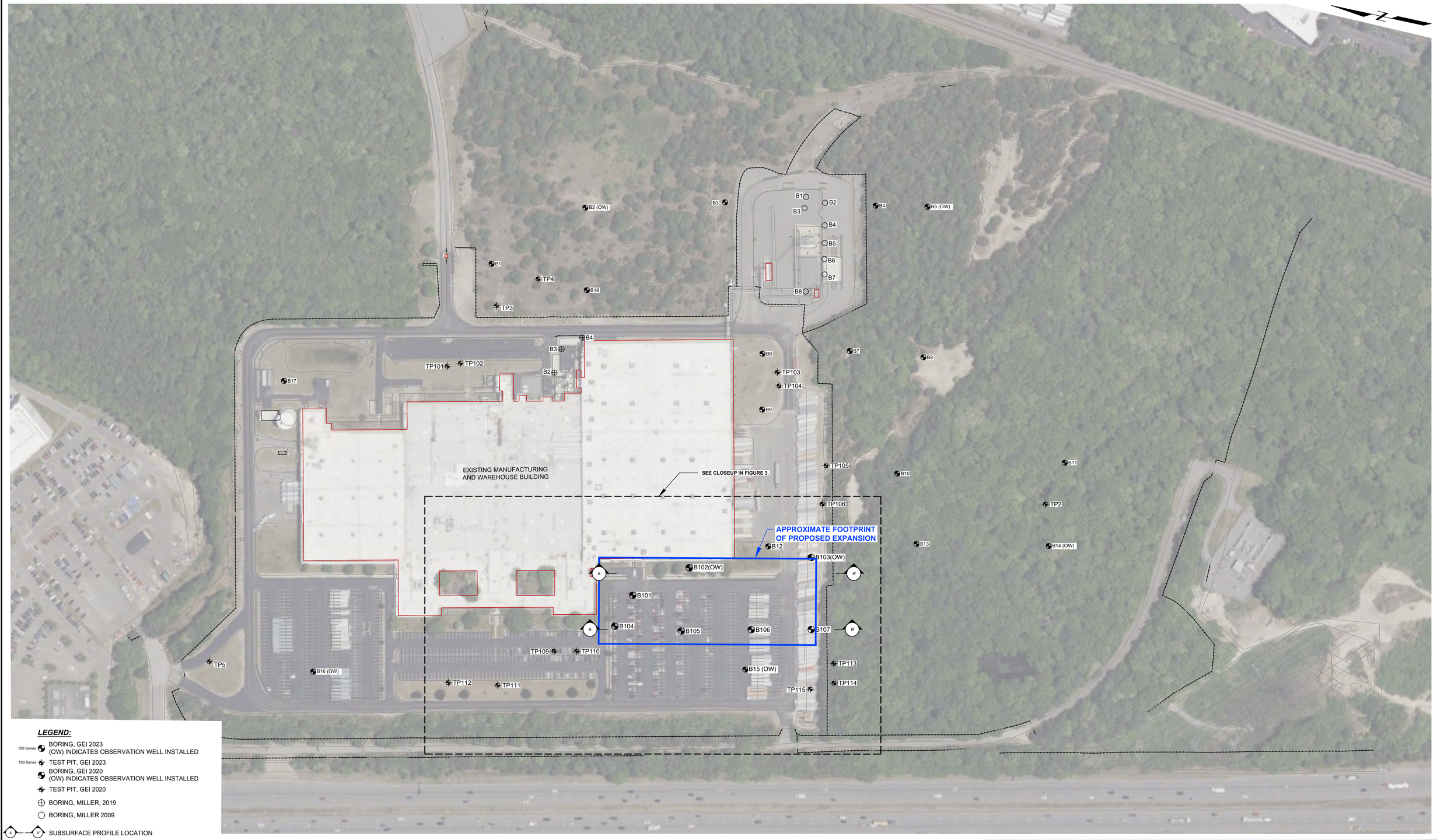
This Image provided by MassGIS is from U.S.G.S. Topographic
7.5 X 15 Minute Series
Somerset, MA Quadrangle, 1985.
Datum is National Geodetic Vertical Datum of 1929 (NGVD29).
Contour Interval is 3 Meters.



MASSACHUSETTS
QUADRANGLE LOCATION

Project Principio Andover, Massachusetts	GEI Consultants	SITE LOCATION MAP
Fennick McCredie Architecture Boston, Massachusetts	Project 2300951	June 2023 Fig. 1

B:\Working\FENNICK MCCREDIE ARCHITECTURE\2300951 Project Principio Andover\00_CAD\Figures\2300951 - SLM



LEGEND:

- 100 Series — BORING, GEI 2023 (OW) INDICATES OBSERVATION WELL INSTALLED
- 100 Series — TEST PIT, GEI 2023
- BORING, GEI 2020 (OW) INDICATES OBSERVATION WELL INSTALLED
- TEST PIT, GEI 2020
- BORING, MILLER, 2019
- BORING, MILLER 2009
- A — A' SUBSURFACE PROFILE LOCATION

NOTE::

1. COORDINATES ARE MASSACHUSETTS STATE PLANE (2011) US SURVEY FEET.
2. AS DRILLED BORING AND TEST PIT LOCATIONS WERE DETERMINED ARE ESTIMATED USING NEARBY SURVEY INFORMATION.
3. PLAN BASED ON MAP PREPARED BY SKANSKA.

0 120 240
SCALE: 1" = 120'

Project Principio
Andover, Massachusetts

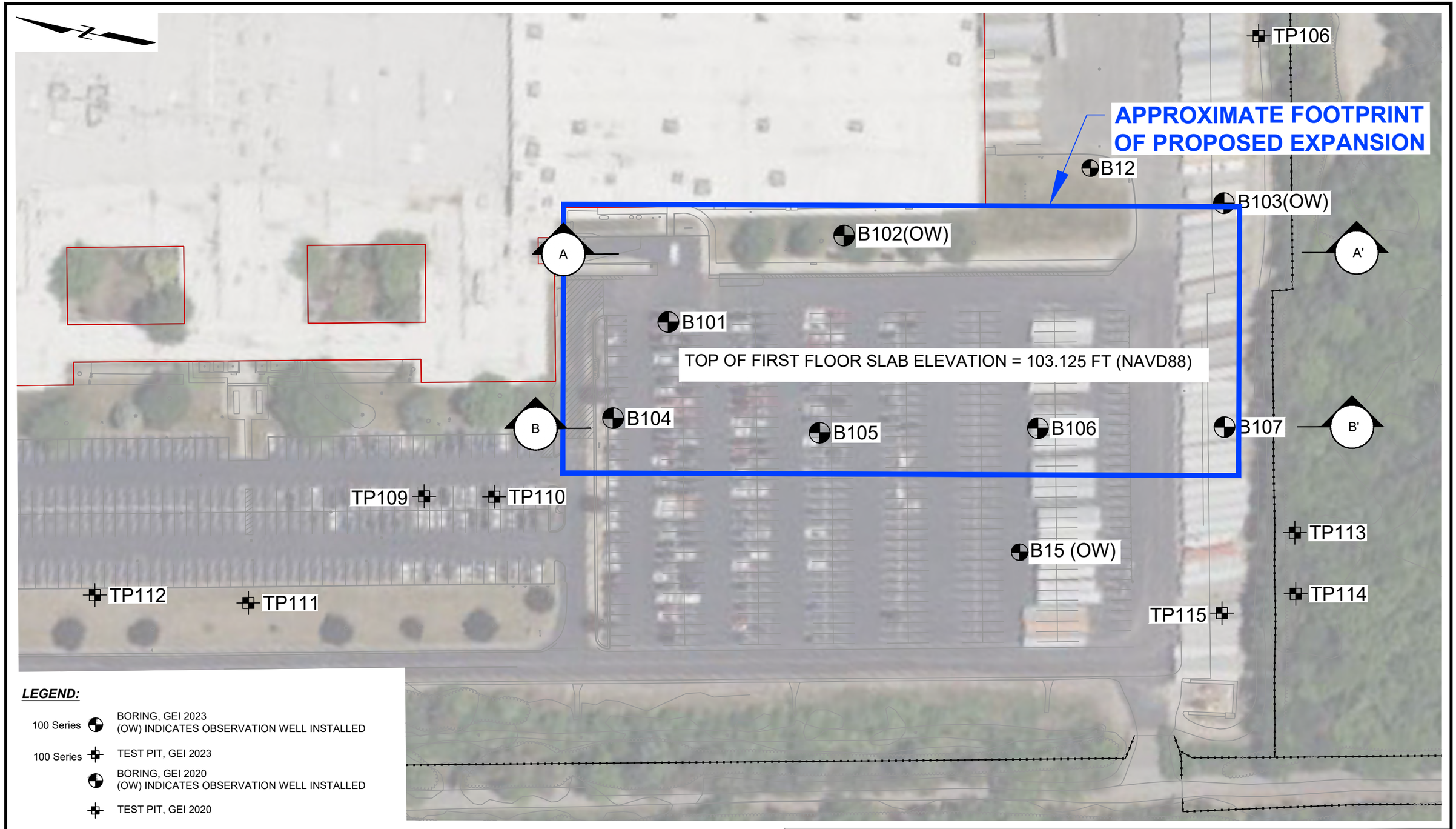
Fennick McCredie Architecture
Boston, Massachusetts

GEI Consultants

EXPLORATION LOCATION PLAN
OVERALL VIEW
(SHEET 1 OF 2)

Project 2300951 | June 2023 | Fig. 2

WINTER, EMILY B:\Working\FENNICK MCCREDIE ARCHITECTURE\2300951 Project Principio Andover\00_CAD\Figures\2300951 As-Drilled Exploration Location Plan.dwg - 6/2/2023



LEGEND:

- 100 Series — BORING, GEI 2023 (OW) INDICATES OBSERVATION WELL INSTALLED
- 100 Series — TEST PIT, GEI 2023
- BORING, GEI 2020 (OW) INDICATES OBSERVATION WELL INSTALLED
- TEST PIT, GEI 2020
- BORING, MILLER, 2019
- BORING, MILLER 2009
- A — A' SUBSURFACE PROFILE LOCATION

0 80 160
SCALE, FEET

Project Principio
Andover, Massachusetts

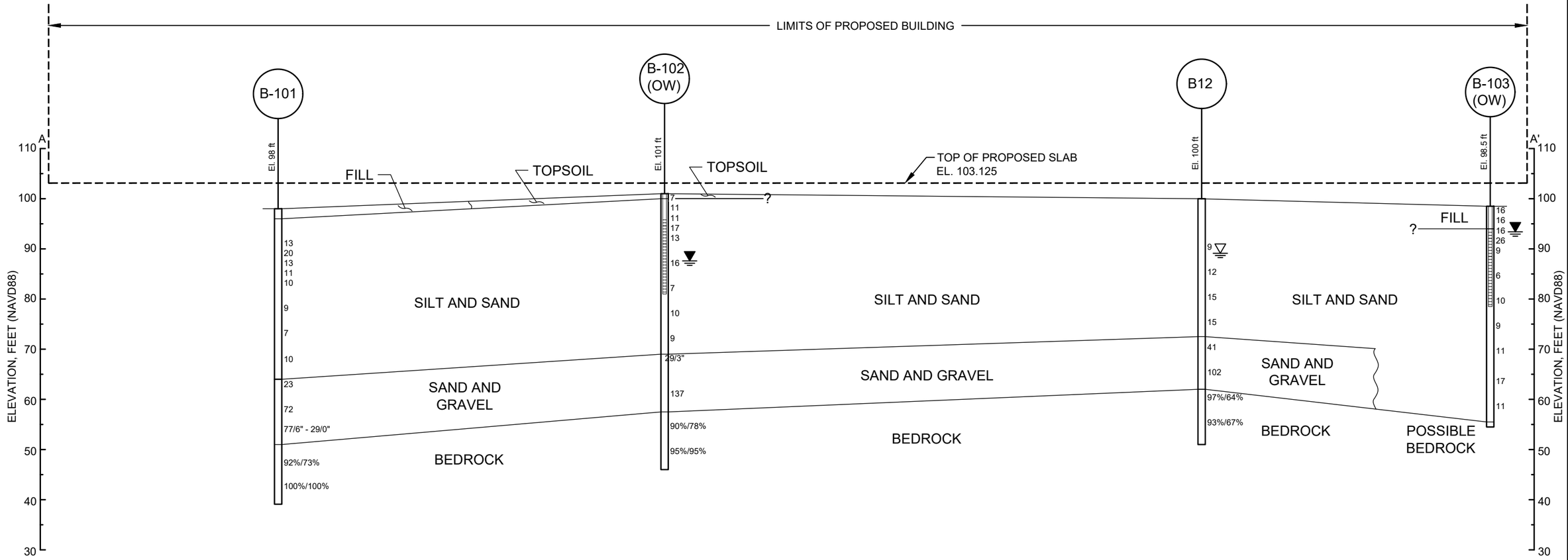
Fennick McCredie Architecture
Boston, Massachusetts

GEI Consultants

EXPLORATION LOCATION PLAN
CLOSEUP
(SHEET 2 OF 2)

Project 2300951 | June 2023 | Fig. 3

\\geiconsulta B:\Working\FENNICK MCCREDIE ARCHITECTURE\2300951 Project Principio Andover\00_CAD\Figures\2300951 As-Drilled Exploration Location Plan.dwg - 5/25/2023



B5 — BORING NUMBER

EL. 167.3 — ELEVATION OF GROUND SURFACE

EXISTING GROUND SURFACE

2-IN. DIAMETER PVC RISER PIPE

GROUND WATER LEVEL MEASURED AT COMPLETION OF DRILLING

GROUND WATER LEVEL MEASURED IN OBSERVATION WELL

SCREENED SECTION OF OBSERVATION WELL

STRATUM BOUNDARY

DRILLED THROUGH BOULDER

107 — N-VALUES FROM STANDARD PENETRATION TEST, CORRECTED FOR HAMMER ENERGY, N60, BLOWS PER FOOT

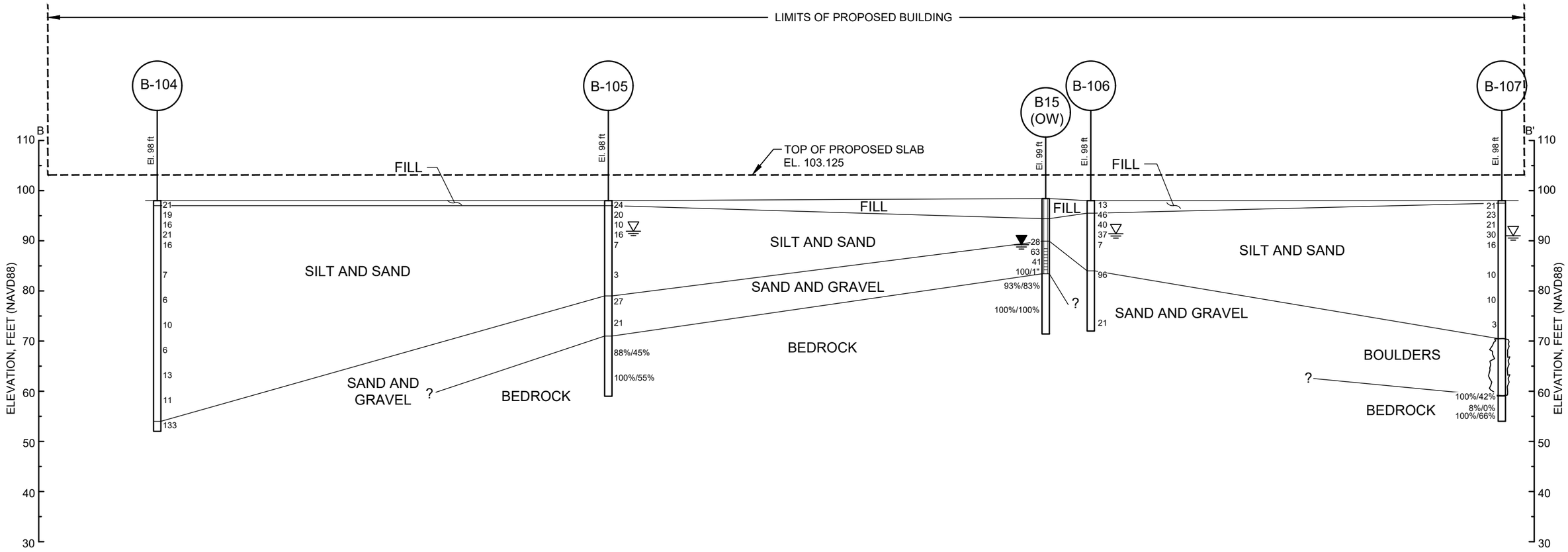
93%/40% — ROCK CORE RECOVERY/ROCK QUALITY DESIGNATION (RQD)

HORIZONTAL SCALE, FEET
0 40 80
0 20 40
VERTICAL SCALE, FEET
NOTE: 2x VERTICAL EXAGGERATION

NOTES

1. BORING LOCATIONS ARE SHOWN IN FIGURE 2 AND 3.
2. GROUNDWATER LEVELS MAY VARY AT OTHER LOCATIONS AND AT OTHER TIMES OF THE YEAR. LEVELS MEASURED AT THE COMPLETION OF DRILLING MAY NOT REFLECT THE STABILIZED GROUNDWATER LEVEL.
3. THE BOUNDARIES BETWEEN SOIL STRATA MAY BE TRANSITIONAL. THE STRATA BOUNDARIES BETWEEN BORINGS MAY VARY SIGNIFICANTLY FROM THE INTERPOLATIONS SHOWN.
4. APPROXIMATE ELEVATIONS ARE BASED ON GREENE INTERNATIONAL EXISTING CONDITIONS MAP DATED 06/05/2020.

Project Principio Andover, Massachusetts	GEI Consultants	SUBSURFACE PROFILE A-A'
Fennick McCredie Architecture Boston, Massachusetts	Project 2300951	June 2023 Fig. 4



B5 — BORING NUMBER

EL. 167.3 — ELEVATION OF GROUND SURFACE

EXISTING GROUND SURFACE

2-IN. DIAMETER PVC RISER PIPE

GROUND WATER LEVEL MEASURED AT COMPLETION OF DRILLING

GROUND WATER LEVEL MEASURED IN OBSERVATION WELL

SCREENED SECTION OF OBSERVATION WELL

STRATUM BOUNDARY

DRILLED THROUGH BOULDER

107 — N-VALUES FROM STANDARD PENETRATION TEST, CORRECTED FOR HAMMER ENERGY, N60, BLOWS PER FOOT

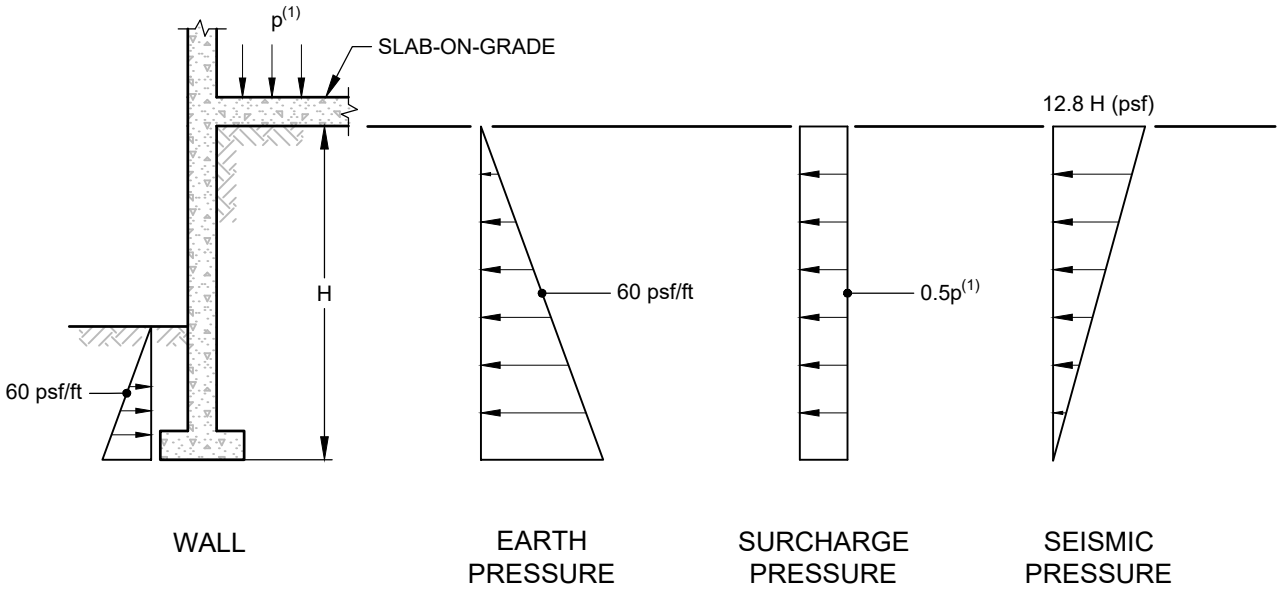
93%/40% — ROCK CORE RECOVERY/ROCK QUALITY DESIGNATION (RQD)

HORIZONTAL SCALE, FEET
0 40 80
0 20 40
VERTICAL SCALE, FEET
NOTE: 2x VERTICAL EXAGGERATION

NOTES

1. BORING LOCATIONS ARE SHOWN IN FIGURE 2 AND 3.
2. GROUNDWATER LEVELS MAY VARY AT OTHER LOCATIONS AND AT OTHER TIMES OF THE YEAR. LEVELS MEASURED AT THE COMPLETION OF DRILLING MAY NOT REFLECT THE STABILIZED GROUNDWATER LEVEL.
3. THE BOUNDARIES BETWEEN SOIL STRATA MAY BE TRANSITIONAL. THE STRATA BOUNDARIES BETWEEN BORINGS MAY VARY SIGNIFICANTLY FROM THE INTERPOLATIONS SHOWN.
4. APPROXIMATE ELEVATIONS ARE BASED ON GREENE INTERNATIONAL EXISTING CONDITIONS MAP DATED 06/05/2020.

Project Principio Andover, Massachusetts	GEI Consultants	SUBSURFACE PROFILE B-B'
Fennick McCredie Architecture Boston, Massachusetts	Project 2300951	June 2023 Fig. 5



NOTE:

1. p = TOTAL BEARING PRESSURE (psf) FROM ADJACENT SLAB-ON-GRADE INCLUDING STATIC AND SUSTAINED LIVE LOADS.

Project Principio Andover, Massachusetts	GEI Consultants	RECOMMENDED LATERAL EARTH PRESSURES ON FOUNDATION SUPPORTING RAISED SLAB
Fennick McCredie Architecture Boston, Massachusetts	Project 2300951	June 2023 Fig. 6

Appendix A

2023 Boring Logs

BORING INFORMATION

NORTHING (ft): 3,046,499 **EASTING (ft):** 744,890
GROUND SURFACE EL. (ft): 98 **DATE START/END:** 5/1/2023 - 5/2/2023
VERT./HORIZ. DATUMS: NAVD88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 58.9 **DRILLER NAME:** J. Raymond
LOGGED BY: R. Oulal **RIG TYPE:** Mobile B-48 Track Rig

BORING

B-101

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:** NX
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** 2.625 inch **CORE BARREL I.D./O.D.:** 2.625 inch / 3 inch
DRILLING METHOD: Rotary Drilling with Casing
WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		VAC EX	0 to 6	72		Vacuum excavated to 6.0 ft on 5/1/2023	FILL	(0-2"): ASPHALT (2"-24"): WIDELY GRADED SAND WITH GRAVEL (SW); ~60% fine to coarse sand, ~40% fine to coarse gravel, tan.
							SILT AND SAND	(2'-6'): NARROWLY GRADED SAND (SP); ~95% fine to medium sand, ~5% nonplastic fines, light tan.
	5	S1	6 to 8	24/7	6-4-5-5			S1: SILT (ML); 88.2% nonplastic fines, 11.8% fine sand, light tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
90		S2	8 to 10	24/9	8-6-8-4			S2: SILT (ML); Similar to S1.
	10	S3	10 to 12	24/13	3-4-5-5			S3: SILT (ML); Similar to S1, except tan and wet.
		S4	12 to 14	24/16	5-3-5-4			S4: SILT (ML); Similar to S3.
	15	S5	14 to 16	24/18	2-3-4-4			S5: SANDY SILT (ML); 60.3% nonplastic fines. 39.7% fine sand, tan.Orange mottling present. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
80								
	20	S6	19 to 21	24/16	1-3-3-4			S6: SILT (ML); 88.5% nonplastic fines, 11.5% fine sand, tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].

NOTES: 1. Northern Drill Service installed 4-inch ID casing with water spigot to keep a head on the hole.
2. Existing ground surface elevation and location are estimated using nearby survey information provided by Skanska.

PROJECT NAME: Project Principio Andover
CITY/STATE: Andover, MA
GEI PROJECT NUMBER: 2300951

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2300951 PROJECT PRINCIPIO ANDOVER BORING LOGS.GPJ 6/16/23

NORTHING (ft): 3,046,499 **EASTING (ft):** 744,890
GROUND SURFACE EL. (ft): 98 **DATE START/END:** 5/1/2023 - 5/2/2023
VERT./HORIZ. DATUMS: NAVD88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B-101

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S7	24 to 26	24/14	2-2-3-4		SILT AND SAND	S7: SANDY SILT (ML); 60.8% nonplastic fines, 39.2% fine sand, tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
70								
	30	S8	29 to 31	24/14	3-3-4-3			S8: SANDY SILT (ML); 65.2% nonplastic fines, 34.8% fine sand, tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
	35	S9	34 to 36	24/20	4-7-9-20			S9(0-13"): SANDY SILT (ML); ~65% nonplastic fines, ~35% fine to medium sand, tan.
60							SAND AND GRAVEL	S9(13"-20"): SILTY SAND WITH GRAVEL (SM); ~65% fine to coarse sand, ~20% nonplastic to low plasticity fines, ~15% fine to coarse gravel, tan with orange mottling.
	40	S10	39 to 41	24/16	17-22-28-40			S10: SILTY SAND (SM); ~55% fine to coarse sand, ~40% nonplastic fines, ~5% fine gravel, tan.
						Change in roller bit action at 43 ft.		
	45	S11	44 to 45	12/7	22-54-20/0"	Decomposed rock in tip.		S11: SILTY SAND WITH GRAVEL (SM); ~55% fine to coarse sand, ~30% fine to coarse gravel, ~15% nonplastic fines, orange.
50						Driller indicated bedrock at 47 ft.	BEDROCK	
	50	C1	49 to 54	60/55	73	Core times (min/ft): 2.5, 2.5, 2.5, 2.5, 4.0 Telescoped 3-inch casing to 49 ft.		C1: GNEISS; Dark gray to greenish gray, medium hard, fine to medium grained, slightly weathered, joints at 10 to 70 degrees and spaced at 1" to 38", foliations throughout, migmatite features, contact zone.

NOTES: 1. Northern Drill Service installed 4-inch ID casing with water spigot to keep a head on the hole.
2. Existing ground surface elevation and location are estimated using nearby survey information provided by Skanska.

PROJECT NAME: Project Principio Andover
CITY/STATE: Andover, MA
GEI PROJECT NUMBER: 2300951

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2300951 PROJECT PRINCIPIO ANDOVER BORING LOGS.GPJ 6/16/23

NORTHING (ft): 3,046,499 **EASTING (ft):** 744,890
GROUND SURFACE EL. (ft): 98 **DATE START/END:** 5/1/2023 - 5/2/2023
VERT./HORIZ. DATUMS: NAVD88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B-101

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	55	C2	54 to 58.9	59/59	100	Core times (min/ft): 2.5, 3.0, 3.0, 3.5, 4.0 Core jammed at bottom.	BEDROCK	C2(0-11"): GNEISS; Similar to C1. C2(11"-55"): PEGMATITE; white, very hard, coarse grained, slightly weathered, joints at 2" to 8" apart at 0 to 10 degrees. Large interlocking feldspar, muscovite and quartz grains, likely a large grain cutting through C2. C2(55"-59"): GNEISS; Similar to C1.
40								Bottom of boring at depth 58.9 ft. Backfilled with gravel and topped with asphalt.
	60							
	65							
30								
	70							
	75							
20								
	80							

NOTES: 1. Northern Drill Service installed 4-inch ID casing with water spigot to keep a head on the hole.
2. Existing ground surface elevation and location are estimated using nearby survey information provided by Skanska.

PROJECT NAME: Project Principio Andover
CITY/STATE: Andover, MA
GEI PROJECT NUMBER: 2300951

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2300951 PROJECT PRINCIPIO ANDOVER BORING LOGS.GPJ 6/16/23

BORING INFORMATION

NORTHING (ft): 3,046,365 **EASTING (ft):** 744,996
GROUND SURFACE EL. (ft): 101 **DATE START/END:** 5/2/2023 - 5/3/2023
VERT./HORIZ. DATUMS: NAVD88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 55.0 **DRILLER NAME:** J. Raymond
LOGGED BY: R. Oulal **RIG TYPE:** Mobile B-48 Track Rig

BORING
B-102 (OW)

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:** NX
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** 2.625 inch **CORE BARREL I.D./O.D.:** 2.625 inch / 3 inch
DRILLING METHOD: Rotary Drilling with Casing
WATER LEVEL DEPTHS (ft): ▽ 12.5 5/3/2023 7:15 am

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
100		S1	0 to 2	24/22	1-1-4-4	"TS" denotes "Topsoil".	TS	S1(0-9"): TOPSOIL
							SILT AND SAND	S1(9"-22"): SILTY SAND (SM); 57.9% mostly fine sand, 42.1% nonplastic fines, tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
		S2	2 to 4	24/20	4-4-4-4			S2: SILT (ML); ~85% nonplastic fines, ~15% fine sand, light tan.
	5	S3	4 to 6	24/11	2-4-4-7			S3: SANDY SILT (ML); ~70% nonplastic fines, ~30% fine sand, tan.
		S4	6 to 8	24/11	6-6-6-8			S4: SILT WITH SAND (ML); ~80% nonplastic fines, ~20% fine sand, tan.
		S5	8 to 10	24/11	3-4-5-7			S5: SILT WITH SAND (ML); Similar to S4.
90	10							
	15	S6	14 to 16	24/17	2-5-6-6	Advanced 4-inch ID casing to 14 ft.		S6: SANDY SILT (ML); ~70% nonplastic fines, ~30% fine sand, tan.
		S7	19 to 21	24/21	3-3-2-3			S7: SILTY SAND (SM); 57.7% mostly fine sand, 42.3% nonplastic fines, tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
80	20							

NOTES: 1. Northern Drill Service installed 4-inch ID casing with water spigot to keep a head on the hole.
2. Existing ground surface elevation and location are estimated using nearby survey information provided by Skanska.

PROJECT NAME: Project Principio Andover
CITY/STATE: Andover, MA
GEI PROJECT NUMBER: 2300951

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2300951 PROJECT PRINCIPIO ANDOVER BORING LOGS.GPJ 6/16/23

NORTHING (ft): 3,046,365 **EASTING (ft):** 744,996
GROUND SURFACE EL. (ft): 101 **DATE START/END:** 5/2/2023 - 5/3/2023
VERT./HORIZ. DATUMS: NAVD88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B-102 (OW)

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S8	24 to 26	24/15	3-3-4-5		SILT AND SAND	S8: SANDY SILT (ML); 54.1% nonplastic fines, 45.9% fine sand, tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
	30	S9	29 to 31	24/11	3-3-3-4			S9: SILT (ML); 92.5% nonplastic fines, 7.5% mostly fine sand, tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
70						Change in roller bit action at 32.4 ft.		
	35	S10	34 to 34.3	3/1	20/3"	Spoon bouncing at 34 ft. Boulder from 34.3 to 36 ft.	SAND AND GRAVEL	S10: WIDELY GRADED GRAVEL WITH SILT AND SAND (GW-GM); ~50% fine to coarse sand, ~40% fine to coarse sand, ~10% nonplastic fines, tan.
	40	S11	39 to 41	24/11	34-48-48-44			S11: WIDELY GRADED GRAVEL WITH SILT AND SAND (GW-GM); ~45% fine to coarse gravel, ~45% fine to coarse sand, ~10% nonplastic fines, tan.
60								
	45	C1	45 to 50	60/54	78	Driller indicated top of bedrock at 43.5 ft. Telescoped 3-inch ID casing to 45 ft. Core times (min/ft): 3.0, 3.0, 3.0, 3.5, 3.5	BEDROCK	C1: GNEISS; Dark to light gray, medium hard, fine to coarse grained, slightly weathered, fractures at 30 to 70 degrees and spaced at 1 to 13" apart, calcite and muscovite in joints and throughout core. Contact zone, core grades into pegmatite at bottom 18-in.
	50	C2	50 to 55	60/57	95	Core times (min/ft): 3.0, 3.0, 3.5, 2.0, 3.5		C2: PEGMATITE; Light gray, very hard, medium to coarse grained, irregular joints spaced at 6 to 22-in, predominantly quartz and feldspar interlocked grains, garnet throughout.
50								

NOTES: 1. Northern Drill Service installed 4-inch ID casing with water spigot to keep a head on the hole.
2. Existing ground surface elevation and location are estimated using nearby survey information provided by Skanska.

PROJECT NAME: Project Principio Andover
CITY/STATE: Andover, MA
GEI PROJECT NUMBER: 2300951

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2300951 PROJECT PRINCIPIO ANDOVER BORING LOGS.GPJ 6/16/23

NORTHING (ft): 3,046,365 **EASTING (ft):** 744,996
GROUND SURFACE EL. (ft): 101 **DATE START/END:** 5/2/2023 - 5/3/2023
VERT./HORIZ. DATUMS: NAVD88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B-102 (OW)

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
							BEDROCK	
	55							Bottom of boring at depth 55 ft. Installed observation well.
40	60							
	65							
30	70							
	75							
20	80							

NOTES: 1. Northern Drill Service installed 4-inch ID casing with water spigot to keep a head on the hole.
2. Existing ground surface elevation and location are estimated using nearby survey information provided by Skanska.

PROJECT NAME: Project Principio Andover
CITY/STATE: Andover, MA
GEI PROJECT NUMBER: 2300951

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2300951 PROJECT PRINCIPIO ANDOVER BORING LOGS.GPJ 6/16/23

BORING INFORMATION

NORTHING (ft): 3,046,047 **EASTING (ft):** 745,092
GROUND SURFACE EL. (ft): 98.5 **DATE START/END:** 4/26/2023 - 4/27/2023
VERT./HORIZ. DATUMS: NAVD88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 44.0 **DRILLER NAME:** J. Raymond
LOGGED BY: R. Oulal **RIG TYPE:** Mobile B-48 Track Rig

BORING
B-103 (OW)
PAGE 1 of 2

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:**
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Rotary Drilling with Casing
WATER LEVEL DEPTHS (ft): ▼ 3.7 4/27/2023 7:51 am

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S1	0 to 2	24/12	3-5-6-11		FILL	S1: SILTY SAND (SM); 74.9% fine to coarse sand, 19.1% nonplastic fines, 6% fine gravel, tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
		S2	2 to 4	24/2	10-6-5-4			S2: NARROWLY GRADED SAND (SP); ~100% fine to medium sand, tan.
	5	S3	4 to 6	24/14	1-3-8-9			S3(0-7"): SANDY SILT (ML); ~50% nonplastic fines, ~50% fine sand, tan.
								S3(7"-14"): WIDELY GRADED SAND (SW); ~90% fine to coarse sand, ~5% fine gravel, ~5% nonplastic fines, brown.
		S4	6 to 8	24/13	10-10-8-9			S4: SILTY SAND (SM); ~85% fine sand, ~15% nonplastic fines, brown, some ionization.
90		S5	8 to 10	24/14	2-2-4-4			S5: SILTY SAND (SM); 86% mostly fine to medium sand, 14% nonplastic fines, tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
	10							
		S6	14 to 16	24/18	2-2-2-3		SILT AND SAND	S6: SILT (ML); 97.7% nonplastic fines, 2.3% fine to medium sand, tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
	15							
80								
		S7	19 to 21	24/13	3-4-3-3			S7: SILT WITH SAND (ML); 83.9% nonplastic fines, 16.1% mostly fine sand, tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
	20					Advanced 4-inch ID casing to 20 ft.		

NOTES: 1. Northern Drill Service installed 4-inch ID casing with water spigot to keep a head on the hole.
2. Existing ground surface elevation and location are estimated using nearby survey information provided by Skanska.

PROJECT NAME: Project Principio Andover
CITY/STATE: Andover, MA
GEI PROJECT NUMBER: 2300951

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2300951 PROJECT PRINCIPIO ANDOVER BORING LOGS.GPJ 6/16/23

NORTHING (ft): 3,046,047 **EASTING (ft):** 745,092
GROUND SURFACE EL. (ft): 98.5 **DATE START/END:** 4/26/2023 - 4/27/2023
VERT./HORIZ. DATUMS: NAVD88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B-103 (OW)

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S8	24 to 26	24/13	4-3-3-3		SILT AND SAND	S8: SILT(ML); 91.5% nonplastic fines, 8.5% fine sand, tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
70	30	S9	29 to 31	24/13	2-4-4-4			S9: SILT (ML); ~90% nonplastic fines, ~10% fine sand, tan.
	35	S10	34 to 36	24/15	3-4-8-6			S10: SILT (ML); Similar to S9, some gray.
60	40	S11	39 to 41	24/15	1-4-4-3	Rig chatter at 42 ft. Grinding through hard material.		S11: SILT (ML); Similar to S9.
						"WR" denotes "Weathered Rock". Driller indicated weathered rock from 42 to 43 ft.	WR	(42'-43'): WEATHERED ROCK Top of bedrock at 43 ft.
50	45							Bottom of boring at depth 44 ft. Installed observation well.
	50							

NOTES: 1. Northern Drill Service installed 4-inch ID casing with water spigot to keep a head on the hole.
2. Existing ground surface elevation and location are estimated using nearby survey information provided by Skanska.

PROJECT NAME: Project Principio Andover
CITY/STATE: Andover, MA
GEI PROJECT NUMBER: 2300951

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2300951 PROJECT PRINCIPIO ANDOVER BORING LOGS.GPJ 6/16/23

BORING INFORMATION

NORTHING (ft): 3,046,529 **EASTING (ft):** 744,798
GROUND SURFACE EL. (ft): 97.5 **DATE START/END:** 4/28/2023 - 4/28/2023
VERT./HORIZ. DATUMS: NAVD88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 46.0 **DRILLER NAME:** J. Raymond
LOGGED BY: R. Oulal **RIG TYPE:** Mobile B-48 Track Rig

BORING
B-104
PAGE 1 of 2

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:**
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Rotary Drilling with Casing
WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S1	0 to 2	24/15	26-8-7-7	"F." denotes "Fill".	F.	(0-3"): ASPHALT S1(0-5"): WIDELY GRADED SAND WITH GRAVEL(SW); ~70% fine to coarse sand, ~25% fine gravel, ~5% nonplastic fines, brown.
		S2	2 to 4	24/15	6-6-7-6		SILT AND SAND	S1(5"-15"): NARROWLY GRADED SAND (SP); ~95% fine sand, ~5% nonplastic fines, light tan. S2: SANDY SILT (ML); ~60% nonplastic fines, ~40% fine sand, light tan.
90	5	S3	4 to 6	24/10	3-5-6-7			S3: SILT WITH SAND (ML); 84.6% nonplastic fines, 15.4% mostly fine sand, light tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
		S4	6 to 8	24/10	8-8-7-8			S4: SILT (ML); ~90% nonplastic fines, ~10% fine sand, light tan.
	10	S5	8 to 10	24/9	3-5-6-6			S5: SILTY SAND (SM); ~80% fine sand, ~20% nonplastic fines, light tan.
80	15	S6	14 to 16	24/10	2-3-2-3			S6: SILT WITH SAND (ML); 84.5% nonplastic fines, 15.5% fine sand, tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
	20	S7	19 to 21	24/14	2-2-2-2	Advanced 4-inch ID casing to 19 ft.		S7: SANDY SILT (ML); 70.1% nonplastic fines, 29.9% mostly fine sand, tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].

NOTES: 1. Northern Drill Service installed 4-inch ID casing with water spigot to keep a head on the hole.
2. Existing ground surface elevation and location are estimated using nearby survey information provided by Skanska.

PROJECT NAME: Project Principio Andover
CITY/STATE: Andover, MA
GEI PROJECT NUMBER: 2300951

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2300951 PROJECT PRINCIPIO ANDOVER BORING LOGS.GPJ 6/16/23

NORTHING (ft): 3,046,529 **EASTING (ft):** 744,798
GROUND SURFACE EL. (ft): 97.5 **DATE START/END:** 4/28/2023 - 4/28/2023
VERT./HORIZ. DATUMS: NAVD88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B-104

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S8	24 to 26	24/16	3-3-4-5		SILT AND SAND	S8: SANDY SILT (ML); 64.8% nonplastic fines, 35.2% fine sand, tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
70								
	30	S9	29 to 31	24/17	2-2-2-3			S9: SILT (ML); 90.1% nonplastic fines, 9.9% fine sand, tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
	35	S10	34 to 36	24/16	3-4-5-6			S10: NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine sand, ~10% nonplastic fines, tan.
60								
	40	S11	39 to 41	24/6	3-4-4-4			S11: SILT (ML); ~90% nonplastic fines, ~10% fine sand, tan.
	45	S12	44 to 46	24/16	21-39-56-55	Rig grinding on a hard material at 43 ft. "S & G" denotes " Sand and Gravel".	S & G	S12: SILTY SAND WITH GRAVEL (SM); ~60% fine to coarse sand, ~20% fine to coarse gravel, ~20% nonplastic to low plasticity fines, brown, compact.
50								Bottom of boring at depth 46 ft. Backfilled with gravel and topped with asphalt.
	50							

NOTES: 1. Northern Drill Service installed 4-inch ID casing with water spigot to keep a head on the hole.
2. Existing ground surface elevation and location are estimated using nearby survey information provided by Skanska.

PROJECT NAME: Project Principio Andover
CITY/STATE: Andover, MA
GEI PROJECT NUMBER: 2300951

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2300951 PROJECT PRINCIPIO ANDOVER BORING LOGS.GPJ 6/16/23

BORING INFORMATION

NORTHING (ft): 3,046,350 **EASTING (ft):** 744,823
GROUND SURFACE EL. (ft): 98 **DATE START/END:** 4/27/2023 - 4/28/2023
VERT./HORIZ. DATUMS: NAVD88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 39.0 **DRILLER NAME:** J. Raymond
LOGGED BY: R. Oulal **RIG TYPE:** Mobile B-48 Track Rig

BORING
B-105

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:** NX
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** 2.625 inch **CORE BARREL I.D./O.D.:** 2.625 inch / 3 inch
DRILLING METHOD: Rotary Drilling with Casing
WATER LEVEL DEPTHS (ft): ▽ 6.1 4/28/2023 7:20 am ▼ 9.3 4/28/2023 9:25 am

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample No.	Sample Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S1	0 to 2	24/15	15-8-9-7	"F." Denotes "Fill".	F.	(0-2"): ASPHALT S1(0-7"): WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~60% fine to coarse sand, ~30% fine to coarse gravel, ~10% nonplastic fines, brown.
		S2	2 to 4	24/20	6-7-7-5		SILT AND SAND	S1(7"-15"): NARROWLY GRADED SAND (SP); ~95%fine to medium sand, ~5% nonplastic fines, light tan. S2: SILT (ML); 90% nonplastic fines, 10% fine sand, light tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
	5	S3	4 to 6	24/10	3-4-3-6	Advanced 4-inch ID casing to 4 ft.		S3: SILT (ML); 97.5% nonplastic fines, 2.5% mostly fine sand, tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
		S4	6 to 8	24/14	6-5-6-6			S4: SANDY SILT (ML); ~55% nonplastic fines, ~40% fine to coarse sand, ~5% fine gravel, tan.
90		S5	8 to 10	24/11	1-3-2-2			S5: SILT WITH SAND (ML); 78.9% nonplastic fines, 21.1% fine sand, tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
	10							
		S6	14 to 16	24/10	3-1-1-2			S6: SILT (ML); 96.8% nonplastic fines, 3.2% fine sand, tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
	15							
80								
		S7	19 to 21	24/9	10-8-11-12		SAND AND GRAVEL	S7: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~50% fine to coarse sand, ~40% fine to coarse gravel, ~10% nonplastic fines, tan. Muscovite present.
	20					Cobble at 22 ft.		

NOTES: 1. Northern Drill Service installed 4-inch ID casing with water spigot to keep a head on the hole.
2. Existing ground surface elevation and location are estimated using nearby survey information provided by Skanska.

PROJECT NAME: Project Principio Andover
CITY/STATE: Andover, MA
GEI PROJECT NUMBER: 2300951

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2300951 PROJECT PRINCIPIO ANDOVER BORING LOGS.GPJ 6/16/23

NORTHING (ft): 3,046,350 **EASTING (ft):** 744,823
GROUND SURFACE EL. (ft): 98 **DATE START/END:** 4/27/2023 - 4/28/2023
VERT./HORIZ. DATUMS: NAVD88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B-105

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S8	24 to 25.6	19/4	8-7-8-20/1"	Spoon bouncing at 25.6 ft.	SAND AND GRAVEL	S8: WIDELY GRADED GRAVEL WITH SILT AND SAND (GW-GM); ~50% fine to coarse gravel, ~40% fine to coarse sand, ~10% nonplastic fines, tan.
70						Hard drilling at 27 ft. Driller indicated rock at 27 ft.	BEDROCK	
	30	C1	29 to 34	60/53	45	No water return while coring. Core times (min/ft): 2.0, 2.0, 2.0, 2.0, 2.0		C1: PEGMATITE; White and some gray, medium hard, coarse grained, slightly weathered, joints at 0 to 30 degrees, jagged and spaced 1 to 16 inches apart. Muscovite throughout and rusting at joints. Sand seam at 15 inches. Large interlocking quartz, feldspar and muscovite grains, muscovite flaking and readily dislodged at joints. Pegmatite grading into granite at 0 to 9 inches.
	35	C2	34 to 39	60/60	55	No water return while coring. Core times (min/ft): 2.5, 3.0, 3.0, 3.5, 4.0		C2(0-52"): PEGMATITE; Similar to C1. C2(52"-60"): GNEISS; Dark gray, hard, fine grained, moderately weathered, joints at 0 to 70 degrees and 1 inch apart. Calcite and muscovite in joints, migmatite features, contact zone.
60								
	40							Bottom of boring at depth 39 ft. Backfilled with gravel and topped with asphalt.
	45							
50								
	50							

NOTES: 1. Northern Drill Service installed 4-inch ID casing with water spigot to keep a head on the hole.
2. Existing ground surface elevation and location are estimated using nearby survey information provided by Skanska.

PROJECT NAME: Project Principio Andover
CITY/STATE: Andover, MA
GEI PROJECT NUMBER: 2300951

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2300951 PROJECT PRINCIPIO ANDOVER BORING LOGS.GPJ 6/16/23

BORING INFORMATION

NORTHING (ft): 3,046,165 **EASTING (ft):** 744,867
GROUND SURFACE EL. (ft): 97.5 **DATE START/END:** 4/26/2023 - 4/26/2023
VERT./HORIZ. DATUMS: NAVD88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 26.0 **DRILLER NAME:** J. Raymond
LOGGED BY: R. Oulal **RIG TYPE:** Mobile B-48 Track Rig

BORING
B-106
PAGE 1 of 2

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:**
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Rotary Drilling with Casing
WATER LEVEL DEPTHS (ft): ▼ 6.6 4/26/2023 11:44 am

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S1	0 to 2	24/19	12-6-3-10		FILL	(0-5"): ASPHALT S1: SILTY SAND (SM); 73.3% fine to coarse sand, 23.6% nonplastic fines, 3.1% fine gravel, brown. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
		S2	2 to 4	24/19	17-16-16-17		SILT AND SAND	S2(0-3"): WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~60% fine to coarse sand, ~30% fine to coarse gravel, ~10% nonplastic fines, brown. S2(3"-19"): SILT (ML); ~90% nonplastic fines, ~10% fine sand, tan.
90	5	S3	4 to 6	24/19	9-11-17-16			S3: SILT WITH SAND (ML); ~80% nonplastic fines, ~20% fine sand, tan, some orange ionization.
		S4	6 to 8	24/17	13-13-13-11			S4: SILTY SAND (SM); ~60% fine sand, ~40% nonplastic fines, tan.
	10	S5	8 to 10	24/19	3-3-2-3			S5: SILT (ML); 99.6% nonplastic fines, 0.4% fine sand, tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
		S6	14 to 16	24/6	14-38-29-31	Change in wash action at 14 ft.	SAND AND GRAVEL	S6: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~50% fine to coarse sand, ~40$ fine to coarse egravel, ~10% nonplastic fines, tan, brown.
80	15					Rig chatter at 16 ft. Advanced 4-inch ID casing to 17 ft. Grinding through hard material at 17.5 ft.		
	20							

NOTES: 1. Northern Drill Service installed 4-inch ID casing with water spigot to keep a head on the hole.
2. Existing ground surface elevation and location are estimated using nearby survey information provided by Skanska.

PROJECT NAME: Project Principio Andover
CITY/STATE: Andover, MA
GEI PROJECT NUMBER: 2300951

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2300951 PROJECT PRINCIPIO ANDOVER BORING LOGS.GPJ 6/16/23

NORTHING (ft): 3,046,165 **EASTING (ft):** 744,867
GROUND SURFACE EL. (ft): 97.5 **DATE START/END:** 4/26/2023 - 4/26/2023
VERT./HORIZ. DATUMS: NAVD88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B-106

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
						Washed to 24 ft. Muscovite and possible bedrock in wash. Applied 600 to 800 psi.		
	25	S7	24 to 26	24/6	18-11-4-53			S7: WIDELY GRADED SAND WITH GRAVEL (SW-SM); ~70% fine to coarse sand, ~25% fine to coarse gravel, ~5% nonplastic fines, tan. Possibly weathered rock; muscovite and calcite throughout.
								Bottom of boring at depth 26 ft. Backfilled with soil cuttings and gravel and topped with asphalt.
70	30							
60	35							
	40							
	45							
50	50							

NOTES: 1. Northern Drill Service installed 4-inch ID casing with water spigot to keep a head on the hole.
2. Existing ground surface elevation and location are estimated using nearby survey information provided by Skanska.

PROJECT NAME: Project Principio Andover
CITY/STATE: Andover, MA
GEI PROJECT NUMBER: 2300951

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2300951 PROJECT PRINCIPIO ANDOVER BORING LOGS.GPJ 6/16/23

BORING INFORMATION

NORTHING (ft): 3,046,006 **EASTING (ft):** 744,902
GROUND SURFACE EL. (ft): 98 **DATE START/END:** 4/24/2023 - 4/25/2023
VERT./HORIZ. DATUMS: NAVD88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 44.0 **DRILLER NAME:** J. Raymond
LOGGED BY: R. Oulal **RIG TYPE:** Mobile B-48 Track Rig

BORING

B-107

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:** NX
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** 2.625 inch **CORE BARREL I.D./O.D.:** 2.625 inch / 3 inch
DRILLING METHOD: Rotary Drilling with Casing
WATER LEVEL DEPTHS (ft): ▼ 6.0 4/25/2023 7:47 am

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S1	0 to 2	24/16	4-5-10-10	"F." denotes "Fill".	F.	S1(0-4"): WIDELY GRADED SAND (SW); ~85% fine to coarse sand, ~10% fine gravel, ~5% nonplastic fines, brown, wet. S1(4"-16"): NARROWLY GRADED SAND (SP); ~95% fine to coarse, mostly fine sand, ~5% nonplastic fines, tan, moist.
		S2	2 to 4	24/8	9-8-8-7		SILT AND SAND	S2: SILTY SAND (SM); 78.9% fine to coarse sand, 18.1% nonplastic fines, 3% fine gravel, tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
	5	S3	4 to 6	24/13	3-6-9-11			S3: SANDY SILT (ML); ~50% fine sand, ~50% nonplastic fines, tan, moist. Iron staining from 11 to 13 inches.
		S4	6 to 8	24/15	13-10-11-11			S4: NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine to medium, mostly fine sand, ~10% nonplastic fines, tan, moist. Orange mottling present.
90		S5	8 to 10	24/14	5-7-4-4			S5: SILT WITH SAND (ML); ~75% nonplastic fines, ~25% fine sand, tan.
	10							
		S6	14 to 16	24/13	4-3-4-5			S6: SILT (ML); 94.7% nonplastic fines, 3.5% fine gravel, 1.8% mostly fine sand, tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
	15							
80								
		S7	19 to 21	24/4	3-3-4-5			S7: SILT (ML); 99.3% nonplastic fines, 0.7% mostly fine sand, tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
	20							

NOTES: 1. Northern Drill Service installed 4-inch ID casing with water spigot to keep a head on the hole.
2. Existing ground surface elevation and location are estimated using nearby survey information provided by Skanska.

PROJECT NAME: Project Principio Andover
CITY/STATE: Andover, MA
GEI PROJECT NUMBER: 2300951

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2300951 PROJECT PRINCIPIO ANDOVER BORING LOGS.GPJ 6/16/23

NORTHING (ft): 3,046,006 **EASTING (ft):** 744,902
GROUND SURFACE EL. (ft): 98 **DATE START/END:** 4/24/2023 - 4/25/2023
VERT./HORIZ. DATUMS: NAVD88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B-107

Elev. (ft)	Depth (ft)	Sample No.	Sample Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S8	24 to 26	24/21	1-1-1-2		SILT AND SAND	S8: SILT (ML); 97.2% nonplastic fines, 2.8% fine sand, tan. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
						Advanced 4-inch ID casing to 26 ft.		
70						Rig chatter at 27.5 ft. Possibly top of bedrock at 27.5 ft.	BOULDER	
	30	C1	29 to 30	12/12	0	Telescoped 3-inch ID casing to 29 ft. Core times (min/ft): 21.5		C1: GRANITE; White and gray, hard, fine to medium grained, freshly weathered, fractures at 0 degrees spaced at 1 to 3 inches. Muscovite throughout.
		C2	30	7/7	100	Core times (min/ft): 14/6.5"		C2: GRANITE; Similar to C1.
		C3	30 to 30.5 30.5 to 34	42/30	63	Core times (min/ft): 0.5/5.5", 4.0, 7.0, 8.0		C3(0-8"): GRANITE; Similar to C1, except driller noted there may have been a sand seam at 8". C3(8"-30"): GRANITE; Dark gray, hard, fine to coarse grained, freshly weathered, joints at 2 to 13 inches apart.
		C4	34 to 35.1	13/13	62	Core times (min/ft): 23.0, 10.5/1"		C4: GNEISS; Dark gray, fine to medium grained, hard, joints at 30 degrees and 5 to 8 inches apart. Rock jammed at bottom of core.
	35	C5	35.1 to 37	23/23	0	Core times (min/ft): 15.0, 9.0		C5(0-21"): SAND SEAM C5(21"-23"): GRANITE; Similar to C4.
60								
	40	C6	39 to 42	36/36	42	Core times (min/ft): 18.0, 9.0, 11.5	BEDROCK	C6: PEGMATITE; White with purple, hard, coarse grained, severely weathered, joints at 0 to 30 degrees spaced at 0 to 6 inches apart, interlocking large quartz, feldspar and muscovite.
		C7	42 to 43	12/1	0	Core times (min/ft): 29.0		C7: PEGMATITE; Similar to C6, possible sand seam encountered.
		C8	43 to 44	12/12	66	Core times (min/ft): 21.0		C8: PEGMATITE; Similar to C6.
	45							Bottom of boring at deptH 44 ft. Backfilled with soil cuttings and gravel.
50								
	50							

NOTES: 1. Northern Drill Service installed 4-inch ID casing with water spigot to keep a head on the hole.
2. Existing ground surface elevation and location are estimated using nearby survey information provided by Skanska.

PROJECT NAME: Project Principio Andover
CITY/STATE: Andover, MA
GEI PROJECT NUMBER: 2300951

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GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2300951 PROJECT PRINCIPIO ANDOVER BORING LOGS.GPJ 6/16/23

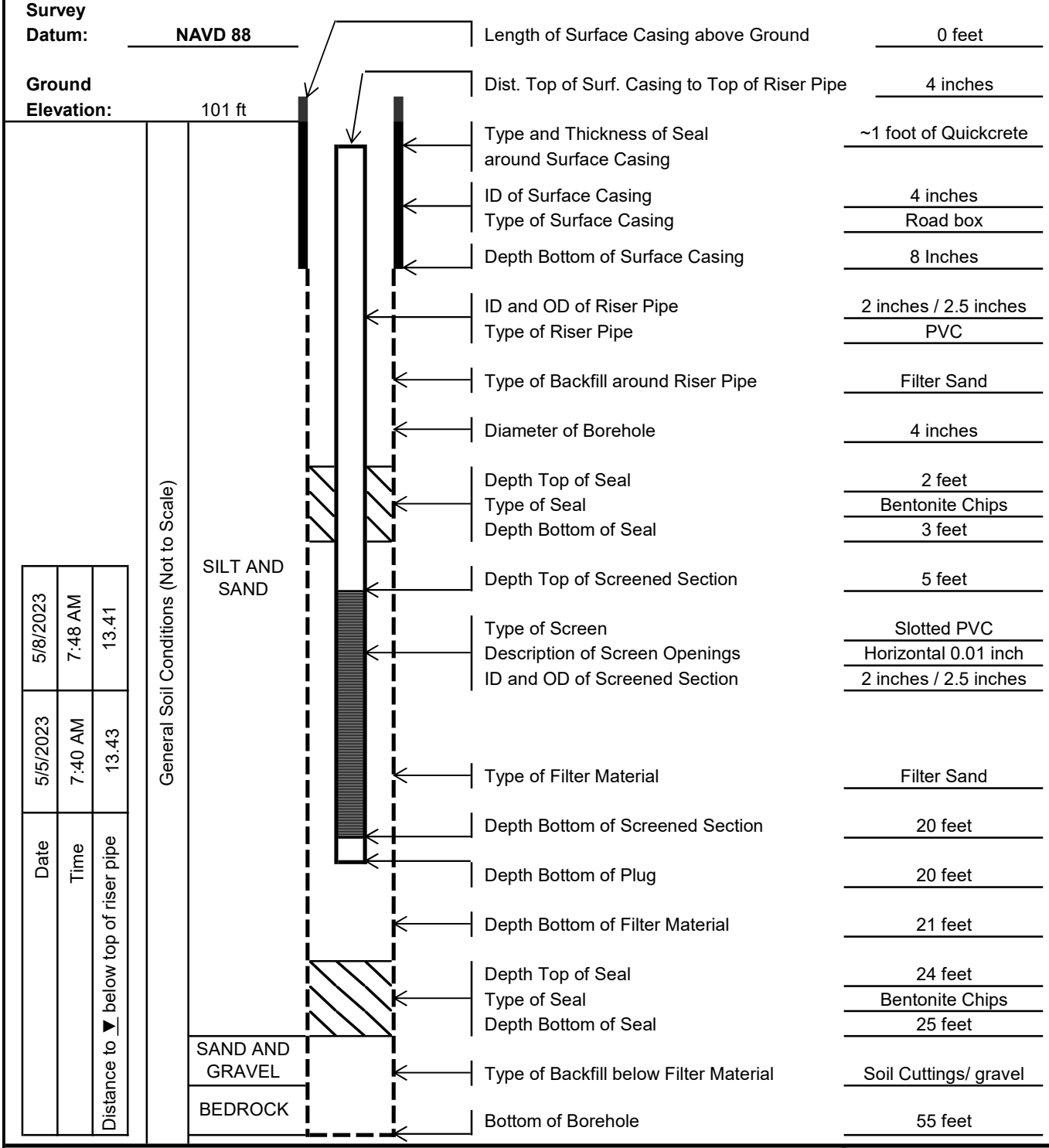
Groundwater Well Installation Log

B-102 (OW)

Project	Project Principio	**GEI Proj. No.**	2300951
City / Town	Andover, Massachusetts	**Location**	N: 3,046,365
Client	Fennick McCredie Architecture		E: 744,996
Contractor	Northern Drill Service, Inc.		(See Boring Location Plan)
Driller	J. Raymond **GEI Rep.** R. Oulal	**Install Date**	5/3/2023

Survey Datum: **NAVD 88**

Ground Elevation: 101 ft



Date	Time	Distance to ▼ below top of riser pipe
5/8/2023	7:48 AM	13.41
5/5/2023	7:40 AM	13.43

Notes: Hole was flushed with clean water before setting well.

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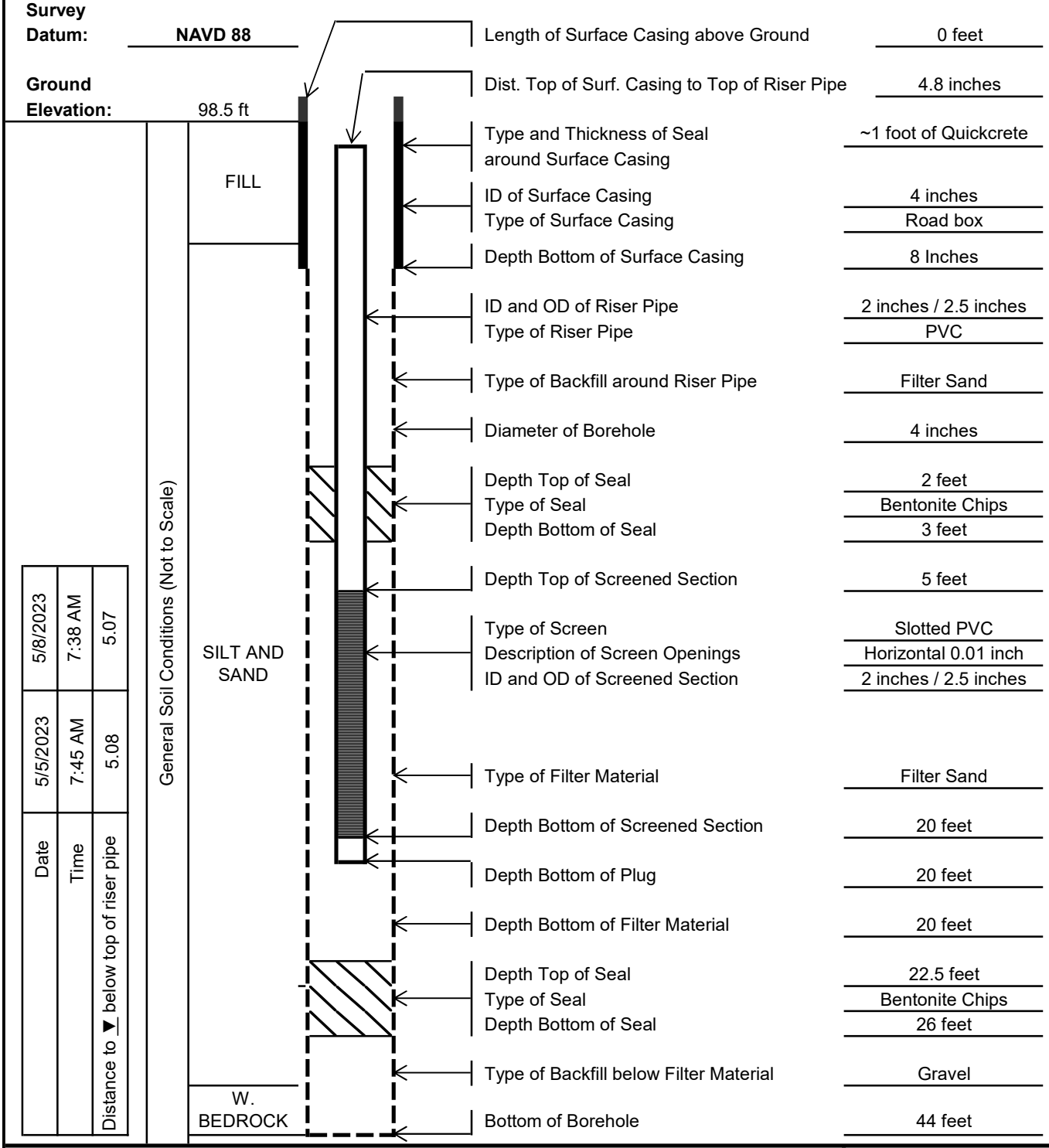
Groundwater Well Installation Log

B-103 (OW)

Project	Project Principio	**GEI Proj. No.**	2300951
City / Town	Andover, Massachusetts	**Location**	N: 3,046,047
Client	Fennick McCredie Architecture		E: 745,083
Contractor	Northern Drill Service, Inc.		(See Boring Location Plan)
Driller	J. Raymond **GEI Rep.** R. Oulal	**Install Date**	4/27/2023

Survey Datum: **NAVD 88**

Ground Elevation: 98.5 ft



Date	Time	Distance to ▼ below top of riser pipe
5/8/2023	7:38 AM	5.07
5/5/2023	7:45 AM	5.08

Length of Surface Casing above Ground	0 feet
Dist. Top of Surf. Casing to Top of Riser Pipe	4.8 inches
Type and Thickness of Seal around Surface Casing	~1 foot of Quickcrete
ID of Surface Casing	4 inches
Type of Surface Casing	Road box
Depth Bottom of Surface Casing	8 Inches
ID and OD of Riser Pipe	2 inches / 2.5 inches
Type of Riser Pipe	PVC
Type of Backfill around Riser Pipe	Filter Sand
Diameter of Borehole	4 inches
Depth Top of Seal	2 feet
Type of Seal	Bentonite Chips
Depth Bottom of Seal	3 feet
Depth Top of Screened Section	5 feet
Type of Screen	Slotted PVC
Description of Screen Openings	Horizontal 0.01 inch
ID and OD of Screened Section	2 inches / 2.5 inches
Type of Filter Material	Filter Sand
Depth Bottom of Screened Section	20 feet
Depth Bottom of Plug	20 feet
Depth Bottom of Filter Material	20 feet
Depth Top of Seal	22.5 feet
Type of Seal	Bentonite Chips
Depth Bottom of Seal	26 feet
Type of Backfill below Filter Material	Gravel
Bottom of Borehole	44 feet

Notes: Hole was flushed with clean water before setting well.

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Appendix B

2023 Test Pit Logs

TEST PIT LOG

TP-101

Project	Project Principio	**PG.**	1 **OF** 1
City/Town	Andover, MA	**Location**	N 3,047,122
Client	Fennick McCredie Architecture		E 745,392
Contractor	Northern Drill Service, Inc.	**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4	**Datum**	NAVD88
Operator	J. Raymond **GEI Rep** R. Oulal	**GEI Proj. No.**	2300951
Weather	40's F, Overcast	**Date**	5/4/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1			(0-9"): Top soil, black/dark brown.
2	G1	1 - 2.5 ft	SILTY SAND (SM); 79.5% fine to coarse sand, 12.6% nonplastic to low plasticity fines, 7.9% fine to coarse gravel, tan. [FILL] [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
3	G2	3 - 4 ft	Thin rusting color soil on the east face at 2.2 ft.
4			SILTY SAND (SM); 63.9% mostly fine sand, 35.3% nonplastic fines, 0.8% fine gravel, gray. [FILL] [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
5			
6	G3	6 - 6.5 ft	WIDELY GRADED GRAVEL WITH SAND (GW); ~60% fine to coarse gravel, ~40% medium to coarse sand, gray. Some cobbles present.
7			Bottom of test pit at 6.5 ft.
8			Test pit dry at completion.
9			Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator bucket.
10			

Notes:
1. Terminated test pit because of collapsing soils and close proximity to utilities.

Pit Dimensions (ft)

Length	12
Width	3
Depth	6.5

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TEST PIT LOG	TP-101



Photo 1: TP-101 at about 6.5'.



Photo 2: Rusting seam at 2.2 ft on the east face.

TEST PIT LOG

TP-102

Project	Project Principio			**PG.** 1 **OF** 1	
City/Town	Andover, MA			**Location**	N 3,047,089
Client	Fennick McCredie Architecture				E 745,407
Contractor	Northern Drill Service, Inc.			**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	J. Raymond	**GEI Rep**	R. Oulal	**GEI Proj. No.**	2300951
Weather	40's F, Overcast			**Date**	5/4/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1			(0-8"): Top soil, black/dark brown.
2	G1	1 - 2 ft	NARROWLY GRADED SAND WITH SILT (SP-SM); 75.1% fine to coarse sand, 14.4% fine to coarse gravel, 10.5% nonplastic to low plasticity fines, tan. Some cobbles. [FILL][GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
3			
4			
5			
6			
7	G2	6 - 7 ft	NARROWLY GRADED GRAVEL WITH SAND (GP); 52.2% fine to coarse gravel, 46.3% fine to coarse sand, 1.5% nonplastic to low plasticity fines, gray. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
8			Bottom of test pit at 7.0 ft. Test pit dry at completion. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator bucket.
9			
10			

Notes:

1. Terminated test pit because of collapsing soils and close proximity to utilities.

Pit Dimensions (ft)

Length	12
Width	3
Depth	7

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TEST PIT LOG	TP-102



Photo 1: TP-102 at about 7'. Walls Collapsing.



Photo 2: excavated soils.

TEST PIT LOG

TP-103

Project	Project Principio			**PG.**	1 **OF** 1
City/Town	Andover, MA			**Location**	N 3,046,243
Client	Fennick McCredie Architecture				E 745,565
Contractor	Northern Drill Service, Inc.			**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	J. Raymond	**GEI Rep**	R. Oulal	**GEI Proj. No.**	2300951
Weather	40's F, Overcast			**Date**	5/4/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1			(0-1'): Top soil, black/dark brown.
2	G1	1 - 2.5 ft	WIDELY GRADED SAND WITH GRAVEL (SW); ~60% fine to coarse sand, ~40% fine to coarse gravel, tan. [FILL]
3 4 5 6 7	G2	5 - 5.5 ft	SILT (ML); 93.1% nonplastic to low plasticity fines, 6.9% mostly fine sand, bluish gray and some tan, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
8 9 10	G3	7.5 - 8.5 ft	Rust color staining at 7.5 feet. NARROWLY GRADED SAND (SP); 98.8% fine to coarse sand, 6.2% nonplastic to low plasticity fines, tan with some orange, wet. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
11			Bottom of test pit at 10.5 ft. Test pit dry at completion. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator

Notes:

Pit Dimensions (ft)

Length	14
Width	3
Depth	10.5

GEI Consultants

TEST PIT LOG	TP-103



Photo 1: TP-103 at about 10.5'.



Photo 1: TP-103 at about 7.5'.

TEST PIT LOG

TP-104

Project	Project Principio			**PG.**	1 **OF** 1
City/Town	Andover, MA			**Location**	N 3,046,231
Client	Fennick McCredie Architecture				E 745,530
Contractor	Northern Drill Service, Inc.			**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	J. Raymond	**GEI Rep**	R. Oulal	**GEI Proj. No.**	2300951
Weather	40's F, Overcast			**Date**	5/4/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1	G1	0 - 1	(0-2"): Top soil, black/dark brown. WIDELY GRADED GRAVEL WITH SAND (GW); ~55% fine to coarse gravel, ~45% fine to coarse sand, brown. Some cobbles present. 1" thick concrete obstruction at 1.5 ft.
2	G2	1.5 - 2	NARROWLY GRADED SAND (SP); ~95% fine to medium sand, ~5% nonplastic fines, tan, moist.
3 4 5	G3	3 - 4	SILT (ML); 96.5% nonplastic to low plasticity fines, 3.5% mostly fine sand, bluish gray with some tan, wet. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
6 7	G4	6 - 6.5	Rust color staining at 6 ft.
8	G5	7 - 8	
9			Water seeping into test pit at 9 ft.
10			Bottom of test pit at 9 ft. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator

Notes:

Pit Dimensions (ft)

Length	3
Width	23
Depth	9

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TEST PIT LOG	TP-104



Photo 1: TP-104 at about 9'.



Photo 1: TP-104 at about 6'.

TEST PIT LOG

TP-105

Project	Project Principio			**PG.**	1 **OF** 1
City/Town	Andover, MA			**Location**	N 3,046,061
Client	Fennick McCredie Architecture				E 745,345
Contractor	Northern Drill Service, Inc.			**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	J. Raymond	**GEI Rep**	R. Oulal	**GEI Proj. No.**	2300951
Weather	40's F, Overcast			**Date**	5/4/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1	G1	0 - 1	WIDELY GRADED GRAVEL WITH SAND (SW); ~70% fine to coarse gravel, ~30% fine to coarse sand, brown. 1-1' boulder, topsoil and grass present. [FILL]
2 3 4 5 6	G2	3 - 4	NARROWLY GRADED SAND WITH SILT (SP-SM); 89.9% fine to medium sand, ~10.1% nonplastic fines, tan, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
7 8	G3	7 - 8	SILT WITH SAND (ML); 78.9% nonplastic to low plasticity fines, 21.1% mostly fine sand, bluish gray, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
9 10 11			Bottom of test pit at 8 ft. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator bucket.

Notes:

Pit Dimensions (ft)

Length	9
Width	3
Depth	8

GEI Consultants

TEST PIT LOG	TP-105



Photo 1: TP-105 at about 8'.



Photo 1: TP-105 from about 2' to 8'.

TEST PIT LOG

TP-106

Project	Project Principio			**PG.**	1 **OF** 1
City/Town	Andover, MA			**Location**	N 3,046,106
Client	Fennick McCredie Architecture				E 745,248
Contractor	Northern Drill Service, Inc.			**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	J. Raymond	**GEI Rep**	R. Oulal	**GEI Proj. No.**	2300951
Weather	40's F, Overcast			**Date**	5/4/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1			WIDELY GRADED GRAVEL WITH SAND (SW); ~70% fine to coarse gravel, ~30% fine to coarse sand, brown. [FILL]
2 3 4 5	G1	3 - 4	SILTY SAND (SM); 84.4% mostly fine sand, 15.6% nonplastic fines, tan, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
6 7 8 9	G2	6 - 8	Water seeping into at 6 ft. SANDY SILT (ML); 66.9% nonplastic to low plasticity fines, 32.2% fine sand, bluish gray, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED] Rust color staining at 7.5'.
10			Bottom of test pit at 9.5 ft. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator bucket.

Notes:

Pit Dimensions (ft)

Length	9
Width	3
Depth	9.5

GEI Consultants

TEST PIT LOG	TP-106



Photo 1: TP-106 at about 9.5'.



Photo 1: TP-106 from about 4.5' to 9.5'.

TEST PIT LOG

TP-109

Project	Project Principio			**PG.** 1 **OF** 1	
City/Town	Andover, MA			**Location**	N 3,046,675
Client	Fennick McCredie Architecture				E 744,697
Contractor	Northern Drill Service, Inc.			**Ground El.**	98.5 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	J. Raymond	**GEI Rep**	R. Oulal	**GEI Proj. No.**	2300951
Weather	50's F, Overcast			**Date**	5/5/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1	G1	0.2 - 2	(0 - 0.2'): Asphalt WIDELY GRADED GRAVEL WITH SAND (GW); ~70% fine to coarse gravel, ~30% fine to coarse sand, brown. Some bricks and debris present.
2			
3	G2	2.5 - 2.8	SILTY SAND (SM); 55.5% Fine to coarse sand, 42.4% nonplastic to low plasticity fines, 2.1% fine gravel, tan, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED] Rust color staining at 2.5'.
4			
5			
6			
7			SANDY SILT (ML); 68.3% nonplastic to plasticity fines, 31.7% mostly fine sand, tan, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
8			
9	G3	8.5 - 8.7	
10			Bottom of test pit at 9.5 ft. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator bucket up to 3 ft. From 3 ft to 0.2 ft below ground surface the test pit was backfilled with 1 ft thick lifts and compacted multiple time with Wacker Nueson VP 1340 compactor. The test pit was topped with hot mix.
11			

Notes:

Pit Dimensions (ft)

Length	9
Width	3
Depth	9.5

GEI Consultants

TEST PIT LOG	TP-109



Photo 1: TP-109 at about 9.5'.



Photo 1: TP-109 from about 2' to 5'.

TEST PIT LOG

TP-110

Project	Project Principio			**PG.**	1 **OF** 1
City/Town	Andover, MA			**Location**	N 3,046,616
Client	Fennick McCredie Architecture				E 744,709
Contractor	Northern Drill Service, Inc.			**Ground El.**	98 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	J. Raymond	**GEI Rep**	R. Oulal	**GEI Proj. No.**	2300951
Weather	50's F, Overcast			**Date**	5/5/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1	G1	1 - 1.5	(0-0.25'): Asphalt. NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); 55.5% fine to coarse sand, 34.4% fine to coarse gravel, 10.1% nonplastic to low plasticity fines, brown. Bricks and debris present. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
2 3 4 5 6 7 8 9	G2	6.5 - 7	SANDY SILT (ML); 70.7% nonplastic to low plasticity, 29.3% mostly fine sand, light tan. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
10 11			Bottom of test pit at 9 ft. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator bucket up to 3 ft. From 3 ft to 0.2 ft below ground surface the test pit was backfilled with 1 ft thick lifts and compacted multiple time with Wacker Nueson VP 1340 compactor. The test pit was topped with hot mix.

Notes:

Pit Dimensions (ft)

Length	9
Width	3
Depth	9

GEI Consultants

TEST PIT LOG	TP-110



Photo 1: TP-110 from about 0 to 3'.



Photo 1: TP-110 from about 3' to 9'.

TEST PIT LOG

TP-111

Project	Project Principio			**PG.** 1 **OF** 1	
City/Town	Andover, MA			**Location**	N 3,046,806
Client	Fennick McCredie Architecture				E 744,574
Contractor	Northern Drill Service, Inc.			**Ground El.**	97.5 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	J. Raymond	**GEI Rep**	R. Oulal	**GEI Proj. No.**	2300951
Weather	40's F, Overcast			**Date**	5/4/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
	G1	0 - 0.8	(0-0.8'): Top soil, black/dark brown.
1			
2			NARROWLY GRADED SAND WITH SILT(SP-SM); 87.9% fine to coarse sand, 8.6% nonplastic fines, 3.5% fine to coarse gravel, tan, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
3			
4	G2	3 - 4 ft	Rust color staining at 4 ft.
5			
6	G3	5.5 - 6	Top soil; possibly top of old ground.
7			
8			SANDY SILT (ML); 53.8% nonplastic fines, 46.2% mostly fines sand, tan and gray, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
9			
10	G4	10 - 10.5	
11			Bottom of test pit at 10.5 ft. Test pit dry at completion. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator bucket.

Notes:

Pit Dimensions (ft)

Length	10
Width	3
Depth	10.5

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TEST PIT LOG	TP-111



Photo 1: TP-111 at about 10.5'.



Photo 2:Old topsoil from about 5' to 6.5'.

TEST PIT LOG

TP-112

Project	Project Principio			**PG.** 1 **OF** 1	
City/Town	Andover, MA			**Location**	N 3,046,938
Client	Fennick McCredie Architecture				E 744,553
Contractor	Northern Drill Service, Inc.			**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	J. Raymond	**GEI Rep**	R. Oulal	**GEI Proj. No.**	2300951
Weather	40's F, Overcast			**Date**	5/4/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1			(0-0.8'): Top soil, black/dark brown.
2	G1	1 - 1.8	WIDELY GRADED SAND WITH GRAVEL (SW); ~70% fine to coarse sand, ~25% fine to coarse gravel, ~5% nonplastic fines, gray, moist.
3			Trace of rust color staining at 2 ft.
4			
5			SILTY SAND (SM); 63.8% fine to coarse sand, 36.1% nonplastic to low plasticity fines, 0.1% fine gravel, gray and tan, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
6	G2	5.5 - 6	
7			Top soil; possibly top of old ground.
8			
9			SILTY SAND (SM); 55.2% mostly fine sand, 44.8% nonplastic fines, gray and tan, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
10	G3	9.8 - 10	
11			Bottom of test pit at 10.5 ft. Test pit dry at completion. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator bucket.

Notes:

Pit Dimensions (ft)

Length	10
Width	3
Depth	10.5

GEI Consultants

TEST PIT LOG	TP-112



Photo 1: TP-111 at about 10.5'.



Photo 2:Old topsoil from about 4.5' to 10.5'.

TEST PIT LOG

TP-113

Project	Project Principio			**PG.**	1 **OF** 1
City/Town	Andover, MA			**Location**	N 3,045,927
Client	Fennick McCredie Architecture				E 744,825
Contractor	Northern Drill Service, Inc.			**Ground El.**	100 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	J. Raymond	**GEI Rep**	R. Oulal	**GEI Proj. No.**	2300951
Weather	50's F, Overcast			**Date**	5/3/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
			(0-0.5'): Top soil, black/dark brown.
1			Roots present from 0 to 2 ft.
2			
3			Rust color staining at 2.5 ft. Water seeping into at 3 ft.
4			
5			
6			SILTY SAND (SM); 55% mostly fine sand, 45% nonplastic to low plasticity sand, tan and gray, wet. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
7			
8	G1	7.5 - 8.5	
9			
10			
11			Bottom of test pit at 10 ft. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator

Notes:

Pit Dimensions (ft)

Length	14
Width	6
Depth	10

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TEST PIT LOG	TP-113



Photo 1: TP-113 at about 10'.



Photo 2:Old topsoil from about 6'.

TEST PIT LOG

TP-114

Project	Project Principio			**PG.**	1 **OF** 1
City/Town	Andover, MA			**Location**	N 3,045,915
Client	Fennick McCredie Architecture				E 744,773
Contractor	Northern Drill Service, Inc.			**Ground El.**	100 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	J. Raymond	**GEI Rep**	R. Oulal	**GEI Proj. No.**	2300951
Weather	50's F, Overcast			**Date**	5/3/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1			(0-1'): Top soil, black/dark brown.
2	G1	3 - 3.5	Rust color staining at 3.5 ft.
3			
4			
5			SILT WITH SAND (ML); 71.5% nonplastic to low plastic fines, 28.5% mostly fine sand, bluish gray with some rust color staining from 3.5 to 11 ft. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
6			
7			
8			Water seeping into at 8 ft.
9			
10			
11			
			Bottom of test pit at 11 ft. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator

Notes:

Pit Dimensions (ft)

Length	8
Width	4
Depth	11

GEI Consultants

TEST PIT LOG	TP-114



Photo 1: TP-114 at about 3.5 ft.



Photo 2:TP-114 at 11 ft.

TEST PIT LOG

TP-115

Project	Project Principio	**PG.**	1 **OF** 1
City/Town	Andover, MA	**Location**	N 3,045,974
Client	Fennick McCredie Architecture		E 744,743
Contractor	Northern Drill Service, Inc.	**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4	**Datum**	NAVD88
Operator	J. Raymond **GEI Rep** R. Oulal	**GEI Proj. No.**	2300951
Weather	40's F, Overcast/ Light rain	**Date**	5/4/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1 2	G1	0 - 2	SILTY SAND (SM); 72.4% fine to coarse sand, 22.9% nonplastic to low plasticity fines, 4.7% fine to coarse gravel, brown. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
3 4 5 6	G2	4 - 6	WIDELY GRADED SAND WITH SILT (SW-SM); ~80% fine to coarse sand, ~10% fine to coarse gravel. ~10% nonplastic fines, tan, moist. Water seeping into at 4.5 ft.
7	G3	6 - 7	WIDELY GRADED SAND WITH SILT(SW); ~85% fine to coarse sand, ~10% fine to medium gravel, ~5% nonplastic fines, brown. [POSSIBLE OLD TOPSOIL] Bluish gray silty sand at 7 ft.
8 9 10			Bottom of test pit at 7 ft. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator bucket.

Notes:

Pit Dimensions (ft)

Length	12
Width	4
Depth	7

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TEST PIT LOG	TP-115



Photo 1: TP-115 at about 7 ft.

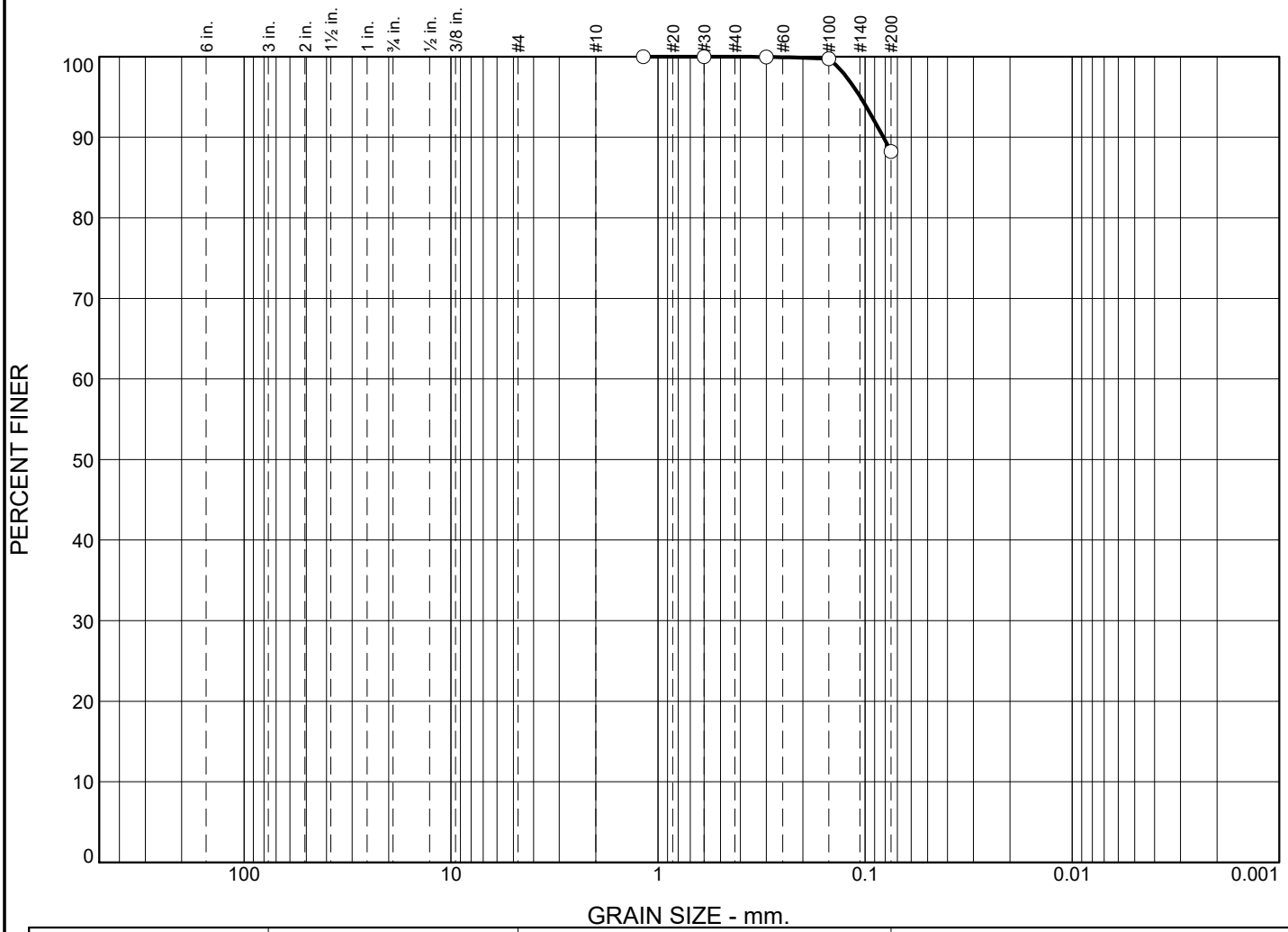


Photo 2:TP-115 from about 1 to 7 ft.

Appendix C

Laboratory Tests Results

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	11.8	88.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										

Material Description	USCS	AASHTO
○ SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-101 **Depth:** 6-8 ft **Sample Number:** S1

Remarks:

○ As Received WC=12.0%

Fines classified visually

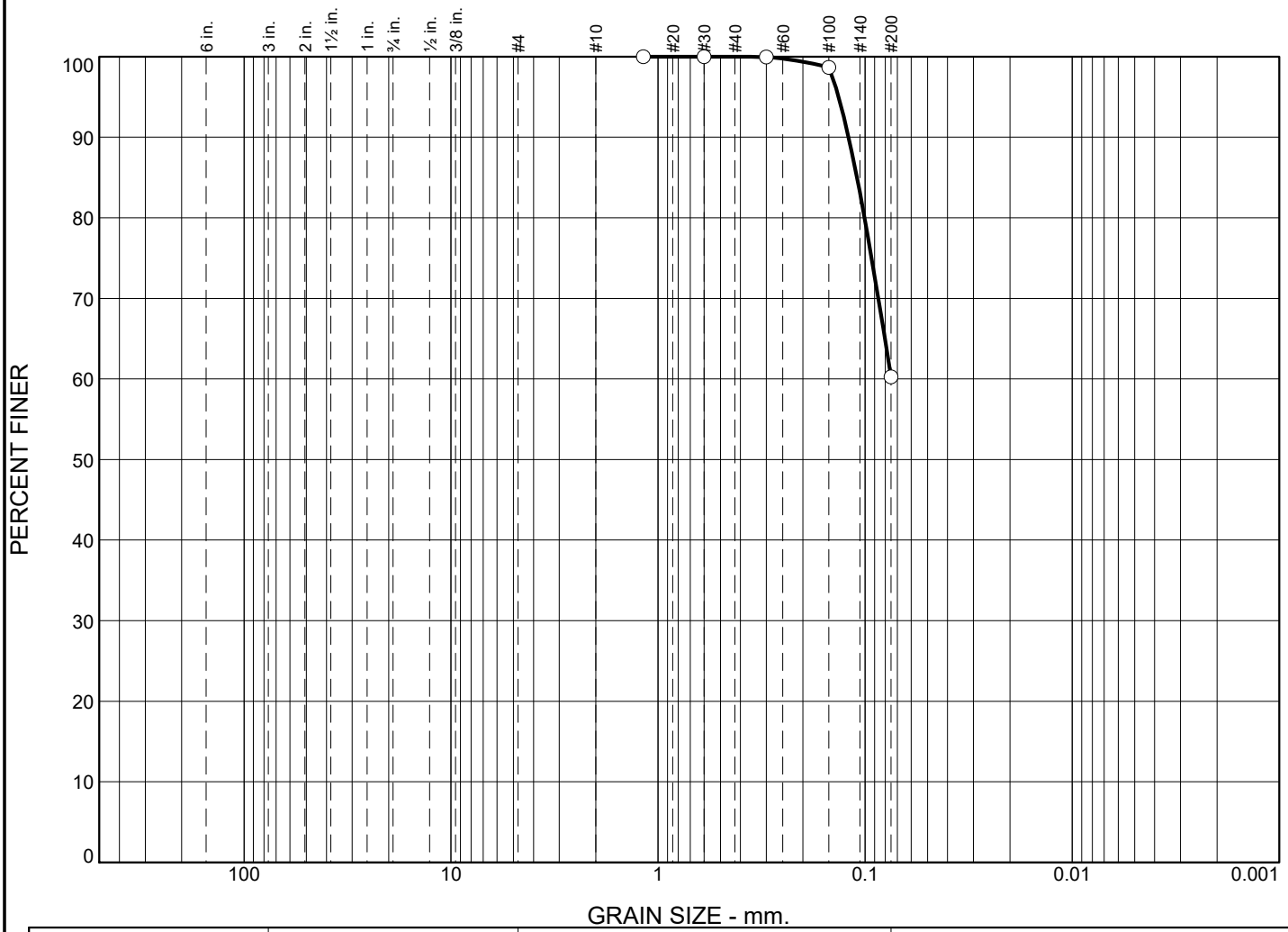
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Woburn, MA 01801

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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** A. Han 5/11/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	39.7	60.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1095							

	Material Description	USCS	AASHTO
○	Sandy SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-101 **Depth:** 14-16 ft **Sample Number:** S5

Remarks:

○ As Received WC=30.5%

Fines classified visually

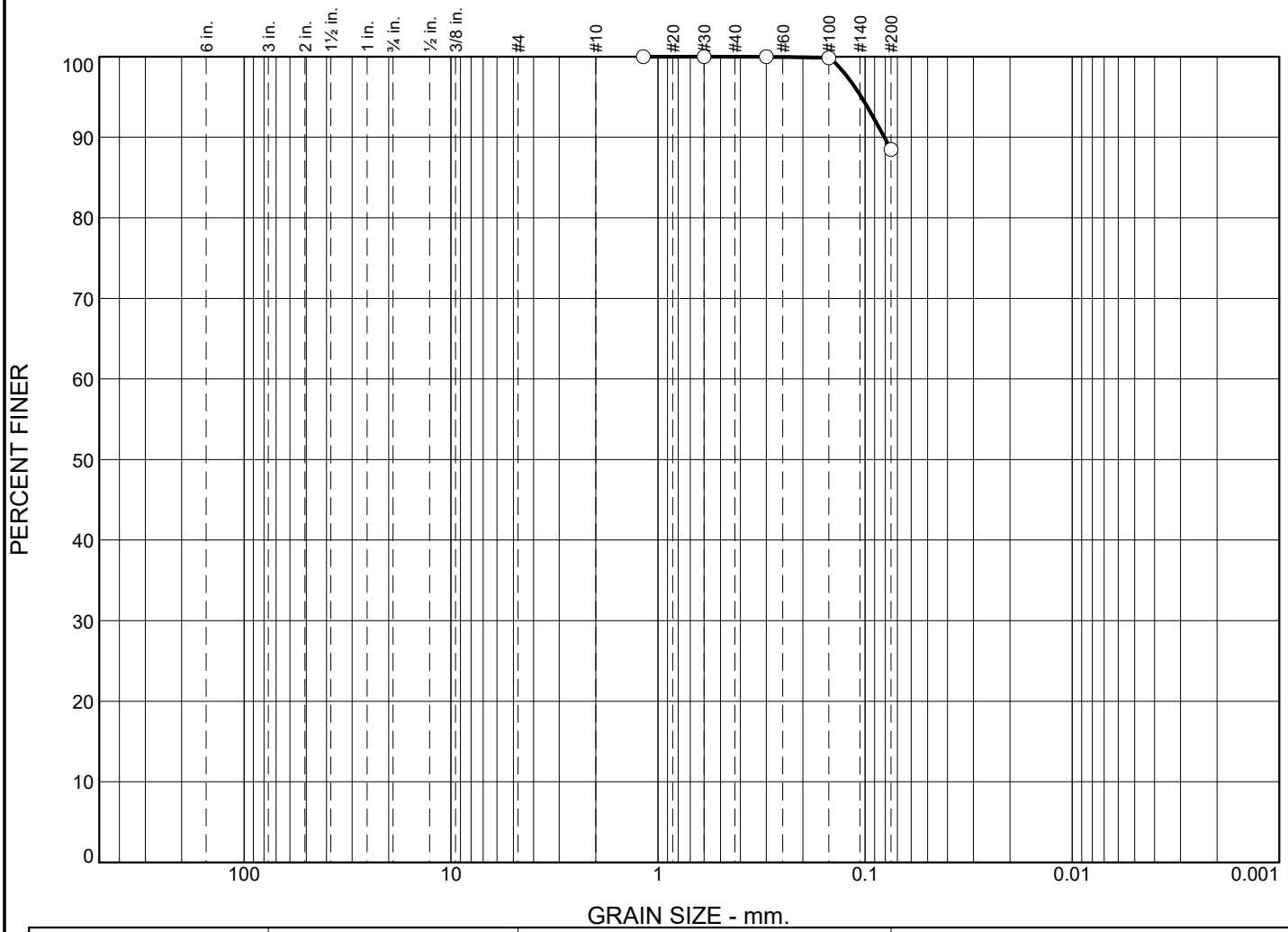
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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** A. Han 5/11/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	11.5	88.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										

Material Description	USCS	AASHTO
○ SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-101 **Depth:** 19-21 ft **Sample Number:** S6

Remarks:

○ As Received WC=25.7%

Fines classified visually

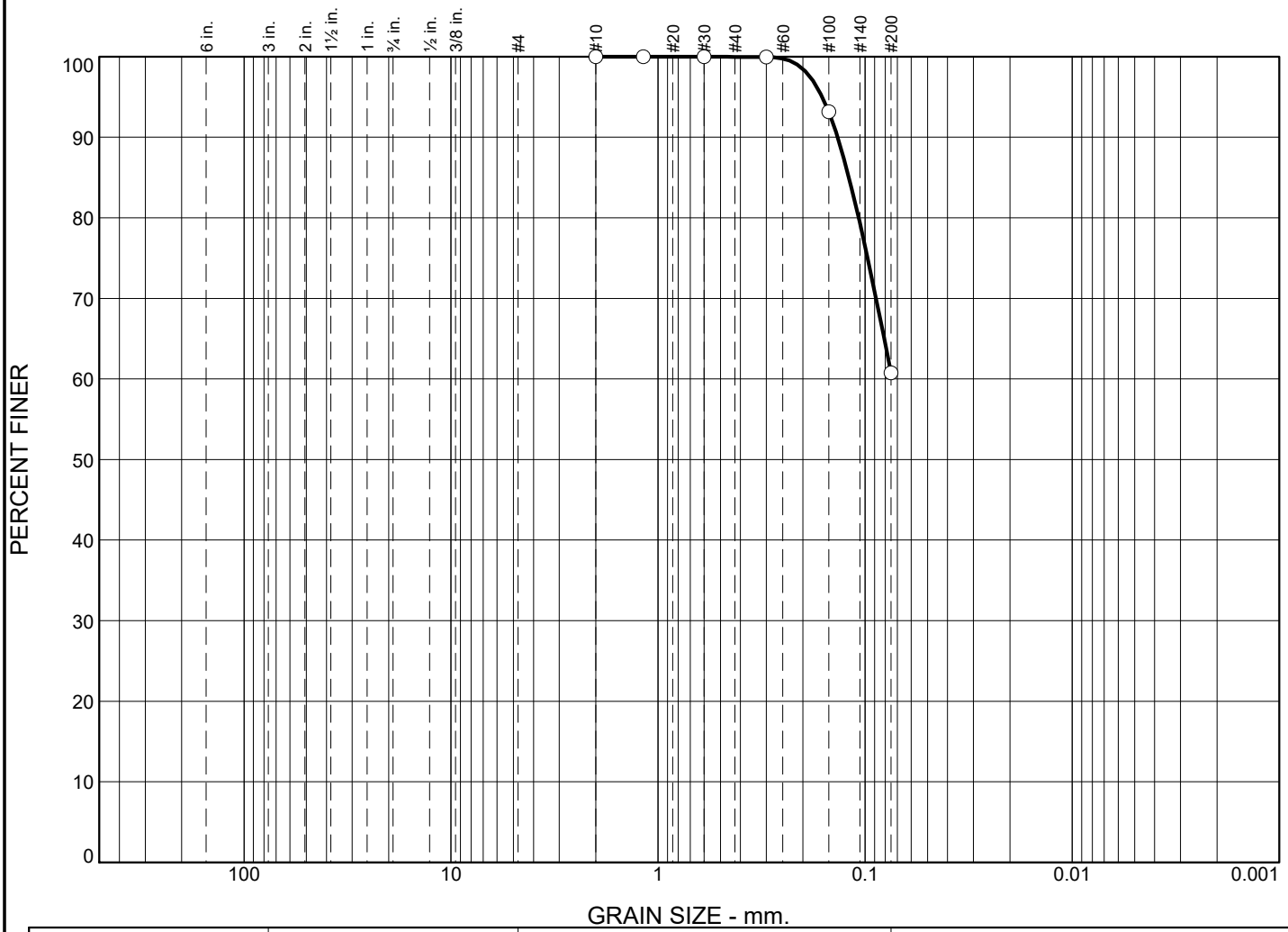
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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** A. Han 5/11/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	39.2	60.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1198							

	Material Description	USCS	AASHTO
○	Sandy SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-101 **Depth:** 24-26 ft **Sample Number:** S7

Remarks:

○ As Received WC=25.2%

Fines classified visually

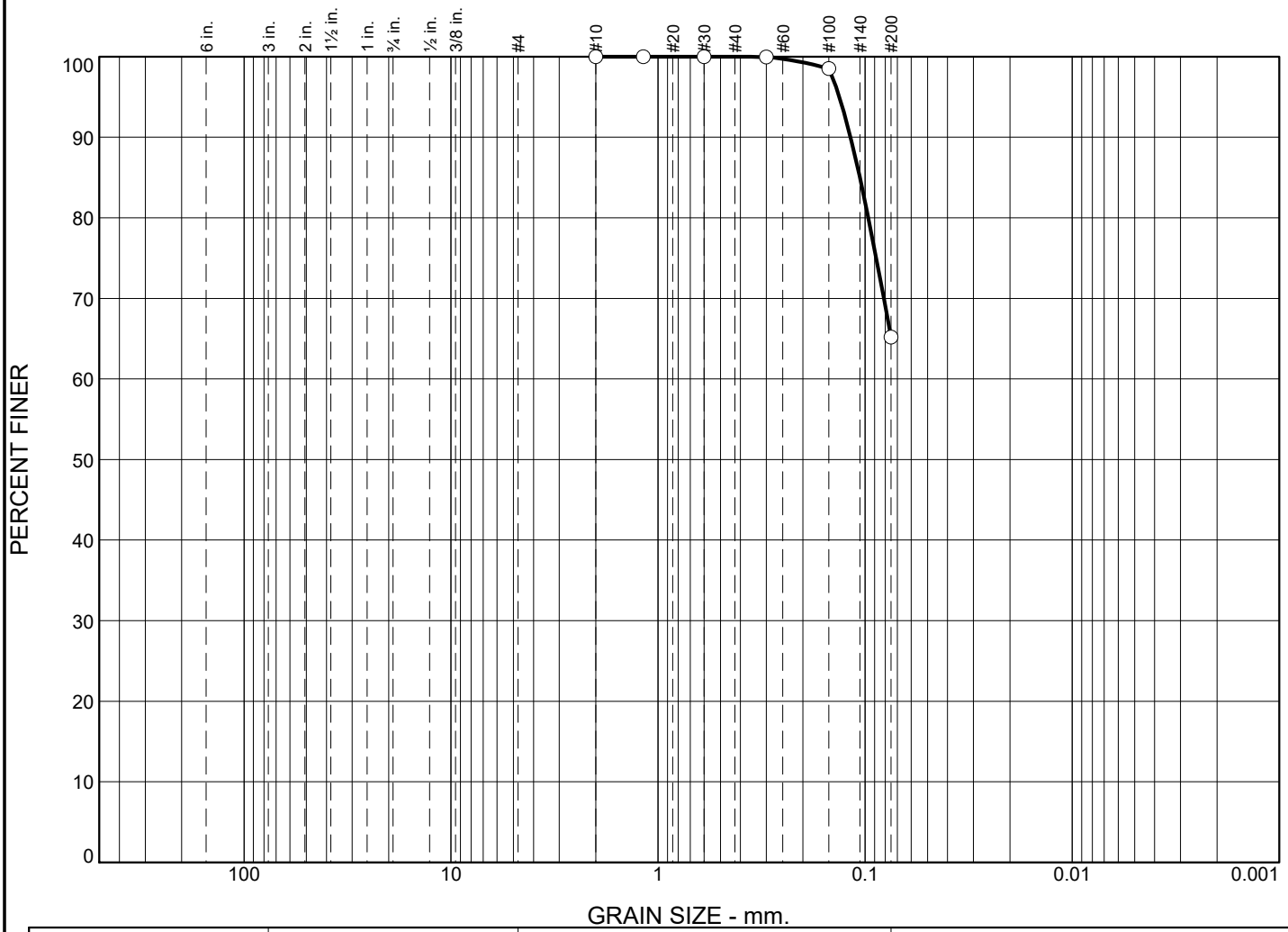
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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** A. Han 5/11/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	34.8	65.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1060							

	Material Description	USCS	AASHTO
○	Sandy SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-101 **Depth:** 29-31 ft **Sample Number:** S8

Remarks:

○ As Received WC=24.3%

Fines classified visually

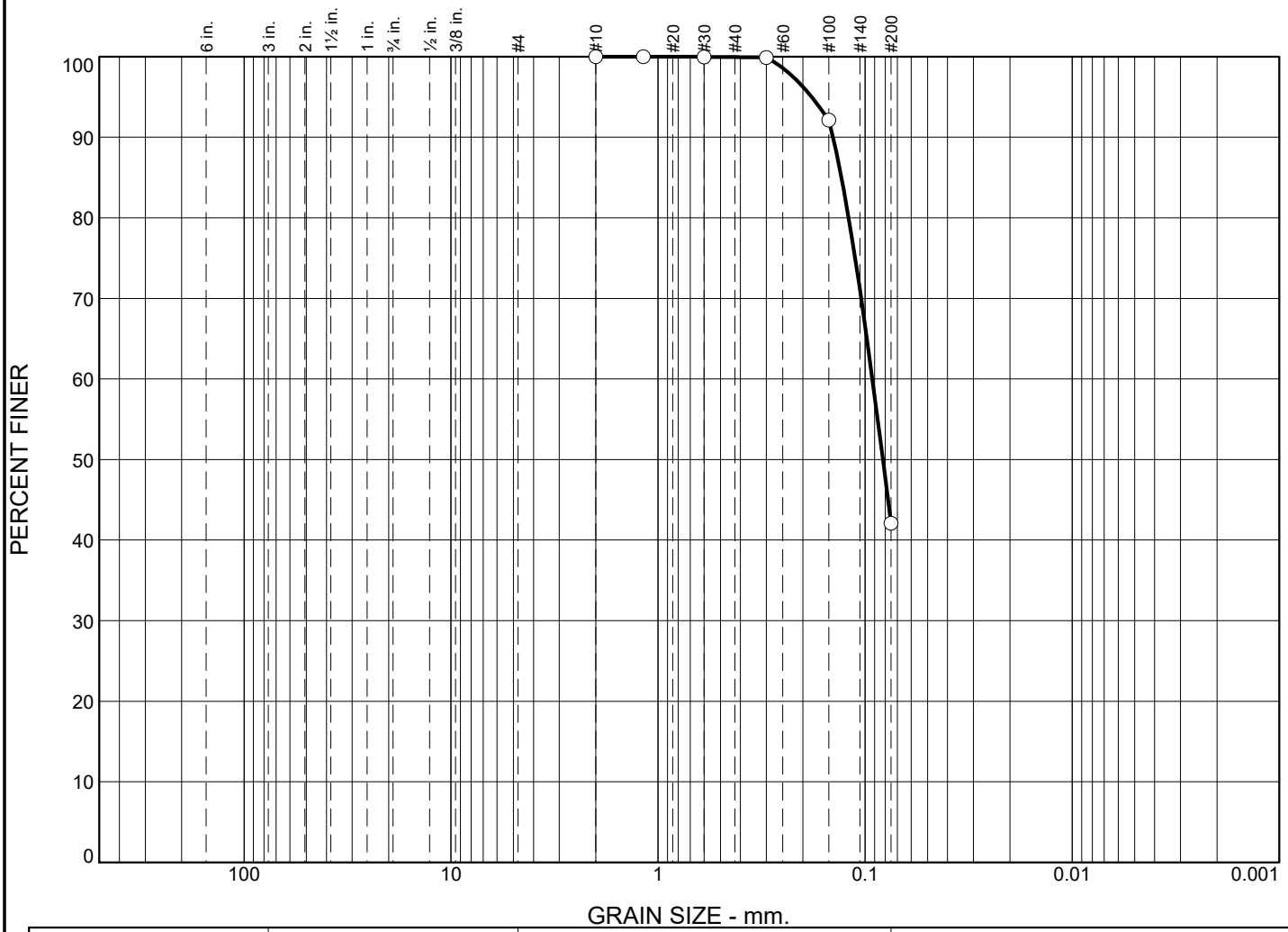
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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** A. Han 5/11/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	57.8	42.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1301	0.0923	0.0821					

	Material Description	USCS	AASHTO
○	Silty SAND	SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-102 **Depth:** 0-2 ft **Sample Number:** S1(9"-22")

Remarks:

○ As Received WC=14.5%

Fines classified visually

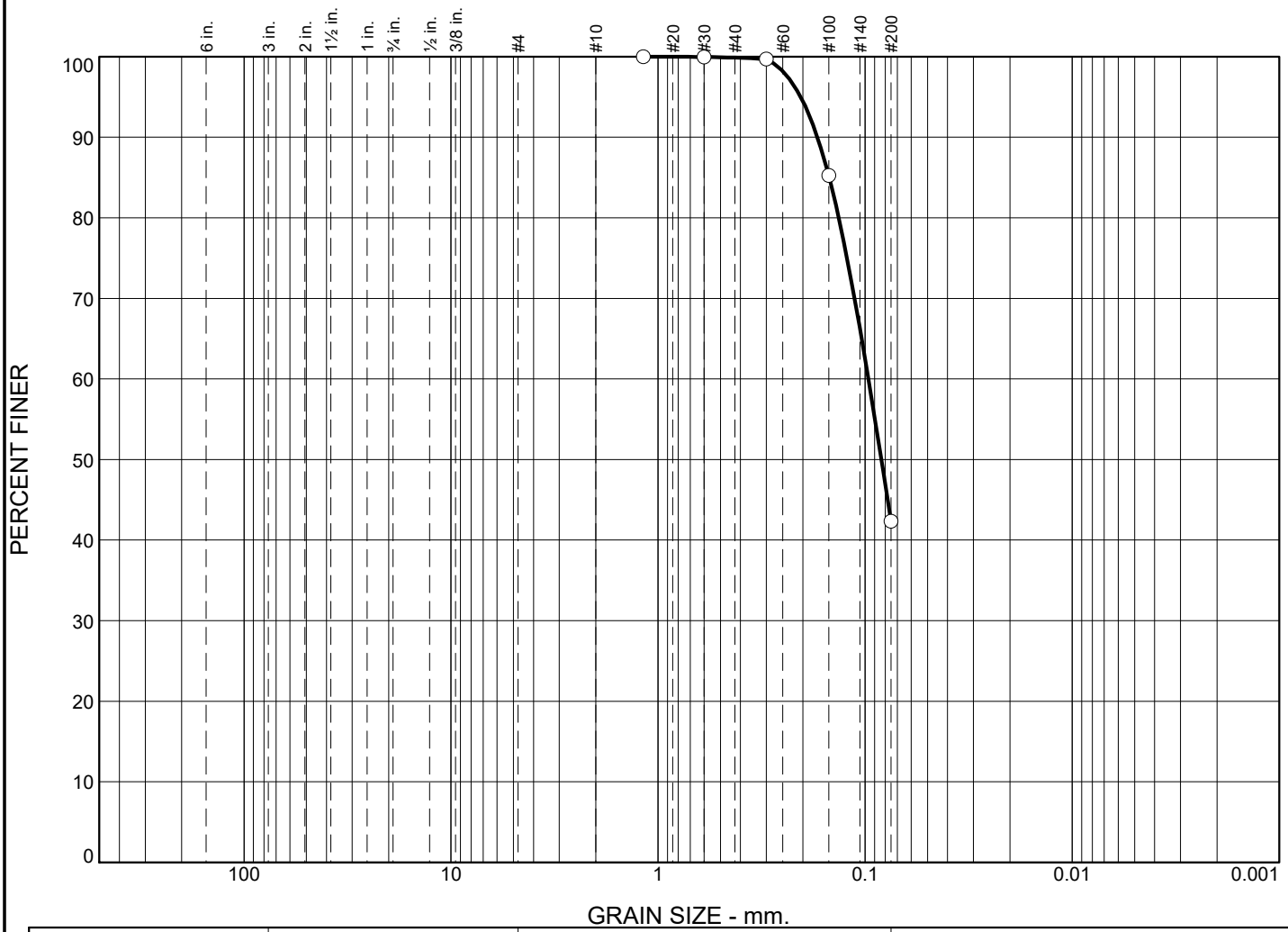
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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** A. Han 5/11/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	57.6	42.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1491	0.0965	0.0835					

	Material Description	USCS	AASHTO
○	Silty SAND	SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-102 **Depth:** 19-21 ft **Sample Number:** S7

Remarks:

○ As Received WC=28.4%

Fines classified visually

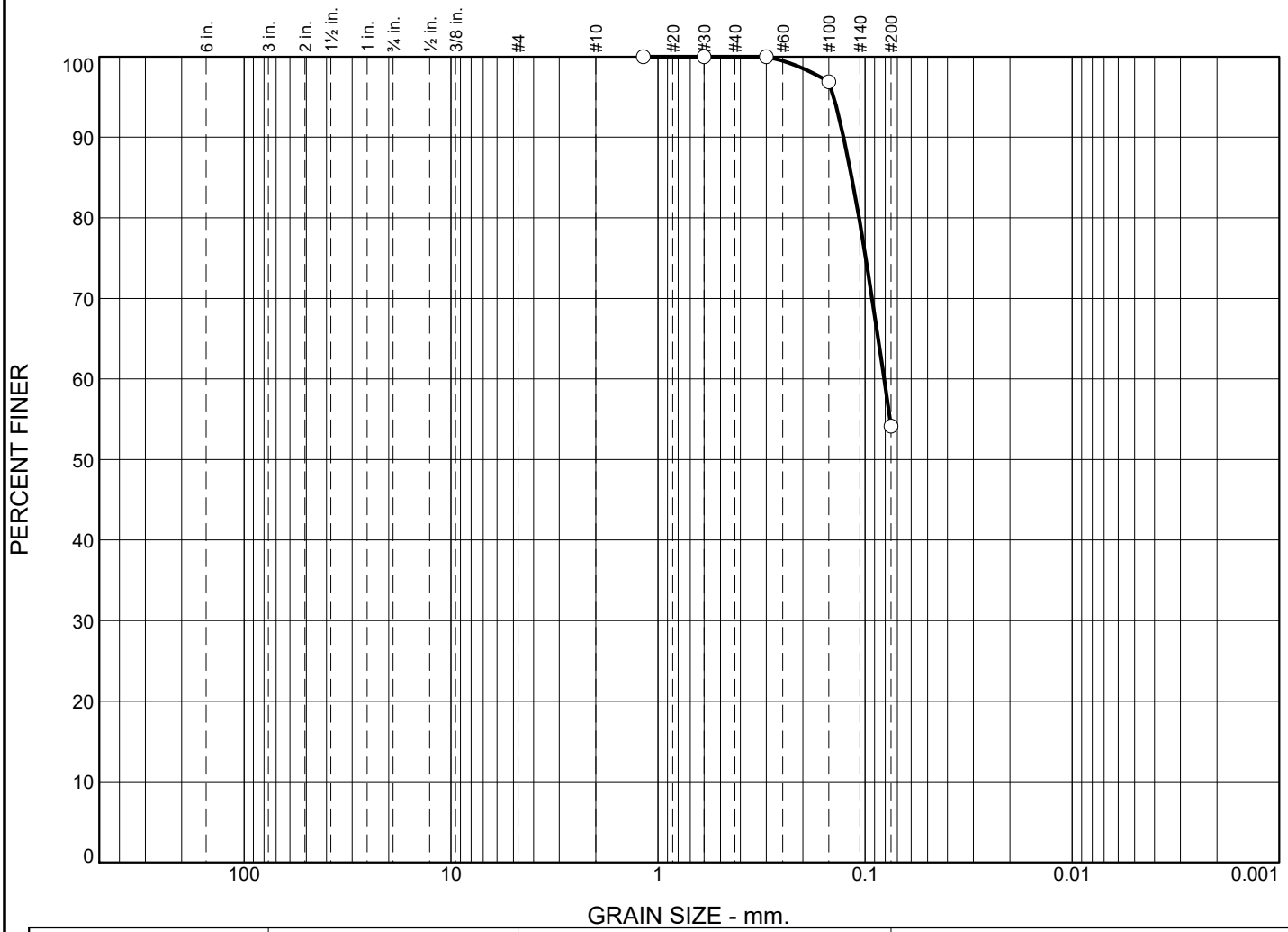
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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** A. Han 5/11/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	45.9	54.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1160	0.0810						

Material Description	USCS	AASHTO
○ Sandy SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-102 **Depth:** 24-26 ft **Sample Number:** S8

Remarks:

○ As Received WC=24.9%

Fines classified visually

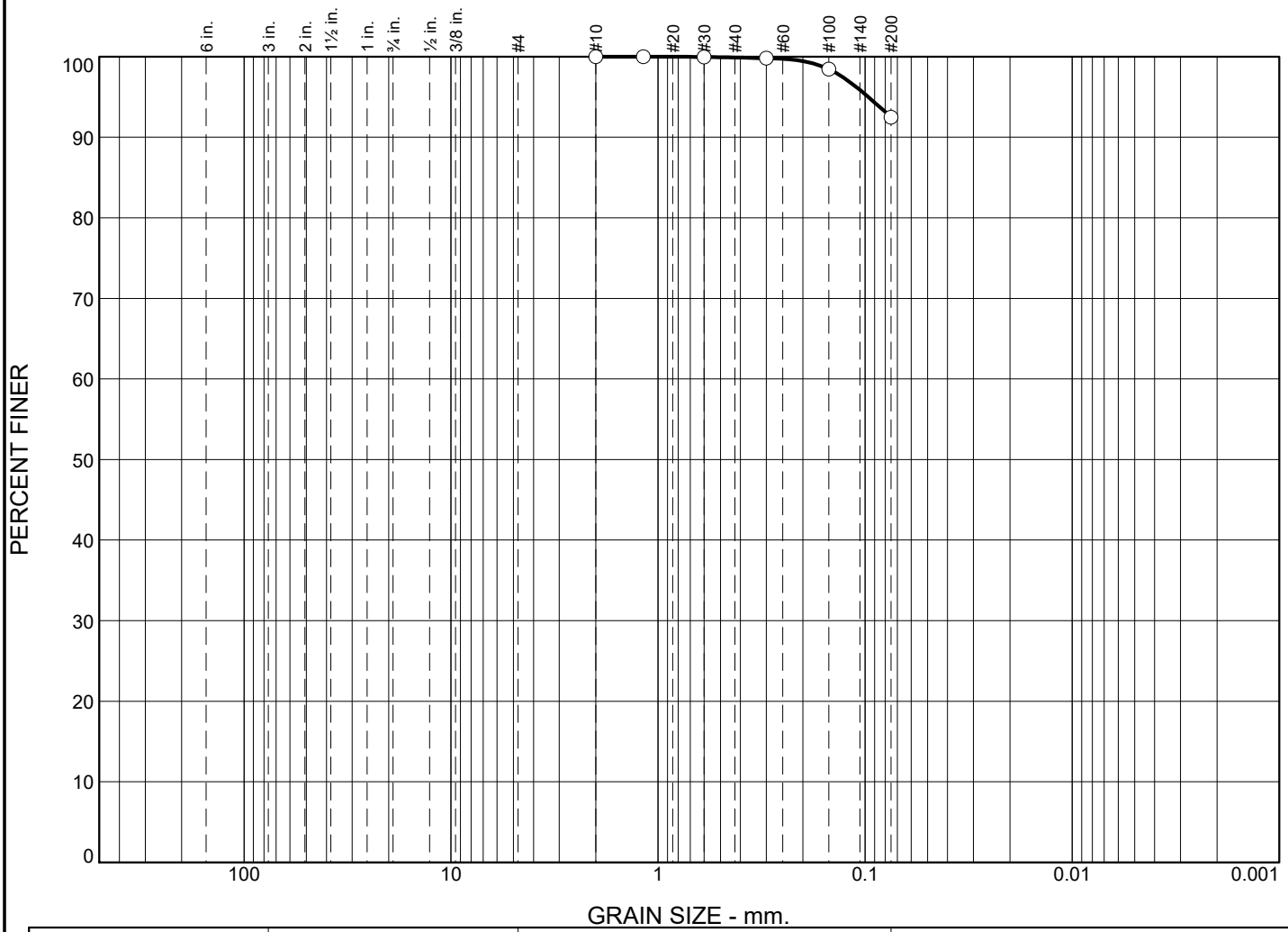
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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** A. Han 5/11/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	7.4	92.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										

Material Description	USCS	AASHTO
○ SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-102 **Depth:** 29-31 ft **Sample Number:** S9

Remarks:

○ As Received WC=29.3%

Fines classified visually

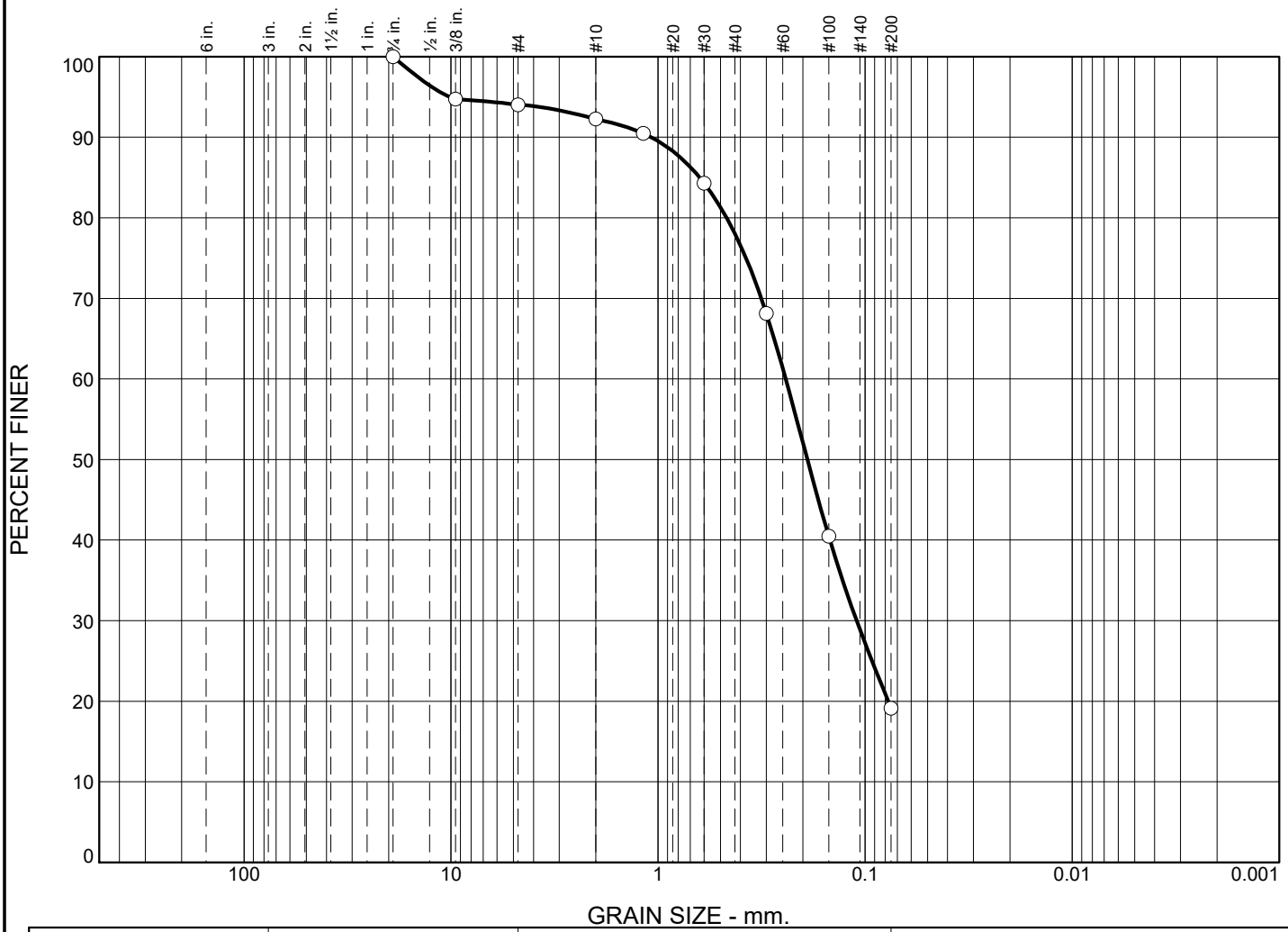
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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** A. Han 5/11/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	6.0	1.7	14.3	58.9	19.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.6308	0.2420	0.1902	0.1099				

	Material Description	USCS	AASHTO
○	Silty SAND	SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-103 **Depth:** 0-2 ft **Sample Number:** S1

Remarks:

○ As Received WC=6.6%

Fines classified visually

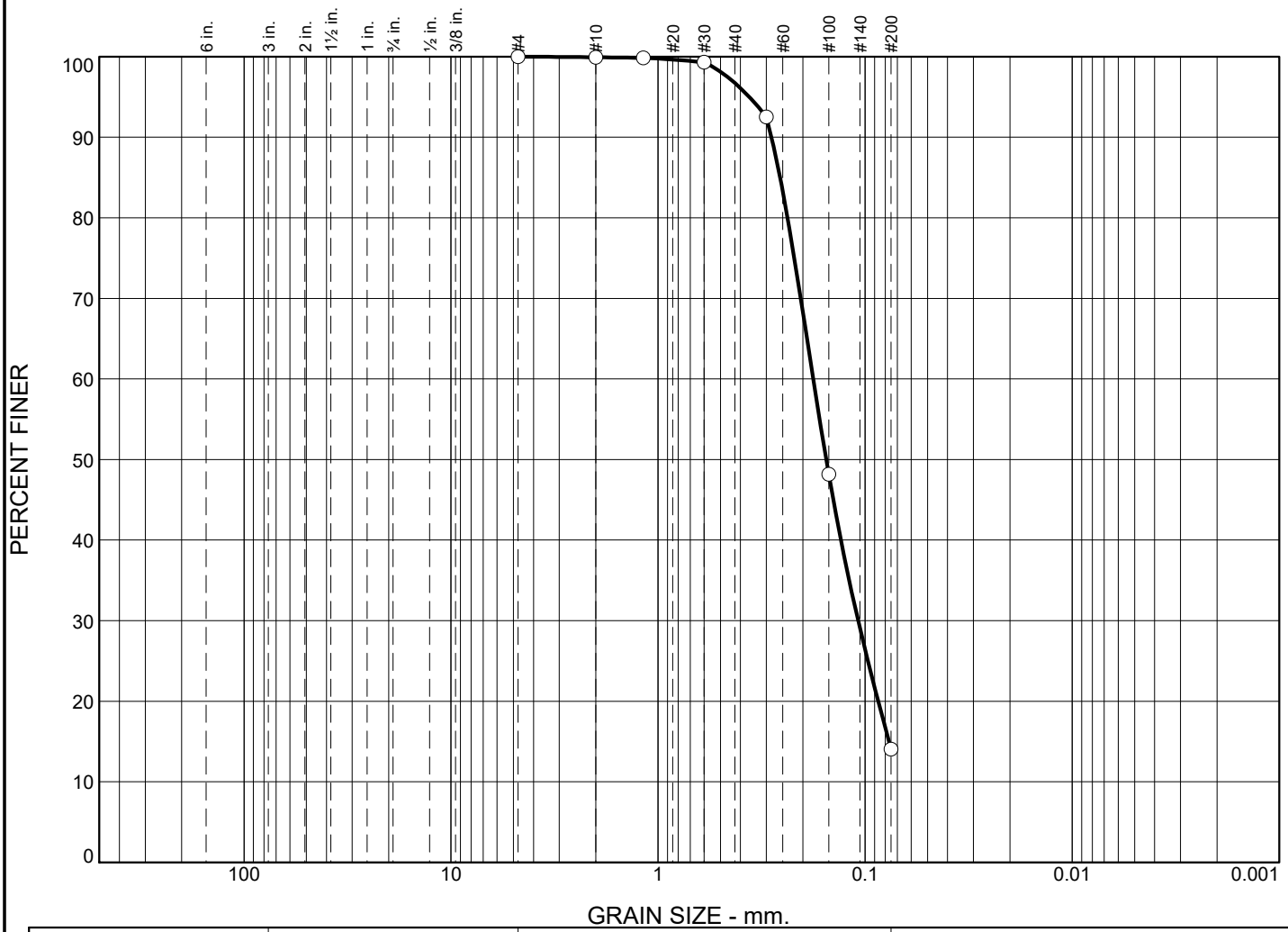
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Woburn, MA 01801

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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** E. Fazlic 5/12/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	3.2	82.7	14.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.2575	0.1781	0.1542	0.1080	0.0767			

	Material Description	USCS	AASHTO
○	Silty SAND	SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-103 **Depth:** 8-10 ft **Sample Number:** S5

Remarks:

○ As Received WC=30.1%

Fines classified visually

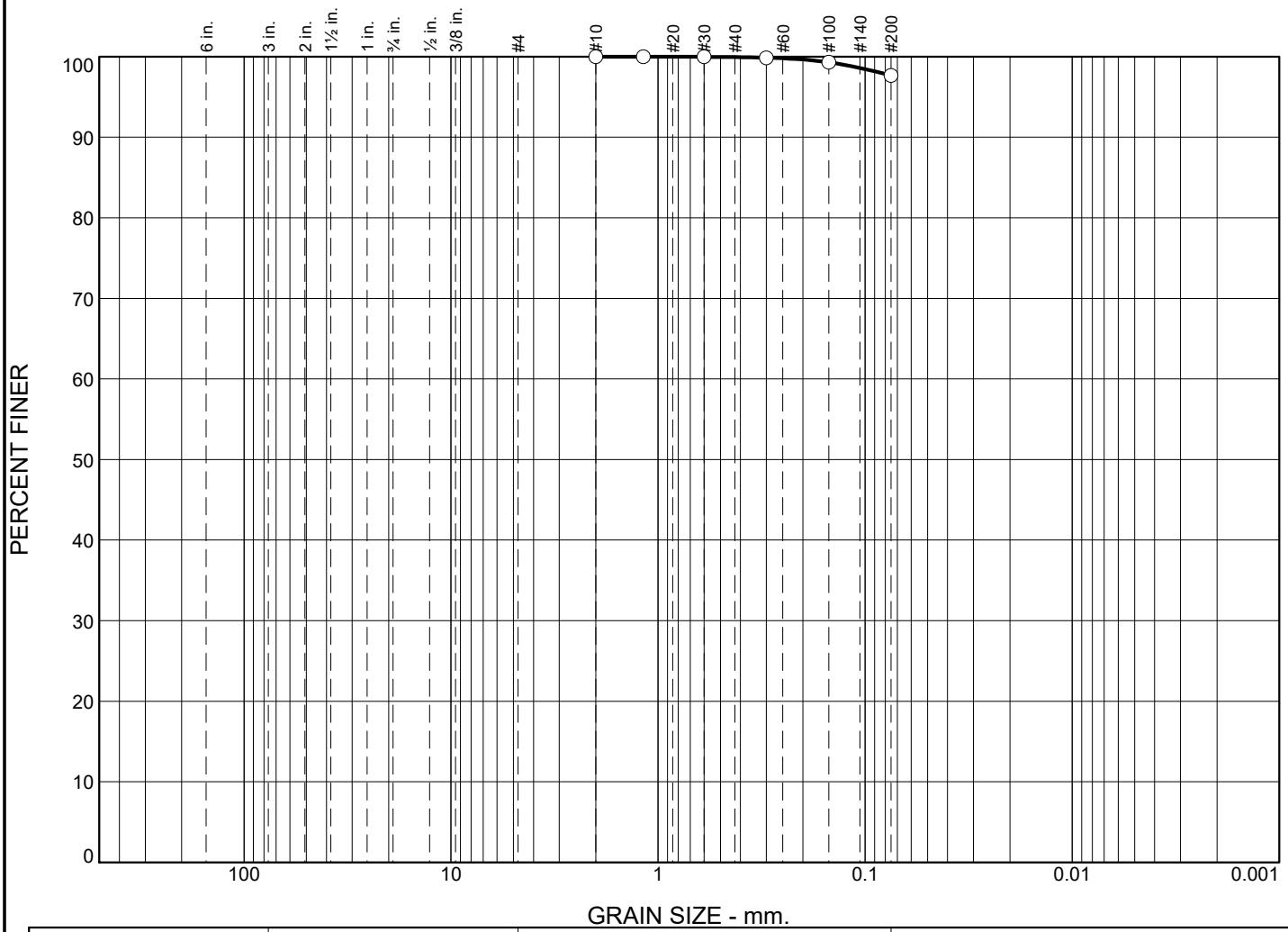
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Woburn, MA 01801

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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** E. Fazlic 5/12/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	2.2	97.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										

Material Description	USCS	AASHTO
○ SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-103 **Depth:** 14-16 ft **Sample Number:** S6

Remarks:

○ As Received WC=31.8%

Fines classified visually

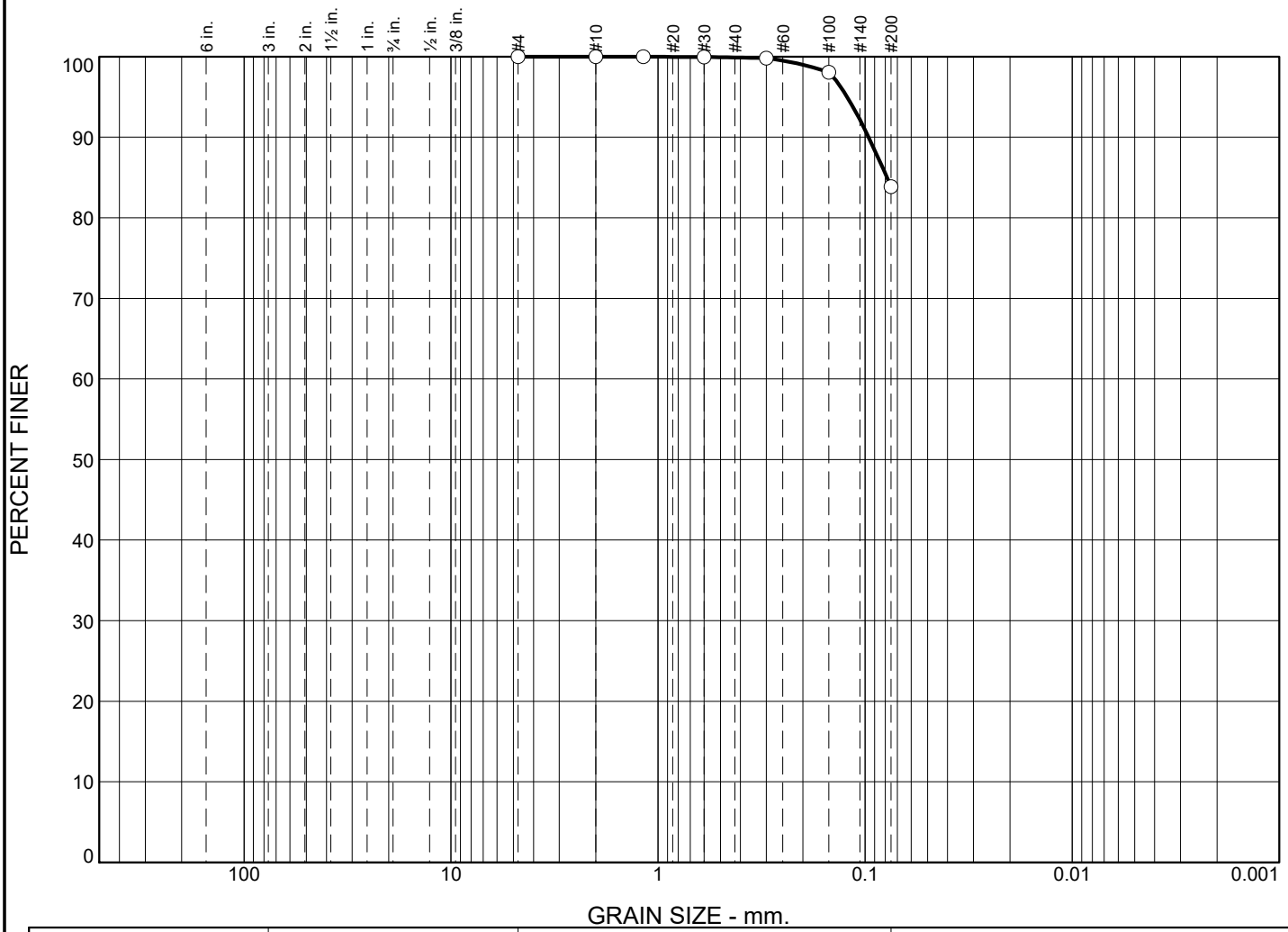
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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** E. Fazlic 5/12/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	16.0	83.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.0784							

	Material Description	USCS	AASHTO
○	SILT with Sand	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-103 **Depth:** 19-21 ft **Sample Number:** S7

Remarks:

○ As Received WC=26.2%

Fines classified visually

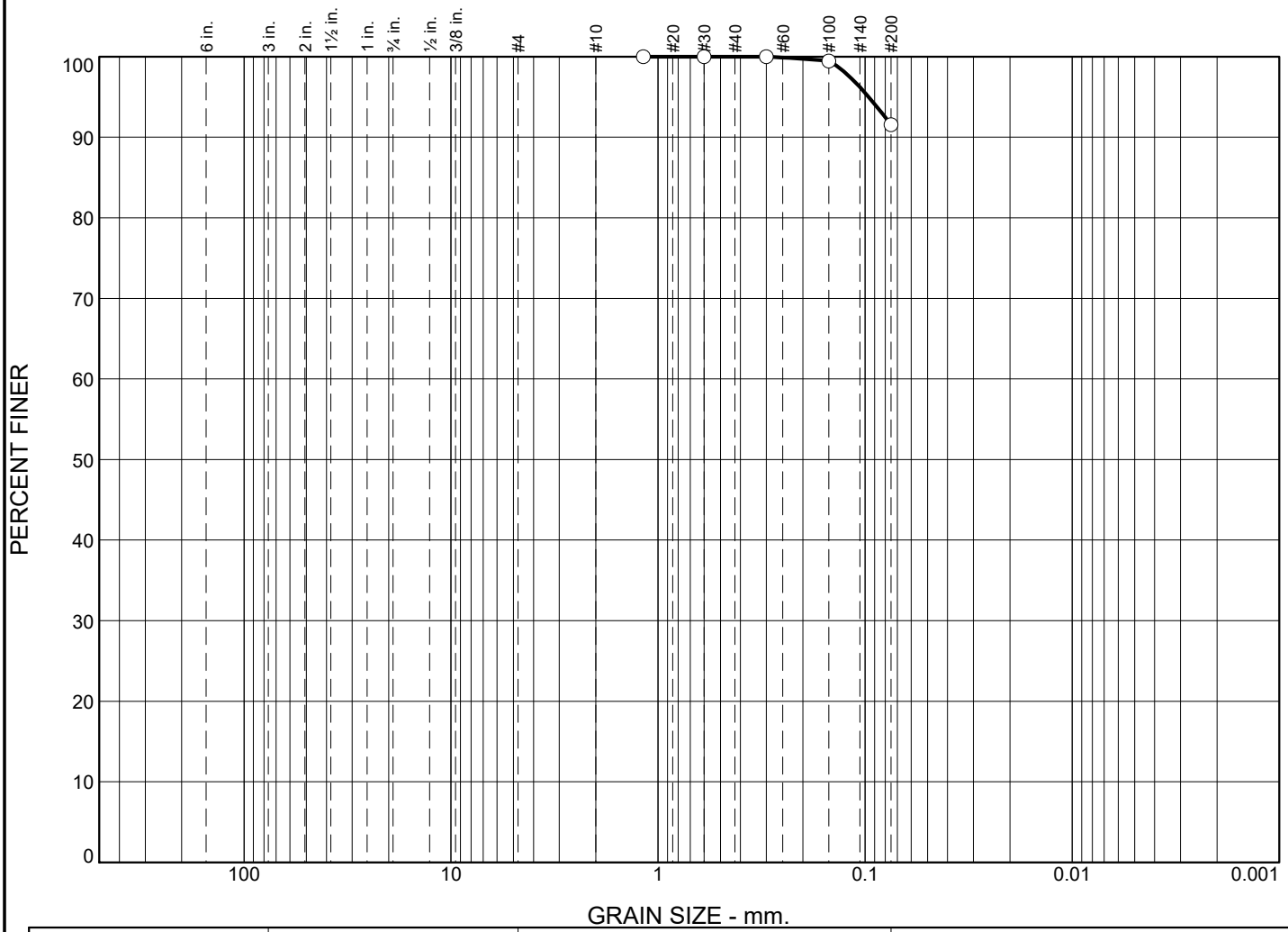
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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** E. Fazlic 5/12/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	8.5	91.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										

Material Description	USCS	AASHTO
○ SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-103 **Depth:** 24-26 ft **Sample Number:** S8

Remarks:

○ As Received WC=26.4%

Fines classified visually

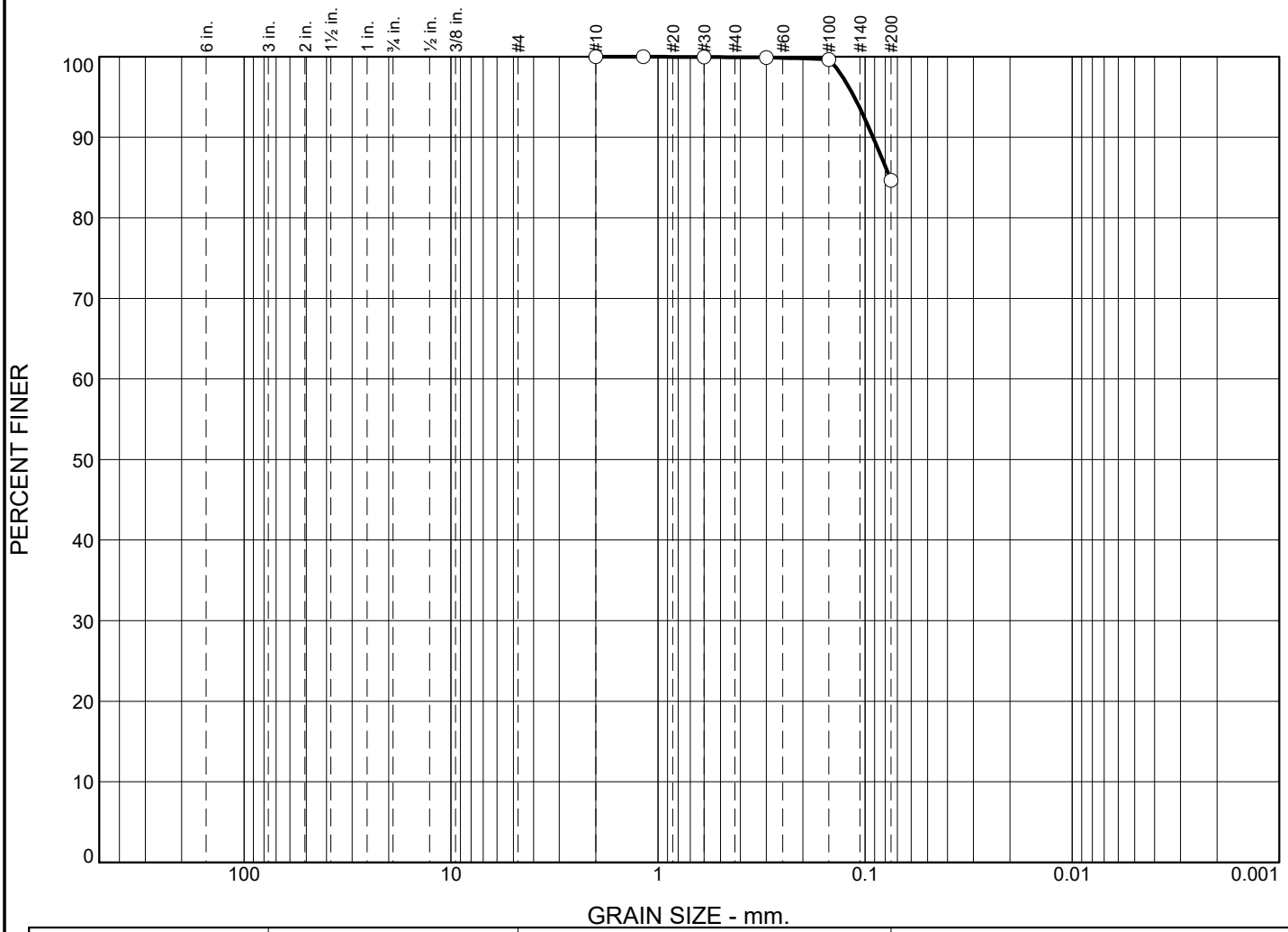
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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** E. Fazlic 5/12/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	15.3	84.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.0760							

Material Description	USCS	AASHTO
○ SILT with Sand	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-104 **Depth:** 4-6 ft **Sample Number:** S3

Remarks:

○ As Received WC=20.7%

Fines classified visually

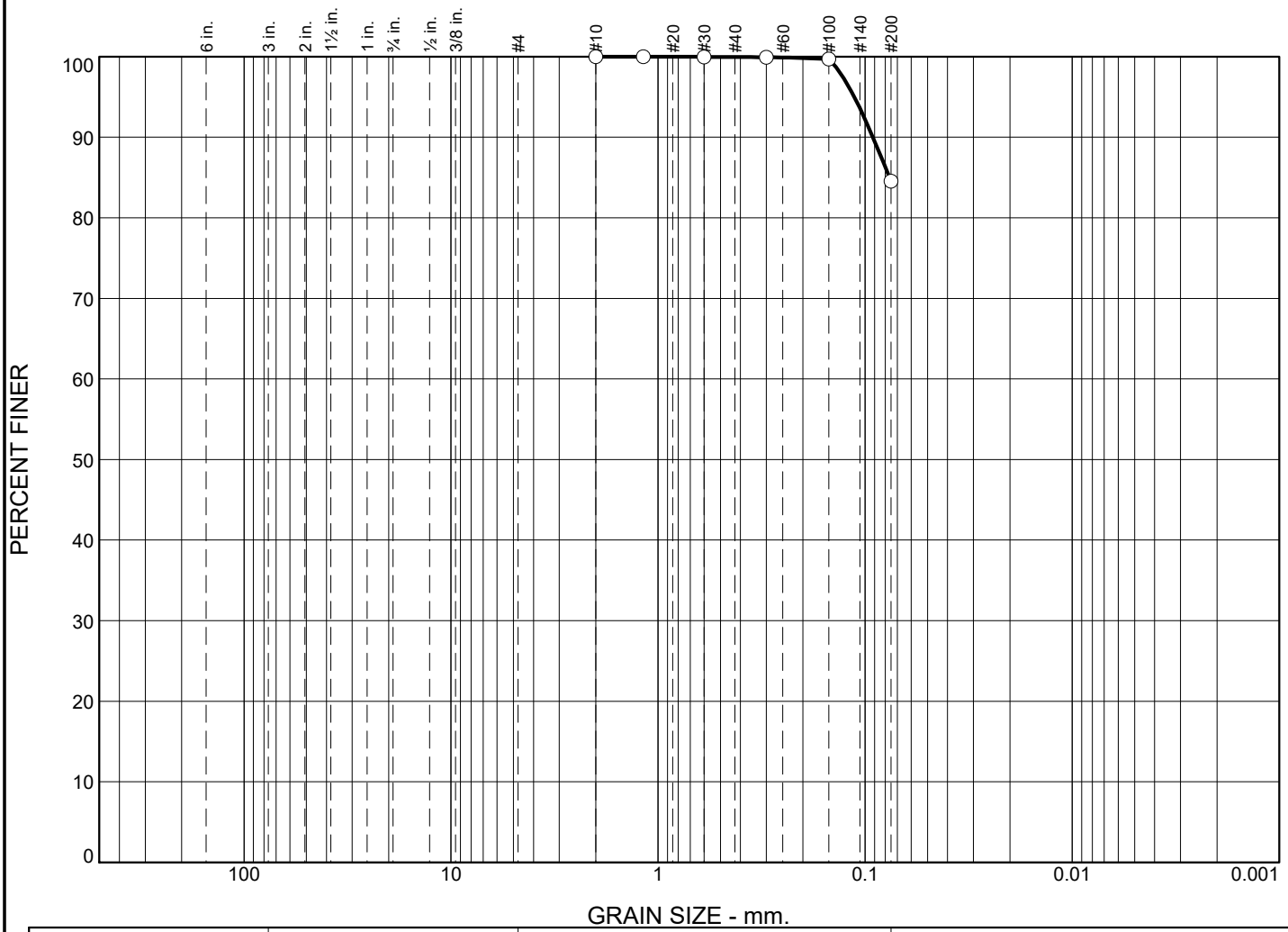
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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** E. Fazlic 5/12/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	15.5	84.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.0763							

	Material Description	USCS	AASHTO
○	SILT with Sand	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-104 **Depth:** 14-16 ft **Sample Number:** S6

Remarks:

○ As Received WC=28.5%

Fines classified visually

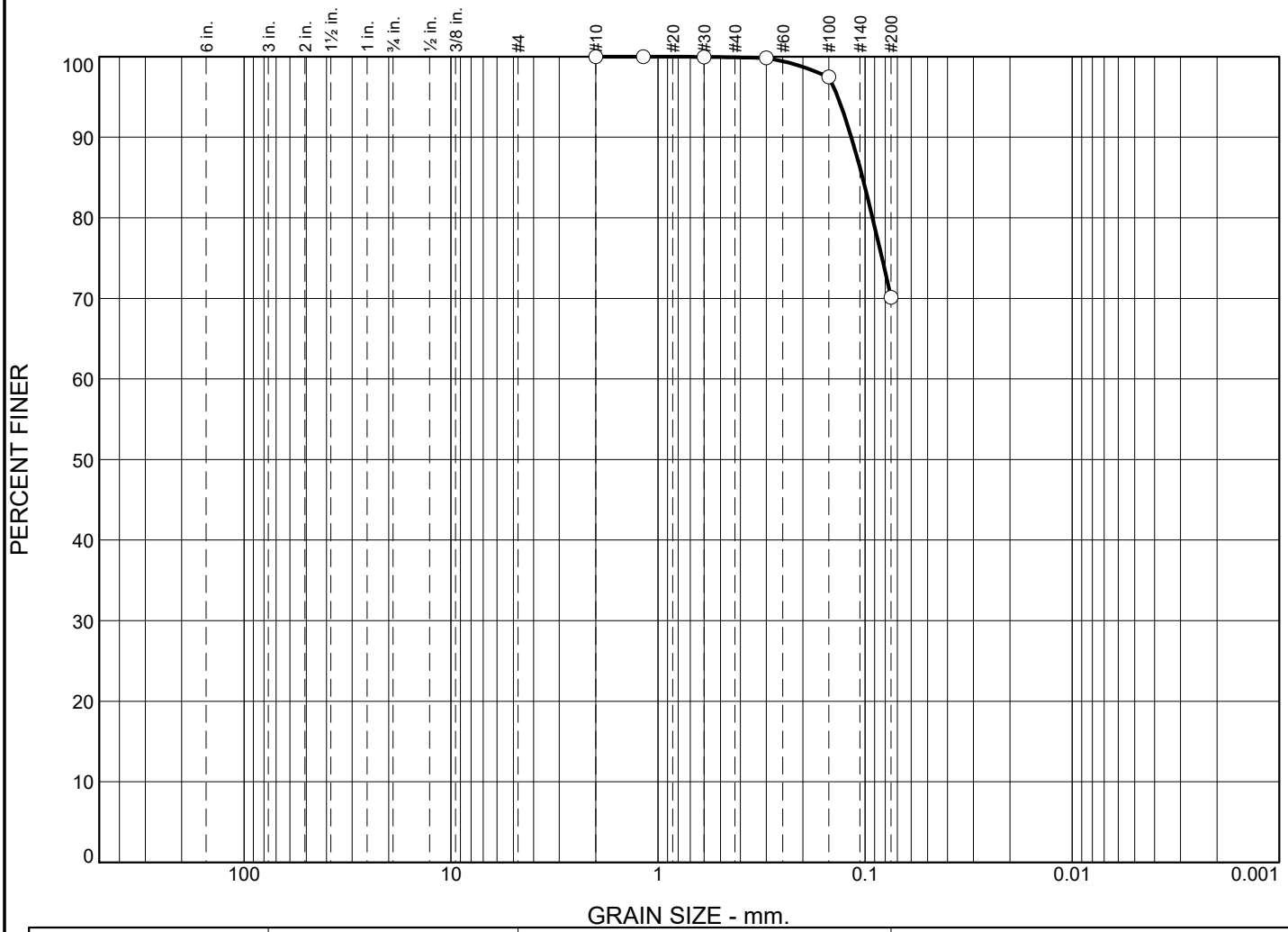
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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** E. Fazlic 5/12/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	29.8	70.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1030							

Material Description	USCS	AASHTO
○ Sandy SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-104 **Depth:** 19-21 ft **Sample Number:** S7

Remarks:

○ As Received WC=32.7%

Fines classified visually

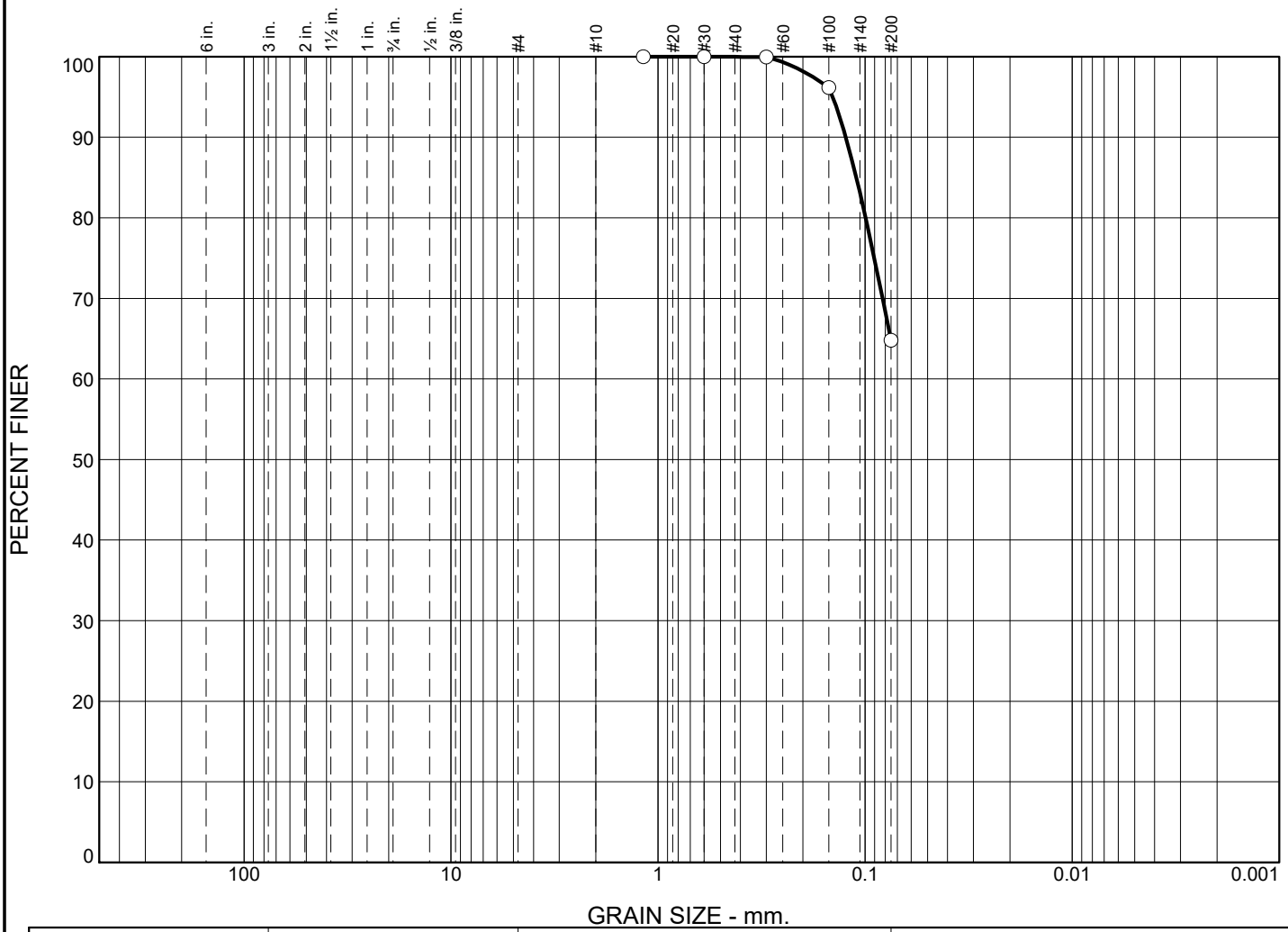
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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** E. Fazlic 5/12/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	35.2	64.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1103							

Material Description	USCS	AASHTO
○ Sandy SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-104 **Depth:** 24-26 ft **Sample Number:** S8

Remarks:

○ As Received WC=24.4%

Fines classified visually

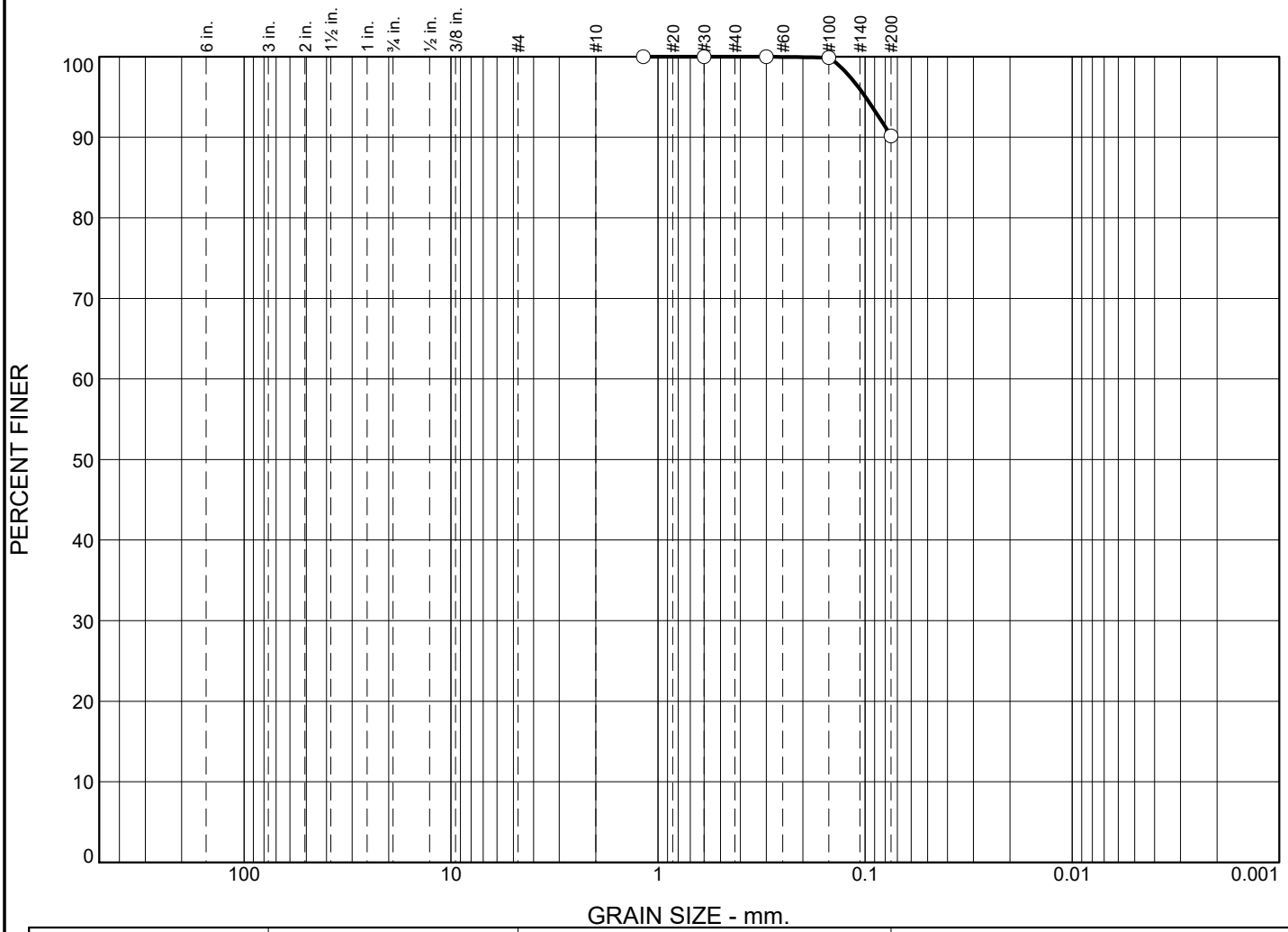
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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** E. Fazlic 5/12/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	9.9	90.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										

Material Description	USCS	AASHTO
○ SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-104 **Depth:** 29-31 ft **Sample Number:** S9

Remarks:

○ As Received WC=27.4%

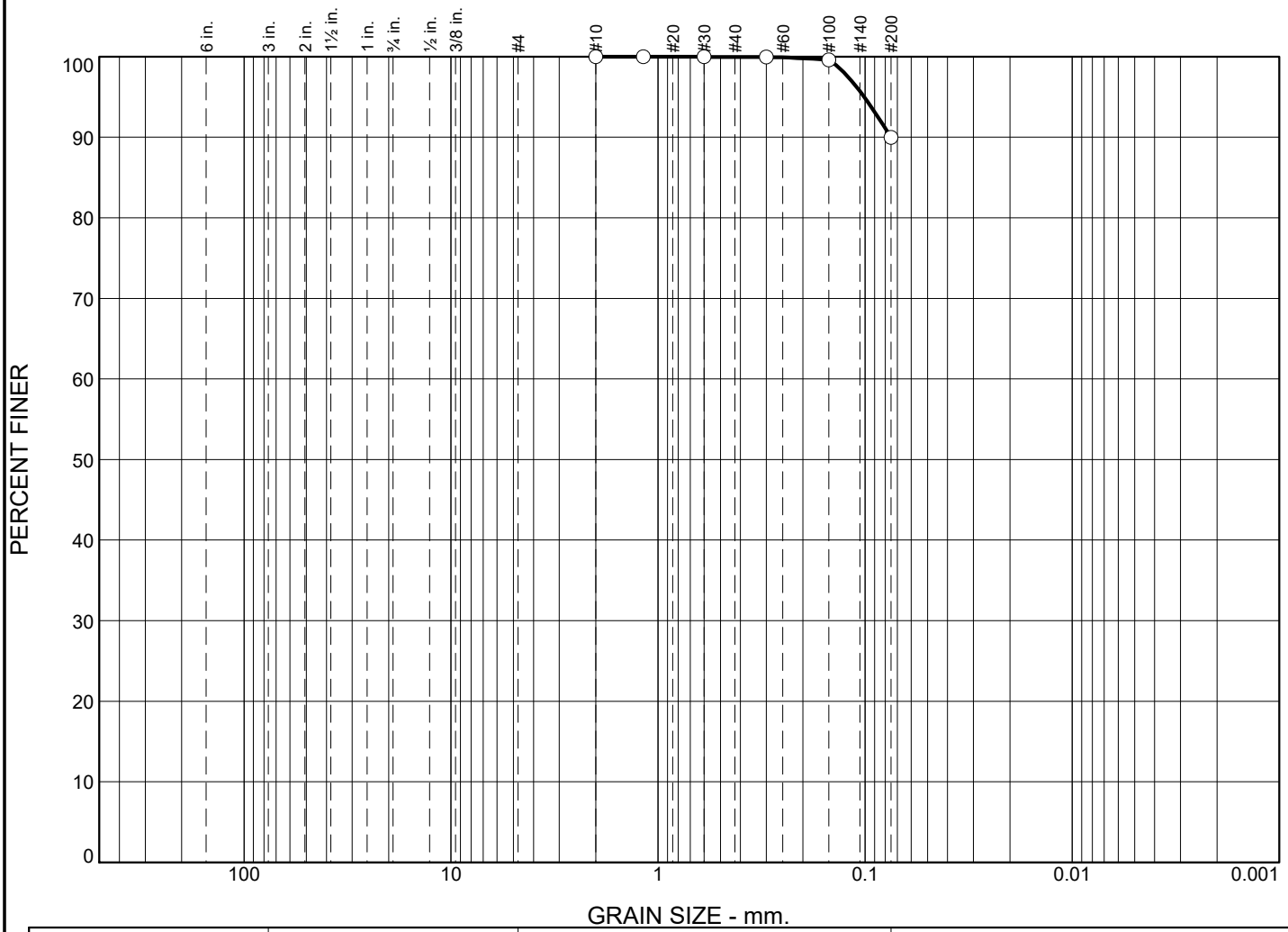
Fines classified visually

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Woburn, MA 01801

Figure

Tested By: M. Alstede 5/11/23 **Checked By:** E. Fazlic 5/12/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	10.0	90.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										

Material Description	USCS	AASHTO
○ SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-105 **Depth:** 2-4 ft **Sample Number:** S2

Remarks:

○ As Received WC=15.6%

Fines classified visually

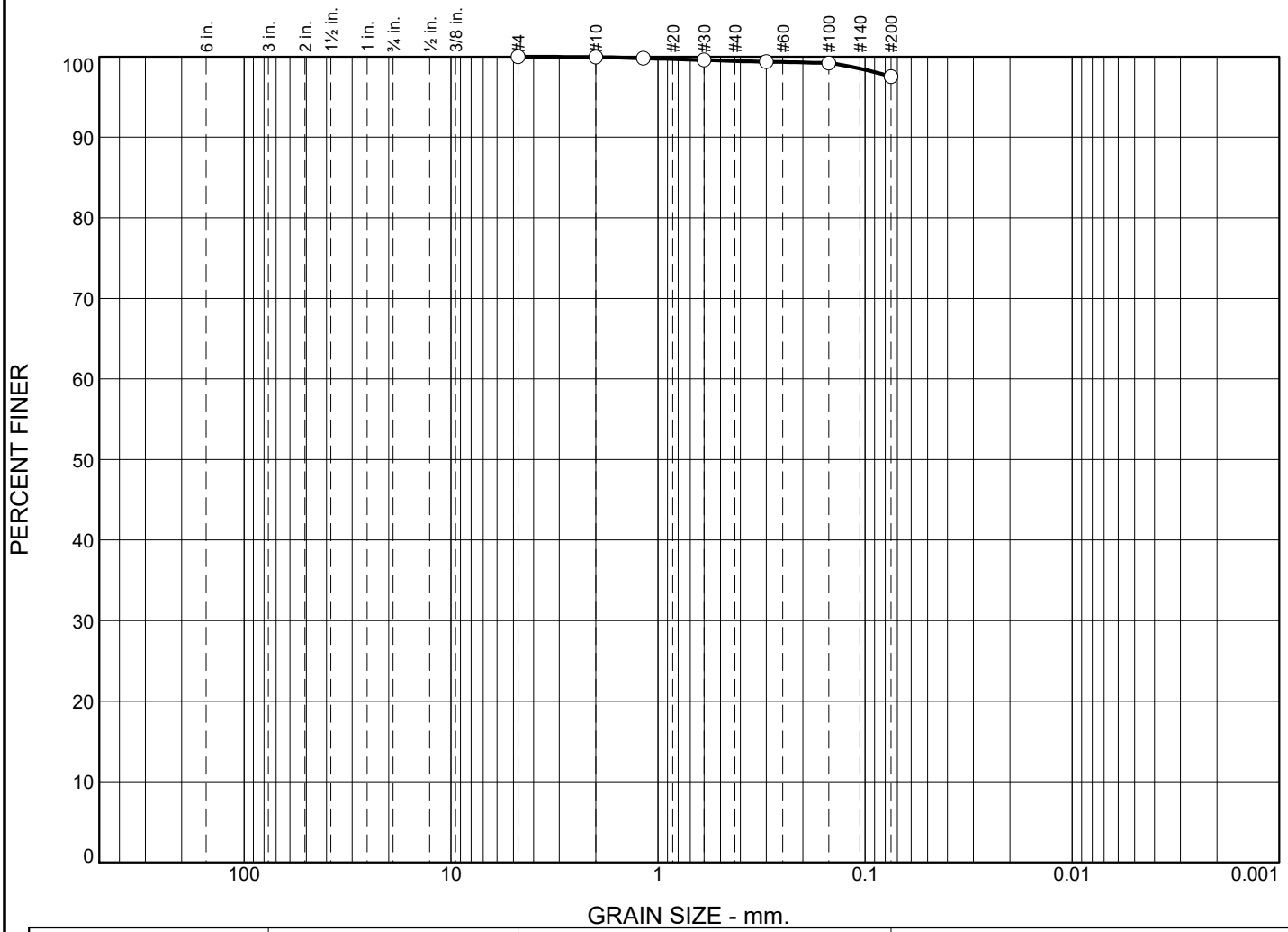
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Woburn, MA 01801

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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** E. Fazlic 5/12/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.5	2.0	97.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										

Material Description	USCS	AASHTO
○ SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-105 **Depth:** 4-6 ft **Sample Number:** S3

Remarks:

○ As Received WC=28.3%

Fines classified visually

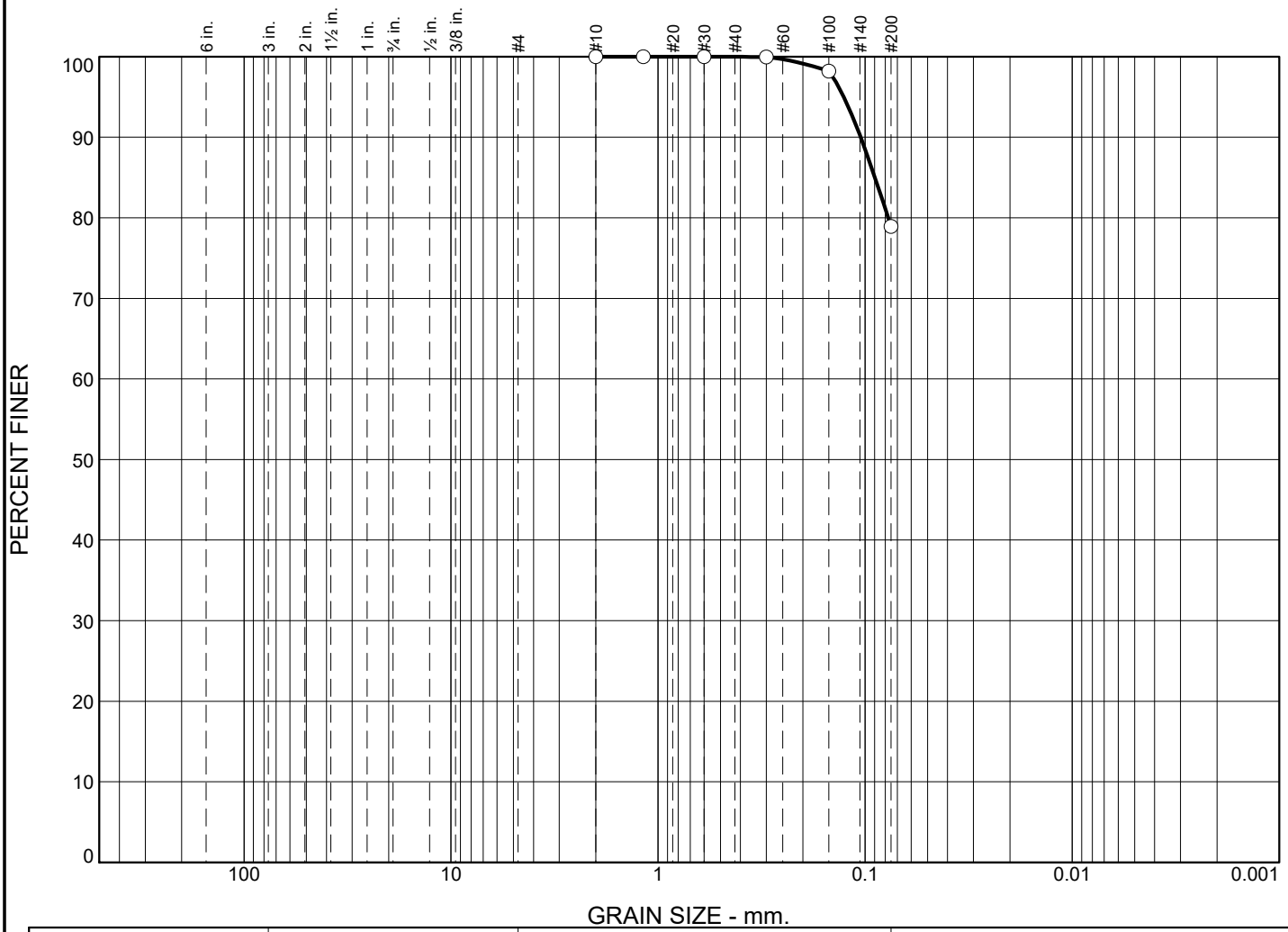
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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** E. Fazlic 5/12/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	21.1	78.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.0897							

Material Description	USCS	AASHTO
○ SILT with Sand	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-105 **Depth:** 8-10 ft **Sample Number:** S5

Remarks:

○ As received WC = 28.9%

Fines visually classified

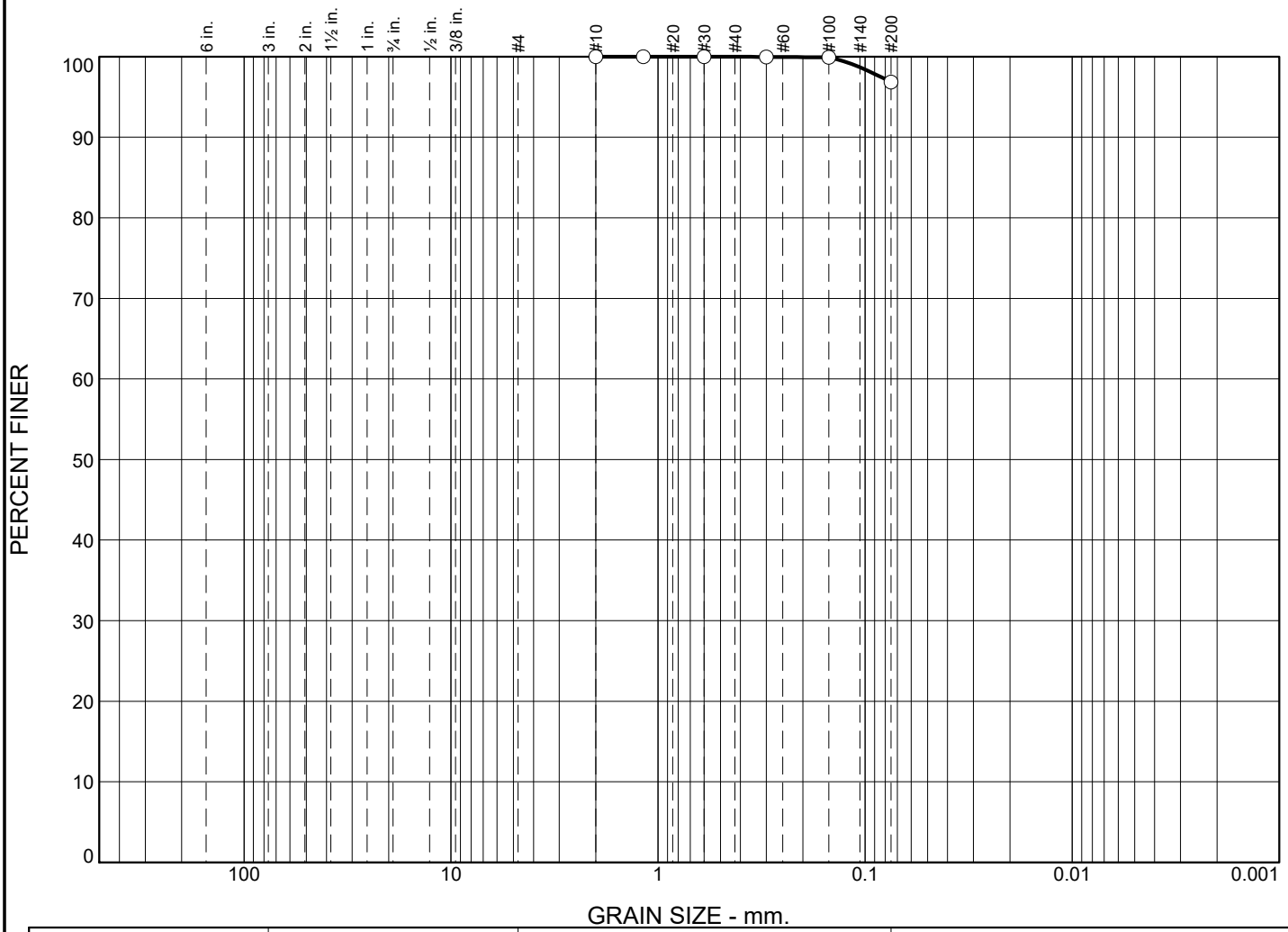
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Figure

Tested By: E. Driscoll 5/12/23 **Checked By:** E. Fazlic 5/12/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	3.2	96.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										

Material Description	USCS	AASHTO
○ SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-105 **Depth:** 14-16 ft **Sample Number:** S6

Remarks:

○ As Received WC=26.5%

Fines classified visually

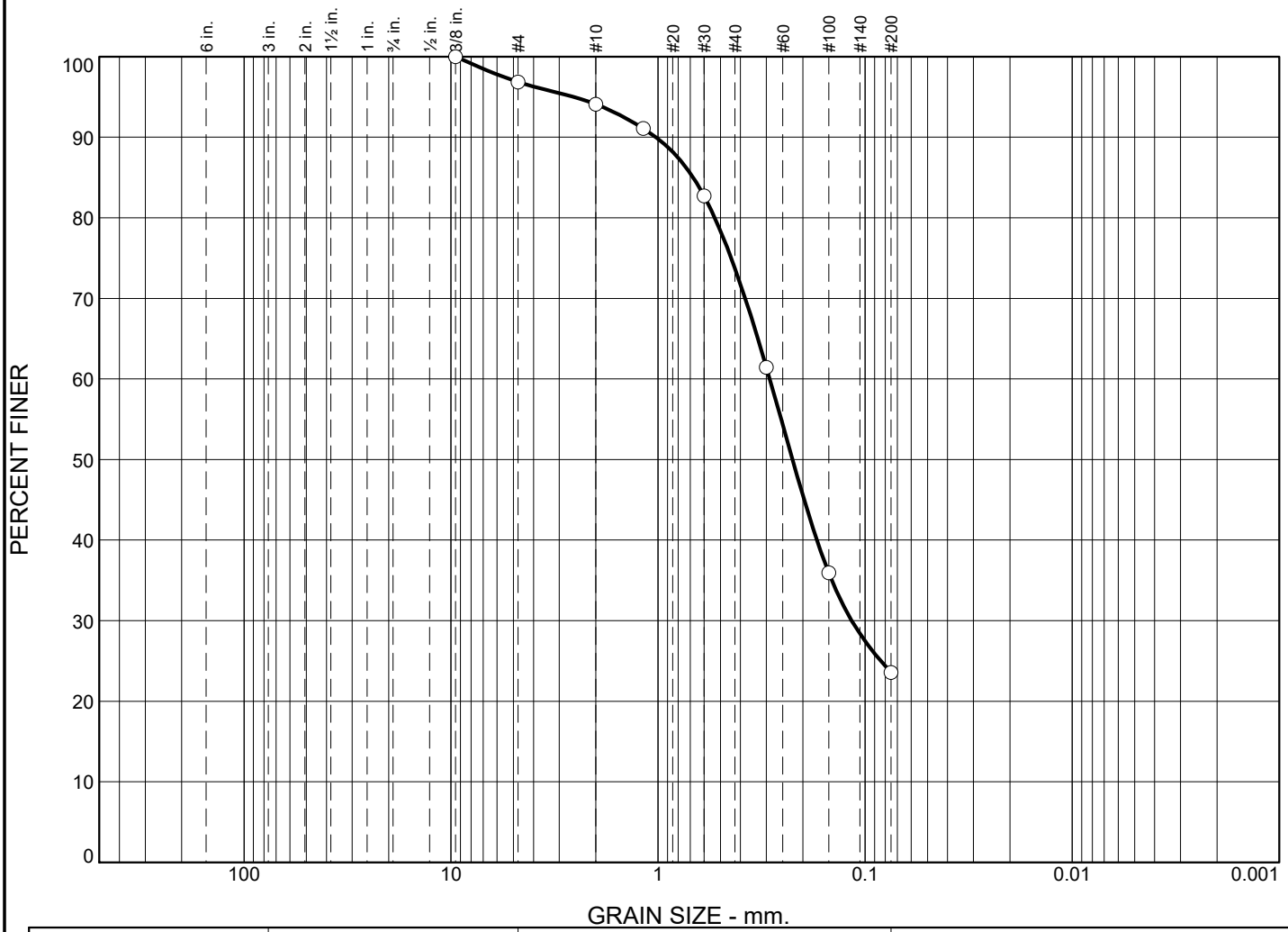
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Figure

Tested By: E. Driscoll 5/12/23 **Checked By:** E. Fazlic 5/12/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	3.1	2.8	20.4	50.1	23.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.6773	0.2889	0.2244	0.1162				

Material Description	USCS	AASHTO
○ Silty SAND	SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-106 **Depth:** 0-2 ft **Sample Number:** S1

Remarks:

○ As received WC = 11.8%

Fines visually classified

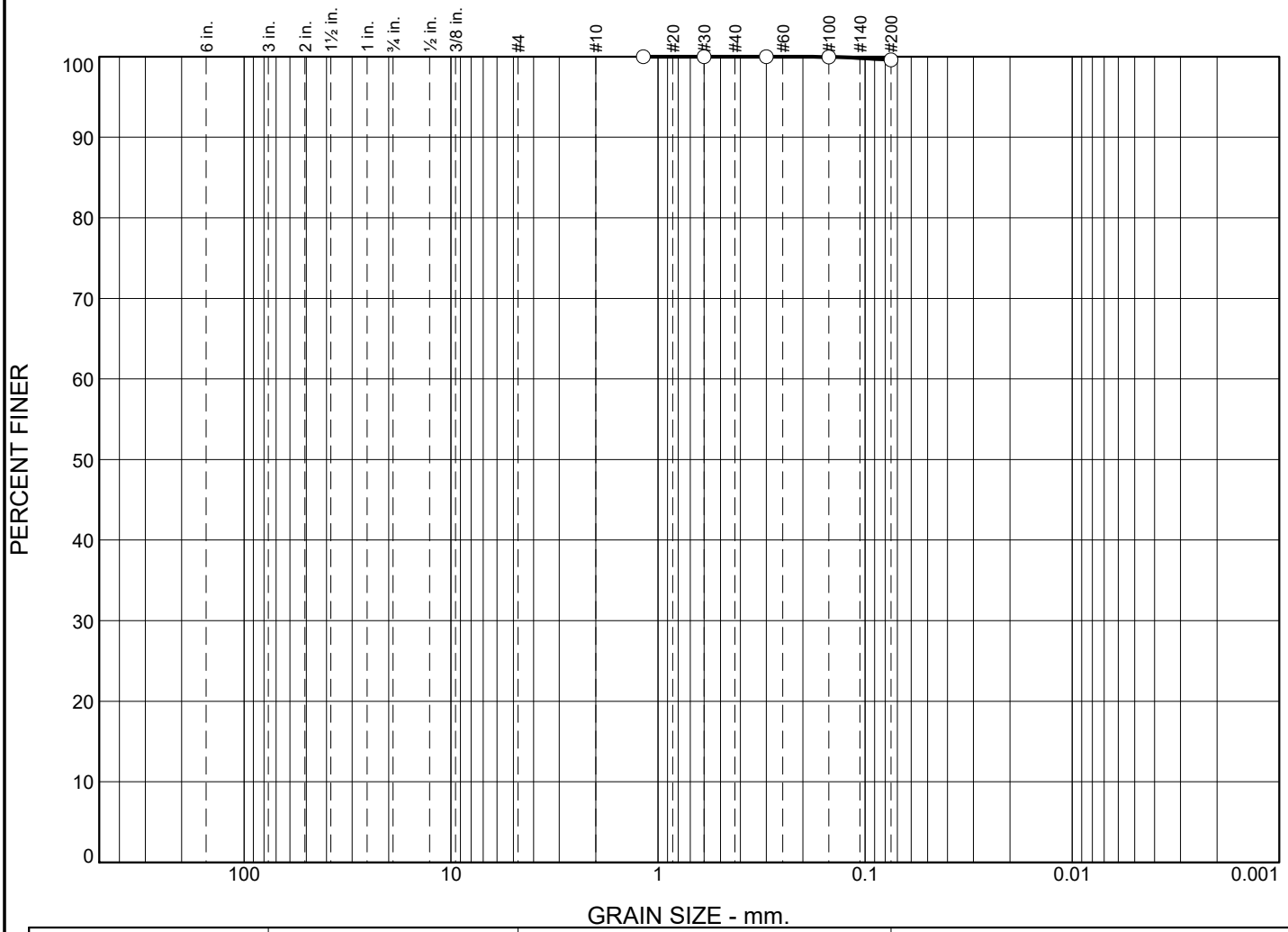
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Figure

Tested By: E. Driscoll 5/12/23 **Checked By:** E. Fazlic 5/12/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	0.4	99.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										

	Material Description	USCS	AASHTO
○	SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-106 **Depth:** 8-10 ft **Sample Number:** S5

Remarks:

○ As Received WC=32.3%

Fines classified visually

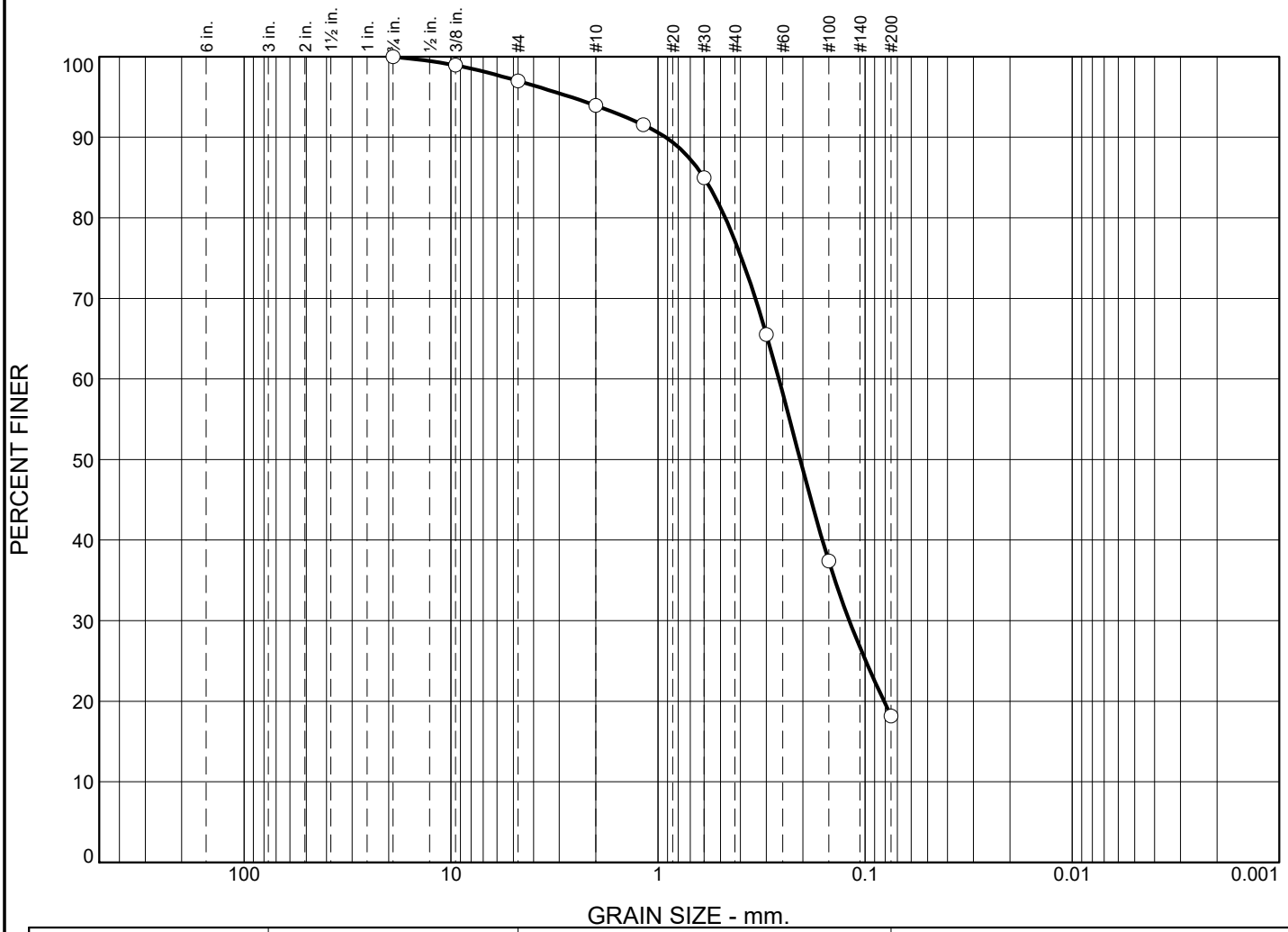
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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** E. Fazlic 5/12/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	3.0	3.1	16.8	59.0	18.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.6013	0.2611	0.2059	0.1193				

	Material Description	USCS	AASHTO
○	Silty SAND	SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-107 **Depth:** 2-4 ft **Sample Number:** S2

Remarks:

○ As Received WC=10.3%

Fines classified visually

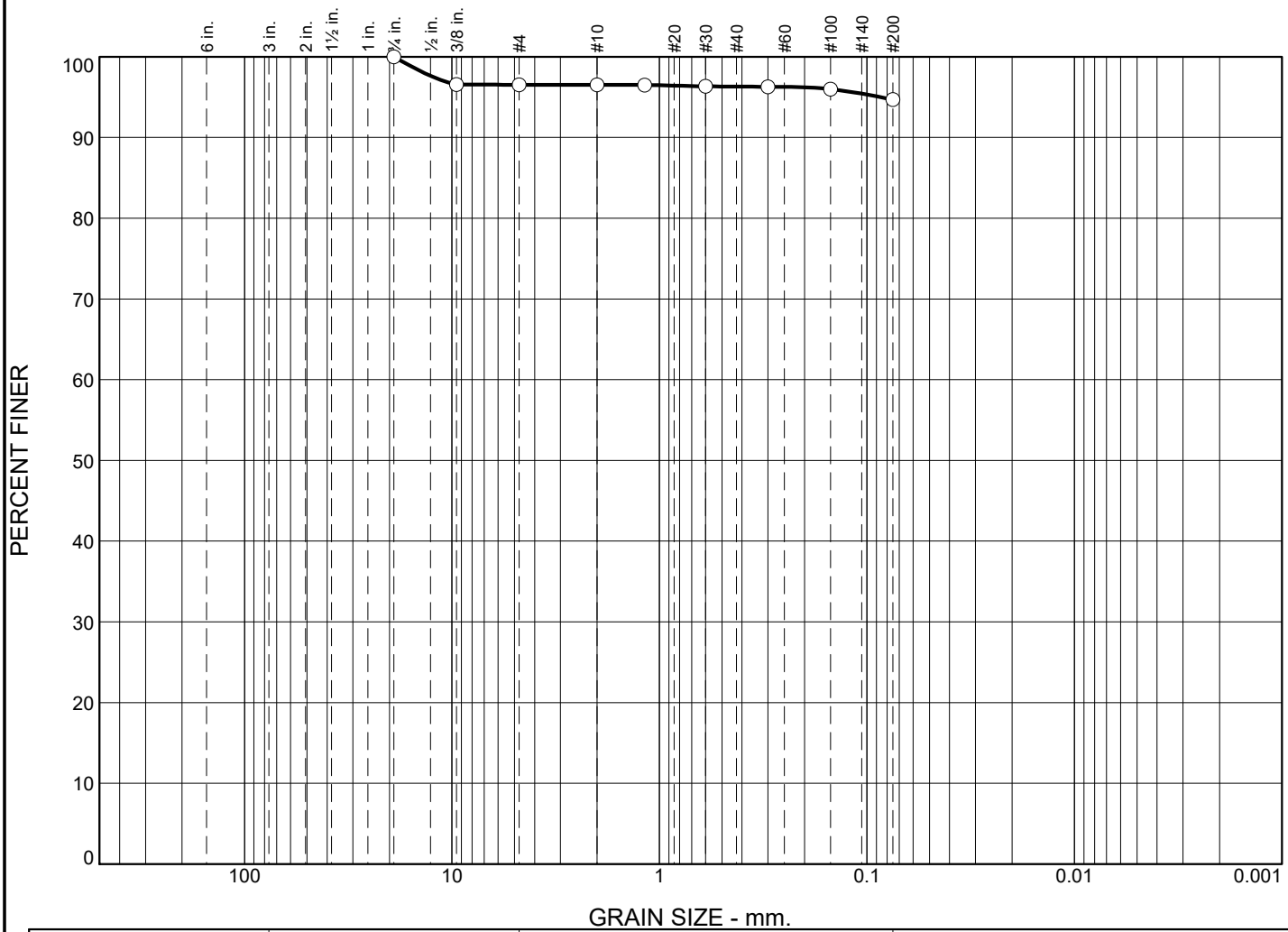
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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** E. Fazlic 5/12/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	3.5	0.0	0.2	1.6	94.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										

Material Description	USCS	AASHTO
○ SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-107 **Depth:** 14-16 ft **Sample Number:** S6

Remarks:

○ As received WC = 31.3%

Fines visually classified

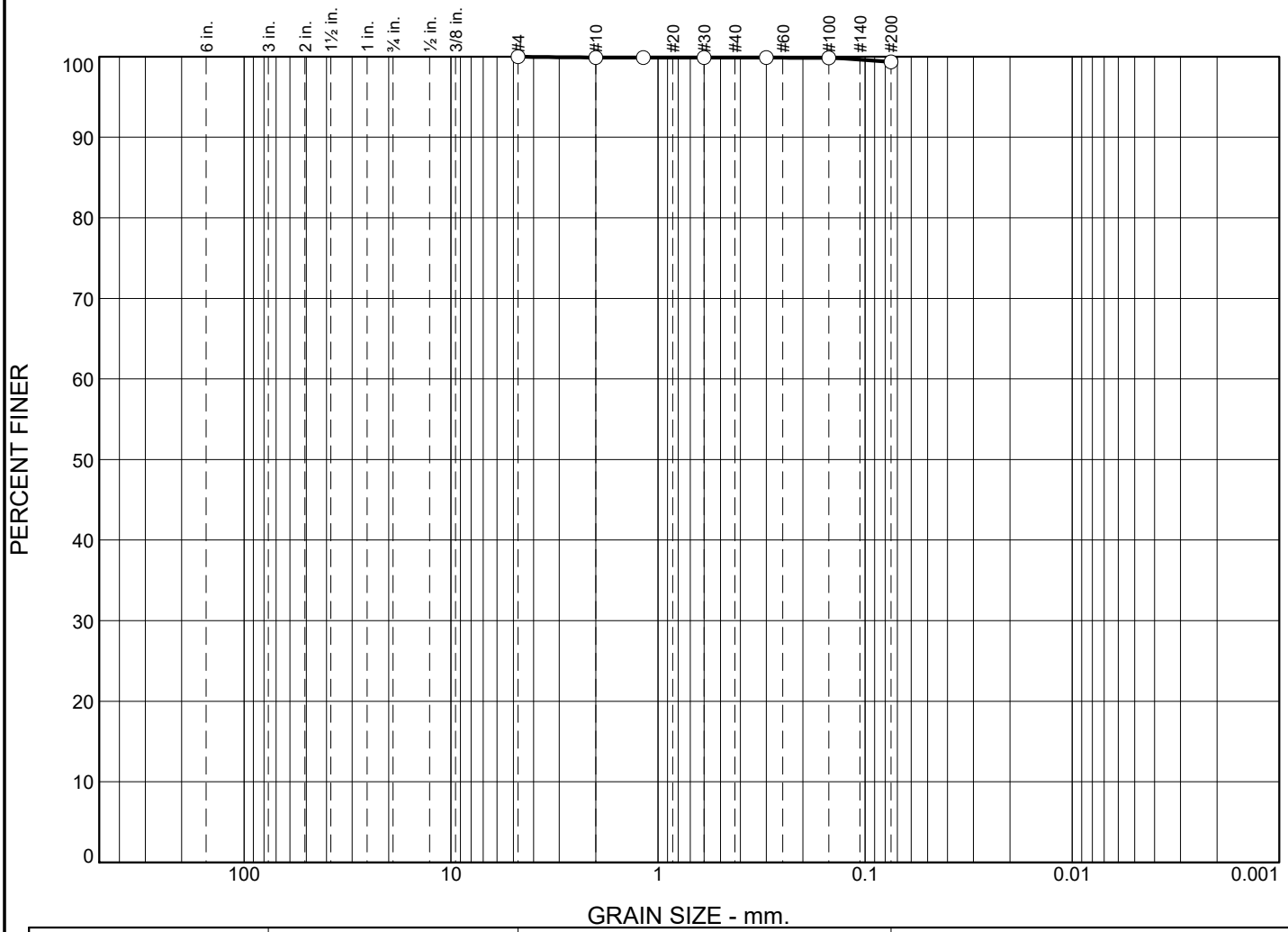
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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** E. Fazlic 5/12/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	0.0	0.6	99.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										

Material Description	USCS	AASHTO
○ SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-107 **Depth:** 19-21 ft **Sample Number:** S7

Remarks:

○ As Received WC=32.6%

Fines classified visually

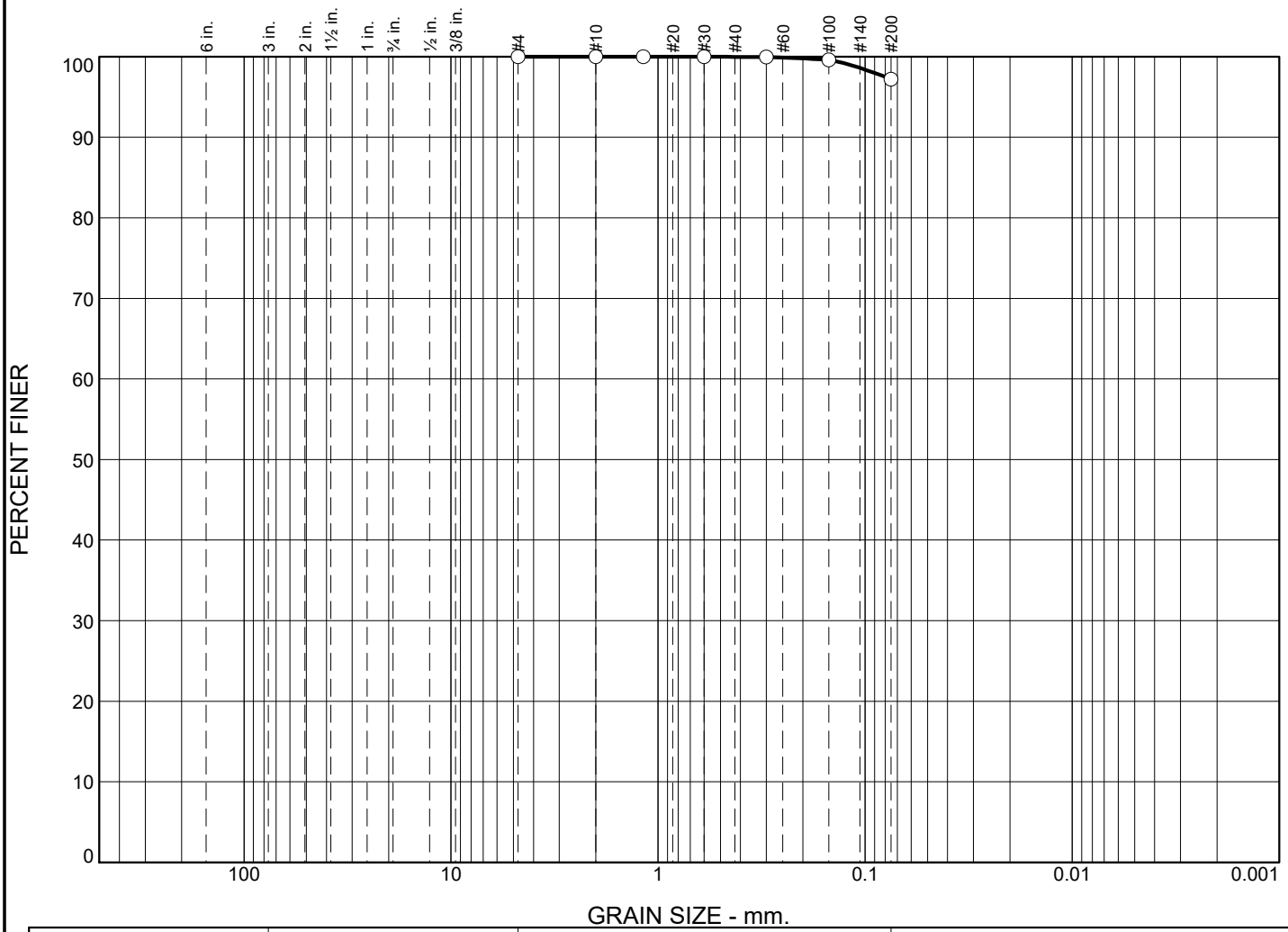
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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** E. Fazlic 5/12/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	2.8	97.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○										

Material Description	USCS	AASHTO
○ SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** B-107 **Depth:** 24-26 ft **Sample Number:** S8

Remarks:

○ As Received WC=33.5%

Fines classified visually

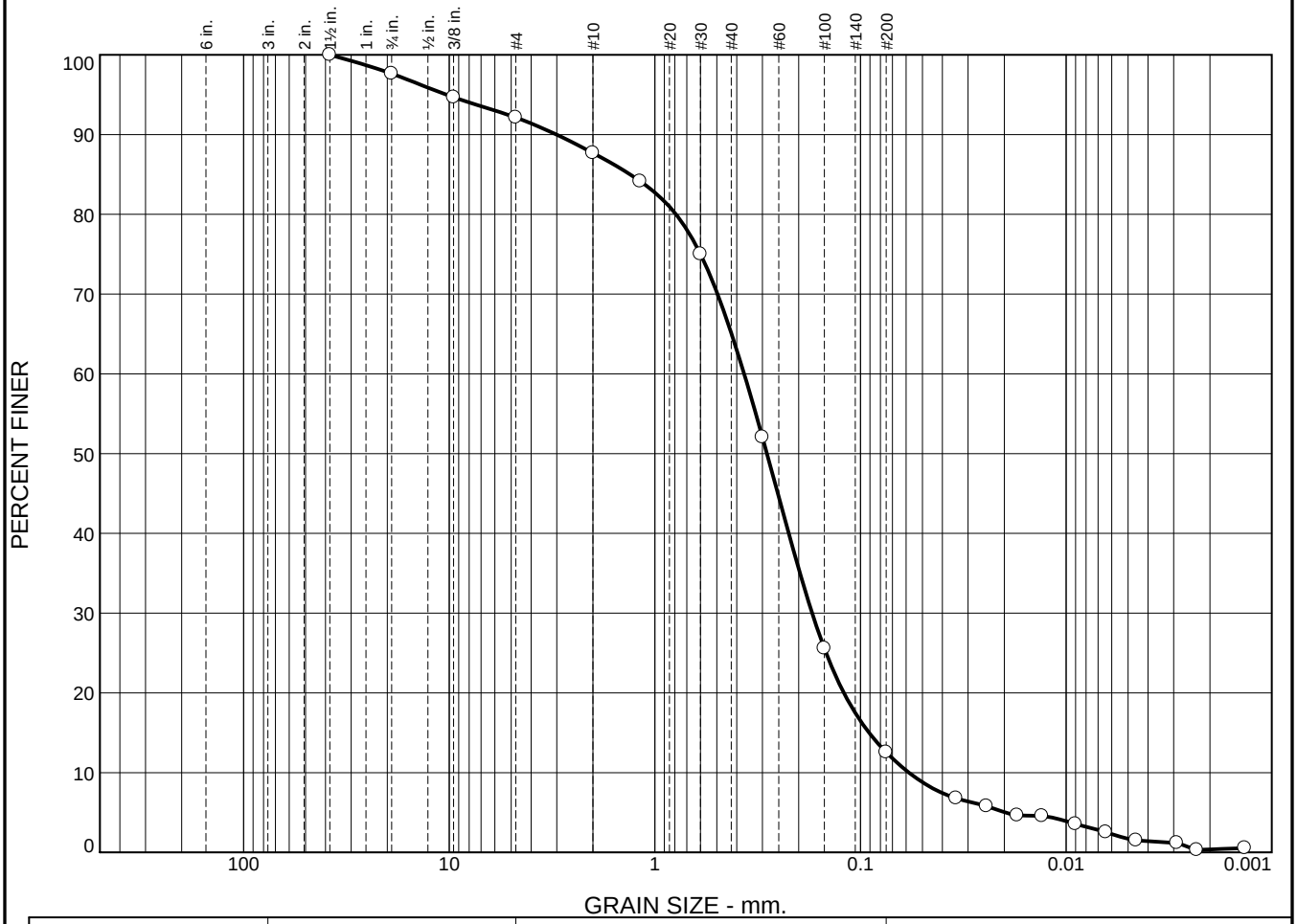
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Figure

Tested By: M. Alstede 5/11/23 **Checked By:** E. Fazlic 5/12/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	2.4	5.5	4.4	22.6	52.5	10.9	1.7

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			1.3203	0.3681	0.2851	0.1718	0.0909	0.0582	1.38	6.33

Material Description	USCS	AASHTO
○ Silty SAND	SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-101 **Depth:** 1.0-2.5 ft **Sample Number:** G1

Remarks:

○As received WC=7.7%.

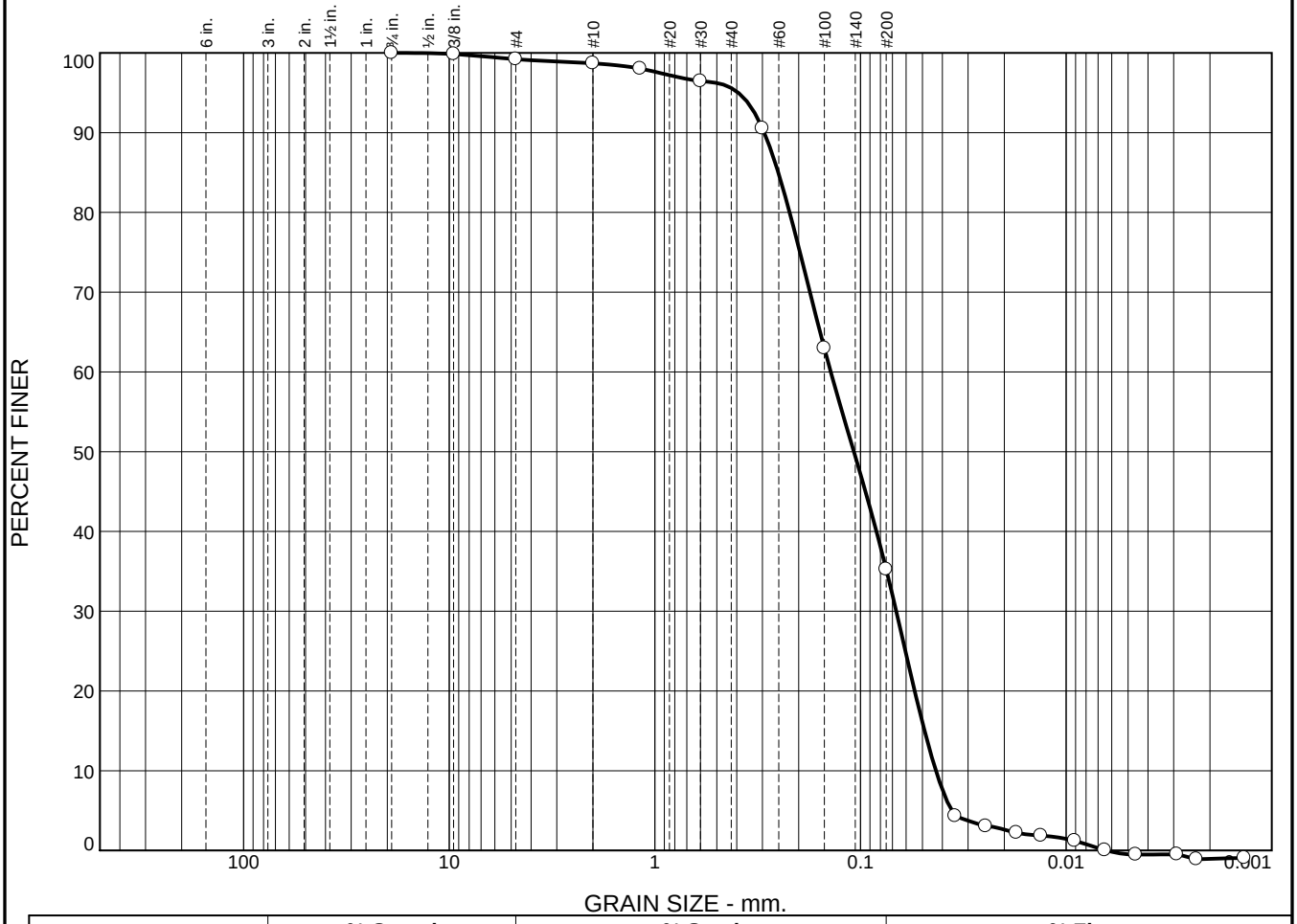
Fines visually classified.

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Woburn, MA 01801

Figure

Tested By: A. Han 5/15/23 **Checked By:** M. Alstede 5/16/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.8	0.5	3.1	60.3	35.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.2513	0.1395	0.1078	0.0670	0.0488	0.0430	0.75	3.24

Material Description	USCS	AASHTO
○ Silty SAND	SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-101 **Depth:** 3-4 ft **Sample Number:** G2

Remarks:

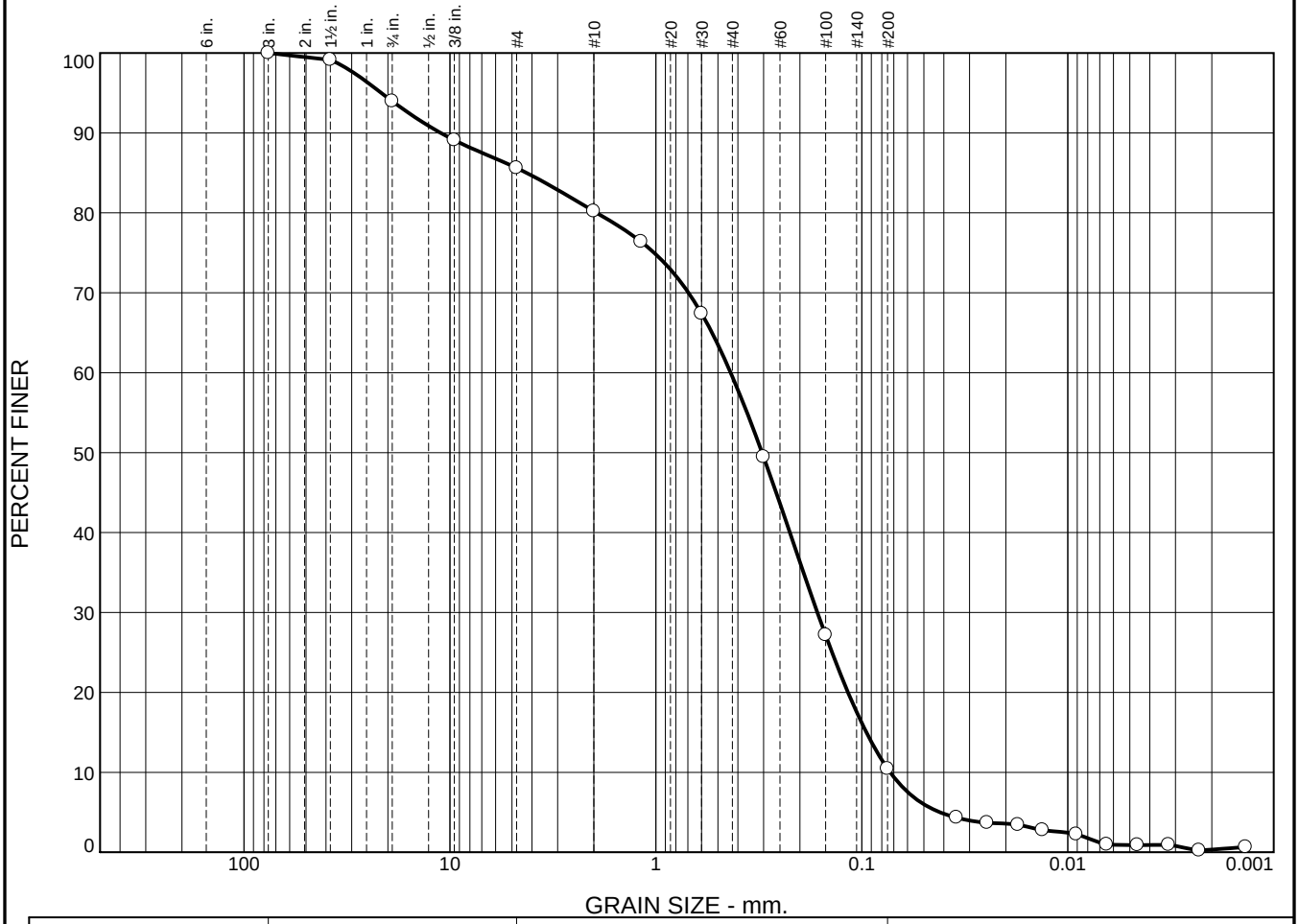
○As received WC=12.9%. Fines visually classified.

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Woburn, MA 01801

Figure

Tested By: A. Han 5/15/23 **Checked By:** M. Alstede 5/16/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	6.0	8.4	5.4	20.7	49.0	9.6	0.9

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			4.2423	0.4333	0.3052	0.1643	0.0951	0.0728	0.86	5.95

Material Description	USCS	AASHTO
○ Narrowly Graded SAND with Silt	SP-SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-102 **Depth:** 1-2 ft **Sample Number:** G1

Remarks:

○As Received WC=6.2%

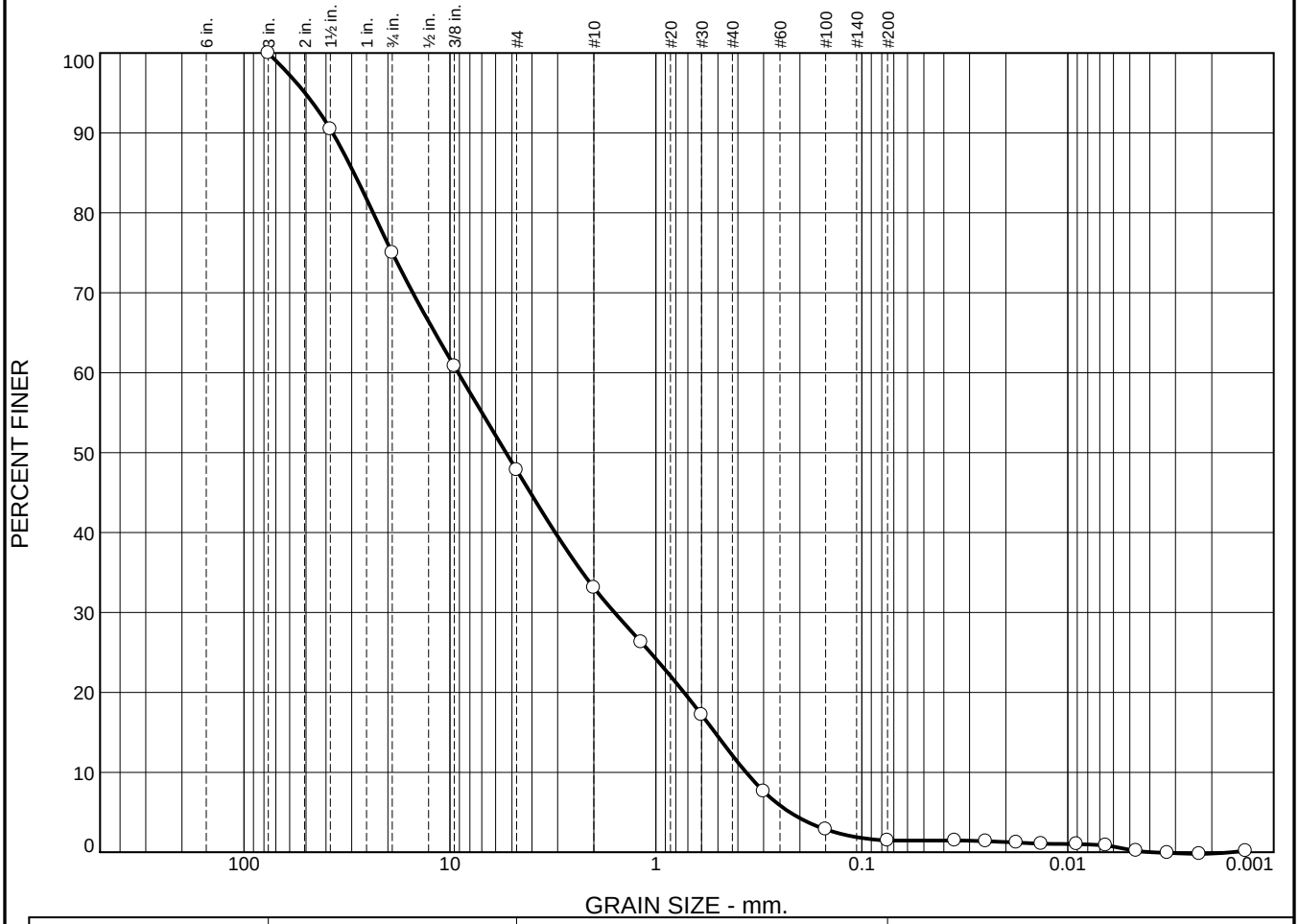
Fines classified visually

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Woburn, MA 01801

Figure

Tested By: M. Alstede 5/19/23 **Checked By:** A. Han 5/23/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	25.0	27.2	14.7	21.0	10.6	1.2	0.3

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			29.2632	9.1204	5.3418	1.5882	0.5172	0.3647	0.76	25.01

Material Description	USCS	AASHTO
○ Narrowly Graded GRAVEL with Sand	GP	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-102 **Depth:** 6-7 ft **Sample Number:** G2

Remarks:

○As received WC = 1.0%

Fines visually classified

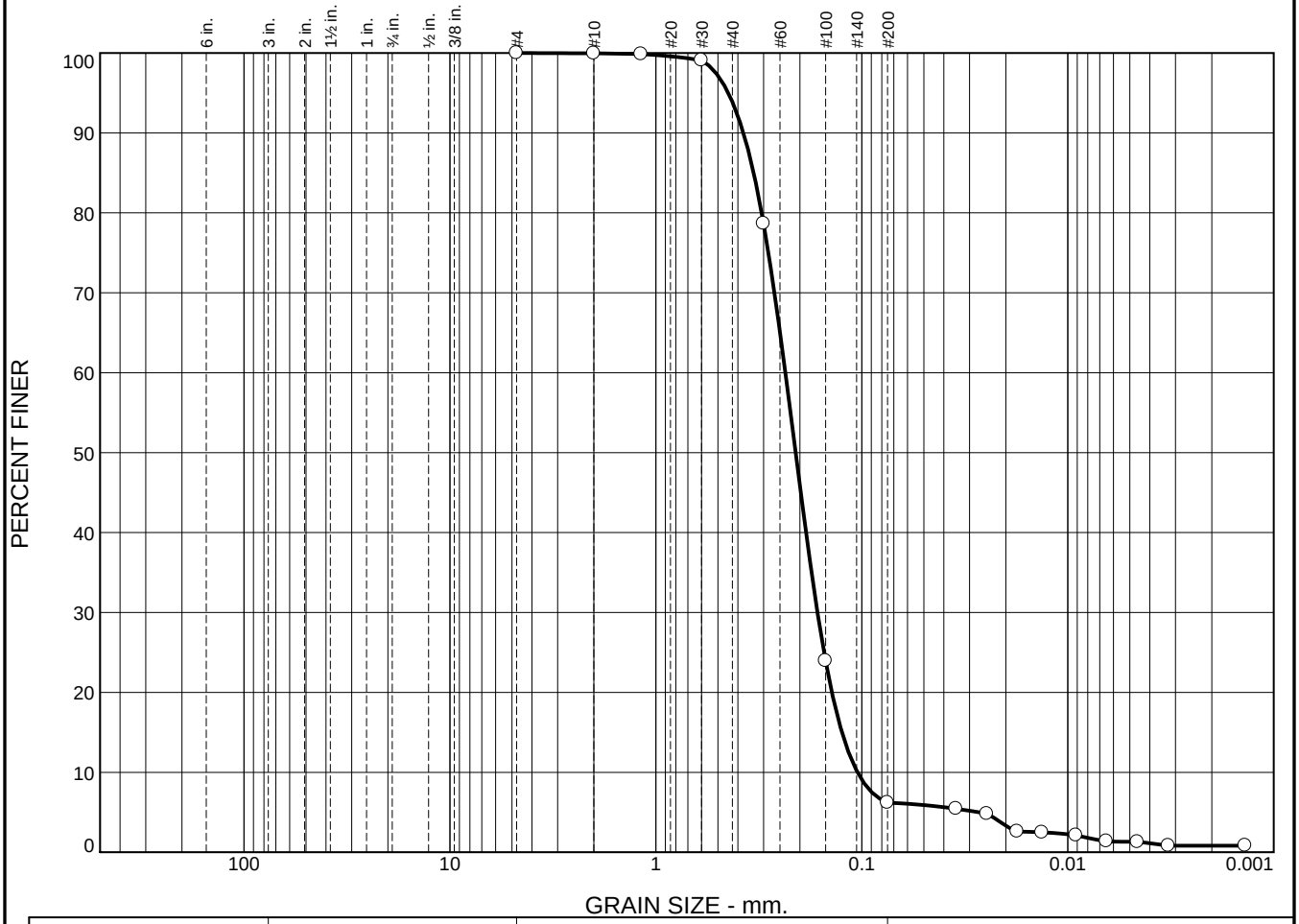
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Figure

Tested By: A. Cali 5/22/23 **Checked By:** M. Alstede 5/23/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	6.1	87.7	4.9	1.3

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.3352	0.2353	0.2096	0.1642	0.1249	0.1051	1.09	2.24

Material Description	USCS	AASHTO
○ Narrowly Graded SAND	SP	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-103 **Depth:** 7.5-8.0 ft **Sample Number:** G3

Remarks:

○As Received WC=28.2%

Fines classified visually

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Figure

Tested By: M. Alstede 5/19/23 **Checked By:** A. Han 5/23/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.3	3.2	91.6	4.9

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.0521	0.0311	0.0255	0.0163	0.0104	0.0087	0.98	3.60

Material Description	USCS	AASHTO
○ SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-104 **Depth:** 3-4 ft **Sample Number:** G3

Remarks:

○As Received WC=26.5%

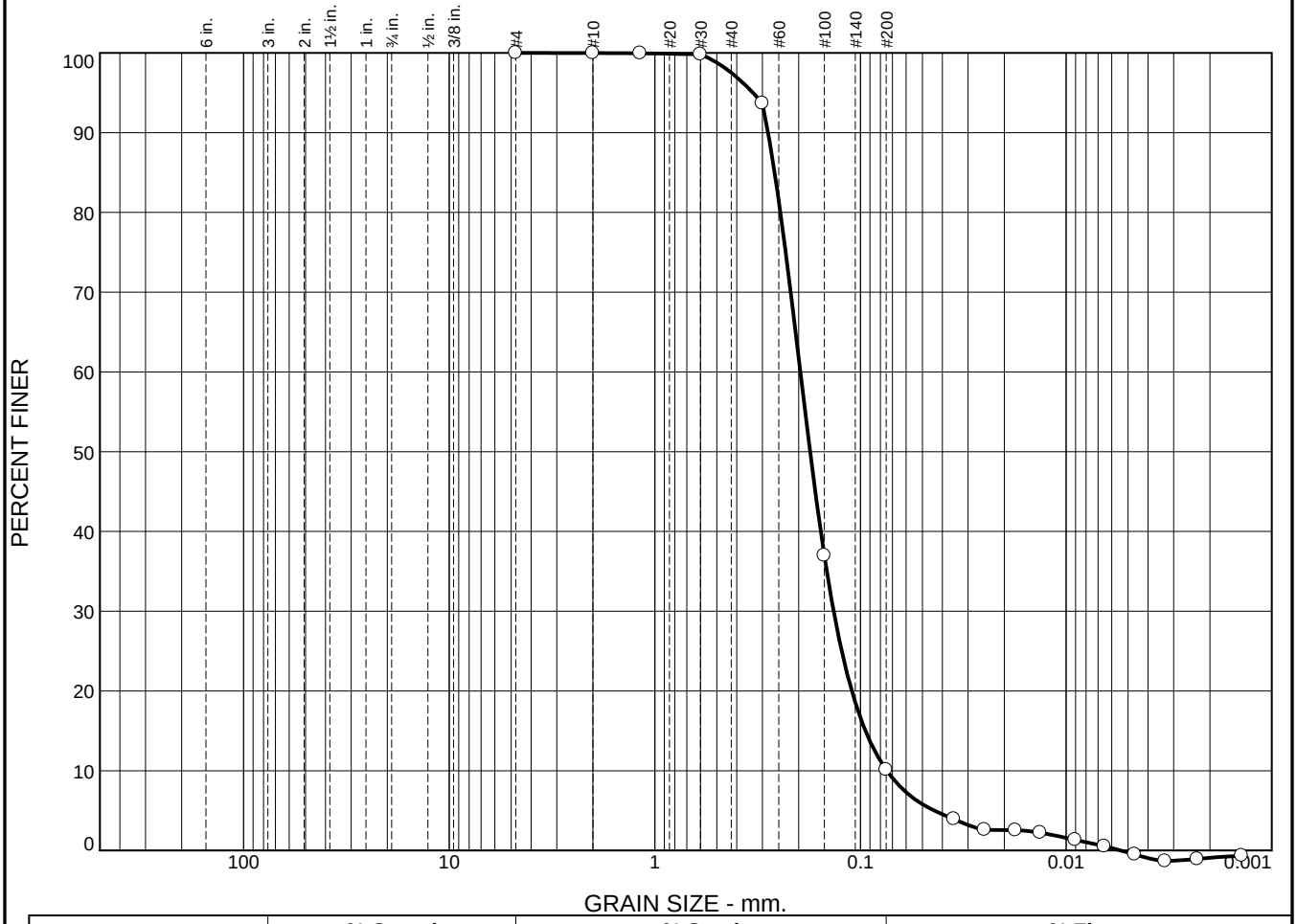
Fines classified visually

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Figure

Tested By: M. Alstede 5/19/23 **Checked By:** A. Han 5/23/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	2.5	87.4	10.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.2616	0.1961	0.1757	0.1352	0.0947	0.0744	1.25	2.64

Material Description	USCS	AASHTO
○ Narrowly Graded SAND with Silt	SP-SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-105 **Depth:** 3-4 ft **Sample Number:** G2

Remarks:

○As received WC = 10.6%

Fines visually classified

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Figure

Tested By: A.Cali 5/22/23 **Checked By:** M. Alstede 5/23/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	21.0	77.4	1.5

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_u
○			0.0836	0.0588	0.0525	0.0417	0.0329	0.0267	1.11	2.20

	Material Description	USCS	AASHTO
○	SILT with Sand	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-105 **Depth:** 7-8 ft **Sample Number:** G3

Remarks:

○As Received WC=27.1%

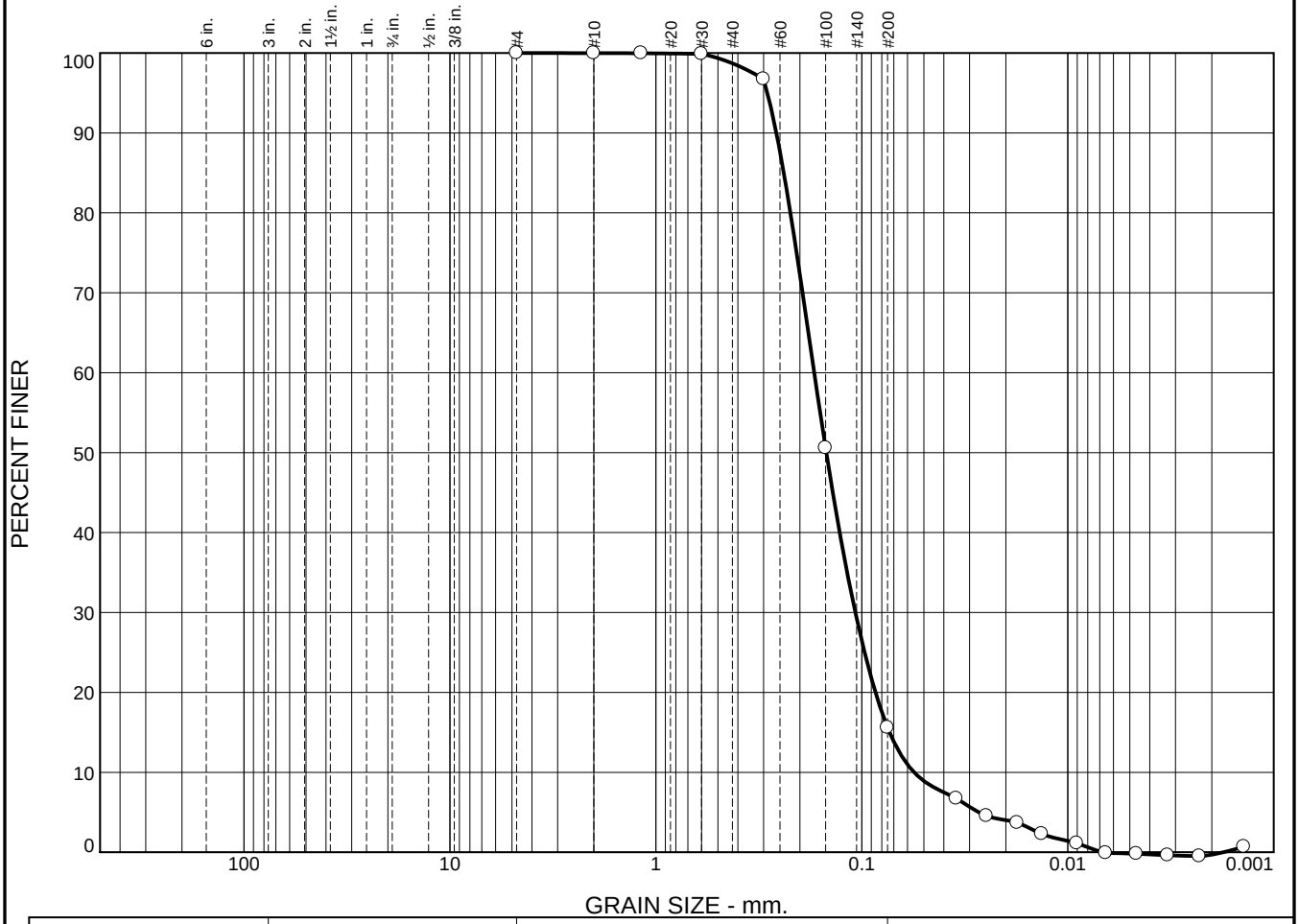
Fines classified visually

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Woburn, MA 01801

Figure

Tested By: M. Alstede 5/19/23 **Checked By:** A. Han 5/23/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	1.3	83.1	15.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.2394	0.1702	0.1488	0.1075	0.0733	0.0558	1.22	3.05

Material Description	USCS	AASHTO
○ Silty SAND	SM	-

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-106 **Depth:** 3-4 ft **Sample Number:** G1

Remarks:

○As received WC = 12.7%

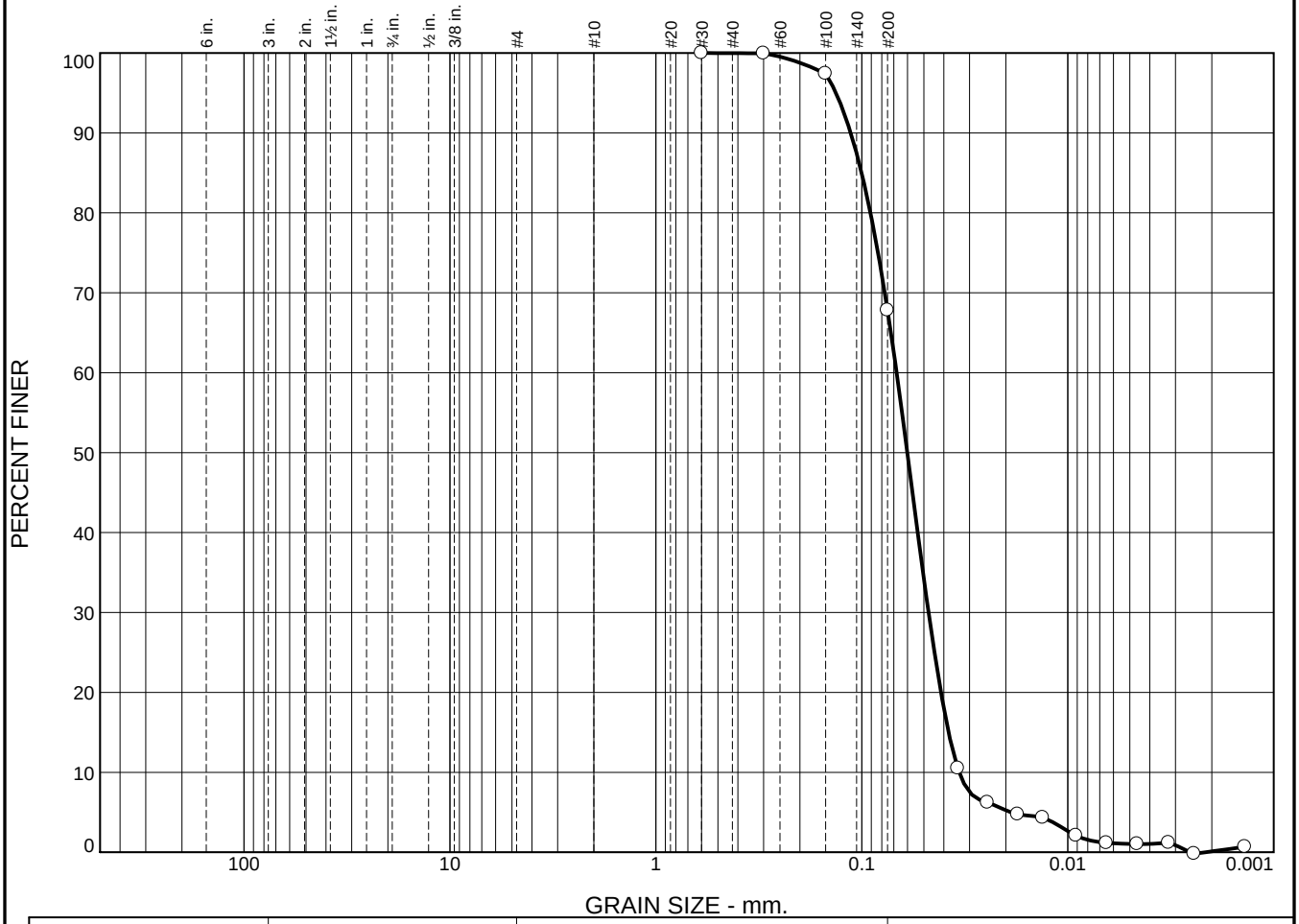
Fines visually classified

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

Figure

Tested By: A.Cali 5/22/23 **Checked By:** M. Alstede 5/23/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	32.2	66.8	1.0

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1003	0.0678	0.0602	0.0474	0.0379	0.0337	0.98	2.01

	Material Description	USCS	AASHTO
○	Sandy SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-106 **Depth:** 6-8 ft **Sample Number:** G2

Remarks:

○As Received WC=28.4%

Fines classified visually

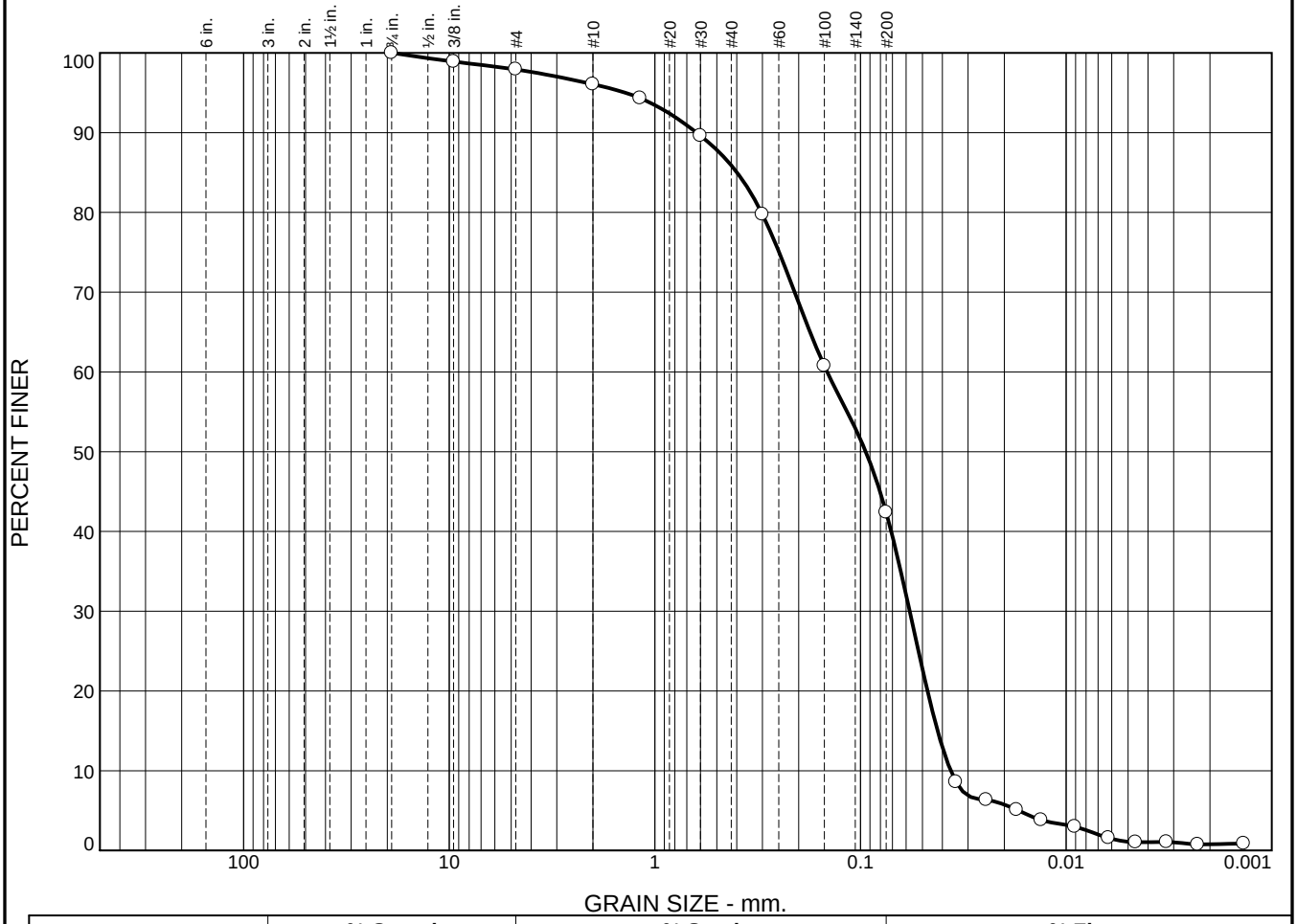
GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

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Figure

Tested By: M. Alstede 5/19/23 **Checked By:** A. Han 5/23/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	2.1	1.8	10.2	43.5	41.3	1.1

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.3985	0.1453	0.0944	0.0577	0.0422	0.0365	0.63	3.99

Material Description	USCS	AASHTO
○ Silty SAND	SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-109 **Depth:** 2.5-2.8 ft **Sample Number:** G2

Remarks:

○As Received WC=11.6%

Fines classified visually

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400 Unicorn Park Drive
Woburn, MA 01801

Figure

Tested By: M. Alstede 5/18/23 **Checked By:** A. Han 5/23/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.6	31.1	67.3	1.0

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1000	0.0672	0.0594	0.0464	0.0364	0.0312	1.02	2.15

Material Description	USCS	AASHTO
○ Sandy SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-109 **Depth:** 8.5-8.7 ft **Sample Number:** G3

Remarks:

○As Received WC=9.6%

Fines classified visually

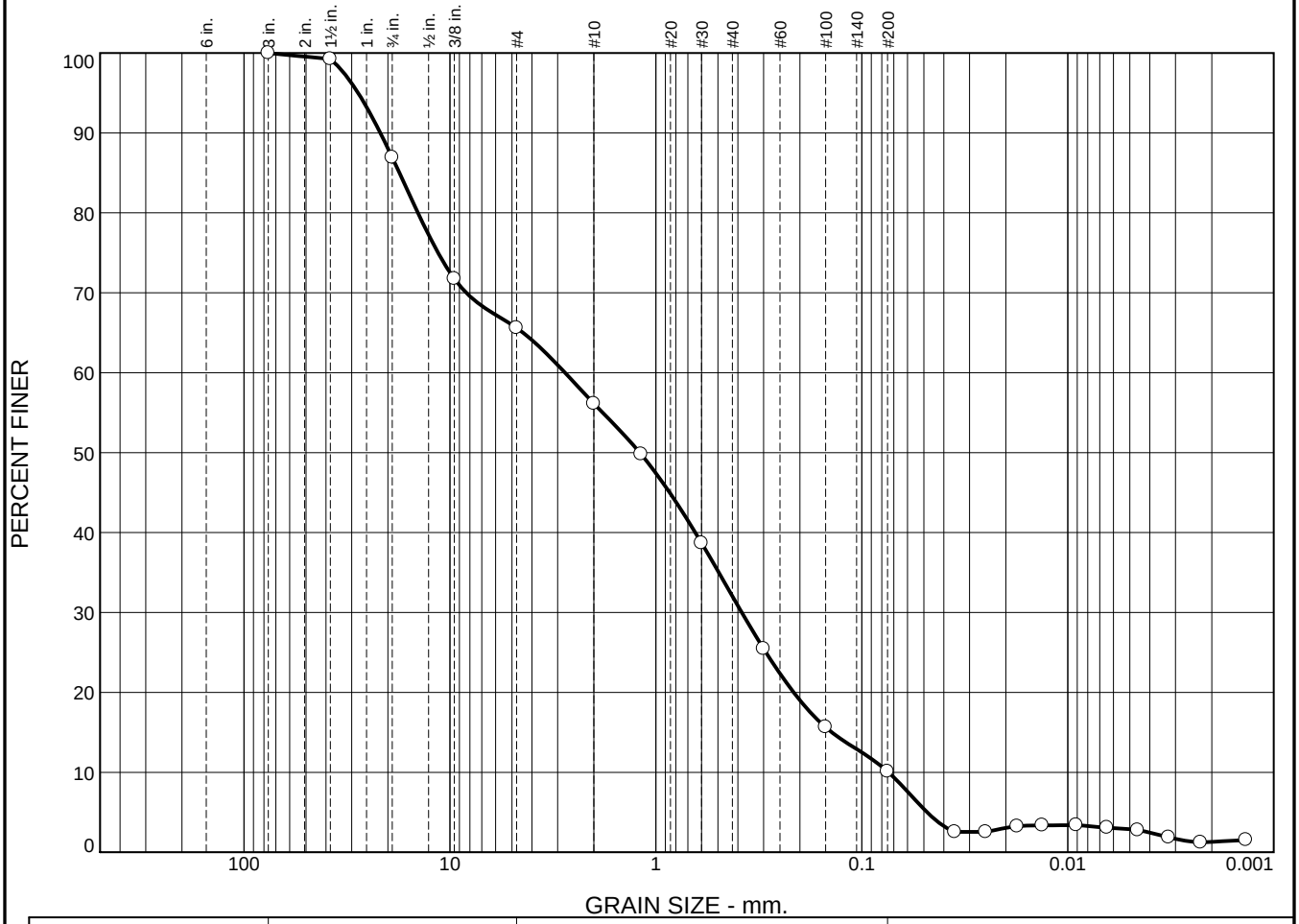
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Woburn, MA 01801

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Figure

Tested By: M. Alstede 5/18/23 **Checked By:** A. Han 5/23/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	13.1	21.3	9.5	24.1	21.9	7.2	2.9

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_u
○			17.5812	2.7611	1.1973	0.3827	0.1398	0.0742	0.71	37.21

Material Description	USCS	AASHTO
○ Narrowly Graded SAND with Silt and Gravel	SP-SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-110 **Depth:** 1-1.5 ft **Sample Number:** G1

Remarks:

○As received WC = 6.0%

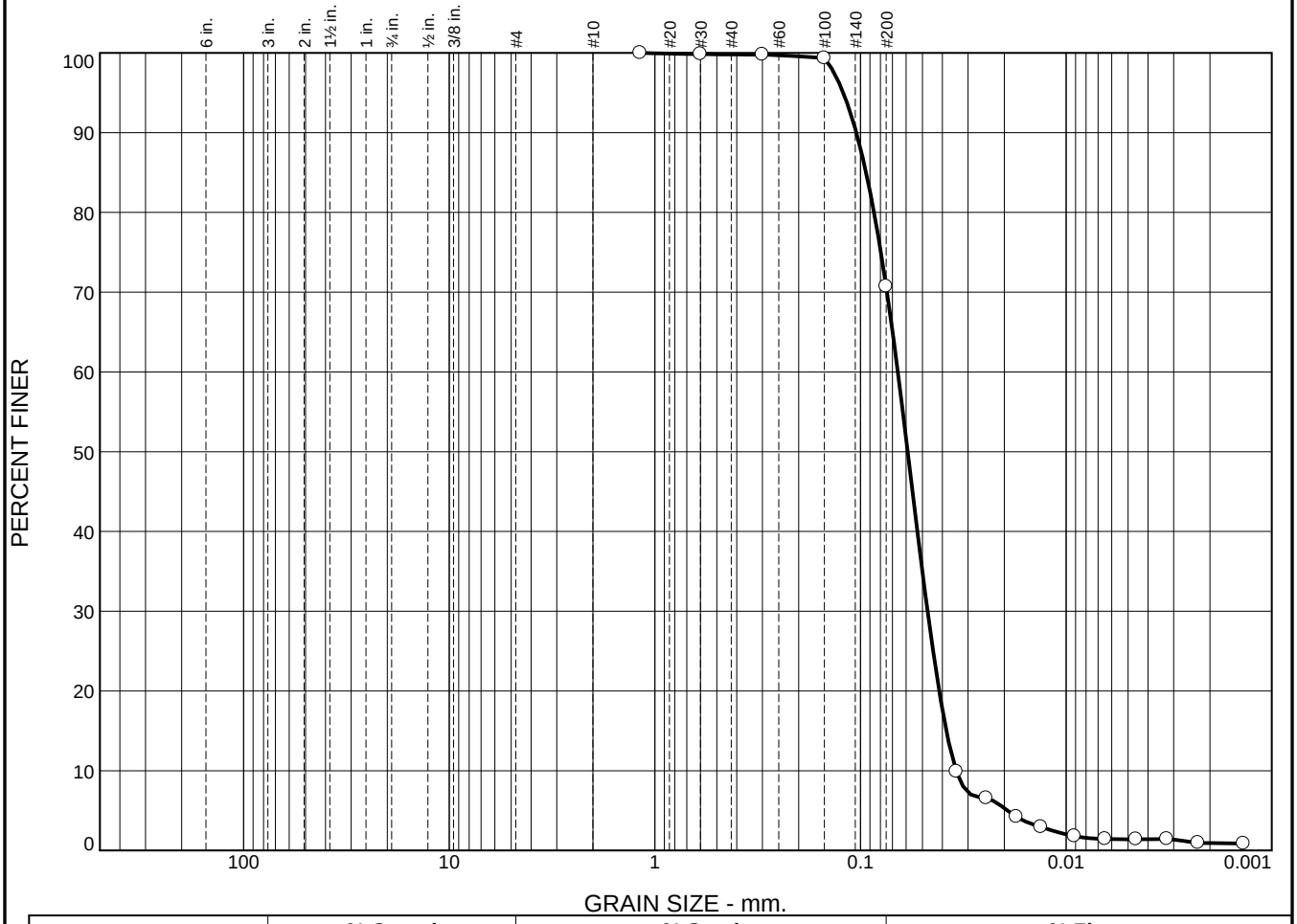
Fines Visually Classified

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

Figure

Tested By: A.Cali 5/22/23 **Checked By:** M. Alstede 5/23/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	29.1	69.3	1.4

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_u
○			0.0940	0.0659	0.0590	0.0472	0.0383	0.0343	0.99	1.92

Material Description	USCS	AASHTO
○ Sandy SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-110 **Depth:** 6.5-7.0 ft **Sample Number:** G2

Remarks:

○As Received WC=9.9%

Fines classified visually

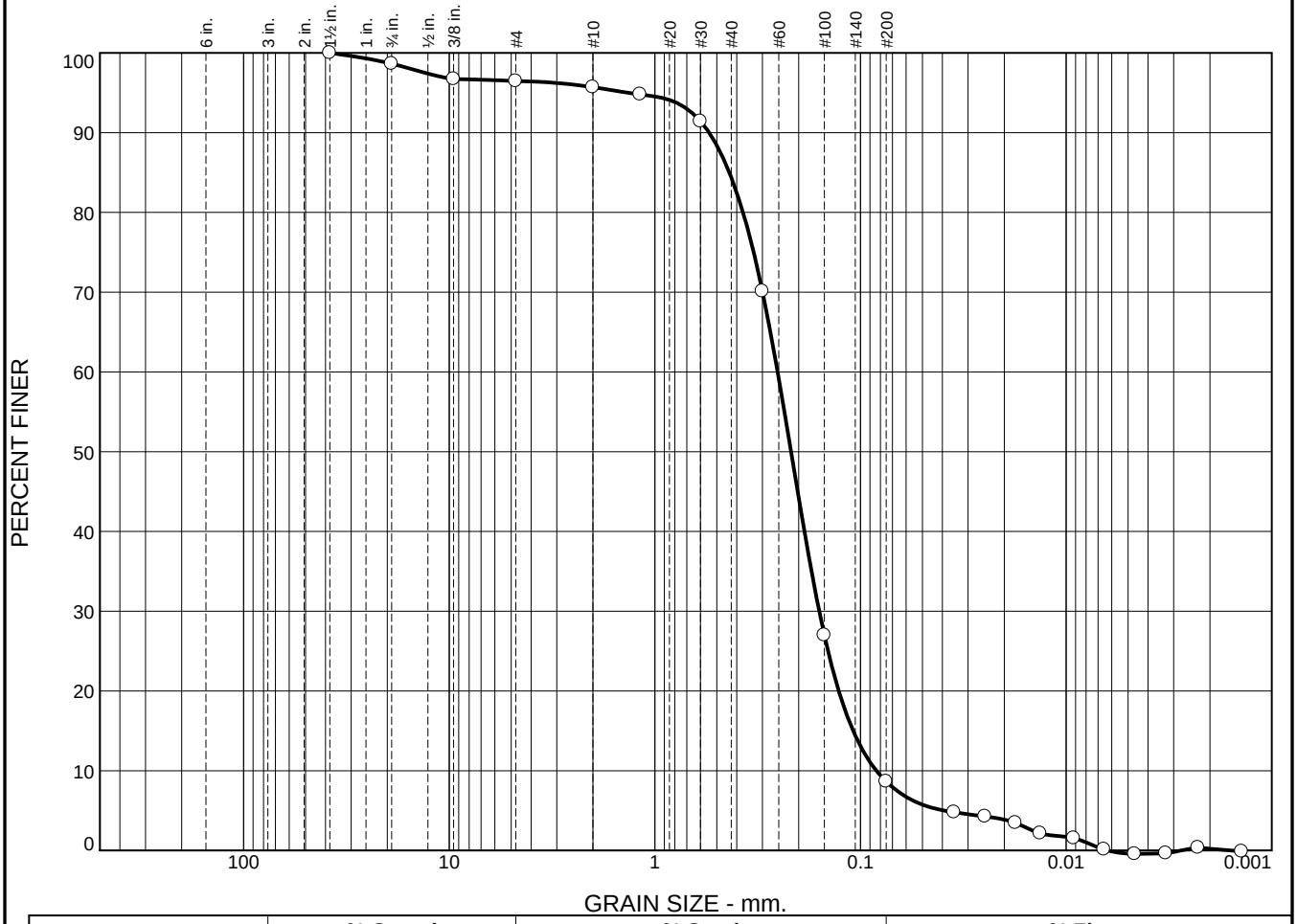
GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

GEI Consultants

Figure

Tested By: M. Alstede 5/18/23 **Checked By:** A. Han 5/23/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	1.4	2.1	0.8	11.3	75.8	8.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.4343	0.2532	0.2177	0.1588	0.1086	0.0838	1.19	3.02

Material Description	USCS	AASHTO
○ Narrowly Graded SAND with Silt	SP-SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-111 **Depth:** 3-4 ft **Sample Number:** G2

Remarks:

○As received WC = 8.7%

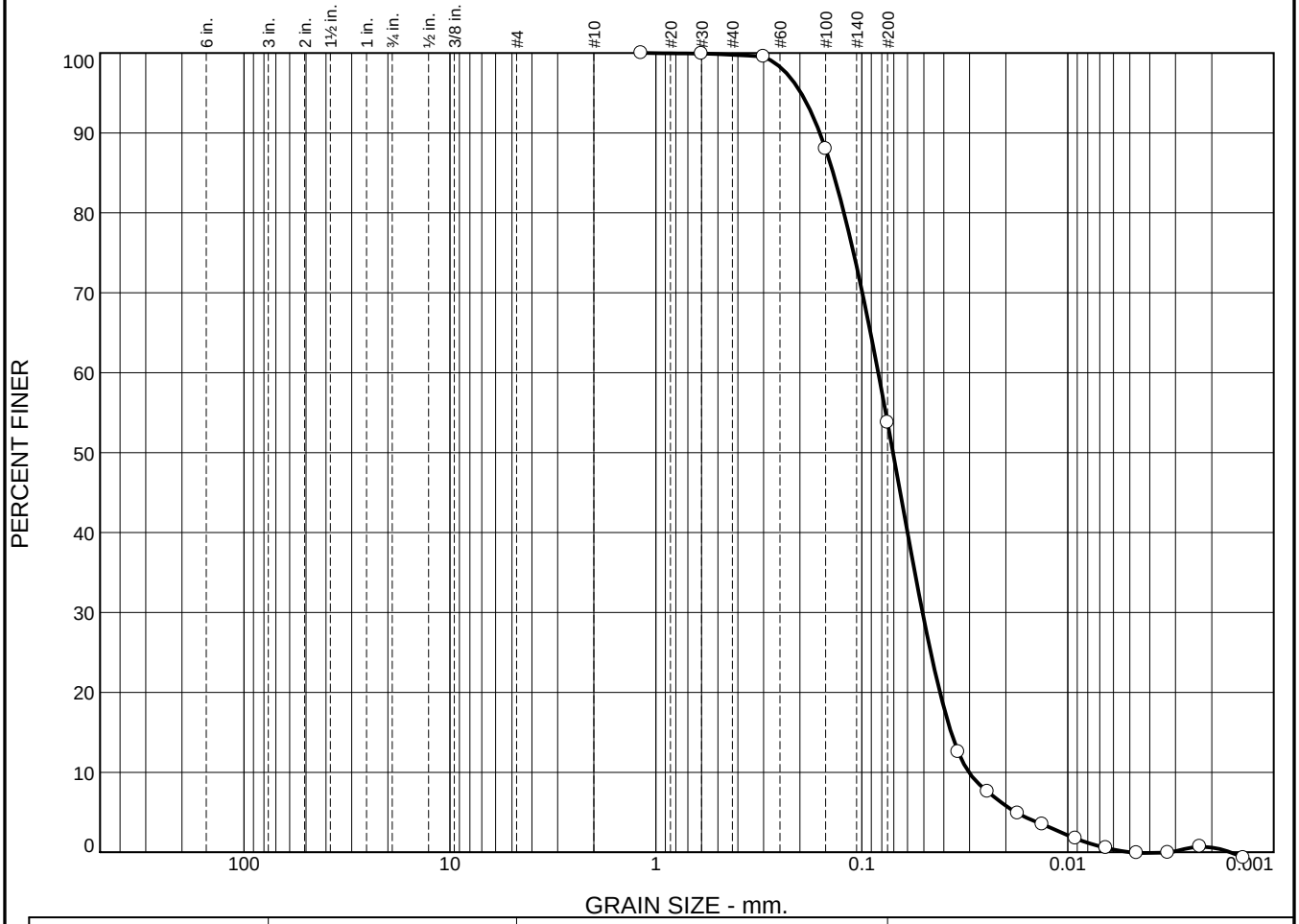
Fines Visually Classified

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400 Unicorn Park Drive
Woburn, MA 01801

Figure

Tested By: A. Cali 5/22/23 **Checked By:** M. Alstede 5/23/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	46.0	53.8	0.0

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1378	0.0832	0.0705	0.0507	0.0369	0.0302	1.02	2.76

Material Description	USCS	AASHTO
○ Sandy SILT	ML	-

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-111 **Depth:** 10-10.5 ft **Sample Number:** G4

Remarks:

○As received WC = 11.5%

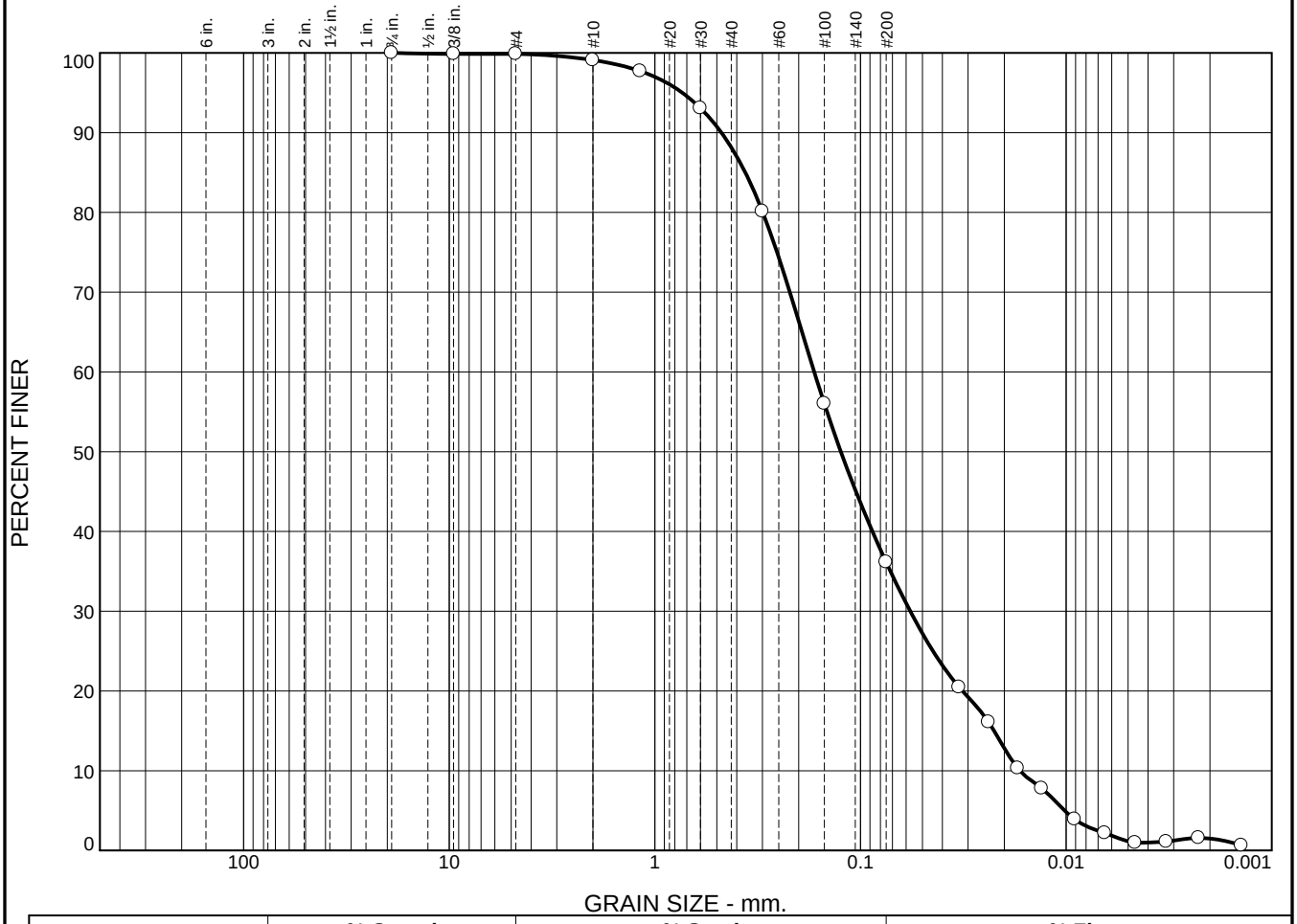
Fines visually classified

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400 Unicorn Park Drive
Woburn, MA 01801

Figure

Tested By: A. Cali 5/22/23 **Checked By:** M. Alstede 5/23/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.1	0.8	10.9	52.1	34.9	1.2

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.3633	0.1678	0.1247	0.0573	0.0224	0.0168	1.16	9.99

Material Description	USCS	AASHTO
○ Silty SAND	SM	-

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-112 **Depth:** 5.5-6.0 ft **Sample Number:** G2

Remarks:

○As received WC = 13.1%

Fines Visually Classified

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Woburn, MA 01801

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Figure

Tested By: A. Cali 5/22/23 **Checked By:** M. Alstede 5/23/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.2	2.7	52.3	44.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_u
○			0.2242	0.1115	0.0849	0.0555	0.0399	0.0340	0.81	3.28

Material Description	USCS	AASHTO
○ Silty SAND	SM	-

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-112 **Depth:** 9.8-10.0 ft **Sample Number:** G3

Remarks:

○As received WC = 11.9%

Fines visually classified

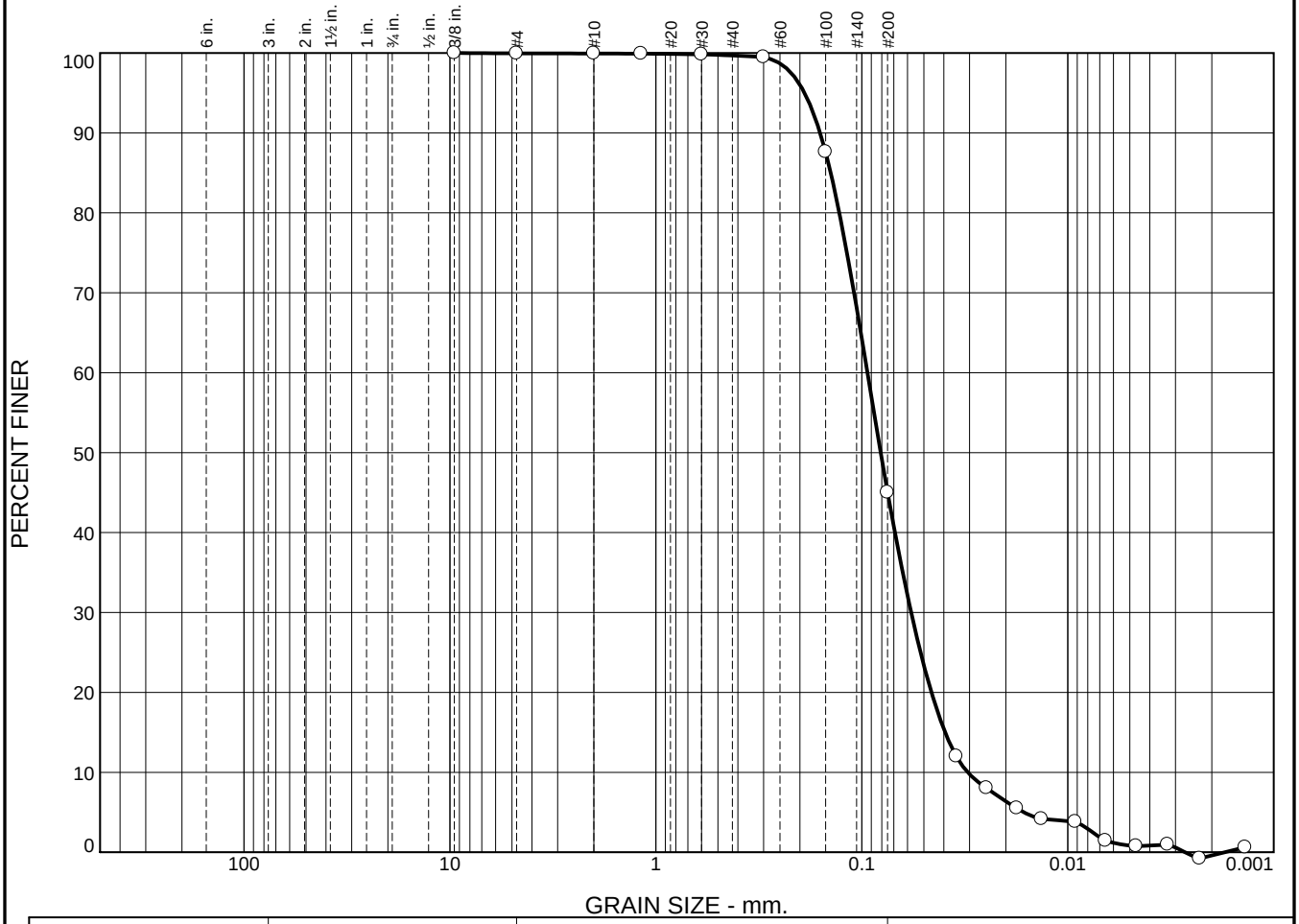
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Woburn, MA 01801

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Figure

Tested By: A. Cali 5/22/23 **Checked By:** M. Alstede 5/23/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	0.2	54.7	44.2	0.8

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1415	0.0940	0.0810	0.0576	0.0394	0.0306	1.15	3.07

Material Description	USCS	AASHTO
○ Silty SAND	SM	-

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-113 **Depth:** 7.5-8.5 ft **Sample Number:** G1

Remarks:

○As received WC = 24.6%

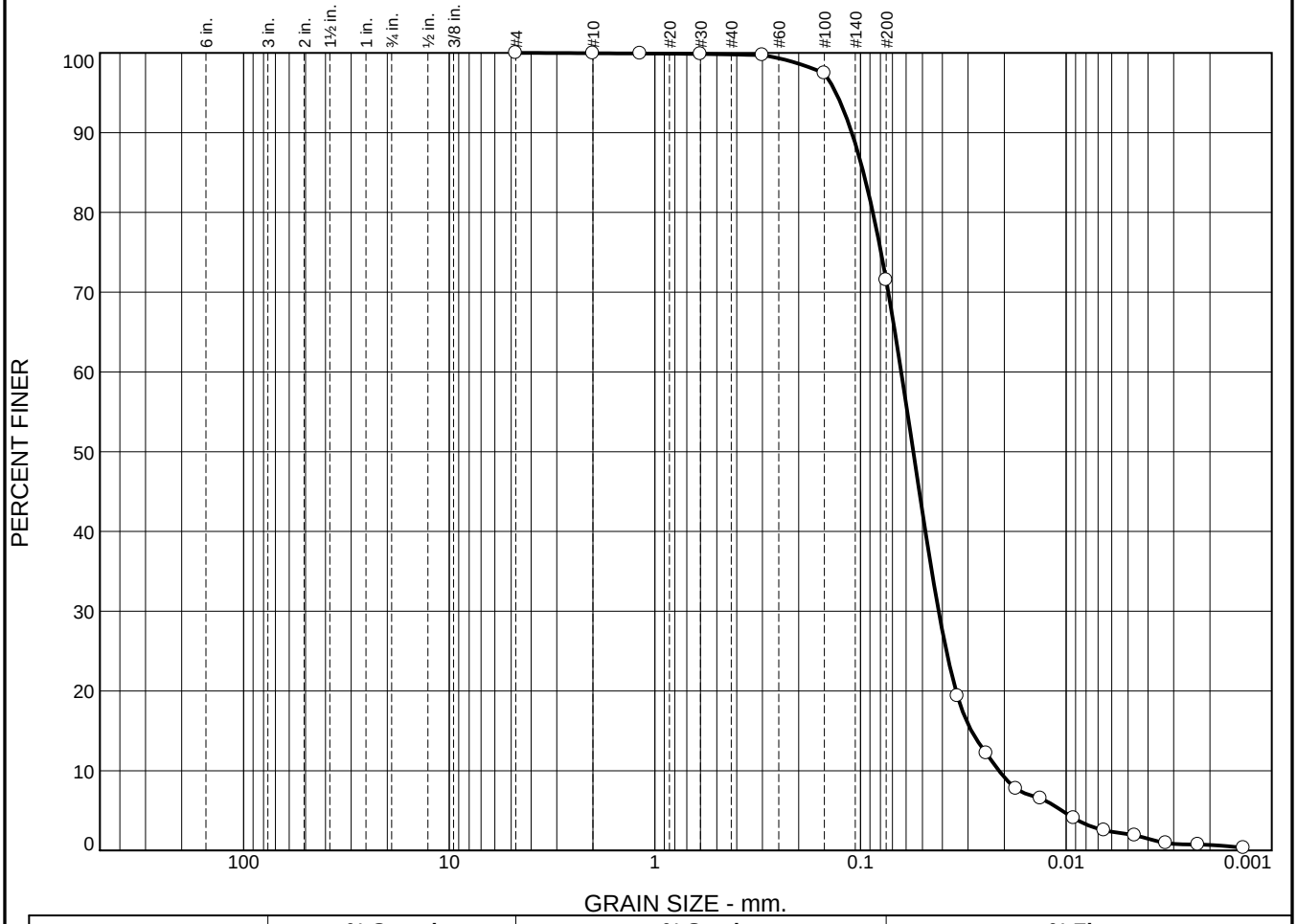
Fines visually classified

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Woburn, MA 01801

Figure

Tested By: A.Cali 5/22/23 **Checked By:** M. Alstede 5/23/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	28.3	69.4	2.1

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.0968	0.0634	0.0554	0.0417	0.0289	0.0212	1.29	2.99

Material Description	USCS	AASHTO
○ SILT with Sand	ML	-

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-114 **Depth:** 3-3.5 ft **Sample Number:** G1

Remarks:

○As received WC = 21.0%

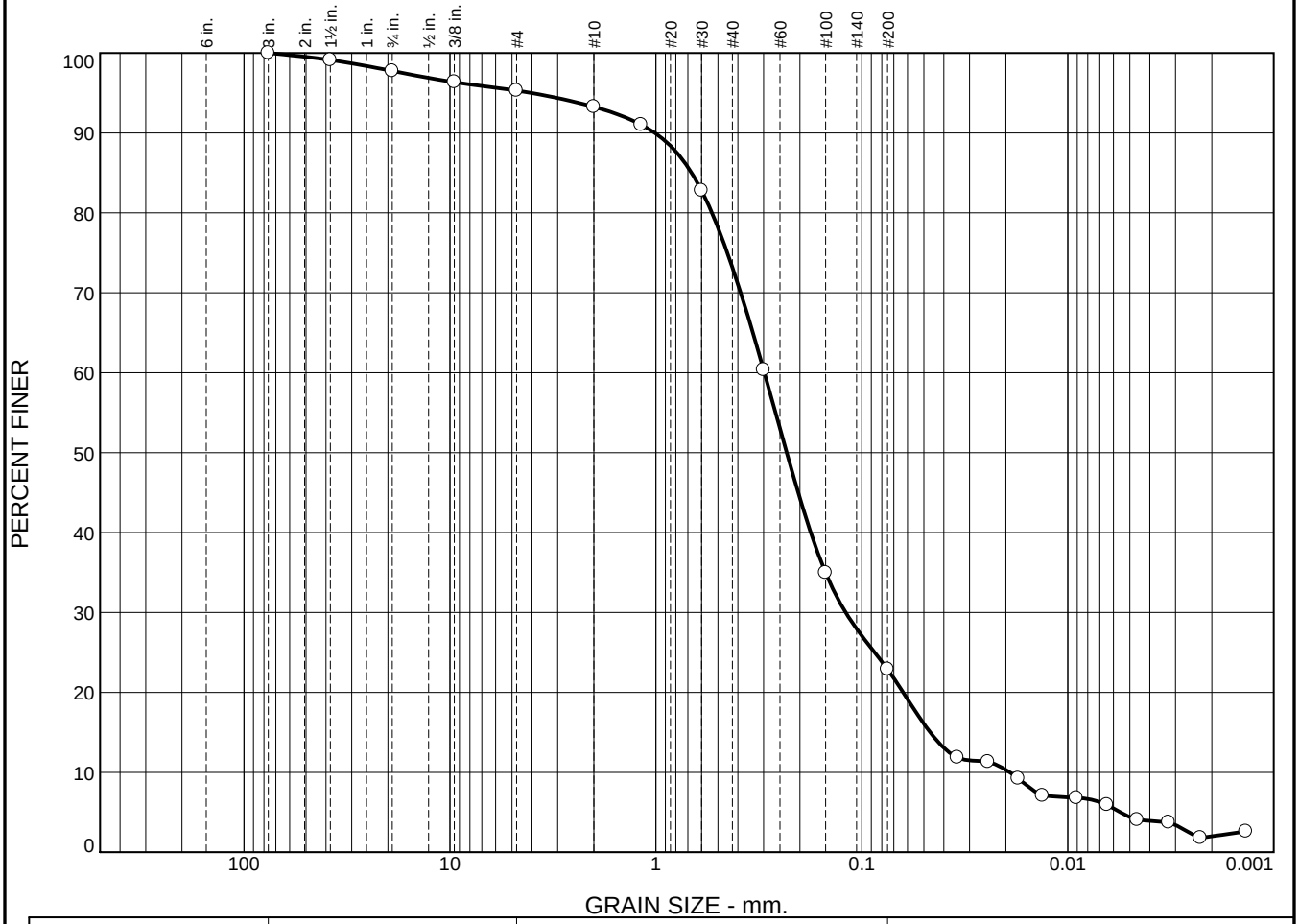
Fines visually classified

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400 Unicorn Park Drive
Woburn, MA 01801

Figure

Tested By: A.Cali 5/22/23 **Checked By:** M. Alstede 5/23/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	2.2	2.5	2.0	20.1	50.3	18.5	4.4

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.6704	0.2973	0.2317	0.1198	0.0466	0.0191	2.52	15.54

Material Description	USCS	AASHTO
○ Silty SAND	SM	-

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-115 **Depth:** 0-2 ft **Sample Number:** G1

Remarks:

○As received WC = 12.5%

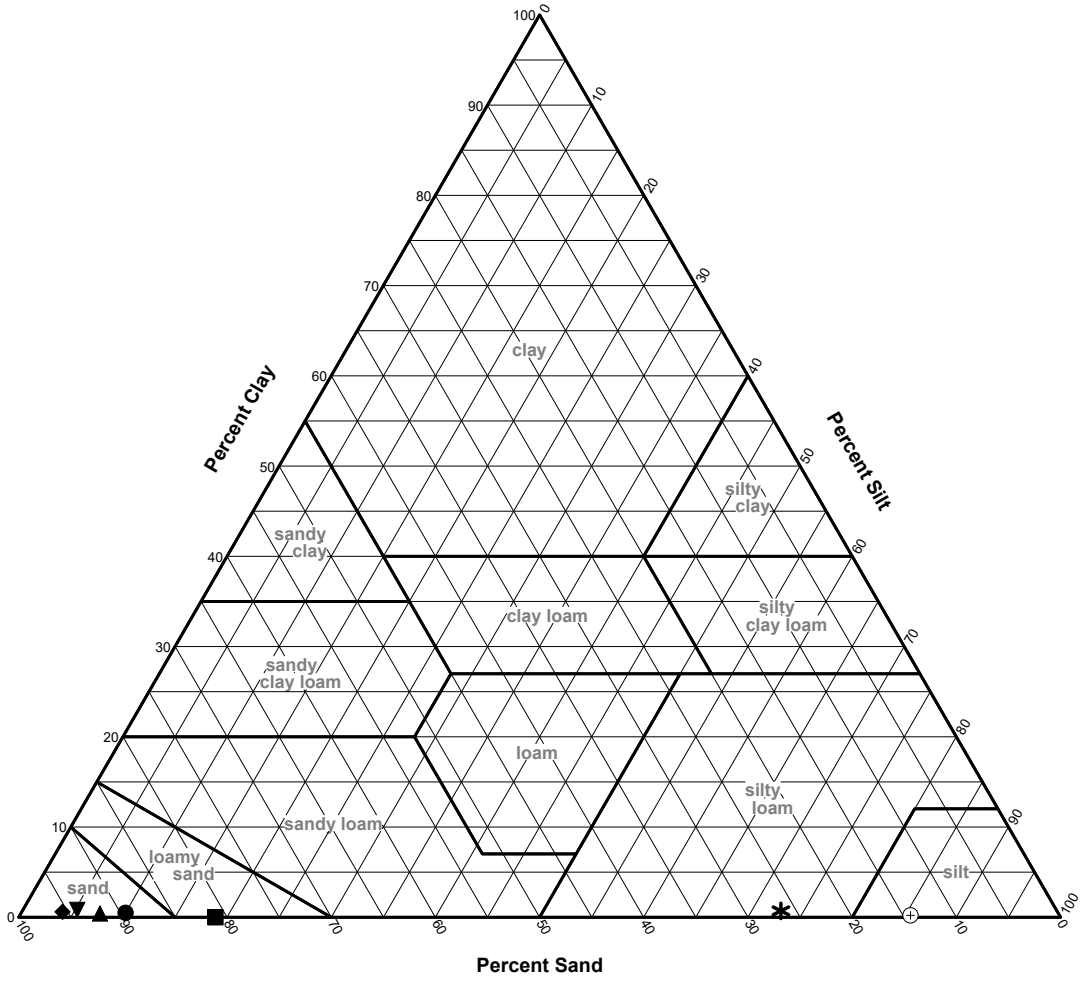
Fines visually classified

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400 Unicorn Park Drive
Woburn, MA 01801

Figure

Tested By: A. Cali 5/22/23 **Checked By:** M. Alstede 5/23/23

USDA Soil Classification



SOIL DATA

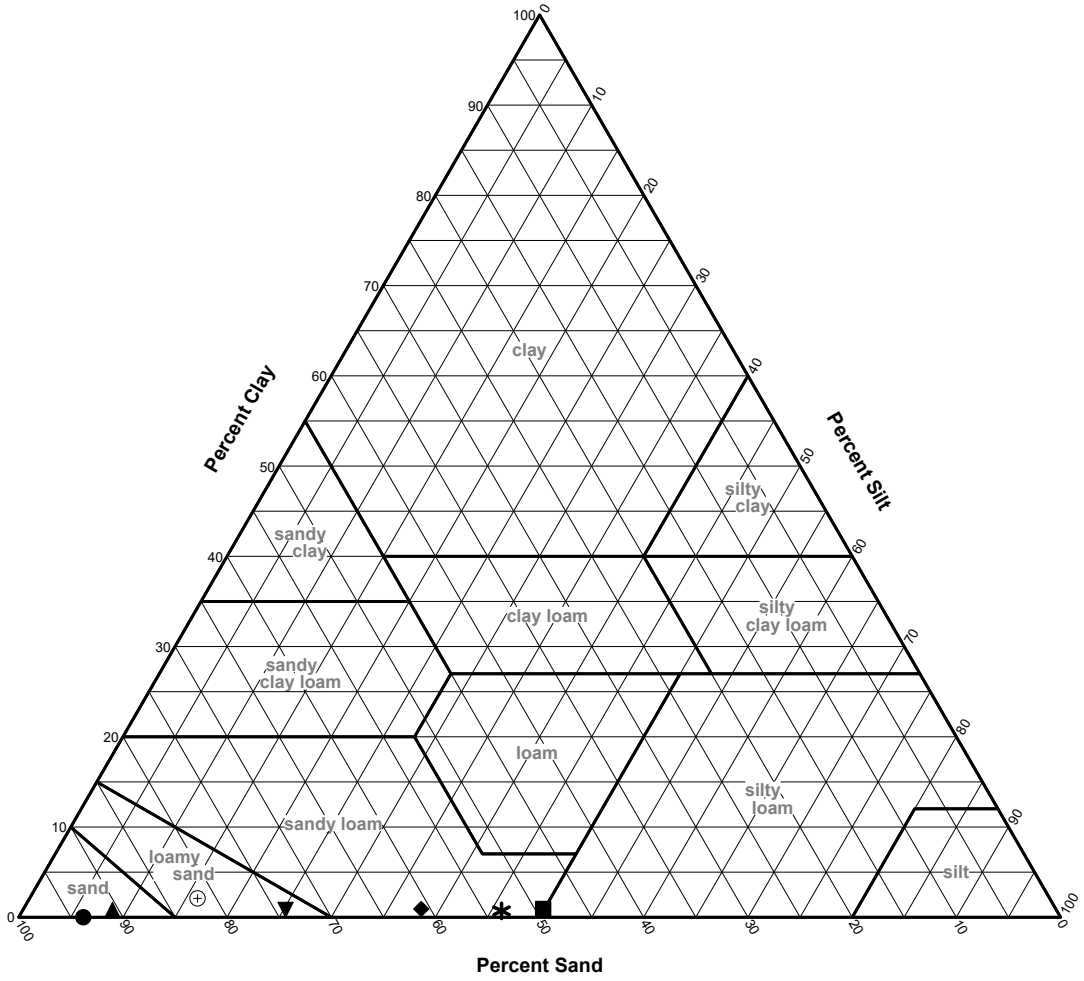
	Source	Sample No.	Depth	Percentages From Material Passing a #10 Sieve			Classification
				Sand	Silt	Clay	
●	TP-101	G1	1.0-2.5 ft	89.5	10.0	0.5	Sand
■	TP-101	G2	3-4 ft	81.1	18.9	0.0	Loamy sand
▲	TP-102	G1	1-2 ft	92.0	7.6	0.4	Sand
◆	TP-102	G2	6-7 ft	95.5	3.9	0.6	Sand
▼	TP-103	G3	7.5-8.0 ft	94.0	5.2	0.8	Sand
✱	TP-103	G2	5.0-5.5 ft	26.5	72.8	0.7	Silt loam
⊕	TP-104	G3	3-4 ft	14.3	85.5	0.2	Silt

Client: Fennick McCredie Architecture

Project: Project Principio

Project No.: 2300951 **Figure**

USDA Soil Classification



SOIL DATA

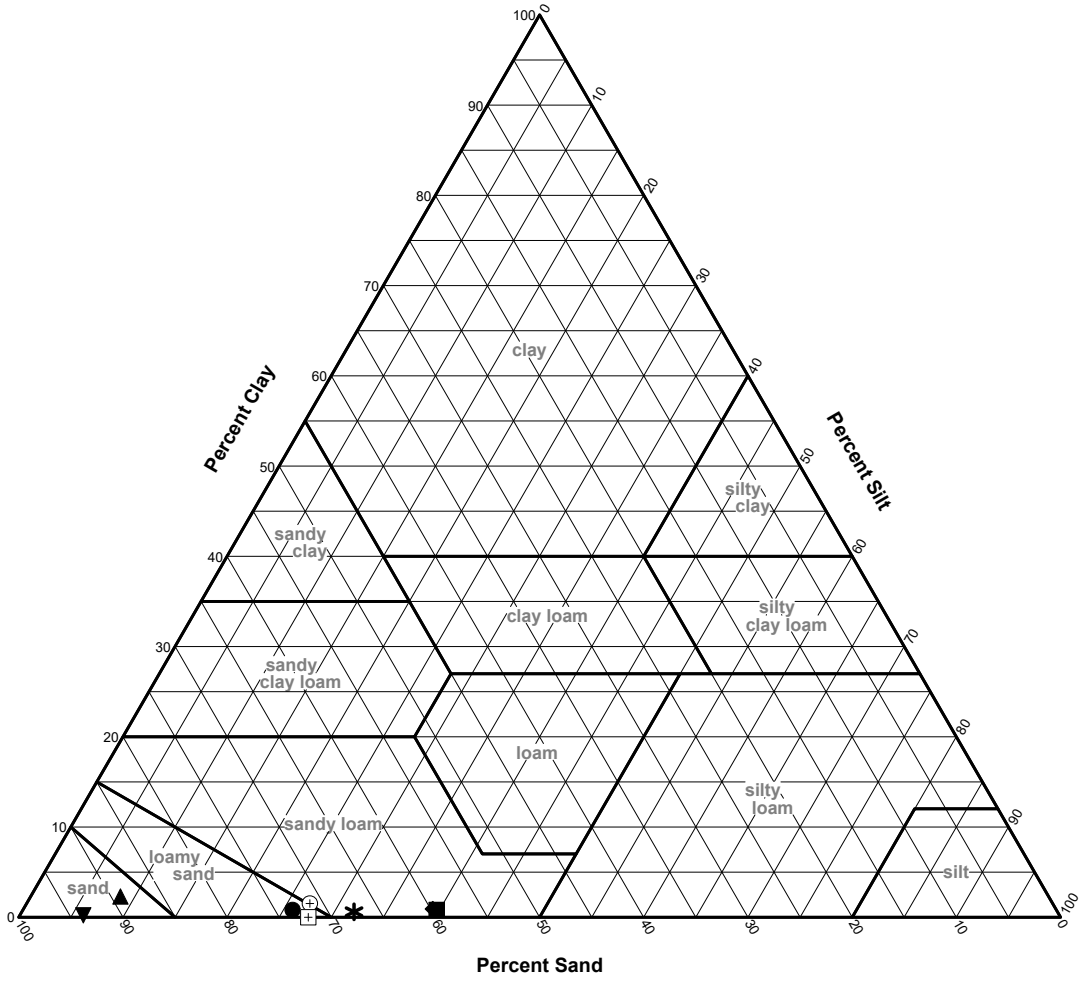
	Source	Sample No.	Depth	Percentages From Material Passing a #10 Sieve			Classification
				Sand	Silt	Clay	
●	TP-105	G2	3-4 ft	93.8	6.2	0.0	Sand
■	TP-105	G3	7-8 ft	49.2	49.9	0.9	Sandy loam
▲	TP-106	G1	3-4 ft	90.6	8.6	0.8	Sand
◆	TP-106	G2	6-8 ft	60.9	38.2	0.9	Sandy loam
▼	TP-113	G1	7.5-8.5 ft	74.0	25.2	0.8	Loamy sand
✱	TP-114	G1	3.0-3.5 ft	53.3	46.0	0.7	Sandy loam
⊕	TP-115	G1	0-2 ft	81.8	16.1	2.1	Loamy sand

Client: Fennick McCredie Architecture

Project: Project Principio

Project No.: 2300951 **Figure**

USDA Soil Classification



SOIL DATA

	Source	Sample No.	Depth	Percentages From Material Passing a #10 Sieve			Classification
				Sand	Silt	Clay	
●	TP-109	G2	2.5-2.8 ft	73.3	25.9	0.8	Loamy sand
■	TP-109	G3	8.5-8.7 ft	59.5	39.7	0.8	Sandy loam
▲	TP-110	G1	1-1.5 ft	89.1	8.6	2.3	Sand
◆	TP-110	G2	6.5-7.0 ft	59.8	39.3	0.9	Sandy loam
▼	TP-111	G2	3-4 ft	93.7	6.1	0.2	Sand
✱	TP-111	G4	10-10.5 ft	67.5	31.9	0.6	Sandy loam
⊕	TP-112	G2	5.5-6.0 ft	71.3	27.1	1.5	Sandy loam
⊞	TP-112	G3	9.8-10.0 ft	72.2	27.8	0.0	Loamy sand

Client: Fennick McCredie Architecture

Project: Project Principio

Project No.: 2300951 **Figure**

Appendix D

2020 Boring Logs

BORING INFORMATION

NORTHING (ft): 3,047,063 **EASTING (ft):** 745,689
GROUND SURFACE EL. (ft): 98.5 **DATE START/END:** 7/28/2020 - 7/28/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 1983 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 41.0 **DRILLER NAME:** J. Stevens
LOGGED BY: E. Winter **RIG TYPE:** Diedrich D-25 ATV Rig

BORING

B1

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:**
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** 2.625 inch **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Driven casing and washed with rotary tooling.
WATER LEVEL DEPTHS (ft): ▼ 12.7 7/28/2020 12:50 pm

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
							SAND	Hand cleared using post-hole digger and shovel to 6 ft. Material is similar throughout.
		G1						G1: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~85% fine to medium sand, ~10% rounded fine gravel, ~5% non-plastic fines, tan.
	5							
		S1	6 to 8	24/17	6-6-6-8			S1: NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine to medium sand, ~10% non-plastic fines, light brown.
90		S2	8 to 10	24/20	6-6-6-7			S2: Similar to S1.
	10					Start driving 4-Inch-ID casing after S2.		
		S3	14 to 16	24/8	4-5-5-6			S3: NARROWLY GRADED SAND (SP); ~95% fine to medium sand, ~5% non-plastic fines, light brown.
	15					Pumped water into 4-Inch-ID casing while pulling up rods.		
80		S4	19 to 21	24/12	5-3-4-3			S4: NARROWLY GRADED SAND WITH GRAVEL (SP); ~80% fine to medium sand, ~15% subrounded gravel, ~5% non-plastic fines, light brown. Gravel is one piece 2" x 1.5" observed at top of recovery. (possibly fell in.)
	20					Return changed from light brown to light gray.		

NOTES: Hand Cleared to 6 feet. Drilled on Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

NORTHING (ft): 3,047,063 **EASTING (ft):** 745,689
GROUND SURFACE EL. (ft): 98.5 **DATE START/END:** 7/28/2020 - 7/28/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 1983 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B1

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S5	24 to 26	24/24	5-4-3-3		SAND	S5: NARROWLY GRADED SAND (SP); ~95% fine sand, ~5% non-plastic fines, light brown.
70								
	30	S6	29 to 31	24/20	2-3-3-3			S6: NARROWLY GRADED SAND WITH SILT (SP-SM); 94.0% fine to medium sand, 6.0% non-plastic fines, light brown. <Grain size analysis performed.>
	35	S7	34 to 36	24/0	4-4-7-7	Advanced 4-Inch-ID casing to 34 ft. Redrove S7 with a 3-Inch split spoon sampler at the same interval.		S7: No Recovery. S7 (Redrive): NARROWLY GRADED SAND (SP); ~95% fine sand, ~5% non-plastic fines, brown.
60								
	40	S8	39 to 41	24/4	5-6-8-12			S8: Similar to S7 (Redrive).
								Bottom of boring at 41 feet. Backfilled with Soil Cuttings.
50	45							
	50							
	55							

NOTES: Hand Cleared to 6 feet. Drilled on Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

BORING INFORMATION

NORTHING (ft): 3,046,847 **EASTING (ft):** 745,892
GROUND SURFACE EL. (ft): 101 **DATE START/END:** 7/29/2020 - 7/31/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 79.0 **DRILLER NAME:** J. Stevens
LOGGED BY: E. Winter **RIG TYPE:** Diedrich D-25 ATV Rig

BORING
B2 (OW)

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:**
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** 2.625 inch **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Driven casing and washed with rotary tooling.
WATER LEVEL DEPTHS (ft): ▼ 12.1 7/29/2020 6:40 am

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
100		S1	0 to 2	24/16	1-4-7-7		GRAVELLY SAND	0" - 2": Topsoil. S1: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~75% fine to coarse sand, ~15% fine gravel, ~10% non-plastic fines, light brown.
		S2	2 to 4	24/19	7-8-8-8			S2: SILTY SAND (SM); ~75% fine to coarse sand, ~25% non-plastic fines, light brown. Fine sand and silt from 2" to 5".
	5	S3	4 to 6	24/14	7-12-15-13	Start driving 4-Inch-ID casing after S2.		S3: Similar to S2.
		S4	6 to 8	24/15	15-19-21-25			S4: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~65% fine to coarse sand, ~25% gravel, ~10% non-plastic fines, brown / light brown. Areas of finer sand and silt throughout sample.
		S5	8 to 10	24/13	19-19-19-16			S5: WIDELY GRADED SAND WITH GRAVEL (SW); ~70% fine to coarse sand, ~25% fine gravel, ~5% non-plastic fines, brown. Black flakey gravel observed at top of recovery.
90	10							
	15	S6	14 to 16	24/9	10-9-10-10			S6: Similar to S5. Except ~50% sand and ~45% fine to coarse gravel.
						Rig chatter at ~17 ft.		
	20	S7	19 to 21	24/8	6-4-4-7			S7: WIDELY GRADED SAND WITH GRAVEL (SW-SM); ~80% fine to coarse sand, ~15% gravel, ~5% non-plastic fines, brown.
80								

NOTES: Drilled on Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

NORTHING (ft): 3,046,847 **EASTING (ft):** 745,892
GROUND SURFACE EL. (ft): 101 **DATE START/END:** 7/29/2020 - 7/31/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B2 (OW)

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
						Rig chatter at ~23.5 ft.	GRAVELLY SAND	
	25	S8	24 to 26	24/12	5-7-12-16			S8: SILTY SAND WITH GRAVEL (SM); ~65% fine to coarse sand, ~20% gravel, ~15% non-plastic fines, brown, dark brown from 7" to 8" and 9.5" - 12". Fine sand and silt observed from 8" to 9.5 ".
							SAND	
	30	S9	29 to 31	24/0	5-5-7-7	Redrove S9 with a 3-Inch split spoon sampler at same interval.		S9: No Recovery. S9 (Redrive): WIDELY GRADED SAND WITH SILT (SW-SM); ~80% fine to coarse sand, ~10% fine gravel, ~10% non-plastic fines, brown with orange staining.
70								
	35	S10	34 to 36	24/9	2-3-6-8			S10: NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine sand, ~10% non-plastic fines, light brown / light gray.
						Advanced 4-Inch-ID casing to 39 ft.		
	40	S11	39 to 41	24/12	9-10-14-16			S11: SILTY SAND (SM); ~80% fine to medium sand, ~15% non-plastic fines, ~5% fine gravel, tan and stained orange from 0" to 5".
60								
						Drilled open hole from S12 through S16		
	45	S12	44 to 46	24/14	3-4-13-12			S12: SILTY SAND (SM); ~80% fine sand, ~20% non-plastic fines, gray with orange staining.
	50	S13	49 to 51	24/13	7-8-8-9			S13: Similar to S12.
50								

NOTES: Drilled on Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

NORTHING (ft): 3,046,847 **EASTING (ft):** 745,892
GROUND SURFACE EL. (ft): 101 **DATE START/END:** 7/29/2020 - 7/31/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B2 (OW)

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	55	S14	54 to 56	24/12	7-6-8-8		SAND	S14: SILTY SAND (SM); ~85% fine sand, ~15% non-plastic fines, light gray.
						Slight loss of water.		
	60	S15	59 to 61	24/16	4-3-5-2			S15: Similar to S14.
40								
	65	S16	64 to 66	24/22	3-3-5-6		FINE SAND AND SILT	S16: SANDY SILT (ML); 53.0% non-plastic fines, 47.0% fine sand, light gray. <Grain size analysis performed.>
	70	S17	69 to 71	24/18	8-18-32-72	Spoon was bouncing through 3rd and 4th interval. Losing water. Very hard drilling at 71.5 ft.	GRAVELLY SAND	S17 (0" - 7"): WIDELY GRADED SAND (SW); ~95% fine to coarse sand, ~5% non-plastic fines, brown stained orange. Sand is coarser towards bottom of recovery. S17 (7" - 18"): SANDY SILT (ML); ~50% non-plastic fines, ~25% fine to coarse gravel, ~25% fine to coarse sand, gray. Rock fragments throughout, black fragments a bottom and sampler tip.
30						Telescoped 3-Inch-ID casing to 72 ft. after sampling S17.		
		C1	72 to 73	12/4		Switched to NX core barrel at 72 ft.		C1: GRANITE Boulder, gray.
		S18	73 to 75	24/9	11-8-8-24	Drilled out boulder at ~73 ft. Switched back to split spoon at 73 ft.		S18: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~45% fine to coarse sand, ~30% fine to coarse gravel, ~25% non-plastic fines, gray. Boulder fragments at top of recovery from previous sample.
	75					Silt and sand observed in return while washing from 75 ft. to 79 ft. Sent split spoon down at 79, hole collapsing and sticking up ~4 ft.		
	80							Bottom of boring at 79 feet. Installed Ground Water Observation Well. Backfilled with Gravel and Soil Cuttings below Observation Well. Backfilled with Clean Sand around Observation Well.
20								

NOTES: Drilled on Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

BORING INFORMATION

NORTHING (ft): 3,046,479 **EASTING (ft):** 745,986
GROUND SURFACE EL. (ft): 102.5 **DATE START/END:** 8/3/2020 - 8/3/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 41.0 **DRILLER NAME:** J. Stevens
LOGGED BY: E. Winter **RIG TYPE:** Diedrich D-25 ATV Rig

BORING

B3

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:**
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** 2.625 inch **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Driven casing and washed with rotary tooling.
WATER LEVEL DEPTHS (ft): ▼ 13.8 8/3/2020 8:50 am

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
								Hand cleared with post-hole digger and shovel to 6 ft.
100		G1						G1: WIDELY GRADED SAND WITH SILT (SW-SM); ~90% fine to coarse sand, ~10% non-plastic fines, light brown.
	5	G2						G2: Similar to G1.
		S1	6 to 8	24/14	3-4-4-4			S1: NARROWLY GRADED SAND WITH SILT (SP-SM); ~90 fine to medium sand, ~10% non-plastic fines, light brown.
		S2	8 to 10	24	4-5-5-5			S2: Similar to S1.
	10					Start driving 4-Inch-ID casing after S2.	SAND	
90								
	15	S3	14 to 16	24/12	3-5-10-9			S3: WIDELY GRADED SAND WITH SILT (SW-SM); ~85% fine to coarse sand, ~10% non-plastic fines, ~<5% gravel, light gray.
		S4	19 to 21	24/14	2-3-4-4			S4: WIDELY GRADED SAND WITH SILT (SW-SM); ~80% fine to coarse sand, ~10% fine gravel, ~10% non-plastic fines, brown with orange staining. Coarser towards top of recovery.
	20							
80						Drill chatter at ~23 ft.		

NOTES: Hand cleared to 6 feet. Drilled ~5 feet North of marked location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

NORTHING (ft): 3,046,479 **EASTING (ft):** 745,986
GROUND SURFACE EL. (ft): 102.5 **DATE START/END:** 8/3/2020 - 8/3/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B3

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S5	24 to 26	24/12	4-4-11-10	Advanced 4-Inch-ID casing to 24 ft.	FINE SAND AND SILT	S5: NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine sand, ~10% non-plastic fines, brown. Gravel observed in wash.
	30	S6	29 to 31	24/13	6-7-8-8			S6: SILTY SAND (SM); ~85% fine sand, ~15% non-plastic fines, light gray. Finer towards bottom of recovery.
70								
	35	S7	34 to 36	24	5-6-6-6			S7: Similar to S6, except light brown.
	40	S8	39 to 41	24/15	7-5-6-8			S8: Similar to S6.
60								Bottom of boring at 41 feet. Backfilled with Soil Cuttings.
	45							
	50							
50								
	55							

NOTES: Hand cleared to 6 feet. Drilled ~5 feet North of marked location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

BORING INFORMATION

NORTHING (ft): 3,046,078 **EASTING (ft):** 746,063
GROUND SURFACE EL. (ft): 100 **DATE START/END:** 8/3/2020 - 8/4/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 81.0 **DRILLER NAME:** J. Stevens
LOGGED BY: E. Winter **RIG TYPE:** Diedrich D-25 ATV Rig

BORING

B4

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:**
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** 2.625 inch **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Driven casing and washed with rotary tooling.
WATER LEVEL DEPTHS (ft): ▼ 12.5 8/4/2020 11:10 am ▼ 9.4 8/4/2020 7:50 am

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
							SAND	Hand cleared with post-hole digger and shovel to 6 ft. Water observed while hand clearing, possible water table.
		G1						G1: WIDELY GRADED SAND WITH SILT (SW-SM); ~80% fine to coarse sand, ~10% gravel, ~10% non-plastic fines, light brown.
	5							
		S1	6 to 8	24/12	1-1-2-5		FINE SAND AND SILT	S1: SILTY SAND (SM); 63.2% mostly fine sand, 36.8% non-plastic fines, light gray. <Grain size analysis performed.>
		S2	8 to 10	24/18	2-3-4-5			S2: SILTY SAND (SM); ~80% fine to coarse sand, ~20% non-plastic fines, brown with orange staining. Sample is wet.
90	10					Start driving 4-Inch-ID casing after S2.		
		S3	14 to 16	24/14	3-4-6-9			S3: SILTY SAND (SM); ~70% fine to medium sand, ~30% non-plastic fines, brown with orange staining.
	15					Drilled open hole from 14 ft. to 21 ft. to take S3 andS4.		
		S4	19 to 21	24/19	5-5-4-5			S4: SILTY SAND (SM); ~70% fine to medium sand, ~30% non-plastic fines, gray.
80	20							

NOTES: Hand Cleared to 6 feet. Drilled on Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

NORTHING (ft): 3,046,078 **EASTING (ft):** 746,063
GROUND SURFACE EL. (ft): 100 **DATE START/END:** 8/3/2020 - 8/4/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B4

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S5	24 to 26	24/18	4-6-5-6	Drilled open hole from 24 ft. to take S5, S6, S7, and S8.	FINE SAND AND SILT	S5: Similar to S4.
70	30	S6	29 to 31	24/14	4-4-5-10			S6: SILTY SAND (SM); ~85% fine to medium sand, ~15% non-plastic fines, light gray with orange staining.
	35	S7	34 to 36	24/16	4-6-6-9			S7: SILTY SAND (SM); ~75% fine to medium sand, ~25% non-plastic fines, light gray. Amount of silt increased towards bottom of recovery.
60	40	S8	39 to 41	24/18	3-3-4-6	Advanced 4-Inch-ID casing to 39 ft.		S8: SANDY SILT (ML); ~60% non-plastic fines, ~40% fine sand, light brown from 0" to 13", light gray from 13" to 18".
	45	S9	44 to 46	24/12	3-5-8-9	Add supermud.		S9: SILTY SAND (SM); ~75% fine sand, ~25% non-plastic fines, light brown.
50	50	S10	49 to 51	24/16	4-4-5-11			S10: SILTY SAND (SM); ~70% fine to medium sand, ~30% non-plastic fines, brown from 0" to 9", gray from 9" to 16". Amount of silt increased towards bottom of recovery.

NOTES: Hand Cleared to 6 feet. Drilled on Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

NORTHING (ft): 3,046,078 **EASTING (ft):** 746,063
GROUND SURFACE EL. (ft): 100 **DATE START/END:** 8/3/2020 - 8/4/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B4

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	55	S11	54 to 56	24/15	5-3-2-3		FINE SAND AND SILT	S11: SANDY SILT (ML); ~60% non-plastic fines, ~40% fine sand, gray.
40	60	S12	59 to 61	24/16	2-3-3-4			S12: Similar to S11.
	65	S13	64 to 66	24/13	11-7-8-12			S13: SILTY SAND (SM); ~80% fine sand, ~20% non-plastic fines, gray.
						Add supermud. Drilling resistance increased from 66 ft. to 69 ft.		
30	70	S14	69 to 71	24/14	9-8-11-12			S14: Similar to S13.
	75	S15	74 to 76	24/13	6-7-10-12			S15: SILTY SAND (SM); ~60% fine sand, ~40% non-plastic fines, gray.
						Sand and silt observed in return.		
20	80	S16	79 to 81	24/12	3-5-8-13			S16: SANDY SILT (ML); ~60% non-plastic fines, ~40% fine sand, gray. Varve of silt observed at 7.5".
								Bottom of boring at 81 feet. Backfilled with Soil Cuttings.

NOTES: Hand Cleared to 6 feet. Drilled on Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

BORING INFORMATION

NORTHING (ft): 3,045,940 **EASTING (ft):** 746,090
GROUND SURFACE EL. (ft): 101 **DATE START/END:** 8/4/2020 - 8/4/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 21.0 **DRILLER NAME:** J. Stevens
LOGGED BY: E. Winter **RIG TYPE:** Diedrich D-25 ATV Rig

BORING
B5 (OW)
PAGE 1 of 1

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:**
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** 2.625 inch **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Driven casing and washed with rotary tooling.
WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
100							FINE SAND AND SILT	Hand cleared with post-hole digger and shovel 2 ft.
		S1	2 to 4	24/22	7-9-10-12			S1: SILTY SAND (SM); ~85% fine to medium sand, ~15% non-plastic fines, light brown.
	5	S2	4 to 6	24/10	6-7-8-7	Start driving 4-Inch-ID casing after S1.		S2: Similar to S1, except orange staining.
		S3	6 to 8	24/15	6-7-6-7			S3: NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine to medium sand, ~10% non-plastic fines, light gray / light brown with orange staining.
		S4	8 to 10	24/6	3-3-4-4			S4: SILTY SAND (SM); ~80% fine sand, ~20% non-plastic fines, light gray / light brown with orange staining.
	10							
90								
		S5	14 to 16	24/17	2-2-3-4			S5: SILTY SAND (SM); 83.6% mostly fine sand, 16.4% non-plastic fines, brown. <Grain size analysis performed.>
	15							
						Advanced 4-Inch-ID casing to 19 ft.		
		S6	19 to 21	24/20	4-5-5-5			S6: SILTY SAND (SM); ~85% fine to medium sand, ~15% non-plastic fines, light gray. Increased silt content towards top of recovery.
	20							
80								Bottom of boring at 21 feet. Installed Ground Water Observation Well. Backfilled with Clean Sand.

NOTES: Hand Cleared to 2 feet. Drilled ~ 7 feet East of Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

BORING INFORMATION

NORTHING (ft): 3,046,293 **EASTING (ft):** 745,606
GROUND SURFACE EL. (ft): 99.5 **DATE START/END:** 8/18/2020 - 8/19/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 61.0 **DRILLER NAME:** J. Stevens
LOGGED BY: E. Winter **RIG TYPE:** Diedrich D-25 ATV Rig

BORING

B6

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:**
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** 2.625 inch **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Driven casing and washed with rotary tooling.
WATER LEVEL DEPTHS (ft): ▼ 13.3 8/18/2020

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
								VACUUM EXCAVATED TO 9.5 FT. ON 8/18/2020. Soil is wet at ~8.5 ft, possible water table. ~0' - 1.5' TOPSOIL, dark brown.
							SAND	Grab samples were taken from orignal vactor location. G1: Dark brown with cobbles up to 6 inches.
	5							G2: SILTY SAND WITH GRAVEL (SM); ~55% fine to coarse sand, ~25% gravel, ~20% non-plastic fines, light brown.
								G3: SILTY SAND (SM); ~75% fine to coarse sand, ~25% non-plastic fines, light brown.
								G4: SILTY SAND (SM); ~65% fine to coarse sand, ~35% non-plastic fines, brown.
90	10	S1	10 to 12	24/18	4-5-4-5	Start driving 4-Inch-ID casing after vacuum excavating.	FINE SAND AND SILT	S1: SILTY SAND (SM); ~75% fine to medium sand, ~25% non-plastic fines, brown. Some orange discoloration.
	15	S2	14 to 16	24/14	2-3-5-3			S2: SILTY SAND (SM); ~70% fine sand, ~30% non-plastic fines, light gray.
80	20	S3	19 to 21	24/15	3-3-4-6			S3 (0" - 9"): SILTY SAND (SM); ~65% fine sand, ~35% non-plastic fines, brown. S3 (9" - 15"): SANDY SILT (ML); ~80% non-plastic fines, ~20% fine sand, light brown.

NOTES: Encountered pipe during initial vacuum excavation at 6.5 feet, offset ~3 feet East. Grab samples were taken from orignal location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

NORTHING (ft): 3,046,293 **EASTING (ft):** 745,606
GROUND SURFACE EL. (ft): 99.5 **DATE START/END:** 8/18/2020 - 8/19/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B6

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S4	24 to 26	24/11	1-2-3-6		FINE SAND AND SILT	S4: SILTY SAND (SM); ~78.2% fine sand, ~21.8% non-plastic fines, light gray with orange discoloration from 5" to 11". <Grain size analysis performed.>
70	30	S5	29 to 31	24/2	4-5-8-9	Increased resistance while driving casing from 29 ft. to 34 ft.		S5: SILTY SAND (SM); ~70% fine sand, ~30% non-plastic fines, light brown. Possibly wash.
	35	S6	34 to 36	24/14	4-5-6-15	Advanced 4-Inch-ID casing to 34 ft.		S6: SILTY SAND (SM); ~60% fine sand, ~40% non-plastic fines, brown.
60	40	S7	39 to 41	24/13	9-11-15-9			S7: SILTY SAND (SM); ~70% fine sand, ~30% non-plastic fines, brown. Discolored orange throughout.
	45	S8	44 to 46	24/19	5-5-5-5	Loss of water while washing from 46 ft. to 49 ft.		S8: SILTY SAND (SM); ~65% fine sand, ~35% non-plastic fines, light gray.
50	50	S9	49 to 51	24/19	5-8-9-7	Loss of water while washing from 51 ft. to 54 ft.		S9: Similar to S8.

NOTES: Encountered pipe during initial vacuum excavation at 6.5 feet, offset ~3 feet East. Grab samples were taken from orignal location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

NORTHING (ft): 3,046,293 **EASTING (ft):** 745,606
GROUND SURFACE EL. (ft): 99.5 **DATE START/END:** 8/18/2020 - 8/19/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B6

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
							FINE SAND AND SILT	
	55	S10	54 to 56	24/15	5-5-6-7			S10: Similar to S8.
40	60	S11	59 to 61	24	5-5-4-8			S11: SANDY SILT (ML); ~50% non-plastic fines, ~50% fine sand, gray.
								Bottom of boring at 61 feet. Backfilled with Soil Cuttings.
	65							
30	70							
	75							
20	80							

NOTES: Encountered pipe during initial vacuum excavation at 6.5 feet, offset ~3 feet East. Grab samples were taken from orignal location.

PROJECT NAME: Project Red Squirrel

CITY/STATE: Andover, Massachusetts

GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

BORING INFORMATION

NORTHING (ft): 3,046,063 **EASTING (ft):** 745,663
GROUND SURFACE EL. (ft): 106.5 **DATE START/END:** 8/14/2020 - 8/14/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 57.0 **DRILLER NAME:** J. Stevens
LOGGED BY: E. Winter **RIG TYPE:** Diedrich D-25 ATV Rig

BORING

B7

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:**
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** 2.625 inch **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Driven casing and washed with rotary tooling.
WATER LEVEL DEPTHS (ft): ▼ 13.7 8/14/2020

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S1	0 to 2	24/17	2-2-2-4		SAND	S1: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~65% fine to coarse sand, ~15% gravel, ~10% non-plastic fines, brown. Roots present in top 6 inches.
		S2	2 to 4	24/20	4-5-6-8			S2: SILTY SAND (SM); ~80% fine to medium sand, ~20% non-plastic fines, light brown with some orange staining.
	5	S3	4 to 6	24/10	4-5-5-7	Start driving 4-Inch-ID casing after S2.		S3: SILTY SAND (SM); ~80% fine to medium sand, ~20% non-plastic fines, light gray.
100		S4	6 to 8	24/9	6-6-7-9	Gravel observed in return while washing from 6 ft. to 8 ft.		S4: Similar to S3, except some orange staining.
		S5	8 to 10	24/8	5-7-6-8			S5: SILTY SAND (SM); ~85% fine to medium sand, ~15% non-plastic fines, brown.
	10							
		S6	14 to 16	24/8	3-4-4-4		FINE SAND AND SILT	S6: SILTY SAND (SM); ~60% fine sand, ~40% non-plastic fines, gray. Muscovite present.
90	15							
		S7	19 to 21	24/19	2-3-5-7	Advanced 4-Inch-ID casing to 19 ft.		S7: SILTY SAND (SM); ~80% fine sand, ~20% non-plastic fines, gray.
	20					Add supermud.		

NOTES: Drilled ~5 feet East of Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

NORTHING (ft): 3,046,063 **EASTING (ft):** 745,663

GROUND SURFACE EL. (ft): 106.5 **DATE START/END:** 8/14/2020 - 8/14/2020

VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B7

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
							FINE SAND AND SILT	
	25	S8	24 to 26	24/13	3-2-5-5			S8 (0" - 9"): SANDY SILT (ML); ~65% non-plastic fines, ~35% fine sand, gray. S8 (9" - 13"): SILTY SAND (SM); ~75% fine to medium sand, ~25% non-plastic fines, brown discolored orange.
80								
	30	S9	29 to 31	24/15	4-4-7-7			S9: SILT WITH SAND (ML); ~80% non-plastic fines, ~20% fine sand, brown. Coarser towards bottom. Varve of dark material at 5".
	35	S10	34 to 36	24/14	8-9-13-10			S10: SILTY SAND (SM); ~65% fine sand, ~35% non-plastic fines, brown.
70								
	40	S11	39 to 41	24/14	7-8-9-12			S11: Similar to S10.
	45	S12	44 to 46	24/16	4-3-5-10			S12: SANDY SILT (ML); ~70% non-plastic fines, ~30% fine sand, brown.
60								
	50	S13	49 to 51	24/13	7-9-10-9			S13: SILTY SAND (SM); ~85% fine sand, ~15% non-plastic fines, light brown.

NOTES: Drilled ~5 feet East of Marked Location.

PROJECT NAME: Project Red Squirrel

CITY/STATE: Andover, Massachusetts

GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

NORTHING (ft): 3,046,063 **EASTING (ft):** 745,663
GROUND SURFACE EL. (ft): 106.5 **DATE START/END:** 8/14/2020 - 8/14/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B7

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
50	55	S14	55 to 57	24/16	4-5-9-16			S14: SANDY SILT (ML); ~60% non-plastic fines, ~40% fine sand, brown.
								Bottom of boring at 57 feet. Backfilled with Soil Cuttings.
40	60							
	65							
30	70							
	75							
	80							

NOTES: Drilled ~5 feet East of Marked Location.

PROJECT NAME: Project Red Squirrel

CITY/STATE: Andover, Massachusetts

GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

BORING INFORMATION

NORTHING (ft): 3,045,864 **EASTING (ft):** 745,688
GROUND SURFACE EL. (ft): 101.5 **DATE START/END:** 8/5/2020 - 8/5/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 61.0 **DRILLER NAME:** J. Stevens
LOGGED BY: E. Winter **RIG TYPE:** Diedrich D-25 ATV Rig

BORING

B8

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:**
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** 2.625 inch **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Driven casing and washed with rotary tooling.
WATER LEVEL DEPTHS (ft): ▼ 8.1 8/5/2020

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
100		S1	0 to 2	24/16	2-5-6-10		SAND	S1: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~55% fine to coarse sand, ~35% gravel, ~10% non-plastic fines, brown. Roots present in top 2" of recovery.
		S2	2 to 4	24/17	9-8-9-11			S2: NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine to medium sand, ~10% non-plastic fines, brown with orange horizontal stripes.
	5	S3	4 to 6	24/12	4-5-6-6	Start driving 4-Inch-ID casing after S2.	FINE SAND AND SILT	S3 (0" - 7"): SANDY SILT (ML); ~70% non plastic fines, ~30% fine sand, light brown. S3 (7" - 12"): SILTY SAND (SM); ~80% fine to medium sand, ~20% non-plastic fines, light brown with orange staining.
		S4	6 to 8	24/11	5-5-5-6			S4: Similar to S3 (7" - 12").
		S5	8 to 10	24/13	3-3-3-3			S5: SILTY SAND (SM); ~70% fine sand, ~30% non-plastic fines, light brown. Dark stripe of coarser material at 4" of recovery.
	10							
90						Return changed from brown to gray.		
		S6	14 to 16	24/12	3-3-5-4			S6: SILTY SAND (SM); ~70% fine sand, ~30% non-plastic fines, gray. Fine gravel in wash.
	15							
						Advanced 4-Inch-ID casing to 19 ft.		
		S7	19 to 21	24/15	3-4-5-6			S7: SILTY SAND (SM); ~80% fine to medium sand, ~20% non-plastic fines, gray.
	20							
80						Add supermud.		

NOTES: Drilled ~3 feet South of Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

NORTHING (ft): 3,045,864 **EASTING (ft):** 745,688
GROUND SURFACE EL. (ft): 101.5 **DATE START/END:** 8/5/2020 - 8/5/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B8

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S8	24 to 26	24/15	2-4-3-6		FINE SAND AND SILT	S8: SANDY SILT (SM); ~60% non-plastic fines, ~30% fine sand, brown. Coarser sand from 6" to 10" of recovery.
	30	S9	29 to 31	24/14	6-7-4-6			S9: SILTY SAND (SM); ~65% fine to medium sand, ~35% non-plastic fines, light brown with orange discoloration from 2.5" to 5".
70								
	35	S10	34 to 36	24/15	5-5-5-8			S10: SILTY SAND (SM); ~70% fine sand, ~30% non-plastic fines, light brown with orange discoloration throughout.
	40	S11	39 to 41	24/18	4-3-4-7			S11: Similar to S10.
60								
	45	S12	44 to 46	24/13	7-7-10-11			S12: SILTY SAND (SM); ~70% fine sand, ~30% non-plastic fines, brown.
						Drilling resistance increased from 46 ft. to 49 ft.		
	50	S13	49 to 51	24/15	6-5-10-11			S13: SILTY SAND (SM); ~50% fine sand, ~50% non-plastic fines, brown from 0" to 8" and gray from 8" to 15".
50								

NOTES: Drilled ~3 feet South of Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

NORTHING (ft): 3,045,864 **EASTING (ft):** 745,688
GROUND SURFACE EL. (ft): 101.5 **DATE START/END:** 8/5/2020 - 8/5/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B8

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	55	S14	54 to 56	24/18	4-5-5-6		FINE SAND AND SILT	S14: Similar to S13, except brown from 0" to 10" and light brown from 10" to 18" Silt varve observed at 10" or recovery.
	60	S15	59 to 61	24/14	8-7-8-12			S15: SILTY SAND (SM); ~70% fine sand, ~30% non-plastic fines, light brown.
40								Bottom of boring at 61 feet. Backfilled with Soil Cuttings.
	65							
	70							
30								
	75							
	80							
20								

NOTES: Drilled ~3 feet South of Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

BORING INFORMATION

NORTHING (ft): 3,046,262 **EASTING (ft):** 745,457
GROUND SURFACE EL. (ft): 99.5 **DATE START/END:** 8/19/2020 - 8/20/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 51.0 **DRILLER NAME:** J. Stevens
LOGGED BY: E. Winter **RIG TYPE:** Diedrich D-25 ATV Rig

BORING

B9

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:**
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** 2.625 inch **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Driven casing and washed with rotary tooling.
WATER LEVEL DEPTHS (ft): ▼ 10.3 8/20/2020 6:50 am

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
								VACUUM EXCAVATED TO 9 FT. ON 8/18/2020. ~0" - 12": TOPSOIL, roots visible.
		G1					SAND	G1: NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine sand, ~10% non-plastic fines, light brown.
	5	G2						G2: NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine sand, ~10% non-plastic fines, brown with orange discoloration.
		G3						G3: Similar to G2.
90	10	S1	9 to 11	24/14	3-4-5-4	Start driving 4-Inch-ID casing after vacuum excavating.	FINE SAND AND SILT	S1 (0" - 9"); SILTY SAND (SM); ~75% fine sand, ~25% non-plastic fines, brown with orange discoloration. S1 (9" - 14"): SANDY SILT (ML): ~70% non-plastic fines, ~30% fine sand, gray.
	15	S2	14 to 16	24/16	2-2-3-4	Return is light brown.		S2: SANDY SILT (ML); 53.4% non-plastic fines, 46.6% fine to medium sand, brown. <Grain size analysis performed.>
80	20	S3	19 to 21	24/10	2-3-3-3			S3: SILTY SAND (SM); ~70% fine sand. ~30% silt, brown with orange discoloration throughout.

NOTES: Vacuum Excavated to 8 feet. Drilled ~50 feet East of Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

NORTHING (ft): 3,046,262 **EASTING (ft):** 745,457
GROUND SURFACE EL. (ft): 99.5 **DATE START/END:** 8/19/2020 - 8/20/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B9

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S4	24 to 26	24/3	1-4-6-9	Drilled open hole from 24 ft. to 29 ft. to take S4 and S5.	FINE SAND AND SILT	S4: SILTY SAND (SM); ~65% fine sand, ~35% non-plastic fines, brown.
70	30	S5	29 to 31	24/19	5-6-5-7	Advanced 4-Inch-ID casing to 29 ft.		S5: SILTY SAND (SM); ~60% fine sand, ~40% non-plastic fines, brown.
	35	S6	34 to 36	24/15	4-6-8-7			S6: SILTY SAND (SM); ~80% fine to medium sand, ~20% non-plastic fines, brown with orange discoloration.
60	40	S7	39 to 41	24/16	6-8-12-10			S7: Similar to S6.
						Drilling resistance from 41 ft. to 44 ft.		
	45	S8	44 to 46	24/19	4-4-5-6			S8: SILTY SAND (SM); ~65% fine sand, ~35% silt, brown with orange discoloration.
						Loss of water.		
50	50	S9	49 to 51	24/19	7-5-6-6			S9: SILTY SAND (SM); ~85% fine sand, ~15% non-plastic fines, brown from 0" to 6" and gray from 6" to 19".
	55							Bottom of boring at 51 feet. Backfilled with Soil Cuttings.

NOTES: Vacuum Excavated to 8 feet. Drilled ~50 feet East of Marked Location.

PROJECT NAME: Project Red Squirrel

CITY/STATE: Andover, Massachusetts

GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

BORING INFORMATION

NORTHING (ft): 3,045,867 **EASTING (ft):** 745,365
GROUND SURFACE EL. (ft): 110 **DATE START/END:** 8/11/2020 - 8/13/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 78.0 **DRILLER NAME:** J. Stevens
LOGGED BY: E. Winter **RIG TYPE:** Diedrich D-25 ATV Rig

BORING
B10

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:** NX
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** 2.625 inch **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Driven casing and washed with rotary tooling.
WATER LEVEL DEPTHS (ft): ▼ 18.4 8/12/2020 12:00 pm

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S1	0 to 2	24/16	1-2-3-5		SAND	S1: SILTY SAND WITH GRAVEL (SM); ~65% fine to coarse sand, ~20% gravel, ~15% non-plastic fines, brown.
		S2	2 to 4	24/18	4-4-5-7			S2: SILTY SAND (SM); ~85% fine to medium sand, ~15% non-plastic fines, light gray. Horizontal orange discoloration from 12" to 15" of recovery.
	5	S3	4 to 6	24/12	4-4-4-5	Start driving 4-Inch-ID casing after S2.		S3: NARROWLY GRADED SAND (SP); 95.2% mostly fine to medium sand, 3.5% non-plastic fines, 1.3% fine gravel, brown. <Grain size analysis performed.>
		S4	6 to 8	24/12	5-4-6-9			S4 (0" - 5"): Similar to S3. Coarser towards bottom of recovery.
		S5	8 to 10	24/11	4-5-7-8		FINE SAND AND SILT	S4 (5" - 12"): SANDY SILT (ML); ~60% non-plastic fines, ~40% fine sand, light gray. S5: SILTY SAND (SM); ~85% fine to medium sand, ~15% non-plastic fines, brown with horizontal orange staining.
100	10							
	15	S6	14 to 16	24/14	3-4-6-4			S6: SILTY SAND (SM); ~75% fine sand, ~25% non-plastic fines, light gray from 0" to 10" and brown with orange staining from 10" to 14".
90	20	S7	19 to 21	24/14	2-2-4-4	Drilled open hole from 19 ft. to 31 ft. to take S7, S8, and S9.		S7: SANDY SILT (ML); ~60% fine sand, ~40% non-plastic fines, light brown.

NOTES: Drilled ~35 feet West of Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

NORTHING (ft): 3,045,867 **EASTING (ft):** 745,365
GROUND SURFACE EL. (ft): 110 **DATE START/END:** 8/11/2020 - 8/13/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B10

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S8	24 to 26	24/13	4-5-5-5		FINE SAND AND SILT	S8: SILTY SAND (SM); ~75% fine sand, ~25% non-plastic fines, light brown.
						Rig chatter at ~27.5 ft.		
80	30	S9	29 to 31	24/15	2-4-5-4	Drilled open hole from 30 ft. to 41 ft. to take S10 and S11.		S9: SILT WITH SAND (ML); ~80% non-plastic fines, ~20% fine sand, light brown. Coarser towards top of recovery. Black varve of silt observed.
	35	S10	34 to 36	24/14	3-4-3-6			S10: SANDY SILT (ML); ~60% non-plastic fines, ~40% fine sand, light brown. Silt in tip alternating colors of orange and light brown.
70	40	S11	39 to 41	24/15	5-6-8-7	Advanced 4-Inch-ID casing to 39 ft.		S11: SILTY SAND (SM); ~65% fine sand, ~35% non-plastic fines, light brown. More silt towards bottom 2" of recovery and in tip.
	45	S12	44 to 46	24/16	5-6-10-17			S12: SILTY SAND (SM); ~60% fine sand, ~40% non-plastic fines, brown. Increased sand content from 3.5" to 12" of recovery. Mostly silt from 12" to 16" of recovery.
60	50	S13	49 to 51	24/18	3-4-6-4			S13: SILTY SAND (SM); ~50% fine sand, ~50% non-plastic fines, brown.

NOTES: Drilled ~35 feet West of Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

NORTHING (ft): 3,045,867 **EASTING (ft):** 745,365
GROUND SURFACE EL. (ft): 110 **DATE START/END:** 8/11/2020 - 8/13/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B10

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	55	S14	54 to 56	24/17	4-3-3-4		FINE SAND AND SILT	S14: SILT (ML); ~90% non-plastic fines, ~10% fine sand, light gray with slight orange discoloration. Able to roll slightly. Dilatancy = quick.
						Add supermud. Slight loss of water.		
50	60	S15	59 to 60.7	20/14	2-3-11-50/2"			S15 (0" - 11"): SILT (ML); ~90% low-plasticity fines, ~10% fine sand. Varves of silt and clay from 9" to 11".
						Spoon bouncing on fourth interval. Switched to 4-Inch button bit after S15	GRAVELLY SAND	S15 (11" - 14"): SILTY SAND WITH GRAVEL (SM); ~45% fine to coarse sand, ~40% low-plasticity fines, ~15% fine to coarse gravel.
		C1	62.5 to 64.5	24/24		Drill chatter and hard drilling at ~61 ft. Start telescoping 3-Inch-ID casing at 62.5 ft. Flushed hole with clean water.		C1: Boulder (60.5' - 64.5')
	65					Switched to NX core barrel at 62.5 ft. Core barrel slipped from ~63.5 ft. to 64 ft. Drilled out boulder at 64.5 ft.		
		S16	67 to 69	24/6	13-15-11-11	Return changed from white to brown to gray. Rig bouncing at ~66 ft. Switched back to split spoon sampler at 67 ft.		S16: SILTY SAND WITH GRAVEL (SM); ~40% fine to coarse sand, ~35% gravel, ~25% non-plastic fines, gray.
40	70					Lost~150 gallons of water while spinning 3-Inch-ID casing to 70 ft.		
						Lost ~150 gallons of water while washing to 73 ft. Used ~ 250 gallons of water to spin 3-Inch-ID casing to 73 ft.	BEDROCK	
		C2	73 to 78	60/48	63	Switched to NX core barrel at 73 ft. Core Times (min/ft): 1.5, 3.5, 4, 3.5, 4.		C2: DIORITE: Black with medium grained white, silver, gray clasts, hard, slightly to moderately weathered joints from 0 to 90 degrees spaced 0" to 14" apart. Nearly vertical joints with sand seams from 8" to 16", 39" to 43" and 43" to 48". Muscovite throughout. Orange discoloration at horizontal joints. ANDOVER GRANITE
	75							
30	80							Bottom of boring at 78 feet. Backfilled with Soil Cuttings.

NOTES: Drilled ~35 feet West of Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

BORING INFORMATION

NORTHING (ft): 3,045,775 **EASTING (ft):** 745,490
GROUND SURFACE EL. (ft): 107.5 **DATE START/END:** 8/5/2020 - 8/6/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 64.0 **DRILLER NAME:** J. Stevens
LOGGED BY: E. Winter **RIG TYPE:** Diedrich D-25 ATV Rig

BORING

B11

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:**
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** 2.625 inch **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Driven casing and washed with rotary tooling.
WATER LEVEL DEPTHS (ft): ▼ 6.2 8/6/2020 7:18 am

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S1	0 to 2	24/12	1/12"-2-4		SAND	0" - 3": TOPSOIL, Roots and wood present. S1 (3" - 12"): SILTY SAND (SM); ~75% fine to coarse sand, ~20% non-plastic fines. 10% fine gravel, light brown. Some roots present.
		S2	2 to 4	24/18	3-4-4-5			S2: SILTY SAND (SM); ~70% fine to medium sand, ~30% non-plastic fines, light brown with orange discoloration from 16" to 18". Roots and piece of black gravel present.
	5	S3	4 to 6	24/9	5-4-7-7	Start driving 4-Inch-ID casing after S2.		S3: Similar to S2, except horizontal orange discoloration at 5".
		S4	6 to 8	24/9	5-7-6-7		FINE SAND AND SILT	S4: SILTY SAND (SM); ~85% fine sand, ~15% non-plastic fines, light brown.
100		S5	8 to 10	24/15	2-3-4-5			S5: SILTY SAND (SM); ~80% fine sand, ~20% non-plastic fines, gray. Piece of gravel in wash.
	10							
		S6	14 to 16	24/22	2-3-3-2			S6: SILTY SAND (SM); ~85% fine to medium sand, ~15% non-plastic fines, light gray.
	15							
90								
		S7	19 to 21	24/24	3-3-5-4	Advanced 4-Inch-ID casing to 19 ft.		S7: SANDY SILT (ML); ~70% non-plastic fines, ~30% fine sand, light gray.
	20					Add supermud.		

NOTES: Drilled ~3 feet North of Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

NORTHING (ft): 3,045,775 **EASTING (ft):** 745,490
GROUND SURFACE EL. (ft): 107.5 **DATE START/END:** 8/5/2020 - 8/6/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B11

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S8	24 to 26	24/18	5-2-2-3		FINE SAND AND SILT	S8: Similar to S7.
80								
	30	S9	29 to 31	24/15	4-3-5-5			S9: Similar to S7, except light brown with horizontal orange staining from 12" to 15".
	35	S10	34 to 36	24/15	4-4-4-4			S10: Similar to S7.
70								
	40	S11	39 to 41	24/17	3-2-2-3			S11: SILT WITH SAND (ML); ~80% non-plastic fines, ~20% fine sand, light brown. Dark gray varve of silt at 16" of recovery.
	45	S12	44 to 46	24/16	4-3-4-5			S12: SILT (ML); ~90% non-plastic fines, ~10% fine sand, light brown. Dark gray varve of silt at 2".
60						Very hard drilling and rig chatter at 46.5 ft. Advanced a 5 ft section of casing to 24 ft. Switched to 4-Inch button bit at 46.5 ft. Rig bouncing at 47.5 ft. Drilled out possible boulder from 46.5 ft to 47.5 ft.	GRAVELLY SAND	
	50	S13	49 to 51	24/11	20-18-30-31			S13: SILTY GRAVEL WITH SAND (GM); ~60% subangular to subrounded gravel, ~20% fine to coarse sand, ~20% non-plastic fines, brown. Muscovite present. Wash consisted of similar material.
						Drilling resistance increased at 51 ft.		

NOTES: Drilled ~3 feet North of Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

NORTHING (ft): 3,045,775 **EASTING (ft):** 745,490
GROUND SURFACE EL. (ft): 107.5 **DATE START/END:** 8/5/2020 - 8/6/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B11

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
						Rig chatter at 53 ft.	GRAVELLY SAND	
	55	S14	54 to 56	24/9	15-19-30-44			S14: Similar to S13, Except gray from 0" to 1", brown from 1" to 5", dark gray from 5" to 7" and orange from 7" to 9".
50						Rig chatter and bouncing at 56.5 ft. Drilled out possible boulder from 56 ft. to 57 ft. Very hard drilling at ~58.5 ft.		
	60	S15	59 to 59.3	4/2	100/4"	Hole collapsing. Spoon bouncing on 1st interval.		S15: SILTY GRAVEL WITH SAND (GM); ~65% fine to coarse subangular gravel, ~20% non-plastic fines, ~15% fine to coarse sand, gray. Recovery only in tip.
						Very Hard drilling.	BEDROCK	Possible top of bedrock.
	65					Drilled with button bit to 64 ft.		Bottom of boring at 64 feet. Backfilled with Soil Cuttings.
40								
	70							
	75							
30								
	80							

NOTES: Drilled ~3 feet North of Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

BORING INFORMATION

NORTHING (ft): 3,046,167 **EASTING (ft):** 745,098
GROUND SURFACE EL. (ft): 100 **DATE START/END:** 8/24/2020 - 8/24/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 49.0 **DRILLER NAME:** J. Stevens / T. Tucker
LOGGED BY: E. Winter **RIG TYPE:** Mobile B-59 Truck Rig

BORING
B12

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:** NX
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** 2.625 inch **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Driven casing and washed with rotary tooling.
WATER LEVEL DEPTHS (ft): ▼ 11.0 8/24/2020 12:00 pm

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
								VACUUM EXCAVATED TO 7 FT ON 8/18/2020. 0.5"-1": TOPSOIL.
		G1						G1: SILTY SAND (SM); ~80% fine sand, ~20% non-plastic fines, light brown.
		G2						G2: Similar to G1.
	5	G3						G3: Similar to G1.
90	10	S1	9 to 11	24/12	2-3-3-3	Start driving 4-Inch-ID casing after vacuum excavating.	FINE SAND AND SILT	S1: SILTY SAND (SM); 53.0% fine sand, 47.0% non-plastic fines, brown. Grain size analysis performed.
	15	S2	14 to 16	24/13	3-4-4-6			S2: SILTY SAND (SM); ~70% fine sand, ~30% non-plastic fines, light brown.
80	20	S3	19 to 21	24/12	5-5-5-5	Advanced 4-Inch-ID casing to 19 ft.		S3: Similar to S1.

NOTES: Vacuum Excavated to 7 feet. Drilled on Marked Location

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

NORTHING (ft): 3,046,167 **EASTING (ft):** 745,098
GROUND SURFACE EL. (ft): 100 **DATE START/END:** 8/24/2020 - 8/24/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B12

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S4	24 to 26	24/3	4-5-5-4			S4: Similar to S1.
						Slight rig chatter at ~ 28 ft.	GRAVELLY SAND	
70	30	S5	29 to 31	24/12	13-12-15-14			S5: SILTY SAND WITH GRAVEL (SM); ~55% fine to coarse sand, ~25% fine to coarse gravel, ~20% non-plastic fines, brown. Possible weathered rock in tip.
						Switched to 3-Inch button bit after S5. Abrupt rig chatter at ~31.5 ft. Telescope 3-Inch-ID casing at 31.5 ft. Loss of water from 31.5 ft. to 34 ft.	W. ROCK	
	35	S6	34 to 36	24/13	27-40-37-40			S6: WEATHERED ROCK; ~70% fine to coarse angular gravel, ~15% fine to coarse sand, ~15% non-plastic fines, gray with black discoloration.
						Advanced 3-Inch-ID casing to 39 ft. Switched to NX core barrel at 39 ft. Core Times (min/ft): 2, 1.5, 2, 2, 2.5.	BEDROCK	
60	40	C1	39 to 44	60/58	64			C1: GRANITE: Gray to black with medium to coarse grained white, clear, light gray, green, silver clasts, very hard, slightly weathered rough, irregular joints spaced 0" to 6" apart, joints dipped at 50 degrees. Nearly vertical joint from 0" to 9". ANDOVER GRANITE
	45	C2	44 to 49	60/56	67	Core Times (min/ft): 2.5, 2.5, 2, 2.5, 2.5.		C2: Similar to C1, except joints are mostly at 30 degrees spaced 1" to 11" apart. Highly fractured irregular joints from 23" to 36".
50	50							Bottom of boring at 49 feet. Backfilled with Soil Cuttings.
	55							

NOTES: Vacuum Excavated to 7 feet. Drilled on Marked Location

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

BORING INFORMATION

NORTHING (ft): 3,045,775 **EASTING (ft):** 745,189
GROUND SURFACE EL. (ft): 111 **DATE START/END:** 8/10/2020 - 8/11/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 66.0 **DRILLER NAME:** J. Stevens
LOGGED BY: E. Winter **RIG TYPE:** Diedrich D-25 ATV Rig

BORING
B13

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:**
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** 2.625 inch **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Driven casing and washed with rotary tooling.
WATER LEVEL DEPTHS (ft): ▼ 15.2 8/11/2020 7:00 am

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
110		S1	0 to 2	24/1	3-4-3-4		SAND	S1: No Recovery. Piece of wood and pine needles stuck in tip.
		S2	2 to 4	24/3	2-4-4-5			S2: SILTY SAND (SM); ~75% fine to coarse sand, ~15% non-plastic fines, ~<5% fine gravel, brown. Pine needles and wood present.
	5	S3	4 to 6	24/8	4-5-8-10	Start advancing 4-Inch-ID casing after S2. Drilling resistance increased at ~ 3.5 ft.		S3: SILTY SAND (SM); ~80% fine to coarse sand, ~20% non-plastic fines, brown. Gravel in wash.
		S4	6 to 8	24/10	7-8-8-10			S4: Similar to S3, except sand is fine to medium.
		S5	8 to 10	24/8	5-4-6-6			S5 (0" - 5"): WIDELY GRADED SAND WITH SILT (SP-SM); ~90% fine to coarse sand, ~10% non-plastic fines, light gray. Coarser from 4" to 5" of recovery.
	10						FINE SAND AND SILT	S5 (5" - 8"): SILTY SAND (SM); ~55% fine sand, ~45% non-plastic fines, light brown. Mostly silt in tip.
100								
	15	S6	14 to 16	24/16	3-4-5-5			S6: SILTY SAND (SM); ~60% fine sand, ~40% non-plastic fines, light brown. Horizontal orange staining from 13" to 15" of recovery.
	20	S7	19 to 21	24/18	4-4-3-2			S7: SILTY SAND (SM); ~65% fine sand, ~35% non-plastic fines, light brown.
90								

NOTES: Drilled ~4 feet East of Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

NORTHING (ft): 3,045,775 **EASTING (ft):** 745,189
GROUND SURFACE EL. (ft): 111 **DATE START/END:** 8/10/2020 - 8/11/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B13

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
						Advanced 4-Inch-ID casing to 24 ft.	FINE SAND AND SILT	
	25	S8	24 to 26	24/13	2-4-4-5			S8: SILT WITH SAND (ML); ~80% non-plastic fines, ~20% fine sand, light brown.
	30	S9	29 to 31	24/19	3-3-4-4			S9: Similar to S8, except sand is fine to medium and stained orange at 2.5".
80								
	35	S10	34 to 36	24/17	3-4-5-6			S10: SANDY SILT (ML); ~70% non-plastic fines, ~30% fine sand, brown.
						Rig chatter at ~ 37 ft.		
	40	S11	39 to 41	24/17	2-3-3-3			S11: SANDY SILT (ML); ~60% non-plastic fines, ~40% fine sand, light brown.
70								
						Add supermud.		
	45	S12	44 to 46	24/18	4-5-5-4			S12: Similar to S11.
	50	S13	49 to 51	24/19	5-4-2-2			S13: SILT (ML); 94.5% non-plastic fines, 5.5% fine sand, light brown. <Grain size analysis performed.>
60								

NOTES: Drilled ~4 feet East of Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

NORTHING (ft): 3,045,775 **EASTING (ft):** 745,189
GROUND SURFACE EL. (ft): 111 **DATE START/END:** 8/10/2020 - 8/11/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B13

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
								S14 (0"-3.5"): Similar to S13.
	55	S14	54 to 56	24/12	8-13-24-56		GRAVELLY SAND	S14 (3.5" - 12"): SILTY GRAVEL WITH SAND (GM); ~60% subangular fine to coarse gravel, ~25% non-plastic fines, ~15% fine to coarse sand, brown. Some gravel is black and some is quartz.
						Hard drilling at ~57 ft.		
						Decreased drilling resistance at ~58 ft. Hard drilling at ~58.5 ft.		
	60					Decreased resistance at ~59.5 ft. Hard drilling from ~59.75 ft. to 61 ft.		
50		S15	61 to 62.8	21/12	48-35-31-100/3"			S15: SILTY GRAVEL WITH SAND (GM); ~60% subangular fine to coarse gravel, ~20% fine to coarse sand, ~20% non-plastic fines, brown. Large quartz and black flakey gravel observed.
						Button bit down to 66 ft. Alternating between chattering and decreased resistance. Return contained black rock fragments. Driller and GEI Rep. agree not competent rock.	POSSIBLE W. ROCK	
	65							
	70							Bottom of boring at 66 feet. Backfilled with Soil Cuttings.
40								
	75							
	80							
30								

NOTES: Drilled ~4 feet East of Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

BORING INFORMATION

NORTHING (ft): 3,045,423 **EASTING (ft):** 745,259
GROUND SURFACE EL. (ft): 107 **DATE START/END:** 8/6/2020 - 8/10/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 59.0 **DRILLER NAME:** J. Stevens
LOGGED BY: E. Winter **RIG TYPE:** Diedrich D-25 ATV Rig

BORING
B14 (OW)
PAGE 1 of 3

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:** NX
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** 2.625 inch **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Driven casing and washed with rotary tooling.
WATER LEVEL DEPTHS (ft): ▼ 14.5 8/10/2020 9:20 am

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S1	0 to 2	24/15	WOR-1-1-1		SAND	0" - 2": TOPSOIL, dark brown with wood and leaves. S1: WIDELY GRADED SAND WITH SILT (SP-SM); ~85% fine to coarse sand, ~10% non-plastic fines, ~<5% gravel. Fine roots and wood present.
		S2	2 to 4	24/20	1-1-2-2			S2: NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine to medium sand, ~10% non-plastic fines, light brown. Fine roots present throughout.
	5	S3	4 to 6	24/9	2-3-3-6	Start driving 4-Inch-ID casing after S2.		S3: NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine to medium sand, ~10% non-plastic fines, brown. Finer roots present. Finer in tip.
100		S4	6 to 8	24/10	5-6-9-6		FINE SAND AND SILT	S4: SILTY SAND (SM); ~70% fine sand, ~30% non-plastic fines, light gray.
		S5	8 to 10	24/14	3-5-5-5			S5: SILTY SAND (SM); ~80% fine to medium sand, ~20% non-plastic fines, light brown with orange discoloration throughout.
	10							
	15	S6	14 to 16	24/12	4-4-5-4			S6: SILTY SAND (SM); ~60% fine sand, ~40% non-plastic fines, light brown from 0" to 2" and light gray from 2" to 12".
90								
	20	S7	19 to 21	24/12	2-1-2-3	Advanced 4-Inch-ID casing to 19 ft.		S7: SILT WITH SAND (ML); 84.7% non-plastic fines, 15.3% fine to medium sand. Black material observed at 11". <Grain size analysis performed.>

NOTES: Drilled ~3 feet North of Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

NORTHING (ft): 3,045,423 **EASTING (ft):** 745,259
GROUND SURFACE EL. (ft): 107 **DATE START/END:** 8/6/2020 - 8/10/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B14 (OW)

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
							FINE SAND AND SILT	
	25	S8	24 to 26	24/15	3-2-4-5			S8: Similar to S7, except varve of dark gray silt at 8 " and orange discoloration from 7" to 8".
80						Advanced 4-Inch-ID casing to 24 ft. after S8.		
	30	S9	29 to 31	24/15	3-2-2-2			S9: SILT (ML); ~90% non-plastic fines, ~10% fine sand, light brown with orange discoloration.
						Advanced 4-Inch-ID casing to 29 ft. after S9.		
	35	S10	34 to 36	24/18	4-3-2-4			S10: Similar to S9.
70								
						Drilling resistance increased at ~38.5 ft.		
	40	S11	39 to 41	24/9	17-17-29-27			S11 (0" - 4") SILT (ML); ~90% non-plastic fines, ~10% fine sand, brown with horizontal orange discoloration.
							GRAVELLY SAND	S11 (4" - 9") SILTY GRAVEL WITH SAND (GM); ~65% subangular to subrounded gravel, ~20% non-plastic fines, ~15% fine to coarse sand, brown.
						Rig bouncing at ~42 ft. Switched to 4-Inch button bit at 42 ft. Drilled out possible boulder from ~42 ft. to 43 ft.		
	45	S12	44 to 46	24/9	19-24-24-68			S12: Similar to S11 (4" - 9"). Some gravel is granite or quartz fragments.
60						Very hard drilling and rig chatter from ~46 ft. to 46.75 ft.		
						Hard chatter from ~49 ft. to 51 ft. Two ~ 6 inch boulders according to driller.		

NOTES: Drilled ~3 feet North of Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

NORTHING (ft): 3,045,423 **EASTING (ft):** 745,259
GROUND SURFACE EL. (ft): 107 **DATE START/END:** 8/6/2020 - 8/10/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B14 (OW)

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	50					Telescoped 3-Inch-ID casing at 51 ft.	W. ROCK	
		S13	51 to 51.3	3/2	100/3"	Slow drilling and loss of water from 51.5 ft. to 54 ft.		S13: SILTY SAND WITH GRAVEL (SM); ~50% fine to coarse sand, ~40% non-plastic fines, ~10% fine gravel, light brown and gray. Muscovite present. Recovery only in tip.
						Advanced 3-Inch-ID casing to 54 ft. Flushed hole with clean water. Switched to NX core barrel at 54 ft.	BEDROCK	
	55	C1	54 to 59	60/57	85	Core Times (min/ft): 3.5, 4.5, 4, 4, 5. Return was white during C1 run.		C1: GRANITE; Generally light gray with white, dark gray and black medium to coarse grains, very hard, slight weathered to fresh rough joints spaced 2" to 25" apart mostly horizontal to 30 degrees. Muscovite, quartz, and biotite present. Joints occur at zones of flakey mica. Slight purple hues around 18" to 57". ANDOVER GRANITE
50								
	60							Bottom of boring at 59 feet. Installed Ground Water Observation Well. Backfilled with Gravel and Soil Cuttings below Observation Well. Backfilled with Clean Sand around Observation Well.
	65							
40								
	70							
	75							
30								

NOTES: Drilled ~3 feet North of Marked Location.

PROJECT NAME: Project Red Squirrel

CITY/STATE: Andover, Massachusetts

GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

BORING INFORMATION

NORTHING (ft): 3,046,158 **EASTING (ft):** 744,758
GROUND SURFACE EL. (ft): 99 **DATE START/END:** 8/20/2020 - 8/20/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 27.0 **DRILLER NAME:** J. Stevens
LOGGED BY: E. Winter **RIG TYPE:** Diedrich D-25 ATV Rig

BORING
B15 (OW)

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:** NX
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** 2.625 inch **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Driven casing and washed with rotary tooling.
WATER LEVEL DEPTHS (ft): ▼ 9.2

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
							FILL	VACUUM EXCAVATED TO 8 FEET ON 8/18/2020. 0" - 2" PAVEMENT
								SUBBASE: ~65% gravel, ~45% fine to coarse sand, ~5% non-plastic fines, dark brown.
		G1						G1: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); 75% fine to coarse sand, ~15% gravel, ~10% non-plastic fines. Gravel up to 4" observed.
		G2					FINE SAND AND SILT	G2: SILTY SAND (SM); ~55% fine sand, ~45% non-plastic fines, light brown.
	5							
		G3						G3: SILTY SAND (SM); ~70% fine sand, ~30% non-plastic fines, light brown and light gray with orange discoloration.
		S1	8 to 10	24/15	5-7-14-16	Start driving 4-Inch-ID casing after vacuum excavating. Drill chatter while washing from 8 ft. to 10 ft.		S1 (0" - 4") SILTY SAND (SM); ~55% fine sand, ~45% non-plastic fines, light brown.
90							GRAVELLY SAND	S1 (4" - 15"): SILTY SAND (SM); 56.3% fine to coarse sand, 30.2% non-plastic fines, 13.5% fine to coarse gravel, brown. <Grain size and hydrometer performed.>
	10	S2	10 to 12	24/8	16-16-31-28			S2: WIDELY GRADED GRADED SAND WITH SILT AND GRAVEL (SW-SM); 47.4% fine to coarse sand, 40.7% fine to coarse gravel, 11.9% non-plastic fines, brown. <Grain size and hydrometer performed.>
		S3	12 to 14	24/7	16-15-16-32			S3: WIDELY GRADED GRAVEL WITH SAND (GW); ~55% fine to coarse gravel, ~40% fine to coarse sand, ~5% non-plastic fines, brown. 1" piece of gravel observed.
		S4	14 to 14.6	7/6	60-60/1"	Advanced 4-Inch-ID casing to 14 ft. Spoon bouncing on second interval. Switched to 4-Inch button bit after S4.	W. ROCK	S4: SILTY SAND WITH GRAVEL (SM); ~50% fine to coarse sand, ~30% fine to coarse gravel, ~20% non plastic fines. 1" piece of gravel in wash.
	15					Very hard drilling from 15 ft. to 17 ft.		
		C1	17 to 22	60/56	83	Switched to NX core barrel at 17 ft. Core Times (min/ft): 3.5, 5, 3.5 4.5, 5.	BEDROCK	C1 (0"-38"): GRANITE: Dark gray with some black and white fines grains, medium hard, slightly weathered joints from 0 to 60 degrees from horizontal spaced 0" to 16" apart. Black and white banding from 0" to 18" at ~60 degrees. ANDOVER GRANITE C1 (38"-56"): GRANITE; Gray with white, black, dark gray, clear, and light purple clasts, medium to coarse grains, hard, slightly weathered, generally intact. ANDOVER GRANITE
80								
	20							

NOTES: Vacuum Excavated to 8 feet. Drilled ~ 10 feet North of Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

NORTHING (ft): 3,046,158 **EASTING (ft):** 744,758
GROUND SURFACE EL. (ft): 99 **DATE START/END:** 8/20/2020 - 8/20/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B15 (OW)

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	C2	22 to 27	60/60	100	Core Times (min/ft): 3.5, 4.5, 8, 9, 12.5.	BEDROCK	C2: GRANITE: Gray with white, dark gray, clear, light purple and black medium to coarse grains, very hard, slightly weathered to fresh rough joints along clasts, nearly horizontal joints spaced 6" to 15" apart. Sand seam at 7". Finer grained from 48" to 56". Banding oriented at 30 degrees at 56". ANDOVER GRANITE
70	30							Bottom of boring at 27 feet. Installed Ground Water Observation Well. Backfilled with Gravel below Observation Well. Backfilled with Clean Sand around Observation Well.
	35							
60	40							
	45							
50	50							

NOTES: Vacuum Excavated to 8 feet. Drilled ~ 10 feet North of Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

BORING INFORMATION

NORTHING (ft): 3,047,303 **EASTING (ft):** 744,505
GROUND SURFACE EL. (ft): 99 **DATE START/END:** 8/24/2020 - 8/25/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 20.0 **DRILLER NAME:** J. Stevens / T. Tucker
LOGGED BY: E. Winter **RIG TYPE:** Mobile B-59 Truck Rig

BORING

B16 (OW)

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:**
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** 2.625 inch **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Driven casing and washed with rotary tooling.
WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
								VACUUM EXCAVATED TO 7 FEET ON 8/18/2020. 0" - 3": PAVEMENT
								SUBBASE: ~60% gravel to 6 inches, ~35% fine to coarse sand, dark brown.
							SAND	G1: SILTY SAND (SM); ~80% fine to coarse sand, ~20% non-plastic fines, light brown.
	5							G2: Similar to G1. Piece of gravel observed, probably fell in from above.
								G3: Similar to G1.
90		S1	8 to 10	24/11	11-17-20-19	Start driving 4-Inch-ID casing after vacuum excavating.		S1: SILTY SAND (SM); 74.3% fine to coarse sand, 25.7% non-plastic fines, light brown. <Grain size and hydrometer performed.>
	10	S2	10 to 12	24/12	12-15-20-16	Drilled open hole from 10 ft. to 14 ft. to take S2 and S3.		S2: NARROWLY GRADED SAND WITH SILT (SP-SM); 88.2% mostly fine to medium sand, 11.8% non-plastic fines, light brown with orange staining. Fine to coarse sand and gravel in wash. <Grain size and hydrometer performed.>
		S3	12 to 14	24/10	4-9-7-7			S3: SILTY SAND (SM); ~85% fine to medium sand, ~15% non-plastic fines, light brown. Bottom of sample is wet.
		S4	14 to 16	24/2	7-9-6-8	Drilled open hole from 14 ft. to 18 ft. to take S4 and S5.		S4: Fine to medium sand in tip, 1.5" by 1" gravel stuck in tip.
	15							S4 (Redrive): SILTY SAND (SM); ~85% fine to coarse sand, ~15% non-plastic fines, brown.
		S5	16 to 18	24/10	3-5-7-7	Redrove S4 with 3-Inch split spoon sampler at the same interval.		S5: NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine to medium sand, ~10% non-plastic fines, brown.
80		S6	18 to 20	24/5	3-4-4-4	Advanced 4-Inch-ID casing to a8 ft.		S6: Similar to S5, except sand is fine to coarse.
	20					Redrove S6 with 3-Inch split spoon sampler at the same interval.		S6 (Redrive): No Recovery.
								Bottom of boring at 20 feet. Installed Ground Water Observation Well. Backfilled with Clean Sand around Observation Well.

NOTES: Vacuum Excavated to 7 feet. Drilled on Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

BORING INFORMATION

NORTHING (ft): 3,047,547 **EASTING (ft):** 745,259
GROUND SURFACE EL. (ft): 99 **DATE START/END:** 8/21/2020 - 8/21/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 41.0 **DRILLER NAME:** J. Stevens
LOGGED BY: E. Winter **RIG TYPE:** Diedrich D-25 ATV Rig

BORING
B17

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:**
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** 2.625 inch **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Driven casing and washed with rotary tooling.
WATER LEVEL DEPTHS (ft): ▼ 19.6 8/21/2020 11:00 am

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
							SAND	VACUUM EXCAVATED TO 8 FEET ON 8/18/2020.
		G1						G1: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~75% fine to coarse sand, ~15% gravel, ~10% non-plastic fines, brown.
	5	G2						G2: SILTY SAND (SM); ~85% fine to coarse sand, ~10% rounded fine gravel, ~5% non-plastic fines, light brown.
90								
	10	S1	9 to 11	24/10	2-3-3-4	Start driving 4-Inch-ID casing after vacuum excavating.		S1: NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% fine to coarse sand, ~10% non-plastic fines, ~5% gravel, brown.
						Increased resistance while driving 4-Inch-ID casing from 9 ft. to 14 ft. Slight rig chatter at 12 ft.		
	15	S2	14 to 16	24/11	5-8-10-11			S2: NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine to medium sand, ~10% non-plastic fines, light brown. Sand is mostly fine.
80								
	20	S3	19 to 21	24/8	5-7-11-12			S3: NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine to medium sand, ~10% non-plastic fines, brown.

NOTES: Vacuum Excavated to 8 feet. Drilled ~ 3 feet North West of Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

NORTHING (ft): 3,047,547 **EASTING (ft):** 745,259
GROUND SURFACE EL. (ft): 99 **DATE START/END:** 8/21/2020 - 8/21/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B17

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S4	24 to 26	24/9	7-8-11-10		SAND	S4: SILTY SAND WITH GRAVEL (SM); ~65% fine to coarse sand, ~20% gravel, ~15% non-plastic fines, brown.
						Slight rig chatter at ~27 ft.		
70	30	S5	29 to 31	24/8	6-7-12-10			S5: SILTY SAND WITH GRAVEL (SM); ~70% fine to coarse sand, ~15% gravel, ~15% non-plastic fines, brown with some orange discoloration.
						Advanced 4-Inch-ID casing to 34 ft.		
	35	S6	34 to 36	24/0	5-7-8-9			S6: No Recovery. S6 Redrive: No Recovery. Wash consisted of gravel to .5 inch and medium to coarse sand.
						Redrove S6 with 3-Inch split spoon sampler at same interval.		
60	40	S7	39 to 41	24/4	6-8-8-10			S7: NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine sand, ~10% non-plastic fines, light brown.
								Bottom of boring at 41 feet. Backfilled with Soil Cuttings.
	45							
50	50							
	55							

NOTES: Vacuum Excavated to 8 feet. Drilled ~ 3 feet North West of Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

BORING INFORMATION

NORTHING (ft): 3,046,796 **EASTING (ft):** 745,674
GROUND SURFACE EL. (ft): 101 **DATE START/END:** 7/28/2020 - 7/29/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.
TOTAL DEPTH (ft): 41.0 **DRILLER NAME:** J. Stevens
LOGGED BY: E. Winter **RIG TYPE:** Diedrich D-25 ATV Rig

BORING
B18

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:**
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** 2.625 inch **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Driven casing and washed with rotary tooling.
WATER LEVEL DEPTHS (ft): ▼ 10.1 7/29/2020 8:55 am

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
100							SAND	Hand cleared with post-hole digger and shovel 6 ft.
		G1						G1: WIDELY GRADED SAND WITH SILT (SP-SM); ~90% fine to coarse sand, ~10% non-plastic fines, tan.
	5	G2						
		S1	6 to 8	24/16	4-4-6-6			G2: WIDELY GRADED SAND WITH SILT (SM); ~85% fine to coarse sand, ~10% non-plastic fines, ~5% rounded fine gravel, tan. S1: SILTY SAND WITH GRAVEL (SM); ~75% fine to coarse sand, ~15% fine to coarse gravel, ~10% non-plastic fines, light brown.
		S2	8 to 10	24/15	5-6-7			S2: Similar to S1, except 0% gravel.
	10							
90								
		S3	14 to 16	24/8	4-6-12-11	Start driving 4-Inch-ID casing after S2.		S3: WIDELY GRADED SAND (SW); ~90% fine to coarse sand, ~5% non-plastic fines, ~5% fine gravel, brown with orange staining. Sample is wet.
	15							
		S4	19 to 21	24/7	2-3-4-5			S4: WIDELY GRADED SAND WITH SILT (SW-SM); ~90% fine to coarse sand, ~10% non-plastic fines, light brown.
	20							
80						Faster to advance 4-Inch-ID casing than previous interval.		

NOTES: Hand Cleared to 6 feet. Drilled ~55 feet East of Marked Location.

PROJECT NAME: Project Red Squirrel
CITY/STATE: Andover, Massachusetts
GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

NORTHING (ft): 3,046,796 **EASTING (ft):** 745,674
GROUND SURFACE EL. (ft): 101 **DATE START/END:** 7/28/2020 - 7/29/2020
VERT./HORIZ. DATUMS: NAVD 88/NAD 83 **DRILLING COMPANY:** Northern Drill Service, Inc.

BORING B18

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S5	24 to 26	24/15	3-3-3-4		SAND	S5: SILTY SAND (SM); 73.8% mostly fine sand, 26.2% non-plastic fines, light brown. <Grain size analysis performed.>
	30	S6	29 to 31	24/6	6-4-5-6			S6: SILTY SAND (SM); ~70% fine to coarse sand, ~25% non-plastic fines, ~<5% gravel, light gray.
70								
	35	S7	34 to 36	24/11	9-11-11-12			S7 (0" - 8"): WIDELY GRADED SAND WITH GRAVEL (SW); ~65% fine to coarse sand, ~30% subrounded gravel, ~5% non-plastic fines, brown. S7 (8" - 11"): SILTY SAND (SM); ~75% fine to coarse sand, ~20% non-plastic fines, ~5% gravel, light brown.
	40	S8	39 to 41	24/12	9-14-18-39	Advanced 4-Inch-ID casing to 39 ft.		S8: WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~70% fine to coarse sand, ~20% fine gravel, ~10~ non-plastic fines, light brown. Finer sand observed from 5" to 12" of recovery.
60								Bottom of boring at 41 feet. Backfilled with Soil Cuttings.
	45							
	50							
50								
	55							

NOTES: Hand Cleared to 6 feet. Drilled ~55 feet East of Marked Location.

PROJECT NAME: Project Red Squirrel

CITY/STATE: Andover, Massachusetts

GEI PROJECT NUMBER: 2001764

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 2001764 TYPED LOGS.GPJ 10/8/20

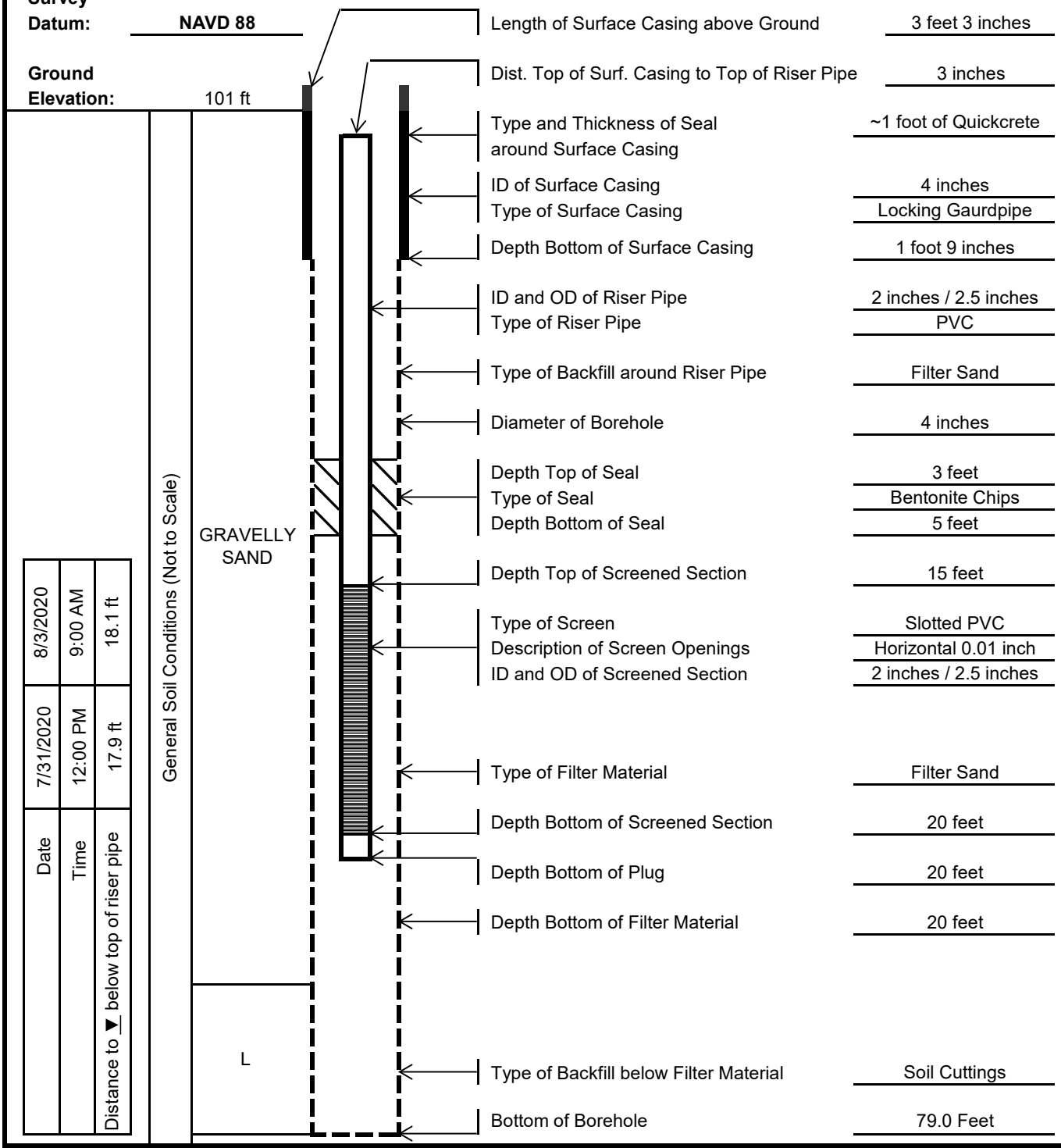
Groundwater Well Installation Log

B2

Project	Red Squirrel Andover	**GEI Proj. No.**	2001764
City / Town	Andover, Massachussetts	**Location**	Wooded Area
Client	Gillette Company		East of Existing Building
Contractor	Northern Drill Service, Inc.		(See Boring Location Plan)
Driller	J. Stevens **GEI Rep.** E. Winter	**Install Date**	7/31/2020

Survey Datum: NAVD 88

Ground Elevation: 101 ft



Date	Time	Distance to ▼ below top of riser pipe
8/3/2020	9:00 AM	18.1 ft
7/31/2020	12:00 PM	17.9 ft

Notes:

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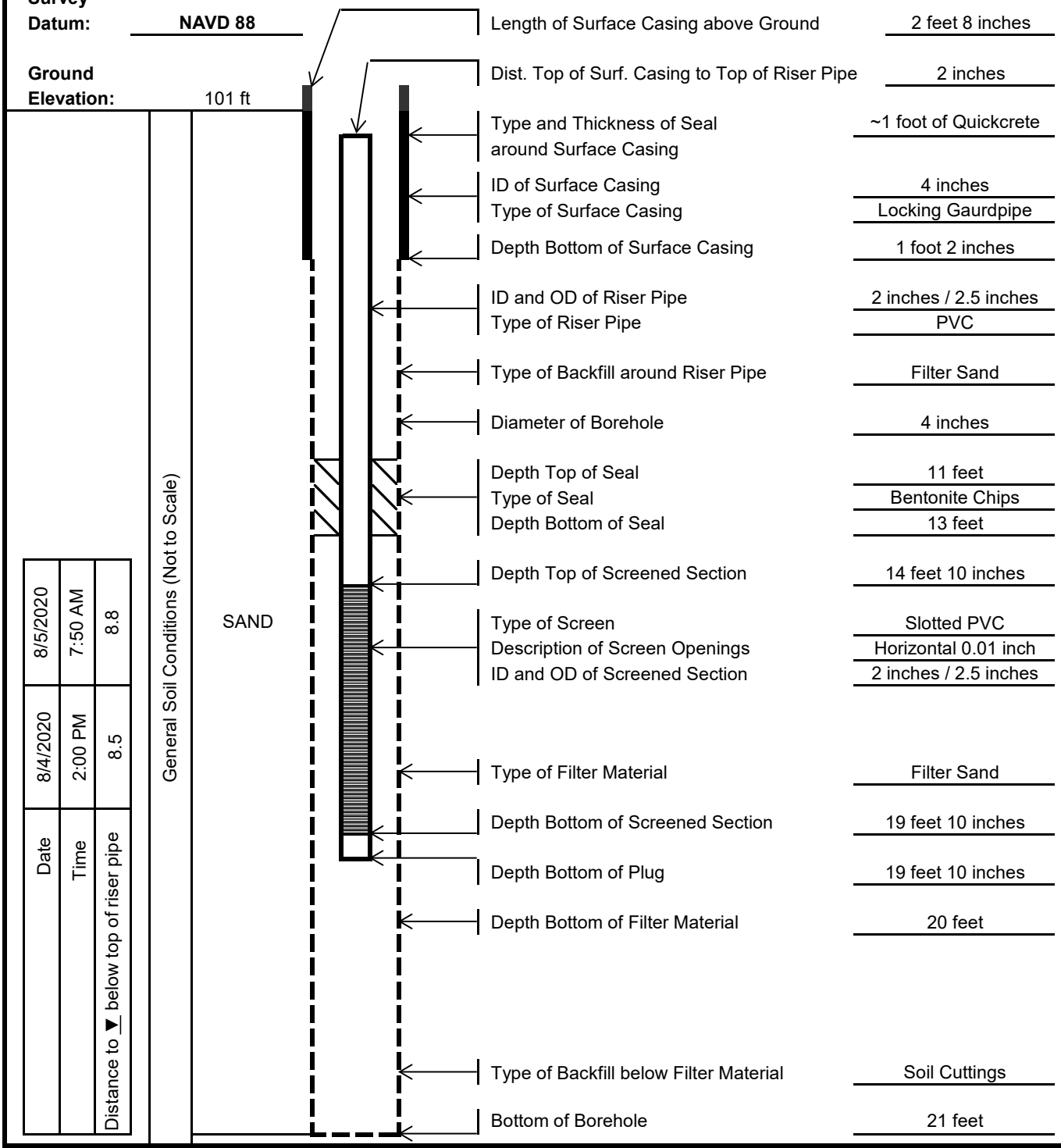
Groundwater Well Installation Log

B5

Project	Red Squirrel Andover	**GEI Proj. No.**	2001764
City / Town	Andover, Massachussetts	**Location**	Wooded Area
Client	Gillette Company		Southeast of Existing Building
Contractor	Northern Drill Service, Inc.		(See Boring Location Plan)
Driller	J. Stevens **GEI Rep.** E. Winter	**Install Date**	8/4/2020

Survey Datum: NAVD 88

Ground Elevation: 101 ft



Date	Time	Distance to ▼ below top of riser pipe
8/5/2020	7:50 AM	8.8
8/4/2020	2:00 PM	8.5

Notes: Hole was flushed with clean water before setting well.

GEI Consultants

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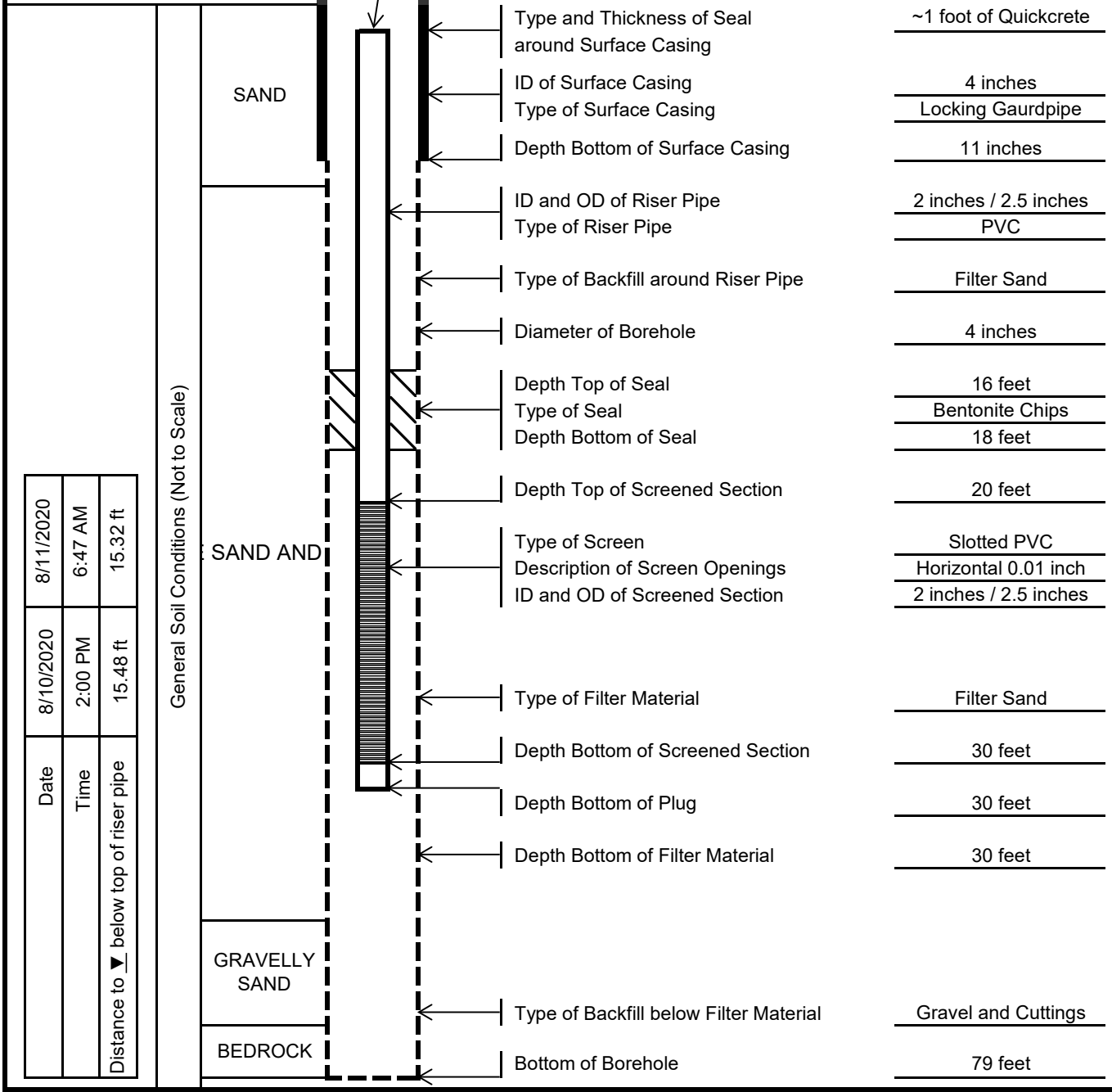
Groundwater Well Installation Log

B14

Project	Red Squirrel Andover	**GEI Proj. No.**	2001764
City / Town	Andover, Massachussetts	**Location**	Wooded Area
Client	Gillette Company		South of Existing Building
Contractor	Northern Drill Service, Inc.		(See Boring Location Plan)
Driller	J. Stevens **GEI Rep.** E. Winter	**Install Date**	8/10/2020

Survey Datum: NAVD 88

Ground Elevation: 107 ft



Length of Surface Casing above Ground	3 feet 1 inch
Dist. Top of Surf. Casing to Top of Riser Pipe	2.5 inches
Type and Thickness of Seal around Surface Casing	~1 foot of Quickcrete
ID of Surface Casing	4 inches
Type of Surface Casing	Locking Gaurdpipe
Depth Bottom of Surface Casing	11 inches
ID and OD of Riser Pipe	2 inches / 2.5 inches
Type of Riser Pipe	PVC
Type of Backfill around Riser Pipe	Filter Sand
Diameter of Borehole	4 inches
Depth Top of Seal	16 feet
Type of Seal	Bentonite Chips
Depth Bottom of Seal	18 feet
Depth Top of Screened Section	20 feet
Type of Screen	Slotted PVC
Description of Screen Openings	Horizontal 0.01 inch
ID and OD of Screened Section	2 inches / 2.5 inches
Type of Filter Material	Filter Sand
Depth Bottom of Screened Section	30 feet
Depth Bottom of Plug	30 feet
Depth Bottom of Filter Material	30 feet
Type of Backfill below Filter Material	Gravel and Cuttings
Bottom of Borehole	79 feet

Date	Time	Distance to ▼ below top of riser pipe
8/11/2020	6:47 AM	15.32 ft
8/10/2020	2:00 PM	15.48 ft

Notes:
Gravel was placed through section of rock core.
Filter sand was used to backfill 30 feet.

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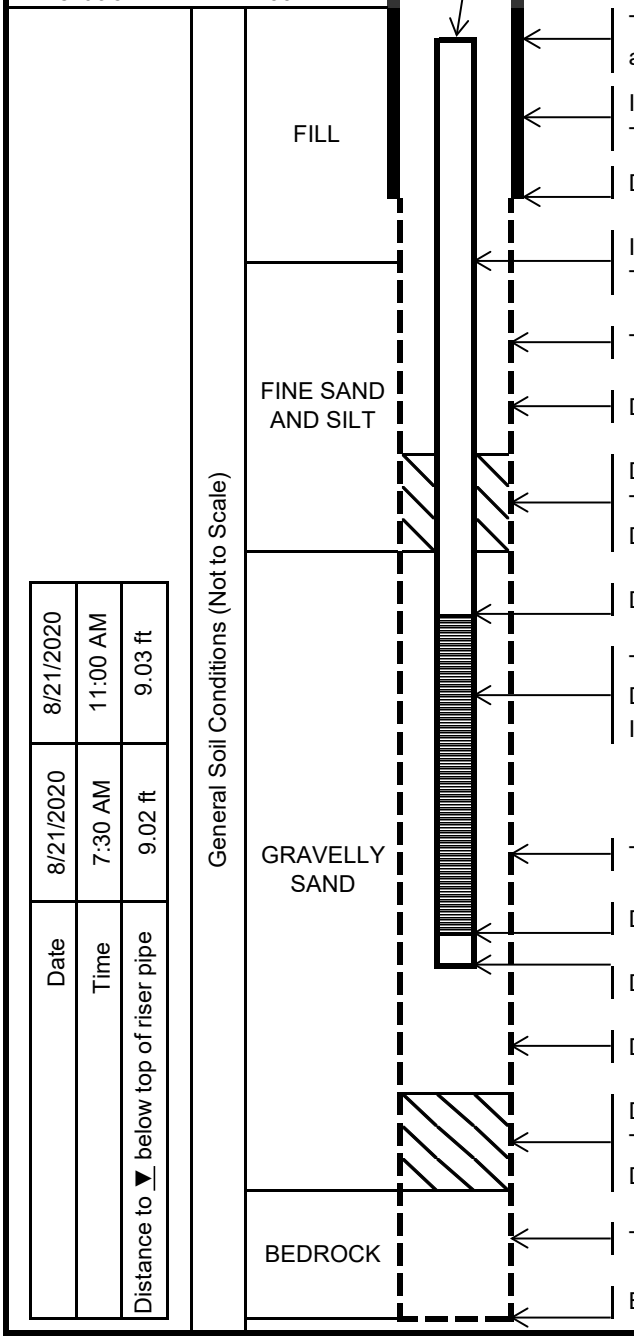
Groundwater Well Installation Log

B15

Project	Red Squirrel Andover	**GEI Proj. No.**	2001764
City / Town	Andover, Massachussetts	**Location**	Paved Area
Client	Gillette Company		Southwest of Existing Building
Contractor	Northern Drill Service, Inc.		(See Boring Location Plan)
Driller	J. Stevens **GEI Rep.** E. Winter	**Install Date**	8/20/2020

Survey Datum: NAVD 88

Ground Elevation: 99 ft



Length of Surface Casing above Ground	0 inches (flush)
Dist. Top of Surf. Casing to Top of Riser Pipe	5 inches
Type and Thickness of Seal around Surface Casing	~7 inches of Quickcrete
ID of Surface Casing	4 inches
Type of Surface Casing	Road Box
Depth Bottom of Surface Casing	10 inches
ID and OD of Riser Pipe	2 inches / 2.5 inches
Type of Riser Pipe	PVC
Type of Backfill around Riser Pipe	Filter Sand
Diameter of Borehole	4 inches
Depth Top of Seal	5 feet
Type of Seal	Bentonite Chips
Depth Bottom of Seal	7 feet
Depth Top of Screened Section	10 feet
Type of Screen	Slotted PVC
Description of Screen Openings	Horizontal 0.01 inch
ID and OD of Screened Section	2 inches / 2.5 inches
Type of Filter Material	Filter Sand
Depth Bottom of Screened Section	15 feet
Depth Bottom of Plug	15 feet
Depth Bottom of Filter Material	16 feet
Depth Top of Seal	16 feet
Type of Seal	Bentonite Chips
Depth Bottom of Seal	17 feet
Type of Backfill below Filter Material	Gravel and Filter sand
Bottom of Borehole	27 feet

Date	Time	Distance to ▼ below top of riser pipe
8/21/2020	11:00 AM	9.03 ft
8/21/2020	7:30 AM	9.02 ft

Notes:

Gravel was placed through section of rock core.
A 1 foot layer of bentonite chips was placed over the gravel from 17 ft to 16 ft.
A 1 foot layer of filter sand was placed between the bentonite chips and plug.

GEI Consultants

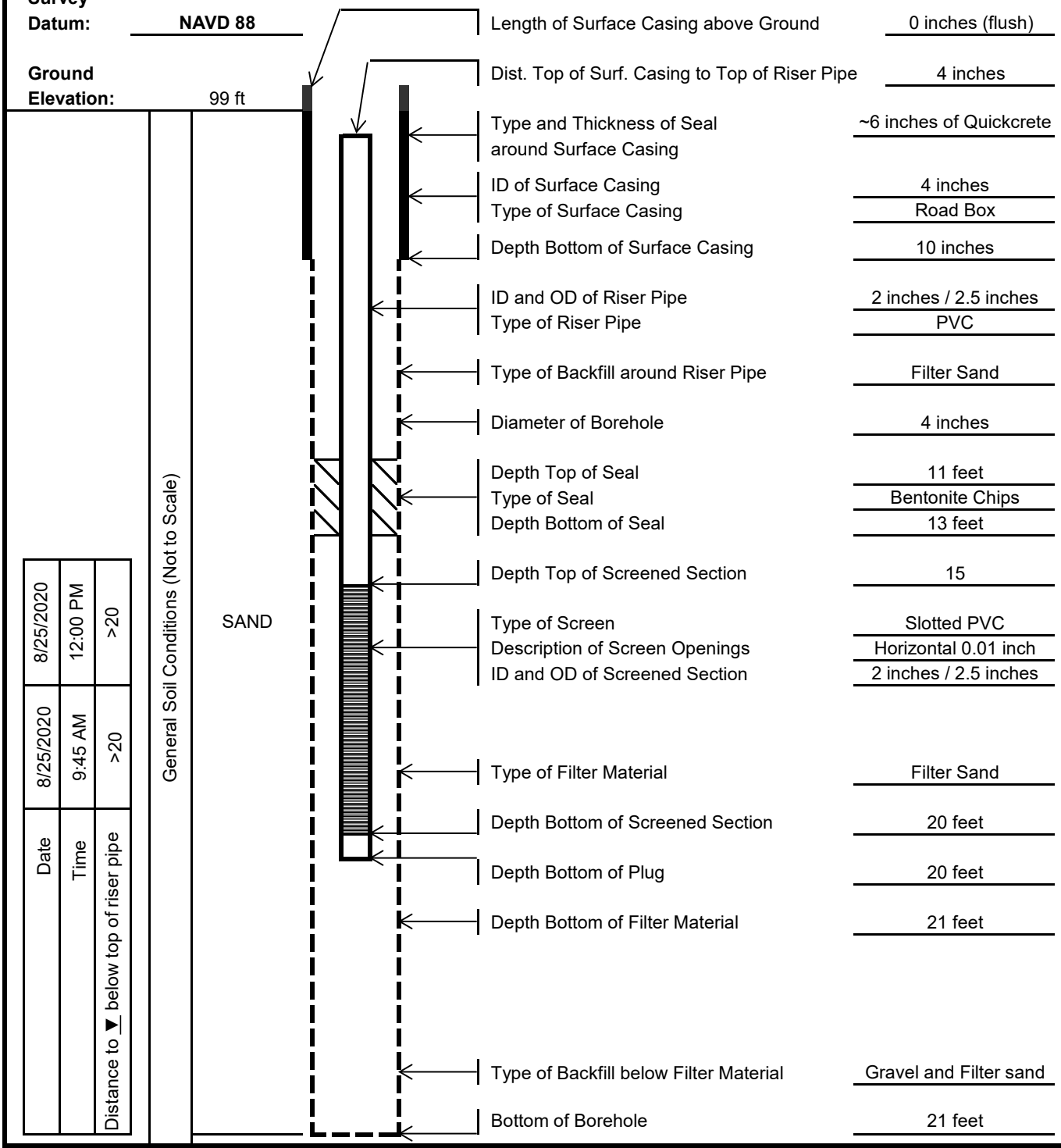
Groundwater Well Installation Log

B16

Project	Red Squirrel Andover	**GEI Proj. No.**	2001764
City / Town	Andover, Massachussetts	**Location**	Paved Area
Client	Gillette Company		West of Existing Building
Contractor	Northern Drill Service, Inc.		(See Boring Location Plan)
Driller	T. Tucker **GEI Rep.** E. Winter	**Install Date**	8/25/2020

Survey Datum: NAVD 88

Ground Elevation: 99 ft



Date	Time	Distance to ▼ below top of riser pipe
8/25/2020	12:00 PM	>20
8/25/2020	9:45 AM	>20

Notes:

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Appendix E

2020 Test Pit Logs

TEST PIT LOG

TP1

Project	Red Squirrel			**PG.**	1 **OF** 1
City/Town	Andover, MA			**Location**	N 3047801
Client	Gillette				E 746409
Contractor	Northern Drill Service, Inc.			**Ground El.**	90 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	C. DeVillers	**GEI Rep**	M. Alstede	**GEI Proj. No.**	2001764
Weather	90's F, Sunny			**Date**	7/28/2020

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1			(0-1'): Top soil, dark brown
2	G1		G1: SILTY SAND (SM); ~60% fine sand, ~30% non-plastic fines, ~10% fine to coarse gravel, black.
3			
4	G2		G2: SILTY SAND (SM); ~70% fine to coarse sand, ~20% nonplastic fines, ~10% fine gravel, tan.
5			
6			5'-8': Similar to G2.
7			
8			
9	G3		G3: SILTY SAND (SM); 73.9% fine to coarse sand, 21.5% nonplastic fines, 4.6% fine gravel, dark brown and black. Grain size and hydrometer test performed.
10			
			Bottom of test pit at 10 ft. Test pit dry at completion. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator bucket.

Notes:

Pit Dimensions (ft)

length	10
width	3
depth	10

GEI Consultants



Photo 1: TP1 at about 6.0'.



Photo 2: TP2 at about 10.0'.

TEST PIT LOG

TP2

Project	Red Squirrel			**PG.**	1 **OF** 1
City/Town	Andover, MA			**Location**	N 745369
Client	Gillette				E 3045456
Contractor	Northern Drill Service, Inc.			**Ground El.**	108 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	C. DeVillers	**GEI Rep**	M. Alstede	**GEI Proj. No.**	2001764
Weather	80's F, Cloudy			**Date**	8/4/2020

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1			(0-1'): Top soil, black/dark brown.
2 3 4	G1		G1: SILTY SAND (SM); ~60% fine to coarse sand, ~30% nonplastic fines, ~10% coarse gravel, orange and brown.
5 6	G2		G2: SILTY SAND (SM); ~70% fine sand, ~30% nonplastic fines, tan.
7 8 9 10	G3		G3: SANDY SILT (ML); 51.1% nonplastic fines, 48.9% medium to fine sand, tan. Grain size and hydrometer test performed.
			Bottom of test pit at 10 ft. Test pit dry at completion. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator bucket

Notes:

Pit Dimensions (ft)

length	12
width	3
depth	10

GEI Consultants



Photo 1: TP2 at about 5.0'.



Photo 2: TP2 at about 10.0'.

TEST PIT LOG

TP3

Project	Red Squirrel			**PG.**	1 **OF** 1
City/Town	Andover, MA			**Location**	N 745561
Client	Gillette				E 3047029
Contractor	Northern Drill Service, Inc.			**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	C. DeVillers	**GEI Rep**	M. Alstede	**GEI Proj. No.**	2001764
Weather	90's F, Sunny			**Date**	7/28/2020

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1			(0-1'): Top soil, dark brown.
2	G1		G1: SILTY SAND (SM); ~70% fine to coarse sand, ~30% nonplastic fines, tan and some orange.
3			
4			
5			
6			(5'-8'): SILTY SAND (SM); similar to G1.
7			
8			
9	G2		G2: NARROWLY GRADED SAND WITH GRAVEL (SP); 67.7% fine to coarse sand, 28% fine gravel, 4.3% nonplastic fines, tan and black. Grain size and hydrometer test performed.
10			
			Bottom of test pit at 10 ft. Test pit dry at completion. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator bucket

Notes:

Pit Dimensions (ft)

length	12
width	8
depth	10

GEI Consultants



Photo 1: TP3 at about 6.0'.



Photo 2: TP3 at about 10.0'. Around 6.0'-7.0' some orange staining is present.

TEST PIT LOG

TP4

Project	Red Squirrel			**PG.**	1 **OF** 1
City/Town	Andover, MA			**Location**	N 745675
Client	Gillette				E 3046931
Contractor	Northern Drill Service, Inc.			**Ground El.**	100 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	C. DeVillers	**GEI Rep**	M. Alstede	**GEI Proj. No.**	2001764
Weather	90's F, Sunny			**Date**	7/28/2020

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1			(0-1'): Top soil, dark brown.
2	G1		G1: SILTY SAND (SM); ~70% fine to coarse sand, ~20% nonplastic fines, ~10% fine to coarse gravel, light brown. Cobbles up to 6 in. found around 3-5 ft.
3			
4			
5			
6	G2		G2: NARROWLY GRADED SAND (SP); 87.5% fine to coarse sand, 8.1% fine gravel, 4.4% nonplastic fines, orange and brown with black spots. Grain size and hydrometer test performed. Orange layer observed at around 9.8 ft.
7			
8			
9			
10			
			Bottom of test pit at 10 ft. Test pit dry at completion. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator bucket.

Notes:

Pit Dimensions (ft)

length	12
width	3
depth	10

GEI Consultants



Photo 1: TP4 at about 5.0 ft.



Photo 2: TP4 at about 10.0 ft. Some orange staining is present at the bottom of the test pit.

TEST PIT LOG

TP5

Project	Red Squirrel			**PG.**	1 **OF** 1
City/Town	Andover, MA			**Location**	N 744742
Client	Gillette				E 3047584
Contractor	Northern Drill Service, Inc.			**Ground El.**	94 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	C. DeVillers	**GEI Rep**	M. Alstede	**GEI Proj. No.**	2001764
Weather	80's F, Sunny			**Date**	7/29/2020

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1			(0-1'): Top soil, dark brown.
2 3 4 5	G1		G1: SILTY SAND (SM); ~80% fine sand, ~20% nonplastic fines, tan. Cobbles up to 6 in.
6 7 8 9 10	G2		G2: SILTY SAND (SM); 60.5% fine to coarse sand, 39.4% nonplastic fines, 0.1% fine gravel, tan. Grain size and hydrometer test performed.
			Bottom of test pit at 10 ft. Test pit dry at completion. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator bucket

Notes:

Pit Dimensions (ft)

length	8
width	3
depth	10

GEI Consultants



Photo 1: TP5 at about 5.4 ft.



Photo 2: TP5 at about 10.0 ft.

TEST PIT LOG

TP-101

Project	Project Principio			**PG.** 1 **OF** 1	
City/Town	Andover, MA			**Location**	N 745392
Client	Fennick McCredie Architecture				E 3047122
Contractor	Northern Drill Service, Inc.			**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	J. Raymond	**GEI Rep**	R. Oulal	**GEI Proj. No.**	2300951
Weather	40's F, Overcast			**Date**	5/4/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1			(0-9"): Top soil, black/dark brown.
2	G1	1 - 2.5 ft	SILTY SAND (SM); 79.5% fine to coarse sand, 12.6% nonplastic to low plasticity fines, 7.9% fine to coarse gravel, tan. [FILL] [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
3	G2	3 - 4 ft	Thin rusting color soil seam on the east face of excavation at 2.2 ft. Not Indicative seasonal high groundwater. Likely perched surface infiltration.
4			SILTY SAND (SM); 63.9% mostly fine sand, 35.3% nonplastic fines, 0.8% fine gravel, gray. [FILL] [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
5			
6	G3	6 - 6.5 ft	WIDELY GRADED GRAVEL WITH SAND (SW); ~60% fine to coarse gravel, ~40% medium to coarse sand, gray. Some cobbles present.
7			Bottom of test pit at 6.5 ft.
8			Test pit dry at completion.
9			Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator bucket.
10			

Notes:

1. Terminated test pit because of collapsing soils and close proximity to utilities.

Pit Dimensions (ft)

Length	12
Width	3
Depth	6.5

GEI Consultants

TEST PIT LOG	TP-101



Photo 1: TP-101 at about 6.5'.



Photo 2: Rusting seam at 2.2 ft on the east face.

TEST PIT LOG

TP-102

Project	Project Principio			**PG.** 1 **OF** 1	
City/Town	Andover, MA			**Location**	N 745407
Client	Fennick McCredie Architecture				E 3047089
Contractor	Northern Drill Service, Inc.			**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	J. Raymond	**GEI Rep**	R. Oulal	**GEI Proj. No.**	2300951
Weather	40's F, Overcast			**Date**	5/4/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1			(0-8"): Top soil, black/dark brown.
2	G1	1 - 2 ft	NARROWLY GRADED SAND WITH SILT (SP-SM); 75.1% fine to coarse sand, 14.4% fine to coarse gravel, 10.5% nonplastic to low plasticity fines, tan. Some cobbles. [FILL][GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
3			
4			
5			
6			
7	G2	6 - 7 ft	NARROWLY GRADED GRAVEL WITH SAND (GP); 52.2% fine to coarse sand, 46.3% fine to coarse sand, 1.5% nonplastic to low plasticity fines, gray. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
8			Bottom of test pit at 7.0 ft. Test pit dry at completion. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator bucket.
9			
10			

Notes:

1. Terminated test pit because of collapsing soils and close proximity to utilities.

Pit Dimensions (ft)

Length	12
Width	3
Depth	7

GEI Consultants

TEST PIT LOG	TP-102



Photo 1: TP-102 at about 7'. Walls Collapsing.



Photo 2: excavated soils.

TEST PIT LOG

TP-103

Project	Project Principio	**PG.**	1 **OF** 1
City/Town	Andover, MA	**Location**	N 745565
Client	Fennick McCredie Architecture		E 3046243
Contractor	Northern Drill Service, Inc.	**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4	**Datum**	NAVD88
Operator	J. Raymond **GEI Rep** R. Oulal	**GEI Proj. No.**	2300951
Weather	40's F, Overcast	**Date**	5/4/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1			(0-1'): Top soil, black/dark brown.
2	G1	1 - 2.5 ft	WIDELY GRADED SAND WITH GRAVEL (SW); ~60% fine to coarse sand, ~40% fine to coarse gravel, tan. [FILL]
3	G2	5 - 5.5 ft	SILT (ML); 93.1% nonplastic to low plasticity fines, 6.9% mostly fine sand, bluish gray and some tan, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
4			
5			
6			
7			
8	G3	7.5 - 8.5 ft	Rust color staining at 7.5 feet. Likely indicative of seasonal high groundwater.
9			NARROWLY GRADED SAND (SP); 98.8% fine to coarse sand, 6.2% nonplastic to low plasticity fines, tan with some orange, wet. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
10			
11			Bottom of test pit at 10.5 ft. Water entering testpit at a depth of about 9 feet. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator

Notes:

Pit Dimensions (ft)

Length	14
Width	3
Depth	10.5

GEI Consultants

TEST PIT LOG	TP-103





TEST PIT LOG

TP-104

Project	Project Principio	**PG.**	1 **OF** 1
City/Town	Andover, MA	**Location**	N 745530
Client	Fennick McCredie Architecture		E 3046231
Contractor	Northern Drill Service, Inc.	**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4	**Datum**	NAVD88
Operator	J. Raymond **GEI Rep** R. Oulal	**GEI Proj. No.**	2300951
Weather	40's F, Overcast	**Date**	5/4/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1	G1	0 - 1	(0-2"): Top soil, black/dark brown. WIDELY GRADED GRAVEL WITH SAND (GW); ~55% fine to coarse gravel, ~45% fine to coarse sand, brown. Some cobbles present. 1" thick concrete obstruction at 1.5 ft.
2	G2	1.5 - 2	WIDELY GRADED SAND (SW); ~95% fine to medium sand, ~5% nonplastic fines, tan, moist.
3 4 5	G3	3 - 4	SILT (ML); 96.5% nonplastic to low plasticity fines, 3.5% mostly fine sand, bluish gray with some tan, wet. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
6 7	G4	6 - 6.5	Rust color staining at 6 ft. Likely indicative of seasonal high groundwater
8	G5	7 - 8	
9			Water seeping into test pit at 9 ft.
10			Bottom of test pit at 9 ft. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator

Notes:

Pit Dimensions (ft)

Length	3
Width	23
Depth	9

GEI Consultants

TEST PIT LOG	TP-104



Photo 1: TP-104 at about 9'.



Photo 1: TP-104 at about 6'.

TEST PIT LOG

TP-105

Project	Project Principio	**PG.**	1 **OF** 1
City/Town	Andover, MA	**Location**	N 745345
Client	Fennick McCredie Architecture		E 3046061
Contractor	Northern Drill Service, Inc.	**Ground El.**	98 ft
Equipment/Reach	Kubota KX080-4	**Datum**	NAVD88
Operator	J. Raymond **GEI Rep** R. Oulal	**GEI Proj. No.**	2300951
Weather	40's F, Overcast	**Date**	5/4/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1	G1	0 - 1	WIDELY GRADED GRAVEL WITH SAND (SW); ~70% fine to coarse gravel, ~30% fine to coarse sand, brown. 1-1' boulder, topsoil and grass present. [FILL]
2 3 4 5 6	G2	3 - 4	NARROWLY GRADED SAND WITH SILT (SP-SM); 89.9% fine to medium sand, ~10.1% nonplastic fines, tan, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
7 8	G3	7 - 8	SILT WITH SAND (ML); 78.9% nonplastic to low plasticity fines, 21.1% mostly fine sand, bluish gray, wet. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
9 10 11			Bottom of test pit at 8 ft. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator bucket. Soil is wet below 7 feet.

Notes:

Pit Dimensions (ft)

Length	9
Width	3
Depth	8

GEI Consultants

TEST PIT LOG	TP-105



Photo 1: TP-105 at about 8'.



Photo 1: TP-105 from about 2' to 8'.

TEST PIT LOG

TP-106

Project	Project Principio	**PG.**	1 **OF** 1
City/Town	Andover, MA	**Location**	N 745530
Client	Fennick McCredie Architecture		E 3046231
Contractor	Northern Drill Service, Inc.	**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4	**Datum**	NAVD88
Operator	J. Raymond **GEI Rep** R. Oulal	**GEI Proj. No.**	2300951
Weather	40's F, Overcast	**Date**	5/4/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1			WIDELY GRADED GRAVEL WITH SAND (SW); ~70% fine to coarse gravel, ~30% fine to coarse sand, brown. [FILL]
2 3 4 5	G1	3 - 4	SILTY SAND (SM); 84.4% mostly fine sand, 15.6% nonplastic fines, tan, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
6 7 8 9	G2	6 - 8	Water entering test pit at a depth of 6 ft. SANDY SILT (ML); 66.9% nonplastic to low plasticity fines, 32.2% fine sand, bluish gray, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED] Rust color staining at 7.5'.
10			Bottom of test pit at 9.5 ft. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator bucket.

Notes:

Pit Dimensions (ft)

Length	9
Width	3
Depth	9.5

GEI Consultants

TEST PIT LOG	TP-106



Photo 1: TP-106 at about 9.5'.



Photo 1: TP-106 from about 4.5' to 9.5'.

TEST PIT LOG

TP-109

Project	Project Principio			**PG.** 1 **OF** 1	
City/Town	Andover, MA			**Location**	N 744697
Client	Fennick McCredie Architecture				E 3046675
Contractor	Northern Drill Service, Inc.			**Ground El.**	98 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	J. Raymond	**GEI Rep**	R. Oulal	**GEI Proj. No.**	2300951
Weather	50's F, Overcast			**Date**	5/5/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1	G1	0.2 - 2	(0 - 0.2'): Asphalt WIDELY GRADED GRAVEL WITH SAND (GW); ~70% fine to coarse gravel, ~30% fine to coarse sand, brown. Some bricks and debris present.
2			
3	G2	2.5 - 2.8	SILTY SAND (SM); 55.5% Fine to coarse sand, 42.4% nonplastic to low plasticity fines, 2.1% fine gravel, tan, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]. Rust color staining at 2.5. Not indicative of seasonal high groundwater. Likely surface infiltration moving through a coarse sand and gravel seam.
4			
5			
6			
7			SANDY SILT (ML); 68.3% nonplastic to plasticity fines, 31.7% mostly fine sand, tan, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
8			
9	G3	8.5 - 8.7	
10			Bottom of test pit at 9.5 ft. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator bucket up to 3 ft. From 3 ft to 0.2 ft below ground surface the test pit was backfilled with 1 ft thick lifts and compacted multiple time with Wacker Nueson VP 1340 compactor. The test pit was topped with hot mix. Test pit dry at completion.
11			

Notes:

Pit Dimensions (ft)

Length	9
Width	3
Depth	9.5

GEI Consultants

TEST PIT LOG	TP-109



Photo 1: TP-109 at about 9.5'.



Photo 1: TP-109 from about 2' to 5'.

TEST PIT LOG

TP-110

Project	Project Principio	**PG.**	1 **OF** 1
City/Town	Andover, MA	**Location**	N 744709
Client	Fennick McCredie Architecture		E 3046616
Contractor	Northern Drill Service, Inc.	**Ground El.**	98 ft
Equipment/Reach	Kubota KX080-4	**Datum**	NAVD88
Operator	J. Raymond **GEI Rep** R. Oulal	**GEI Proj. No.**	2300951
Weather	50's F, Overcast	**Date**	5/5/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1	G1	1 - 1.5	(0-0.25'): Asphalt. NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); 55.5% fine to coarse sand, 34.4% fine to coarse gravel, 10.1% nonplastic to low plasticity fines, brown. Bricks and debris present. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
2 3 4 5 6 7 8 9	G2	6.5 - 7	SANDY SILT (ML); 70.7% nonplastic to low plasticity, 29.3% mostly fine sand, light tan. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
10 11			Bottom of test pit at 9 ft. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator bucket up to 3 ft. From 3 ft to 0.2 ft below ground surface the test pit was backfilled with 1 ft thick lifts and compacted multiple time with Wacker Nueson VP 1340 compactor. The test pit was topped with hot mix. Test pit dry at completion.

Notes:

Pit Dimensions (ft)

Length	9
Width	3
Depth	9

GEI Consultants

TEST PIT LOG	TP-110



Photo 1: TP-110 from about 0 to 3'.



Photo 1: TP-110 from about 3' to 9'.

TEST PIT LOG

TP-111

Project	Project Principio			**PG.**	1 **OF** 1
City/Town	Andover, MA			**Location**	N 744574
Client	Fennick McCredie Architecture				E 3046806
Contractor	Northern Drill Service, Inc.			**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	J. Raymond	**GEI Rep**	R. Oulal	**GEI Proj. No.**	2300951
Weather	40's F, Overcast			**Date**	5/4/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
	G1	0 - 0.8	(0-0.8'): Top soil, black/dark brown.
1 2 3 4 5	G2	3 - 4 ft	NARROWLY GRADED SAND WITH SILT(SP-SM); 87.9% fine to coarse sand, 8.6% nonplastic fines, 3.5% fine to coarse gravel, tan, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED] Rust color staining at 4 ft. Not indicative of seasonal high groundwater Likely caused by surface infiltration perched at intersection of fill and previous topsoil layer.
6	G3	5.5 - 6	Top soil; possibly top of previous ground surface.
7 8 9 10	G4	10 - 10.5	SANDY SILT (ML); 53.8% nonplastic fines, 46.2% mostly fines sand, tan and gray, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
11			Bottom of test pit at 10.5 ft. Test pit dry at completion. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator bucket.

Notes:

Pit Dimensions (ft)

Length	10
Width	3
Depth	10.5

GEI Consultants

TEST PIT LOG	TP-111



Photo 1: TP-111 at about 10.5'.



Photo 2:Old topsoil from about 5' to 6.5'.

TEST PIT LOG

TP-112

Project	Project Principio			**PG.** 1 **OF** 1	
City/Town	Andover, MA			**Location**	N 744553
Client	Fennick McCredie Architecture				E 3046938
Contractor	Northern Drill Service, Inc.			**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	J. Raymond	**GEI Rep**	R. Oulal	**GEI Proj. No.**	2300951
Weather	40's F, Overcast			**Date**	5/4/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1			(0-0.8'): Top soil, black/dark brown.
2	G1	1 - 1.8	WIDELY GRADED SAND WITH GRAVEL (SW); ~70% fine to coarse sand, ~25% fine to coarse gravel, ~5% nonplastic fines, gray, moist.
3			Trace of rust color staining at 2 ft. Not indicative of seasonal high groundwater. Likely caused by surface infiltration perched at the interface of the granular fill and the natural soil.
4			
5			SILTY SAND (SM); 63.8% fine to coarse sand, 36.1% nonplastic to low plasticity fines, 0.1% fine gravel, gray and tan, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
6	G2	5.5 - 6	
7			Top soil; possibly top of old ground.
8			
9			SILTY SAND (SM); 55.2% mostly fine sand, 44.8% nonplastic fines, gray and tan, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
10	G3	9.8 - 10	
11			Bottom of test pit at 10.5 ft. Test pit dry at completion. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator bucket.

Notes:

Pit Dimensions (ft)

Length	10
Width	3
Depth	10.5

GEI Consultants

TEST PIT LOG	TP-112



Photo 1: TP-111 at about 10.5'.



Photo 2:Old topsoil layer at a depth of about 6.5 feet.

TEST PIT LOG

TP-113

Project	Project Principio			**PG.** 1 **OF** 1	
City/Town	Andover, MA			**Location**	N 3,045,927
Client	Fennick McCredie Architecture				E 744,825
Contractor	Northern Drill Service, Inc.			**Ground El.**	100 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	J. Raymond	**GEI Rep**	R. Oulal	**GEI Proj. No.**	2300951
Weather	50's F, Overcast			**Date**	5/3/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
			(0-0.5'): Top soil, black/dark brown.
1			Roots present from 0 to 2 ft.
2			
3			Rust color staining at 2.5 ft.
			Water seeping into excavation at 3 ft.
4			
5			
6			SILTY SAND (SM); 55% mostly fine sand, 45% nonplastic to low plasticity sand, tan and gray, wet. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
7			
8	G1	7.5 - 8.5	
9			
10			
11			Bottom of test pit at 10 ft.
			Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator

Notes:

Pit Dimensions (ft)

Length	14
Width	6
Depth	10

GEI Consultants

TEST PIT LOG	TP-113



Photo 1: TP-113 at about 10'.



Photo 2:Testpit at about 6'.

TEST PIT LOG

TP-114

Project	Project Principio			**PG.** 1 **OF** 1	
City/Town	Andover, MA			**Location**	N 7744773
Client	Fennick McCredie Architecture				E 3045915
Contractor	Northern Drill Service, Inc.			**Ground El.**	100 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	J. Raymond	**GEI Rep**	R. Oulal	**GEI Proj. No.**	2300951
Weather	50's F, Overcast			**Date**	5/3/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1			(0-1'): Top soil, black/dark brown.
2	G1	3 - 3.5	Rust color staining likely indicative of seasonal high groundwater at 3.5 ft.
3			
4			
5			SILT WITH SAND (ML); 71.5% nonplastic to low plastic fines, 28.5% mostly fine sand, bluish gray with some rust color staining from 3.5 to 11 ft. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
6			
7			
8			Water seeping into test pit at 8 ft.
9			
10			
11			
			Bottom of test pit at 11 ft. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator

Notes:

Pit Dimensions (ft)

Length	8
Width	4
Depth	11

GEI Consultants

TEST PIT LOG	TP-114



Photo 1: TP-114 at about 3.5 ft.



Photo 2:TP-114 at 11 ft.

TEST PIT LOG

TP-115

Project	Project Principio			**PG.** 1 **OF** 1	
City/Town	Andover, MA			**Location**	N 744743
Client	Fennick McCredie Architecture				E 3045974
Contractor	Northern Drill Service, Inc.			**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	J. Raymond	**GEI Rep**	R. Oulal	**GEI Proj. No.**	2300951
Weather	40's F, Overcast/ Light rain			**Date**	5/4/2023

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1 2	G1	0 - 2	SILTY SAND (SM); 72.4% fine to coarse sand, 22.9% nonplastic to low plasticity fines, 4.7% fine to coarse gravel, brown. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
3 4 5 6	G2	4 - 6	WIDELY GRADED SAND WITH SILT (SW-SM); ~80% fine to coarse sand, ~10% fine to coarse gravel. ~10% nonplastic fines, tan, moist. Water seeping into test pit at 4.5 ft.
7	G3	6 - 7	WIDELY GRADED SAND WITH SILT(SW); ~85% fine to coarse sand, ~10% fine to medium gravel, ~5% nonplastic fines, brown. Bluish gray silty sand at 7 ft.
8 9 10			Bottom of test pit at 7 ft. Test pit backfilled with excavated soil cuttings in lifts and tamped with excavator bucket.

Notes:

Pit Dimensions (ft)

Length	12
Width	4
Depth	7

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TEST PIT LOG	TP-115



Photo 1: TP-115 at about 7 ft.



Photo 2:TP-115 from about 1 to 7 ft.

Table 4. Test Pit Data and Infiltration Rates from Explorations
Project Principio
Andover, Massachusetts

Exploration Number	Approx. Ground Surface Elevation [1,2]	Bottom of Test Pit		Layer Depth/Elevation		Description of Soil	Observed Mottling Indicative of Seasonal High Groundwater	Groundwater[3]		USDA Soil Texture [4]	NRCS Hydrologic Soil Group [5]	Infiltration Rate[5]
	(ft)	Depth (ft)	El. (ft)	Depth (ft)	Elevation (ft)		(Y/N)	Depth (ft)	El. (ft)			(in/hr)
TP-101	99.0	6.5	92.5	0.0 - 0.8	99.0 - 98.3	Top soil, black/dark brown.	N	Dry >6.5	<92.5	--	--	--
				0.75 - 2.5	98.3 - 96.5	SILTY SAND (SM); 79.5% fine to coarse sand, 12.6% nonplastic to low plasticity fines, 7.9% fine to coarse gravel, tan. [FILL]				Sand	A	8.27
				2.5 - 5.5	96.5 - 93.5	SILTY SAND (SM); 63.9% mostly fine sand, 35.3% nonplastic fines, 0.8% fine gravel, gray. [FILL]				Loamy Sand	A	2.41
				5.5 - 6.5	93.5 - 92.5	WIDELY GRADED GRAVEL WITH SAND (SW); ~60% fine to coarse gravel, ~40% medium to coarse sand, gray. Some cobbles present.				--	--	--
TP-102	99.0	7.0	92.0	0.0 - 0.7	99.0 - 98.3	Top soil, black/dark brown.	N	Dry >7.0	<92.0	--	--	--
				0.7 - 6.0	98.3 - 93.0	NARROWLY GRADED SAND WITH SILT (SP-SM); 75.1% fine to coarse sand, 14.4% fine to coarse gravel, 10.5% nonplastic to low plasticity fines, tan. Some cobbles. [FILL]				Sand	A	8.27
				6.0 - 7.0	93.0 - 92.0	NARROWLY GRADED GRAVEL WITH SAND (GP); 52.2% fine to coarse sand, 46.3% fine to coarse sand, 1.5% nonplastic to low plasticity fines, gray.				Sand	A	8.27
TP-103	99.0	10.5	88.5	0.0 - 1.0	99.0 - 98.0	Top soil, black/dark brown.	Y (~7.5 ft)	9.0	90.0	--	--	--
				1.0 - 2.5	98.0 - 96.5	WIDELY GRADED SAND WITH GRAVEL (SW); ~60% fine to coarse sand, ~40% fine to coarse gravel, tan. [FILL]				--	--	--
				2.5 - 7.5	96.5 - 91.5	SILT (ML); 93.1% nonplastic to low plasticity fines, 6.9% mostly fine sand, bluish gray and some tan, moist.				Silt Loam	C	0.27
				7.5 - 10.5	91.5 - 88.5	NARROWLY GRADED SAND (SP); 98.8% fine to coarse sand, 6.2% nonplastic to low plasticity fines, tan with some orange, wet.				Sand	A	8.27
TP-104	99.0	9.0	90.0	0.0 - 1.5	99.0 - 97.5	(0-2"): Top soil, black/dark brown. WIDELY GRADED GRAVEL WITH SAND (GW); ~55% fine to coarse gravel, ~45% fine to coarse sand, brown. Some cobbles present. 1" thick concrete obstruction at 1.5 ft.	Y (~6 ft)	9.0	<90.0	--	--	--
				1.5 - 2.0	97.5 - 97.0	WIDELY GRADED SAND (SW); ~95% fine to medium sand, ~5% nonplastic fines, tan, moist.				--	--	--
				2.0 - 9.0	97.0 - 90.0	SILT (ML); 96.5% nonplastic to low plasticity fines, 3.5% mostly fine sand, bluish gray with some tan, wet.				Silt	Note 6	Note 6

Table 4. Test Pit Data and Infiltration Rates from Explorations
Project Principio
Andover, Massachusetts

Exploration Number	Approx. Ground Surface Elevation [1,2]	Bottom of Test Pit		Layer Depth/Elevation		Description of Soil	Observed Mottling Indicative of Seasonal High Groundwater	Groundwater[3]		USDA Soil Texture [4]	NRCS Hydrologic Soil Group [5]	Infiltration Rate[5]
	(ft)	Depth (ft)	El. (ft)	Depth (ft)	Elevation (ft)		(Y/N)	Depth (ft)	El. (ft)			(in/hr)
TP-105	99.0	8.0	91.0	0.0 - 1.5	99.0 - 97.5	WIDELY GRADED GRAVEL WITH SAND (SW); ~70% fine to coarse gravel, ~30% fine to coarse sand, brown. 1-1' boulder, topsoil and grass present. [FILL]	N	7.0	92.0	--	--	--
				1.5 - 6.5	97.5 - 92.5	NARROWLY GRADED SAND WITH SILT (SP-SM); 89.9% fine to medium sand, ~10.1% nonplastic fines, tan, moist.				Sand	A	8.27
				6.5 - 8.0	92.5 - 91.0	SILT WITH SAND (ML); 78.9% nonplastic to low plasticity fines, 21.1% mostly fine sand, bluish gray, wet.				Sandy Loam	B	1.02
TP-106	99.0	9.5	89.5	0.0 - 1.5	99.0 - 97.5	WIDELY GRADED GRAVEL WITH SAND (SW); ~70% fine to coarse gravel, ~30% fine to coarse sand, brown. [FILL]	Y (~7.5 ft)	6.0	93.0	--	--	--
				1.5 - 5.5	97.5 - 93.5	SILTY SAND (SM); 84.4% mostly fine sand, 15.6% nonplastic fines, tan, moist.				Sand	A	8.27
				5.5 - 9.5	93.5 - 89.5	SANDY SILT (ML); 66.9% nonplastic to low plasticity fines, 32.2% fine sand, bluish gray, moist.				Sandy Loam	B	1.02
TP-109	98.5	9.5	89.0	0.0 - 2.0	98.5 - 96.5	(0 - 0.2'): Asphalt WIDELY GRADED GRAVEL WITH SAND (GW); ~70% fine to coarse gravel, ~30% fine to coarse sand, brown. Some bricks and debris present.	N	Dry >9.5	<89.0	--	--	--
				2.0 - 4.0	96.5 - 94.5	SILTY SAND (SM); 55.5% Fine to coarse sand, 42.4% nonplastic to low plasticity fines, 2.1% fine gravel, tan, moist. Rust color staining at 2.5. Not indicative of seasonal high groundwater. Likely surface infiltration moving through a coarse sand and gravel seam.				Loamy Sand	A	2.41
				4.0 - 9.5	94.5 - 89.0	SANDY SILT (ML); 68.3% nonplastic to plasticity fines, 31.7% mostly fine sand, tan, moist.				Sandy Loam	B	1.02
TP-110	98.0	9.0	89.0	0.0 - 1.5	98.0 - 96.5	(0-0.25'): Asphalt. NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); 55.5% fine to coarse sand, 34.4% fine to coarse gravel, 10.1% nonplastic to low plasticity fines, brown. Bricks and debris present.	N	Dry >9.0	<89.0	Sand	A	8.27
				1.5 - 9.0	96.5 - 89.0	SANDY SILT (ML); 70.7% nonplastic to low plasticity, 29.3% mostly fine sand, light tan.				Sandy Loam	B	1.02

Table 4. Test Pit Data and Infiltration Rates from Explorations
Project Principio
Andover, Massachusetts

Exploration Number	Approx. Ground Surface Elevation [1,2]	Bottom of Test Pit		Layer Depth/Elevation		Description of Soil	Observed Mottling Indicative of Seasonal High Groundwater	Groundwater[3]		USDA Soil Texture [4]	NRCS Hydrologic Soil Group [5]	Infiltration Rate[5]
	(ft)	Depth (ft)	El. (ft)	Depth (ft)	Elevation (ft)		(Y/N)	Depth (ft)	El. (ft)			(in/hr)
TP-111	97.5	10.5	87.0	0.0 - 0.8	97.5 - 96.7	(0-0.8'): Top soil, black/dark brown.	N	Dry >10.5	<87.0	--	--	--
				0.8 - 5.0	96.7 - 92.5	NARROWLY GRADED SAND WITH SILT(SP-SM); 87.9% fine to coarse sand, 8.6% nonplastic fines, 3.5% fine to coarse gravel, tan, moist. Rust color staining at 4 ft. Not indicative of seasonal high groundwater Likely caused by surface infiltration perched at intersection of fill and previous topsoil layer.				Sand	A	8.27
				5.0 - 6.0	92.5 - 91.5	Top soil; possibly top of previous ground surface.				--	--	--
				6.0 - 10.5	91.5 - 87.0	SANDY SILT (ML); 53.8% nonplastic fines, 46.2% mostly fines sand, tan and gray, moist.				Sandy Loam	B	1.02
TP-112	99.0	10.5	88.5	0.0 - 0.8	99.0 - 98.2	(0-0.8'): Top soil, black/dark brown.	N	Dry >10.5	<88.5	--	--	--
				0.8 - 2.0	98.2 - 97.0	WIDELY GRADED SAND WITH GRAVEL (SW); ~70% fine to coarse sand, ~25% fine to coarse gravel, ~5% nonplastic fines, gray, moist.				--	--	--
				2.0 - 6.5	97.0 - 92.5	SILTY SAND (SM); 63.8% fine to coarse sand, 36.1% nonplastic to low plasticity fines, 0.1% fine gravel, gray and tan, moist.				Sandy Loam	B	1.02
				6.5 - 7.0	92.5 - 92.0	Top soil; possibly top of previous ground surface.						
				7.0 - 10.5	92.0 - 88.5	SILTY SAND (SM); 55.2% mostly fine sand, 44.8% nonplastic fines, gray and tan, moist.				Loamy Sand	A	2.41
TP-113	100	10.0	90.0	0.0 - 0.5	100.0 - 99.5	(0-0.5'): Top soil, black/dark brown.	Y (~2.5 ft)	3.0	97.0	--	--	--
				0.5 - 10.0	99.5 - 90.0	SILTY SAND (SM); 55% mostly fine sand, 45% nonplastic to low plasticity sand, tan and gray, wet.				Loamy Sand	A	2.41
TP-114	100	11.0	89.0	0.0 - 1.0	100.0 - 99.0	(0-1.0'): Top soil, black/dark brown.	Y (~3.5 ft)	8.0	92.0	--	--	--
				1.0 - 11.0	99.0 - 89.0	SILT WITH SAND (ML); 71.5% nonplastic to low plastic fines, 28.5% mostly fine sand, bluish gray with some rust color staining from 3.5 to 11 ft.				Sandy Loam	B	1.02

Table 4. Test Pit Data and Infiltration Rates from Explorations
Project Principio
Andover, Massachusetts

Exploration Number	Approx. Ground Surface Elevation [1,2]	Bottom of Test Pit		Layer Depth/Elevation		Description of Soil	Observed Mottling Indicative of Seasonal High Groundwater	Groundwater[3]		USDA Soil Texture [4]	NRCS Hydrologic Soil Group [5]	Infiltration Rate[5]
	(ft)	Depth (ft)	El. (ft)	Depth (ft)	Elevation (ft)		(Y/N)	Depth (ft)	El. (ft)			(in/hr)
TP-115	99.0	7.0	92.0	0.0 - 2.5	99.0 - 96.5	SILTY SAND (SM); 72.4% fine to coarse sand, 22.9% nonplastic to low plasticity fines, 4.7% fine to coarse gravel, brown.	N	4.5	94.5	Loamy Sand	A	2.41
				2.5 - 6.0	96.5 - 93.0	WIDELY GRADED SAND WITH SILT (SW-SM); ~80% fine to coarse sand, ~10% fine to coarse gravel. ~10% nonplastic fines, tan, moist				--	--	--
				6.0 - 7.0	93.0 - 92.0	WIDELY GRADED SAND WITH SILT(SW); ~85% fine to coarse sand, ~10% fine to medium gravel, ~5% nonplastic fines, brown.				--	--	--

Notes:

1. Elevation datum is the North American Vertical Datum (NAVD) of 1988.
2. Ground surface elevations estimated from spot elevation points on base plan provided by Fennick McCredie Architecture.
3. Groundwater depth in test pits is based on depth were water was observed entering the test pit.
4. USDA soil texture is derived from Fig. 2.3.2, of the Massachusetts Stormwater Handbook (Vol 3, Ch. 1) using the results of sieve analyses and hydrometer tests performed on soil samples obtained from the test pits.
5. NRCS Hydrologic Soil Groups and Infiltration rates are derived from Table 2.3.3, of the Massachusetts Stormwater Handbook (Vol. 3, Ch.1) using the USDA Soil Texture classification.
6. The Massachusetts Stormwater Handbook does not provide a NRCS Hydrologic Soils Group or Rawls Infiltration rate for Silt

July 24, 2024
Project No. 2300951

VIA EMAIL: jmccredie@fmarhitecture.com

Mr. Jonathan McCredie
Fennick McCredie Architecture
70 Franklin Street
Boston, Massachusetts 02110

Re: Subsurface Exploration for Additional Stormwater Test Pits
Project Principio
Andover, Massachusetts

Dear Mr. McCredie:

This letter report presents the results of test pits and laboratory testing performed for the proposed stormwater management systems at the Gillette Company manufacturing facility located at 30 Burtt Road in Andover, Massachusetts. This work is for the proposed industrial development at the Gillette Company manufacturing facility that has been designated Project Principio.

Project Description

Project Principio includes the construction of a new one-story steel-framed manufacturing and warehouse building, construction of new stormwater management systems, new parking areas and roadways, and utility improvements.

GEI performed previous subsurface explorations for the proposed manufacturing and warehouse building and drainage structures. The results of these explorations are provided in the report titled: *Foundation Recommendations, Project Principio, The Gillette Company, Andover, Massachusetts*, dated March 2024. We recommend referring to that report for findings of the prior explorations and have not included the data in this letter.

We understand that the Project Principio project includes the construction of four stormwater management systems across the project site. Three of the proposed stormwater management systems will be in the existing parking areas, and one will be in the existing landscaped area south of the trailer parking area.

Nitsch Engineering provided preliminary top and bottom elevations of the proposed stormwater management systems on July 2, 2024. The system at the southern end of the site has a bottom elevation of El. 90.25, and the other three have a bottom elevation of El. 92.

All elevations in this report are referenced to the North American Vertical Datum of 1988 (NAVD 88).

Test Pits

We engaged Northern Drill Service of Northborough, Massachusetts to perform sixteen test pits (TP-201 through TP-216) to provide information to support the design of the stormwater structures. Test pits TP-201 to TP-203, and TP-206 to TP-214 were excavated during the first mobilization between June 24 and June 27, 2024. During the first mobilization, test pits TP-204 and TP-205 was not excavated since the excavator was unable to remove the asphalt pavement, which was estimated to be about 8-inches thick. The second mobilization included excavating test pits TP-204 and TP-205, and two additional test pits, TP-215 and TP-216, which were requested by Nitsch Engineering between July 18 and July 19, 2024.

Northern Drill Service notified Dig Safe and the appropriate utility agencies prior to performing the test pits. Dig Safe normally does not mark utilities on private property. Therefore, we took the additional step of engaging Infrasense, Inc. of Woburn, Massachusetts to perform utility survey at the proposed location of each test pit. Infrasense, Inc. used ground penetrating radar and electromagnetic induction systems to perform a survey of a 20-foot by 20-foot area around each proposed test pit location to locate utilities or potential obstructions. Based on the results of the utility survey, we adjusted the locations of some of the test pits.

Northern Drill Service engaged Pro Cut Concrete Cutting of Waltham, Massachusetts to cut the asphalt at test pits TP-204, TP-205, and TP-216. Pro Cut Concrete Cutting used a walk-behind saw cutting machine with a 30-inch diameter blade.

Test pits excavated during the first mobilization were advanced using a Kubota KX080-4 excavator. Test pits excavated during the second mobilization were advanced using a Takeuchi TB290 excavator. The test pits were excavated to depths ranging between 11 and 12 feet below ground surface. Upon completion, the test pits were backfilled with excavated soil placed in lifts and tamped with the excavator bucket. The ground surface of test pits excavated in the parking areas was restored with hot mix asphalt.

A GEI field engineer observed and logged the test pit excavations. The completed test pit locations were located in the field by measuring from existing site features; as-excavated locations are shown in Fig. 1. Logs of the test pits are provided in Appendix A.

Laboratory Testing

We performed 23 combined grain size analyses with hydrometers in our laboratory in Woburn, Massachusetts on samples collected from the test pits. The laboratory results are provided in Appendix B. The results of the grain size tests were also plotted on the USDA soil classification chart provided in Appendix B.

Soil Descriptions, Hydrologic Soil Group, and Rawl's Rate

Soil descriptions on the test pit logs (Appendix A) and on the individual grain-size distribution reports (Appendix B) are based on the Unified Soil Classification System (USCS). Also included in Appendix B are figures that shows the results of the mechanical sieve and hydrometer analyses based on the United States Department of Agriculture (USDA) Soil Description.

The USDA soil descriptions were used to obtain the soil texture class, National Resource Conservation Services (NRCS) hydrologic soil group, and estimated infiltration rates (Rawls Rate), as described in the Massachusetts Stormwater Handbook. The soil texture class, hydrologic soil group, and the associated infiltration rate (Rawls Rate) based on the relationships in the Massachusetts Stormwater Handbook are provided in Table 2.

Subsurface Conditions

The soil layers encountered in the test pits are described below starting at the ground surface. The soil conditions were consistent with those encountered in the prior borings and test pits in the report titled: *Foundation Recommendations, Project Principio, The Gillette Company, Andover, Massachusetts*, dated March 2024. The soil conditions are known only at the exploration locations. Conditions between explorations may differ significantly from those described below.

Asphalt – Test pits TP-201, TP-210, TP-211, TP-212, and TP-214 were advanced in the existing parking lots and encountered between 4 and 5 inches of asphalt. Test pits TP-204, TP-205, and TP-216 were advanced in the roadways and encountered between 6 and 9 inches of asphalt.

Topsoil – Test pits TP-202, TP-203, TP-206 to TP-209, TP-213, and TP-215 were advanced in the landscaped areas and encountered between 7 and 16 inches of topsoil at ground surface.

Fill – Test pits TP-201 to TP-216 encountered fill below the asphalt or topsoil. The fill in most of the test pits extended to depths ranging between 1.5 and 3 feet. Test pits TP-212 and TP-213 encountered possible fill up to 4 feet. Test pit TP-214 encountered fill to a depth of 6.5 feet below ground surface. The fill was generally described as narrowly graded sand with silt, narrowly graded sand, or silty sand with varying amounts of gravel.

Silt and Sand – A layer of silt, fine sand, and sand, was encountered below the asphalt, topsoil, and fill. This layer extended to the bottom of the test pits. This layer typically consisted of sand with silt, silty sand, or sandy silt. The test pits terminated in the silt and sand layer.

Groundwater Conditions

Groundwater was encountered in test pits TP-204 to TP-209 and TP-216 at depths ranging between 6 and 7 feet below ground surface, corresponding to El. 93 and El. 92 respectively. The groundwater levels were measured on June 27, 2024 and July 19, 2024, in the four observation wells installed by GEI in 2020 and 2023. Groundwater level measurements are provided in Table 1.

The groundwater elevations measured from June 27 to July 19, 2024, were:

- B102 (OW): El. 88.1 to El. 87.5,
- B103 (OW): El. 92.4 to El. 91.9,
- B15 (OW): El. 91.4 to El. 90.6,
- B16 (OW): El. 78.6.

These groundwater level measurements represent conditions at the times and locations indicated. Significantly different groundwater levels may occur at other times and locations.

Closing

This letter report was prepared for the exclusive use of Fennick McCredie Architecture. The recommendations in this letter report are based in part on the data obtained from the subsurface exploration. The nature and extent of variations between explorations may not be evident until construction. If variations from the anticipated conditions are encountered, it may be necessary to revise the recommendations in this letter report. Our recommendations are based on the project information provided to us at the time of this letter and may require modification if there are any changes in the nature, design, or location of the proposed construction.

Our professional services for this project have been performed in accordance with generally accepted engineering practices, no warranty, express or implied, is made.

If you have any questions, please feel free to contact Steve at 781.721.4048.

Sincerely,

GEI Consultants, Inc.

Stephen J. Sarandis, P.E.
Project Manager

Richard F. Tobin, P.E.
Senior Project Manager

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Attachments

- Tables
- Figure
- Appendix A Test Pit Logs
- Appendix B Laboratory Test Results

Tables

Table 1. Groundwater Data

Table 2. Test Pit Data and Infiltration Rates

Table 1. Groundwater Data
Project Principio
Andover, Massachusetts

Observation Well Number	Ground Elevation (feet)	May 5,2023		May 8, 2023		May 23, 2023		June 1, 2023		June 27, 2024		July 19, 2024	
		Depth (feet)	Elevation (feet)	Depth (feet)	Elevation (feet)	Depth (feet)	Elevation (feet)	Depth (feet)	Elevation (feet)	Depth (feet)	Elevation (feet)	Depth (feet)	Elevation (feet)
B2 (OW)	101.0	17.2	83.8	17.0	84.0	17.1	83.9	17.2	83.8	--	--	--	--
B5 (OW)	101.0	5.8	95.2	6.2	94.8	6.9	94.1	7.3	93.7	--	--	--	--
B14 (OW)	107.0	12.1	94.9	12.1	94.9	12.6	94.4	12.9	94.1	--	--	--	--
B15 (OW)	99.0	7.5	91.5	7.5	91.5	7.8	91.2	8.3	90.7	7.6	91.4	8.4	90.6
B16 (OW)	99.0	Dry	<79.0	Dry	<79.0	Dry	<79.0	20.3	78.3	20.1	78.6	Dry	<79.0
B-102 (OW)	101.0	13.4	87.6	13.4	87.6	13.3	87.7	13.3	87.3	12.6	88.1	13.2	87.5
B-103 (OW)	98.5	5.1	93.4	5.1	93.4	5.5	93.0	5.5	92.6	5.7	92.4	6.2	91.9

Notes:

1. Elevations are based on the North American Vertical Datum of 1988 (NAVD 88).
2. Depth refers to depth below ground surface.
3. OW = Observation well.
4. "--" indicates no measurement was taken.

Table 2. Test Pit Data and Infiltration Rates
Project Principio
Andover, Massachusetts

Exploration Number	Approx. Ground Surface Elevation [1,2]	Bottom of Test Pit		Layer Depth/Elevation		Description of Soil	Observed Mottling Indicative of Seasonal High Groundwater	Groundwater[3]		USDA Soil Texture [4]	NRCS Hydrologic Soil Group [5]	Infiltration Rate[5]
	(ft)	Depth (ft)	El. (ft)	Depth (ft)	Elevation (ft)		(Y/N)	Depth (ft)	El. (ft)			(in/hr)
TP-201	97.0	12.0	85.0	0.0 - 0.4	97.0 - 96.6	Asphalt.	N	Dry >12.0	<85	--	--	--
				0.50 - 2.0	96.5 - 95.0	NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~65% fine to coarse sand, ~25% fine to coarse gravel, ~10% nonplastic fines, trace of brick, dark brown, moist. [FILL]				--	--	--
				2.0 - 5.0	95.0 - 92.0	NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% fine to medium sand, ~10% nonplastic fines, ~5% fine gravel, light brown, moist				--	--	--
				5.0 - 10.0	92.0 - 87.0	SILTY SAND (SM); 63.4% fine to medium sand, 36.6% nonplastic fines, light brown, moist				LOAMY SAND	A	2.41
				10.0 - 12.0	87.0 - 85.0	NARROWLY GRADED SAND WITH SILT (SP-SM); ~80% fine to medium sand, ~10% fine to medium subrounded gravel, ~10% nonplastic fines, light brown, moist				--	--	--
TP-202	98.0	12.0	86.0	0.0 - 0.7	98.0 - 97.3	Topsoil, black/dark brown.	N	Dry >12.0	<86.0	--	--	--
				1.0 - 5.0	97.0 - 93.0	NARROWLY GRADED SAND WITH SILT (SP-SM); ~80% fine to medium sand, ~10% medium to coarse subrounded gravel, ~10% nonplastic fines, light brown, moist.				--	--	--
				5.0 - 9.0	93.0 - 89.0	NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); 75.2% fine to coarse sand, 18.5% fine to coarse gravel, 6.3% nonplastic fines, light brown, moist.				SAND	A	8.27
				9.0 - 12.0	89.0 - 86.0	NARROWLY GRADED SAND WITH GRAVEL (SP); 62.7% fine to coarse sand, 34.4% fine to coarse subrounded gravel, 2.9% nonplastic fines, light brown, moist.				SAND	A	8.27
TP-203	99.0	12.0	87.0	0.0 - 1.3	99.0 - 97.7	Topsoil, black/dark brown.	N	Dry >12.0	<87.0	--	--	--
				1.3 - 6.0	97.7 - 93.0	SILTY SAND (SM); 82.3% fine to coarse sand, 12.1% nonplastic fines, 5.6% fine to coarse gravel, light brown, moist.				SAND	A	8.27
				6.0 - 12.0	93.0 - 87.0	NARROWLY GRADED SAND (SP); ~90% fine to medium sand, ~5% fine subrounded gravel, ~5% nonplastic fines, light brown, moist.				--	--	--
TP-204	98.0	11.0	87.0	0.0 - 0.8	98.0 - 97.2	Asphalt.	N	6.0	92.0	--	--	--
				0.8 - 2.0	97.2 - 96.0	NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~65% fine to coarse sand, ~25% fine to coarse subangular gravel, ~10% nonplastic fines, brown, moist. [FILL]				--	--	--
				2.0 - 3.0	96.0 - 95.0	NARROWLY GRADED SAND (SP); ~90% fine to medium sand, ~5% fine gravel, ~5% nonplastic fines, light grayish brown, moist.				--	--	--
				3.0 - 4.0	95.0 - 94.0	SANDY SILT (ML); 79.4% nonplastic fines, 20.6% fine sand, light gray, moist.				SILT LOAM	C	0.27
				4.0 - 6.0	94.0 - 92.0	SILTY SAND (SM); 63.2% fine sand, 35.0% nonplastic fines, 1.8% coarse angular gravel, light gray, moist.				LOAMY SAND	A	2.41
				6.0 - 8.0	92.0 - 90.0	SILTY SAND (SM); ~55% fine sand, ~45% nonplastic fines, light gray, wet.				--	--	--
				8.0 - 11.0	90.0 - 87.0	NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine to medium sand, ~10% nonplastic fines, brown, wet.				--	--	--

Table 2. Test Pit Data and Infiltration Rates
Project Principio
Andover, Massachusetts

Exploration Number	Approx. Ground Surface Elevation [1,2]	Bottom of Test Pit		Layer Depth/Elevation		Description of Soil	Observed Mottling Indicative of Seasonal High Groundwater	Groundwater[3]		USDA Soil Texture [4]	NRCS Hydrologic Soil Group [5]	Infiltration Rate[5]
	(ft)	Depth (ft)	El. (ft)	Depth (ft)	Elevation (ft)		(Y/N)	Depth (ft)	El. (ft)			(in/hr)
TP-205	98.0	11.0	87.0	0.0 - 0.7	98.0 - 97.3	Asphalt.	N	6.0	92.0	--	--	--
				0.7 - 2.0	97.3 - 96.0	NARROWLY GRADED SAND WITH GRAVEL (SP); ~70% fine to coarse sand, ~25% fine to coarse subangular gravel, ~5% nonplastic fines, brown, moist. [FILL]				--	--	--
				2.0 - 4.5	96.0 - 93.5	SILTY SAND (SM); ~80% fine to medium sand, ~15% nonplastic fines, ~5% coarse subrounded gravel, light grayish brown, moist.				--	--	--
				4.5 - 7.5	93.5 - 90.5	SANDY SILT (ML); 81.7% nonplastic fines, 18.3% fine sand, light gray, moist to wet.				SILT LOAM	C	0.27
				7.5 - 10.5	90.5 - 87.5	NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine to medium sand, ~10% nonplastic fines, brown, wet.				--	--	--
				10.5 - 11.0	87.5 - 87.0	SANDY SILT (ML); ~60% nonplastic fines, ~40% fine sand, light gray, wet.				--	--	--
TP-206	99.0	11.0	88.0	0.0 - 0.7	99.0 - 98.3	Topsoil, black/dark brown.	N	7.0	92.0	--	--	--
				1.0 - 3.0	98.0 - 96.0	NARROWLY GRADED SAND WITH SILT (SP-SM); ~80% fine to medium sand, ~10% fine to coarse subrounded to angular gravel, ~10% nonplastic fines, light brown, moist. [FILL]				--	--	--
				3.0 - 7.0	96.0 - 92.0	NARROWLY GRADED SAND WITH SILT (SP-SM); 87.9% fine to medium sand, 12.0% nonplastic fines, 0.1% fine gravel, light brown, moist.				SAND	A	8.27
				7.0 - 11.0	92.0 - 88.0	NARROWLY GRADED SAND (SP); ~95% fine to medium sand, ~5% nonplastic fines, light gray, wet.				--	--	--
TP-207	99.0	11.0	88.0	0.0 - 1.0	99.0 - 98.0	Topsoil, black/dark brown.	N	7.0	92.0	--	--	--
				1.0 - 3.0	98.0 - 96.0	SILTY SAND WITH GRAVEL (SM); ~70% fine to medium sand, ~15% fine to coarse subrounded gravel, ~15% nonplastic fines, brown, moist. [FILL]				--	--	--
				3.0 - 6.0	96.0 - 93.0	NARROWLY GRADED SAND WITH SILT (SP-SM); 74.2% fine to medium sand, 14.6% fine to coarse subrounded gravel, 11.2% nonplastic fines, light brown, moist.				SAND	A	8.27
				6.0 - 10.0	93.0 - 89.0	SILTY SAND (SM); 66.5% fine sand, 33.5% nonplastic fines, light gray, wet.				LOAMY SAND	A	2.41
				10.0 - 11.0	89.0 - 88.0	SANDY SILT (ML); ~60% low plasticity fines, ~40% fine sand, light gray, wet.				--	--	--
TP-208	99.0	11.0	88.0	0.0 - 1.0	99.0 - 98.0	Topsoil, black/dark brown.	N	6.0	93.0	--	--	--
				1.0 - 2.0	98.0 - 97.0	SILTY SAND WITH GRAVEL (SM); ~70% fine to medium sand, ~15% coarse subrounded gravel, ~15% nonplastic fines, brown, moist. [FILL]				--	--	--
				2.0 - 6.0	97.0 - 93.0	NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine to medium sand, ~10% nonplastic fines, light brown, moist.				--	--	--
				6.0 - 11.0	93.0 - 88.0	SILTY SAND (SM); 57% fine to medium sand, 37.5% nonplastic fines, 5.5% fine to coarse subrounded gravel, light gray to grayish brown, wet.				LOAMY SAND	A	2.41

Table 2. Test Pit Data and Infiltration Rates
Project Principio
Andover, Massachusetts

Exploration Number	Approx. Ground Surface Elevation [1,2]	Bottom of Test Pit		Layer Depth/Elevation		Description of Soil	Observed Mottling Indicative of Seasonal High Groundwater	Groundwater[3]		USDA Soil Texture [4]	NRCS Hydrologic Soil Group [5]	Infiltration Rate[5]
	(ft)	Depth (ft)	El. (ft)	Depth (ft)	Elevation (ft)		(Y/N)	Depth (ft)	El. (ft)			(in/hr)
TP-209	99	11.0	88.0	0.0 - 0.6	99.0 - 98.4	Topsoil, black/dark brown.	N	6.0	93.0	--	--	--
				0.7 - 2.0	98.3 - 97.0	SILTY SAND WITH GRAVEL (SM); ~70% fine to medium sand, ~15% coarse subrounded gravel, ~15% nonplastic fines, brown, moist. [FILL]				--	--	--
				2.0 - 6.0	97.0 - 93.0	NARROWLY GRADED SAND WITH SILT (SP-SM); 87.9% fine to medium sand, 8.9% nonplastic fines, 3.2% fine to coarse subrounded gravel, light brown, moist.				SAND	A	8.27
				6.0 - 11.0	93.0 - 88.0	SILTY SAND (SM); ~85% fine to medium sand, ~15% nonplastic fines, light grayish brown, moist. Orange band of sand at 9 ft.				--	--	--
TP-210	99.0	11.0	88.0	0.0 - 0.4	99.0 - 98.6	Asphalt.	N	Dry >11.0	<88.0	--	--	--
				0.4 - 1.8	98.6 - 97.2	NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~60% fine to coarse sand, ~30% fine to coarse subrounded gravel, ~10% nonplastic fines, brown, moist.				--	--	--
				1.8 - 6.0	97.2 - 93.0	SILTY SAND (SM); ~60% fine sand, ~40% nonplastic fines, light gray to light grayish brown, moist.				--	--	--
				6.0 - 11.0	93.0 - 88.0	SANDY SILT (ML); 64.5% nonplastic fines, 29.4% fine to coarse sand, 6.1% fine to coarse subrounded gravel, light grayish brown, moist.				SANDY LOAM	B	1.02
TP-211	99	11.0	88.0	0.0 - 0.4	99.0 - 98.6	Asphalt.	N	Dry >11.0	<88.0	--	--	--
				0.4 - 1.5	98.6 - 97.5	NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~60% fine to coarse sand, ~30% fine to coarse subangular gravel, ~10% nonplastic fines, brown, moist. [FILL]				--	--	--
				1.5 - 6.0	97.5 - 93.0	SILT WITH SAND (ML); 78.7% nonplastic fines, 21.3% fine sand, light grayish brown, moist.				SANDY LOAM	B	1.02
				6.0 - 11.0	93.0 - 88.0	SILTY SAND (SM); 57.2% fine to medium sand, 42.8% nonplastic fines, light grayish brown, moist				LOAMY SAND	A	2.41
TP-212	98.0	11.0	87.0	0.0 - 0.3	98.0 - 97.7	Asphalt.	N	Dry >11.0	<87	--	--	--
				0.3 - 1.5	97.7 - 96.5	NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~65% fine to coarse sand, ~25% fine to coarse subangular gravel, ~10% nonplastic fines, trace of brick, brown, moist. [FILL]				--	--	--
				1.5 - 4.0	96.5 - 94.0	NARROWLY GRADED SAND WITH GRAVEL (SP); ~80% fine to medium sand, ~15% fine to coarse gravel, ~5% nonplastic fines, light brown, moist. [POSSIBLE FILL]				--	--	--
				4.0 - 8.5	94.0 - 89.5	SILTY SAND (SM); 50.5% fine sand, 49.5% nonplastic fines, light grayish brown, moist.				LOAMY SAND	A	2.41
				8.5 - 11.0	89.5 - 87.0	SILTY SAND (SM); 57.7% fine sand, 42% nonplastic fines, 0.3% fine gravel, light grayish brown, moist.				LOAMY SAND	A	2.41
TP-213	99	11.0	88.0	0.0 - 1.0	99.0 - 98.0	Topsoil, black/dark brown.	N	Dry >11.0	<88	--	--	--
				1.0 - 4.0	98.0 - 95.0	NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine to medium sand, ~10% nonplastic fines, light brown, moist.				--	--	--
				4.0 - 9.0	95.0 - 90.0	SANDY SILT (ML); 52.6% nonplastic fines, 47.4% fine sand, light yellowish brown, moist.				LOAMY SAND	A	2.41
				9.0 - 11.0	90.0 - 88.0	SILTY SAND (SM); ~60% fine sand, ~40% nonplastic fines, light grayish brown, moist				--	--	--

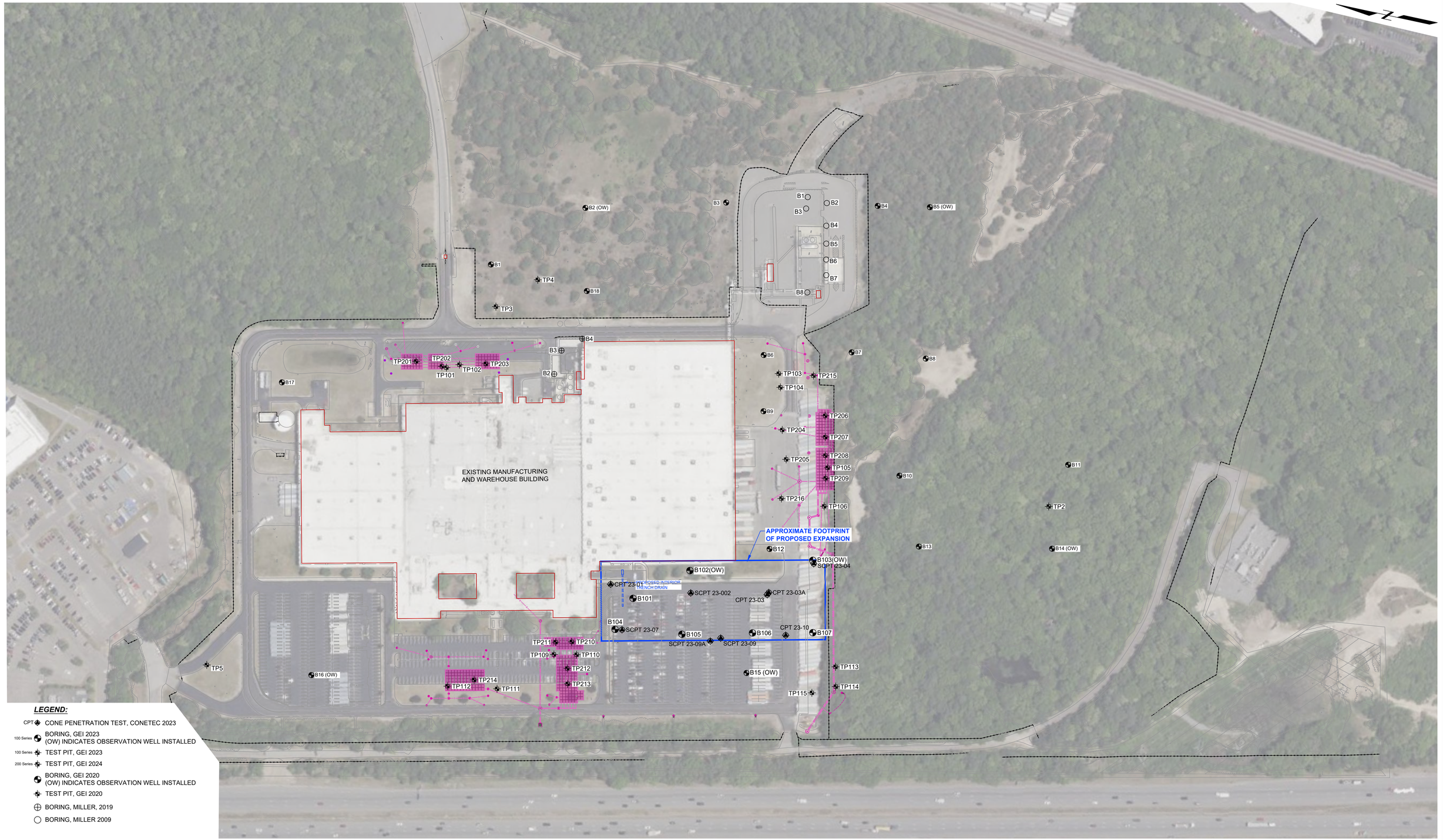
Table 2. Test Pit Data and Infiltration Rates
Project Principio
Andover, Massachusetts

Exploration Number	Approx. Ground Surface Elevation [1,2]	Bottom of Test Pit		Layer Depth/Elevation		Description of Soil	Observed Mottling Indicative of Seasonal High Groundwater	Groundwater[3]		USDA Soil Texture [4]	NRCS Hydrologic Soil Group [5]	Infiltration Rate[5]
	(ft)	Depth (ft)	El. (ft)	Depth (ft)	Elevation (ft)		(Y/N)	Depth (ft)	El. (ft)			(in/hr)
TP-214	98.5	11.0	87.5	0.0 - 0.4	98.5 - 98.1	Asphalt.	N	Dry >11.0	<87.5	--	--	--
				0.4 - 1.5	98.1 - 97.0	NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~70% fine to coarse sand, ~20% fine to medium subangular gravel. ~10% nonplastic fines, trace of brick, dark brown, moist. [FILL]				--	--	--
				1.5 - 5.5	97.0 - 93.0	SILTY SAND (SM), 77.1% fine to coarse sand, 17.1% nonplastic fines, 5.8% fine to coarse subangular gravel, light brown, moist.				SAND	A	8.27
				5.5 - 6.5	93.0 - 92.0	Observed on western side of test pit: SILTY SAND (SM); ~70% fine to medium sand, ~25% nonplastic fines, ~5% fine subrounded gravel, trace of wood, dark brown, moist				--	--	--
				6.5 - 9.0	92.0 - 89.5	SILTY SAND (SM); ~60% fine sand, ~40% nonplastic fines, yellowish brown, moist.				--	--	--
				9.0 - 11.0	89.5 - 87.5	SANDY SILT (ML), 56.3% nonplastic fines, 43.7% fine sand, yellowish brown, moist.				SANDY LOAM	B	1.02
TP-215	98.0	11.0	87.0	0.0 - 0.5	98.0 - 97.5	Topsoil.	N	6	92.0	--	--	--
				0.5 - 3.0	97.5 - 95.0	SILTY SAND (SM); ~70% fine to medium sand, ~25% nonplastic fines, ~5% fine gravel, trace of roots, dark brown, moist. [FILL]				--	--	--
				3.0 - 6.0	95.0 - 92.0	NARROWLY GRADED SAND WITH SILT (SP-SM); 80.5% fine to medium sand, 19.5% nonplastic fines, light grayish brown, moist.				SAND	A	8.27
				6.0 - 11.0	92.0 - 87.0	SILTY SAND (SM); ~80% fine to medium sand, ~20% nonplastic fines, light grayish brown, wet.				--	--	--
TP-216	98.0	11.0	87.0	0.0 - 0.5	98.0 - 97.5	Topsoil.	N	Dry >11.0	<87.5	--	--	--
				0.5 - 1.5	97.5 - 96.5	NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~70% fine to coarse sand, ~20% fine to medium subangular gravel, ~10% nonplastic fines, brown, moist. [FILL]				--	--	--
				1.5 - 6.0	96.5 - 92.0	NARROWLY GRADED SAND WITH SILT (SP-SM), 91.9% fine to medium sand, 8.1% nonplastic fines, light grayish brown, moist.				SAND	A	8.27
				6.0 - 9.0	92.0 - 89.0	SILTY SAND (SM); 75.9% fine to medium sand, 24.1% nonplastic fines, light brown, wet.				SAND	A	8.27
				9.0 - 11.0	89.0 - 87.0	Similar to G3 (sample from 6 to 9 ft).				--	--	--

Notes:
1. Elevation datum is the North American Vertical Datum (NAVD) of 1988.
2. Ground surface elevations estimated from contours shown on Drawing Nos. C-100, C-101, and C-102 of the 100% DD Pricing Set dated March 1, 2024.
3. Groundwater depth in test pits is based on depth were water was observed entering the test pit.
4. USDA soil texture is derived from Fig. 2.3.2, of the Massachusetts Stormwater Handbook (Vol 3, Ch. 1) using the results of sieve analyses and hydrometer tests performed on soil samples obtained from the test pits.
5. NRCS Hydrologic Soil Groups and Infiltration rates are derived from Table 2.3.3, of the Massachusetts Stormwater Handbook (Vol. 3, Ch.1) using the USDA Soil Texture classification.

Figure

Figure 1. Exploration Location Plan



LEGEND:

- CPT — CONE PENETRATION TEST, CONETEC 2023
- 100 Series — BORING, GEI 2023 (OW) INDICATES OBSERVATION WELL INSTALLED
- 100 Series — TEST PIT, GEI 2023
- 200 Series — TEST PIT, GEI 2024
- BORING, GEI 2020 (OW) INDICATES OBSERVATION WELL INSTALLED
- TEST PIT, GEI 2020
- BORING, MILLER, 2019
- BORING, MILLER 2009

NOTE::

1. COORDINATES ARE MASSACHUSETTS STATE PLANE (2011) US SURVEY FEET.
2. AS DRILLED BORING AND TEST PIT LOCATIONS WERE DETERMINED ARE ESTIMATED USING NEARBY SURVEY INFORMATION.
3. PLAN BASED ON MAP PREPARED BY SKANSKA.

0 120 240
SCALE: 1" = 120'

Project Principio
Andover, Massachusetts

Fennick McCredie Architecture
Boston, Massachusetts

GEI Consultants

EXPLORATION LOCATION PLAN
(OVERALL SITE)

Project 2300951 | July 2024 | Fig. 1

CLINGEN, PAUL B:\Working\FENNICK MCCREDIE ARCHITECTURE\2300951 Project Principio Andover\00_CAD\Figures\Gt\2300951-02.dwg - 7/19/2024

Appendix A Test Pit Logs

TEST PIT LOG

TP-201

Project	Project Principio			**PG.**	1 **OF** 1
City/Town	Andover, MA			**Location**	N 3,047,206
Client	Fennick McCredie Architecture				E 745,391
Contractor	Northern Drill Service, Inc.			**Ground El.**	97 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	M. Fleming	**GEI Rep**	M. Chea/N. Troccolo	**GEI Proj. No.**	2300951
Weather	70's F, Clear			**Date**	6/25/2024

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
			(0-5"): Asphalt.
1	G1	0.5 - 2 ft	NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~65% fine to coarse sand, ~25% fine to coarse gravel, ~10% nonplastic fines, trace of brick, dark brown, moist. [FILL]
2			
3	G2	2 - 5 ft	NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% fine to medium sand, ~10% nonplastic fines, ~5% fine gravel, light brown, moist.
4			
5			
6	G3	5 - 10 ft	SILTY SAND (SM); 63.4% fine to medium sand, 36.6% nonplastic fines, light brown, moist. [GRAIN SIZE DISTRIBUTION TEST AND HYDROMETER TEST PERFORMED]
7			
8			
9			
10			
11	G4	10 - 12 ft	NARROWLY GRADED SAND WITH SILT (SP-SM); ~80% fine to medium sand, ~10% fine to medium subrounded gravel, ~10% nonplastic fines, light brown, moist.
12			
			Bottom of test pit at 12 ft. Test pit dry at completion. Test pit backfilled with excavated soil in lifts and tamped with excavator bucket up to 4 ft. From 4 ft to 0.5 ft below ground surface the test pit was backfilled with 1 ft thick lifts and compacted multiple times with Wacker Neuson VP1340 compactor. The test pit was topped with hot mix asphalt.

Notes:

1. PID = 0.5 ppm at 0.75 ft, PID = 0.0 ppm at 2 ft, PID = 0.6 ppm at 4 ft, PID = 1.3 ppm at 9 ft, PID = 0.7 ppm at 10 ft, PID = 1.5 ppm at 12 ft.
2. Collected environmental samples 2300951-TP-201 (0-1.5'), 2300951-TP-201(1.5-6'), and 2300951-TP-201(6-12').

Pit Dimensions (ft)

Length	4.5
Width	10
Depth	12

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TEST PIT LOG	TP-201



Photo 1: TP-201 at about 12'.



Photo 2: Excavated soil from TP-201.

TEST PIT LOG

TP-202

Project	Project Principio			**PG.**	1 **OF** 1
City/Town	Andover, MA			**Location**	N 3,047,135
Client	Fennick McCredie Architecture				E 745,392
Contractor	Northern Drill Service, Inc.			**Ground El.**	98 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	M. Fleming	**GEI Rep**	M. Chea/N. Troccolo	**GEI Proj. No.**	2300951
Weather	70's F, Clear			**Date**	6/24/2024

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1			(0-9"): Topsoil, black/dark brown.
2 3 4 5	G1	1 - 5 ft	NARROWLY GRADED SAND WITH SILT (SP-SM); ~80% fine to medium sand, ~10% medium to subrounded coarse gravel, ~10% nonplastic fines, light brown, moist.
6 7 8 9	G2	5 - 9 ft	NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); 75.2% fine to coarse sand, 18.5% fine to coarse subrounded gravel, 6.3% nonplastic fines, light brown, moist. [GRAIN SIZE DISTRIBUTION TEST AND HYDROMETER TEST PERFORMED]
10 11 12	G3	9 - 12 ft	NARROWLY GRADED SAND WITH GRAVEL (SP); 62.7% fine to coarse sand, 34.4% fine to coarse subrounded gravel, 2.9% nonplastic fines, light brown, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
			Bottom of test pit at 12 ft. Test pit dry at completion. Test pit backfilled with excavated soil in lifts and tamped with excavator bucket.

Notes:

1. PID = 0.0 ppm at 2 ft, PID = 0.0 ppm at 4 ft, PID = 0.6 ppm at 6 ft, PID = 1.3 ppm at 9 ft, PID = 0.0 ppm at 8 ft, PID = 0.0 ppm at 10 ft, PID = 0.7 ppm at 12 ft.
2. Collected environmental samples 2300951-TP-202 (1-6') and 2300951-TP-202 (6-12').

Pit Dimensions (ft)

Length	5
Width	10
Depth	12

GEI Consultants

TEST PIT LOG	TP-202



Photo 1: TP-202 at about 12'.



Photo 2: Excavated soil from TP-202.

TEST PIT LOG

TP-203

Project	Project Principio			**PG.** 1 **OF** 1	
City/Town	Andover, MA			**Location**	N 3,047,020
Client	Fennick McCredie Architecture				E 745,424
Contractor	Northern Drill Service, Inc.			**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	M. Fleming	**GEI Rep**	M. Chea/N. Troccolo	**GEI Proj. No.**	2300951
Weather	70's F, Clear			**Date**	6/25/2024

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1			(0-16"): Topsoil, black/dark brown.
2 3 4 5 6	G1	1.3 - 6 ft	SILTY SAND (SM); 82.3% fine to coarse sand, 12.1% nonplastic fines, 5.6% fine to coarse gravel, light brown, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
7 8 9 10 11 12	G2	6 - 12 ft	NARROWLY GRADED SAND (SP); ~90% fine to medium sand, ~5% fine subrounded gravel, ~5% nonplastic fines, light brown, moist.
			Bottom of test pit at 12 ft. Test pit dry at completion. Test pit backfilled with excavated soil in lifts and tamped with excavator bucket.

Notes:

1. PID = 0.0 ppm at 2 ft, 4 ft, 6 ft, 8 ft, 10 ft, and 12 ft.
2. Wall of excavation collapsed at about 8 ft.
3. Collected environmental samples 2300951-TP-203 (1-4'), 2300951-TP-203 (4-8'), and 2300951-TP-203 (8-12').

Pit Dimensions (ft)

Length	5
Width	8
Depth	12

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TEST PIT LOG	TP-203



Photo 1: TP-203 at about 12'.



Photo 2: Excavated soil from TP-203.

TEST PIT LOG

TP-204

Project	Project Principio	**PG.**	1 **OF** 1
City/Town	Andover, MA	**Location**	N 3,046,202
Client	Fennick McCredie Architecture		E 745,419
Contractor	Northern Drill Service, Inc.	**Ground El.**	98 ft
Equipment/Reach	Takeuchi TB290	**Datum**	NAVD88
Operator	M. Fleming **GEI Rep** M. Chea	**GEI Proj. No.**	2300951
Weather	70's F, Cloudy	**Date**	7/18/2024

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
			(0-9"): Asphalt.
1	G1	0.8 - 2 ft	NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~65% fine to coarse sand, ~25% fine to coarse subangular gravel, ~10% nonplastic fines, brown, moist. [FILL]
2			
3	G2	2 - 3 ft	NARROWLY GRADED SAND (SP); ~90% fine to medium sand, ~5% fine gravel, ~5% nonplastic fines, light grayish brown, moist.
4	G3	3 - 4 ft	SANDY SILT (ML); 79.4% nonplastic fines, 20.6% fine sand, light gray, moist. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
5	G4	4 - 6 ft	SILTY SAND (SM); 63.2% fine sand, 35.0% nonplastic fines, 1.8% coarse angular gravel, light gray, moist. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
6			
7	G5	6 - 8 ft	SILTY SAND (SM); ~55% fine sand, ~45% nonplastic fines, light gray, wet.
8			
9	G6	8 - 11 ft	NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine to medium sand, ~10% nonplastic fines, brown, wet.
10			
11			
			Bottom of test pit at 11 ft. Groundwater at 6 ft. Test pit backfilled with excavated soil in lifts and tamped with excavator bucket up to 4 ft. From 4 ft to 0.8 ft below ground surface the test pit was backfilled with 1 ft thick lifts and compacted multiple times with Wacker Neuson VP1340 compactor. The test pit was topped with hot mix asphalt.

Notes:

1. PID = 3.6 ppm at 1 ft, PID = 0.8 ppm at 2 ft, PID = 0.5 ppm at 3 ft, PID = 0.8 ppm at 4 ft and 5 ft, PID = 1.4 ppm at 6 ft, PID = 0.0 ppm from 6 to 8 ft, and PID = 0.2 ppm from 8 to 11 ft.

2. Collected environmental sample 2300951-TP-204 (1-6').

Pit Dimensions (ft)

Length	4
Width	10
Depth	11

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TEST PIT LOG	TP-204



Photo 1: TP-204 at about 11'.



Photo 2: Excavated soil from TP-204.

TEST PIT LOG

TP-205

Project	Project Principio	**PG.**	1 **OF** 1
City/Town	Andover, MA	**Location**	N 3,046,175
Client	Fennick McCredie Architecture		E 745,343
Contractor	Northern Drill Service, Inc.	**Ground El.**	98 ft
Equipment/Reach	Takeuchi TB290	**Datum**	NAVD88
Operator	M. Fleming **GEI Rep** M. Chea	**GEI Proj. No.**	2300951
Weather	70's F, Cloudy	**Date**	7/18/2024

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
			(0-8"): Asphalt.
1	G1	0.7 - 2 ft	NARROWLY GRADED SAND WITH GRAVEL (SP); ~70% fine to coarse sand, ~25% fine to coarse subangular gravel, ~5% nonplastic fines, brown, moist. [FILL]
2			
3	G2	2 - 4.5 ft	SILTY SAND (SM); ~80% fine to medium sand, ~15% nonplastic fines, ~5% coarse subrounded gravel, light grayish brown, moist.
4			
5	G3	4 - 7.5 ft	SANDY SILT (ML); 81.7% nonplastic fines, 18.3% fine sand, light gray, moist to wet. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
6			
7			
8	G4	7.5 - 10.5 ft	NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine to medium sand, ~10% nonplastic fines, brown, wet.
9			
10			
11	G5	10.5 - 11 ft	SANDY SILT (ML); ~60% nonplastic fines, ~40% fine sand, light gray, wet.
			Bottom of test pit at 11 ft. Groundwater at 6 ft. Test pit backfilled with excavated soil in lifts and tamped with excavator bucket up to 4 ft. From 4 ft to 0.7 ft below ground surface the test pit was backfilled with 1 ft thick lifts and compacted multiple times with Wacker Neuson VP1340 compactor. The test pit was topped with hot mix asphalt.

Notes:

1. PID = 0.6 ppm at 0.5 ft, PID = 0.5 ppm at 1 ft, PID = 2.9 ppm at 1.5 ft, PID = 1.2 ppm at 2 ft and 2.5 ft, PID = 1.5 ppm at 3 ft, PID = 0.8 ppm at 3.5 ft, PID = 2.1 at 4 ft, PID = 0.8 ppm at 4.5 ft, PID = 1.0 ppm at 5 ft, PID = 1.7 ppm at 5.5 ft, PID = 2 ppm at 6 ft, PID = 0.7 ppm from 7.5 to 10.5 ft, and PID = 1.8 ppm from 10.5 to 11 ft.

2. Collected environmental samples 2300951-TP-205 (0-3') and 2300951-TP-205(3-6').

Pit Dimensions (ft)

Length	4
Width	10
Depth	11

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TEST PIT LOG	TP-205



Photo 1: TP-205 at about 11'.



Photo 2: Excavated soil from TP-205.

TEST PIT LOG

TP-206

Project	Project Principio			**PG.**	1 **OF** 1
City/Town	Andover, MA			**Location**	N 3,046,097
Client	Fennick McCredie Architecture				E 745,481
Contractor	Northern Drill Service, Inc.			**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	M. Fleming	**GEI Rep**	M. Chea/N. Troccolo	**GEI Proj. No.**	2300951
Weather	70's F, Clear			**Date**	6/24/2024

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1			(0-8"): Topsoil, black/dark brown.
2	G1	1 - 3 ft	NARROWLY GRADED SAND WITH SILT (SP-SM); ~80% fine to medium sand, ~10% fine to coarse subrounded to angular gravel, ~10% nonplastic fines, light brown, moist. [FILL]
3			
4			
5	G2	3 - 7 ft	NARROWLY GRADED SAND WITH SILT (SP-SM); 87.9% fine to medium sand, 12.0% nonplastic fines, 0.1% fine gravel, light brown, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
6			
7			
8			
9	G3	7 - 11 ft	NARROWLY GRADED SAND (SP); ~95% fine to medium sand, ~5% nonplastic fines, light gray, wet.
10			
11			
			Bottom of test pit at 11 ft. Groundwater at 7 ft. Test pit backfilled with excavated soil in lifts and tamped with excavator bucket.

Notes:

1. PID = 0.0 ppm at 2 ft, 4 ft, 6 ft, 8 ft, and 10 ft.
2. Wall of excavation collapsed at about 9 ft.
3. Collected environmental samples 2300951-TP-206 (1-7') and 2300951-TP-206 (7-11').

Pit Dimensions (ft)

Length	5
Width	10
Depth	11

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TEST PIT LOG	TP-206



Photo 1: TP-206 at about 11'.



Photo 2: Excavated soil from TP-206.

TEST PIT LOG

TP-207

Project	Project Principio			**PG.** 1 **OF** 1	
City/Town	Andover, MA			**Location**	N 3,046,084
Client	Fennick McCredie Architecture				E 745,425
Contractor	Northern Drill Service, Inc.			**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	M. Fleming	**GEI Rep**	M. Chea/N. Troccolo	**GEI Proj. No.**	2300951
Weather	70's F, Clear			**Date**	6/24/2024

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1			(0-12"): Topsoil, black/dark brown.
2	G1	1 - 3 ft	SILTY SAND WITH GRAVEL (SM); ~70% fine to medium sand, ~15% fine to coarse subrounded gravel, ~15% nonplastic fines, brown, moist. [FILL]
3			
4	G2	3 - 6 ft	NARROWLY GRADED SAND WITH SILT (SP-SM); 74.2% fine to medium sand, 14.6% fine to coarse subrounded gravel, 11.2% nonplastic fines, light brown, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
5			
6			
7	G3	6 - 10 ft	SILTY SAND (SM); 66.5% fine sand, 33.5% nonplastic fines, light gray, wet. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED] Orange band of sand from 8 to 10 ft.
8			
9			
10			
11	G4	10 - 11 ft	SANDY SILT (ML); ~60% low plasticity fines, ~40% fine sand, light gray, wet.
			Bottom of test pit at 11 ft. Groundwater at 7 ft. Test pit backfilled with excavated soil in lifts and tamped with excavator bucket.

Notes:

1. PID = 0.0 ppm at 2 ft, 4 ft, 6 ft, 8 ft, and 10 ft.
2. Wall of excavation collapsed at about 6 ft.
3. Collected environmental samples 2300951-TP-207 (1-7') and 2300951-TP-207 (7-11').

Pit Dimensions (ft)

Length	4
Width	9
Depth	11

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TEST PIT LOG	TP-207



Photo 1: TP-207 at about 11'.



Photo 2: Excavated soil from TP-207.

TEST PIT LOG

TP-208

Project	Project Principio			**PG.** 1 **OF** 1	
City/Town	Andover, MA			**Location**	N 3,046,074
Client	Fennick McCredie Architecture				E 745,376
Contractor	Northern Drill Service, Inc.			**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	M. Fleming	**GEI Rep**	M. Chea/N. Troccolo	**GEI Proj. No.**	2300951
Weather	70's F, Clear			**Date**	6/24/2024

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1			(0-12"): Topsoil, black/dark brown.
2	G1	1 - 2 ft	SILTY SAND WITH GRAVEL (SM); ~70% fine to medium sand, ~15% coarse subrounded gravel, ~15% nonplastic fines, brown, moist. [FILL]
3 4 5 6	G2	2 - 6 ft	NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine to medium sand, ~10% nonplastic fines, light brown, moist.
7 8 9 10 11	G3	6 - 11 ft	SILTY SAND (SM); 57% fine to medium sand, 37.5% nonplastic fines, 5.5% fine to coarse subrounded gravel, light gray to grayish brown, wet. [GRAIN SIZE DISTRIBUTION TEST AND HYDROMETER TEST PERFORMED] Cobbles up to 7 inch in size made up about 5% of total volume.
			Bottom of test pit at 11 ft. Groundwater at 6 ft. Test pit backfilled with excavated soil in lifts and tamped with excavator bucket.

Notes:

1. PID = 0.0 ppm at 2 ft, 6 ft, and 10 ft. PID = 0.3 ppm at 4 ft and 8 ft.
2. Wall of excavation collapsed at about 5 ft.
3. Collected environmental samples 2300951-TP-208 (1-6') and 2300951-TP-208 (6-11').

Pit Dimensions (ft)

Length	4
Width	8
Depth	11

GEI Consultants

TEST PIT LOG	TP-208



Photo 1: TP-208 at about 11'.



Photo 2: Excavated soil from TP-208.

TEST PIT LOG

TP-209

Project	Project Principio			**PG.**	1 **OF** 1
City/Town	Andover, MA			**Location**	N 3,046,060
Client	Fennick McCredie Architecture				E 745,316
Contractor	Northern Drill Service, Inc.			**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	M. Fleming	**GEI Rep**	M. Chea/N. Troccolo	**GEI Proj. No.**	2300951
Weather	70's F, Clear			**Date**	6/24/2024

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1			(0-7"): Topsoil, black/dark brown.
2	G1	0.7 - 2 ft	SILTY SAND WITH GRAVEL (SM); ~70% fine to medium sand, ~15% coarse subrounded gravel, ~15% nonplastic fines, brown, moist. [FILL]
3 4 5 6	G2	2 - 6 ft	NARROWLY GRADED SAND WITH SILT (SP-SM); 87.9% fine to medium sand, 8.9% nonplastic fines, 3.2% fine to coarse subrounded gravel, light brown, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
7 8 9 10 11	G3	6 - 11 ft	SILTY SAND (SM); ~85% fine to medium sand, ~15% nonplastic fines, light grayish brown, wet. Orange band of sand at about 9 ft.
			Bottom of test pit at 11 ft. Groundwater at 6 ft. Test pit backfilled with excavated soil in lifts and tamped with excavator bucket.

Notes:

1. PID = 0.0 ppm at 2 ft, 4ft, 6 ft, 8 ft, and 10 ft.
2. Wall of excavation collapsed at about 7 ft.
3. Collected environmental samples 2300951-TP-209 (1-6') and 2300951-TP-209 (6-11').

Pit Dimensions (ft)

Length	4
Width	9
Depth	11

GEI Consultants

TEST PIT LOG	TP-209



Photo 1: TP-209 at about 11'.



Photo 2: Excavated soil from TP-209.

TEST PIT LOG

TP-210

Project	Project Principio	**PG.**	1 **OF** 1
City/Town	Andover, MA	**Location**	N 3,046,636
Client	Fennick McCredie Architecture		E 744,741
Contractor	Northern Drill Service, Inc.	**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4	**Datum**	NAVD88
Operator	M. Fleming **GEI Rep** M. Chea/N. Troccolo	**GEI Proj. No.**	2300951
Weather	70's F, Clear	**Date**	6/26/2024

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
			(0-4"): Asphalt.
1	G1	0.4 - 1.8 ft	NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~60% fine to coarse sand, ~30% fine to coarse subrounded gravel, ~10% nonplastic fines, brown, moist. [FILL]
2			
3	G2	1.8 - 6 ft	SILTY SAND (SM); ~60% fine sand, ~40% nonplastic fines, light gray to light grayish brown, moist.
4			
5			
6			
7	G3	6 - 11 ft	SANDY SILT (ML); 64.5% nonplastic fines, 29.4% fine to coarse sand, 6.1% fine to coarse subrounded gravel, light grayish brown, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
8			
9			
10			
11			
			Bottom of test pit at 11 ft. Test pit dry at completion. Test pit backfilled with excavated soil in lifts and tamped with excavator bucket up to 4 ft. From 4 ft to 0.5 ft below ground surface the test pit was backfilled with 1 ft thick lifts and compacted multiple times with Wacker Neuson VP1340 compactor. The test pit was topped with hot mix asphalt.

Notes:

1. PID = 0.2 ppm at 1 ft, PID = 3.4 ppm at 2 ft, PID = 2.0 ppm at 4 ft, PID = 1.1 ppm at 6 ft, PID = 2.0 ppm at 8 ft, PID = 2.2 ppm at 10 ft.
2. Collected environmental samples 2300951-TP-210 (0-1.5') and 2300951-TP-210 (1.5-11').

Pit Dimensions (ft)

Length	4
Width	10
Depth	11

GEI Consultants

TEST PIT LOG	TP-210



Photo 1: TP-210 at about 11'.



Photo 2: Excavated soil from TP-210.

TEST PIT LOG

TP-211

Project	Project Principio	**PG.**	1 **OF** 1
City/Town	Andover, MA	**Location**	N 3,046,678
Client	Fennick McCredie Architecture		E 744,731
Contractor	Northern Drill Service, Inc.	**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4	**Datum**	NAVD88
Operator	M. Fleming **GEI Rep** M. Chea/N. Troccolo	**GEI Proj. No.**	2300951
Weather	70's F, Clear	**Date**	6/26/2024

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
			(0-4"): Asphalt.
1	G1	0.4 - 1.5 ft	NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~60% fine to coarse sand, ~30% fine to coarse subangular gravel, ~10% nonplastic fines, brown, moist. [FILL]
2			
3	G2	1.5 - 6 ft	SILT WITH SAND (ML); 78.7% nonplastic fines, 21.3% fine sand, light grayish brown, moist. [GRAIN SIZE DISTRIBUTION TEST AND HYDROMETER TEST PERFORMED] Orange band of sand from 4 to 6 ft.
4			
5			
6			
7	G3	6 - 11 ft	SILTY SAND (SM); 57.2% fine to medium sand, 42.8% nonplastic fines, light grayish brown, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
8			
9			
10			
11			
			Bottom of test pit at 11 ft. Test pit dry at completion. Test pit backfilled with excavated soil in lifts and tamped with excavator bucket up to 4 ft. From 4 ft to 0.5 ft below ground surface the test pit was backfilled with 1 ft thick lifts and compacted multiple times with Wacker Neuson VP1340 compactor. The test pit was topped with hot mix asphalt.

Notes:

1. PID = 5.1 ppm at 2 ft, PID = 3.0 ppm at 4 ft, PID = 5.8 ppm at 6 ft, PID = 3.7 ppm at 8 ft, PID = 0.3 ppm at 10 ft.
2. Collected environmental samples 2300951-TP-211 (1.5-11').

Pit Dimensions (ft)

Length	4
Width	10
Depth	11

GEI Consultants

TEST PIT LOG	TP-211



Photo 1: TP-211 at about 11'.



Photo 2: Excavated soil from TP-211.

TEST PIT LOG

TP-212

Project	Project Principio	**PG.**	1 **OF** 1
City/Town	Andover, MA	**Location**	N 3,046,632
Client	Fennick McCredie Architecture		E 744,668
Contractor	Northern Drill Service, Inc.	**Ground El.**	98 ft
Equipment/Reach	Kubota KX080-4	**Datum**	NAVD88
Operator	M. Fleming **GEI Rep** M. Chea/N. Troccolo	**GEI Proj. No.**	2300951
Weather	80's F, Clear	**Date**	6/26/2024

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
			(0-4"): Asphalt.
1	G1	0.3 - 1.5 ft	NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~65% fine to coarse sand, ~25% fine to coarse subangular gravel, ~10% nonplastic fines, trace of brick, brown, moist. [FILL]
2			
3	G2	1.5 - 4 ft	NARROWLY GRADED SAND WITH GRAVEL (SP); ~80% fine to medium sand, ~15% fine to coarse gravel, ~5% nonplastic fines, light brown, moist. [POSSIBLE FILL]
4			
5	G3	4 - 8.5 ft	SILTY SAND (SM); 50.5% fine sand, 49.5% nonplastic fines, light grayish brown, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
6			
7			
8			
9	G4	8.5- 11 ft	SILTY SAND (SM); 57.7% fine sand, 42% nonplastic fines, 0.3% fine gravel, light grayish brown, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
10			
11			
			Bottom of test pit at 11 ft. Test pit dry at completion. Test pit backfilled with excavated soil in lifts and tamped with excavator bucket up to 4 ft. From 4 ft to 0.5 ft below ground surface the test pit was backfilled with 1 ft thick lifts and compacted multiple times with Wacker Neuson VP1340 compactor. The test pit was topped with hot mix asphalt.

Notes:

1. PID = 1.1 ppm at 1 ft, PID = 0.0 ppm at 2 ft, PID = 2.1 ppm at 4 ft, PID = 2.9 ppm at 8 ft, PID = 1.4 ppm at 10 ft.
2. Collected environmental samples 2300951-TP-212 (0-1.5'), 2300951-TP-212 (1.5-5'), 2300951-TP-212 (5-8'), and 2300951-TP-212 (8-11').

Pit Dimensions (ft)

Length	4
Width	10
Depth	11

GEI Consultants

TEST PIT LOG	TP-212



Photo 1: TP-212 at about 11'.



Photo 2: Excavated soil from TP-212.

TEST PIT LOG

TP-213

Project	Project Principio			**PG.**	1 **OF** 1
City/Town	Andover, MA			**Location**	N 3,046,623
Client	Fennick McCredie Architecture				E 744,628
Contractor	Northern Drill Service, Inc.			**Ground El.**	99 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	M. Fleming	**GEI Rep**	M. Chea/N. Troccolo	**GEI Proj. No.**	2300951
Weather	80's F, Clear			**Date**	6/25/2024

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
1			(0-12"): Topsoil, black/dark brown.
2 3 4	G1	1 - 4 ft	NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine to medium sand, ~10% nonplastic fines, light brown, moist.
5 6 7 8 9	G2	4 - 9 ft	SANDY SILT (ML); 52.6% nonplastic fines, 47.4% fine sand, light yellowish brown, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED] Orange band of sand at about 4 ft.
10 11	G3	9 - 11 ft	SILTY SAND (SM); ~60% fine sand, ~40% nonplastic fines, light grayish brown, moist.
			Bottom of test pit at 11 ft. Test pit dry at completion. Test pit backfilled with excavated soil in lifts and tamped with excavator bucket.

Notes:

1. PID = 0.0 ppm at 2 ft, PID = 0.5 ppm at 4 ft, PID = 0.1 ppm at 6 ft, PID = 0.6 ppm at 8 ft, and PID = 0.0 ppm at 10 and 11 ft.
2. Collected environmental samples 2300951-TP-213 (1-4'), 2300951 - TP-213 (4-8'), and 2300951-TP-213 (8-11').

Pit Dimensions (ft)

Length	3
Width	8
Depth	11

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TEST PIT LOG	TP-213



Photo 1: TP-213 at about 11'.



Photo 2: Excavated soil from TP-213.

TEST PIT LOG

TP-214

Project	Project Principio			**PG.** 1 **OF** 1	
City/Town	Andover, MA			**Location**	N 3,046,871
Client	Fennick McCredie Architecture				E 744,585
Contractor	Northern Drill Service, Inc.			**Ground El.**	98.5 ft
Equipment/Reach	Kubota KX080-4			**Datum**	NAVD88
Operator	M. Fleming	**GEI Rep**	M. Chea/N. Troccolo	**GEI Proj. No.**	2300951
Weather	80's F, Clear			**Date**	6/25/2024

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
			(0-4"): Asphalt.
1	G1	0.4 - 1.5 ft	NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~70% fine to coarse sand, ~20% fine to medium subangular gravel, ~10% nonplastic fines, trace of brick, dark brown to brown, moist. [FILL]
2			
3	G2	1.5 - 5.5 ft	SILTY SAND (SM), 77.1% fine to coarse sand, 17.1% nonplastic fines, 5.8% fine to coarse subangular gravel, light brown, moist. [FILL] [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
4			
5			
6	G3	5.5 - 6.5 ft	Observed on western side of test pit: SILTY SAND (SM), ~70% fine to medium sand, ~25% nonplastic fines, ~5% fine subrounded gravel, trace of wood, dark brown, moist.
7	G4	6.5 - 9 ft	SILTY SAND (SM); ~60% fine sand, ~40% nonplastic fines, yellowish brown, moist.
8			
9			
10	G5	9 - 11 ft	SANDY SILT (ML), 56.3% nonplastic fines, 43.7% to fine sand, yellowish brown, moist. [GRAIN SIZE DISTRIBUTION AND HYDROMETER TEST PERFORMED]
11			
			Bottom of test pit at 11 ft. Test pit dry at completion. Test pit backfilled with excavated soil in lifts and tamped with excavator bucket up to 4 ft. From 4 ft to 0.5 ft below ground surface the test pit was backfilled with 1 ft thick lifts and compacted multiple times with Wacker Neuson VP1340 compactor. The test pit was topped with hot mix asphalt.

Notes:

1. PID = 0.7 ppm at 1 ft, PID = 0.0 ppm at 2 ft, PID = 0.5 ppm at 4 ft, PID = 0.1 ppm at 6 ft, PID = 0.0 ppm at 8 ft, PID = 0.0 ppm at 10 ft.
2. Collected environmental samples 2300951-TP-214 (0.5-1.5'), 2300951-TP-214 (5-7'), 2300951-TP-214 (7-9'), and 2300951-TP-214 (9-11') .

Pit Dimensions (ft)

Length	4
Width	10
Depth	11

GEI Consultants

TEST PIT LOG	TP-214



Photo 1: TP-214 at about 11'.



Photo 2: Excavated soil from TP-214.

TEST PIT LOG

TP-215

Project	Project Principio			**PG.** 1 **OF** 1	
City/Town	Andover, MA			**Location**	N 3,046,150
Client	Fennick McCredie Architecture				E 745,580
Contractor	Northern Drill Service, Inc.			**Ground El.**	98 ft
Equipment/Reach	Takeuchi TB290			**Datum**	NAVD88
Operator	M. Fleming	**GEI Rep**	M. Chea	**GEI Proj. No.**	2300951
Weather	70's F, Clear			**Date**	7/18/2024

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
			(0-6"): Topsoil, black/dark brown.
1 2 3	G1	0.5 - 3 ft	SILTY SAND (SM); ~70% fine to medium sand, ~25% nonplastic fines, ~5% fine gravel, trace of roots, light brown, moist. [FILL]
4 5 6	G2	3 - 6 ft	NARROWLY GRADED SAND WITH SILT (SP-SM); 80.5% fine to medium sand, 19.5% nonplastic fines, light grayish brown, moist. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
7 8 9 10 11	G3	6 - 11 ft	SILTY SAND (SM); ~80% fine to medium sand, ~20% nonplastic fines, light grayish brown, wet.
			Bottom of test pit at 11 ft. Groundwater at 6 ft. Test pit backfilled with excavated soil in lifts and tamped with excavator bucket.

Notes:

1. PID = 2.7 ppm at 0.5 ft, PID = 1.8 ppm at 1 ft, PID = 4.0 ppm at 1.5 ft, PID = 3.3 ppm at 2 ft, PID = 3.2 ppm at 2.5 ft, PID = 2.5 ppm at 3 ft, PID = 1.7 ppm at 3.5 ft, PID = 0.8 at 4 ft, PID = 1.7 ppm at 4.5 ft, PID = 1.3 ppm at 5 ft, PID = 1.7 ppm at 5.5 ft, PID = 0.5 ppm at 6 ft, PID = 0.1 ppm from 6 to 11 ft.

2. Collected environmental samples 2300951-TP-215 (0-3') and 2300951-TP-215 (3-6').

Pit Dimensions (ft)

Length	6
Width	8
Depth	11

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TEST PIT LOG	TP-215



Photo 1: TP-215 at about 11'.



Photo 2: Excavated soil from TP-215.

TEST PIT LOG

TP-216

Project	Project Principio			**PG.** 1 **OF** 1	
City/Town	Andover, MA			**Location**	N 3,046,165
Client	Fennick McCredie Architecture				E 745,238
Contractor	Northern Drill Service, Inc.			**Ground El.**	98 ft
Equipment/Reach	Takeuchi TB290			**Datum**	NAVD88
Operator	M. Fleming	**GEI Rep**	M. Chea	**GEI Proj. No.**	2300951
Weather	80's F, Cloudy			**Date**	7/18/2024

Depth	Sample No. and Type	Sample Depth (ft)	Soil Description
			(0-6"): Asphalt.
1	G1	0.5 - 1.5 ft	NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~70% fine to coarse sand, ~20% fine to medium subangular gravel, ~10% nonplastic fines, brown, moist. [FILL]
2			
3	G2	1.5 - 6 ft	NARROWLY GRADED SAND WITH SILT (SP-SM), 91.9% fine to medium sand, 8.1% nonplastic fines, light grayish brown, moist. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
4			
5			
6			
7	G3	6 - 9 ft	SILTY SAND (SM); 75.9% fine sand, 24.1% nonplastic fines,light brown, wet. [GRAIN SIZE DISTRIBUTION TEST PERFORMED].
8			
9			
10	G4	9 - 11 ft	Similar to G3.
11			
			Bottom of test pit at 11 ft. Groundwater at 6 ft. Test pit backfilled with excavated soil in lifts and tamped with excavator bucket up to 4 ft. From 4 ft to 0.5 ft below ground surface the test pit was backfilled with 1 ft thick lifts and compacted multiple times with Wacker Neuson VP1340 compactor. The test pit was topped with hot mix asphalt.

Notes:

1. PID = 0.9 ppm at 1 ft, PID = 2.3 ppm at 2 ft, PID = 2.0 ppm at 3 ft, PID = 1.5 ppm at 4 ft, PID = 1.2 ppm at 5 ft, PID = 0.6 ppm at 6 ft, PID = 0.1 ppm from 6 to 9 ft, and PID = 0.1 ppm from 9 to 11 ft. .
2. Collected environmental sample 2300951-TP-216 (0-6').

Pit Dimensions (ft)

Length	4
Width	10
Depth	11

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TEST PIT LOG	TP-216



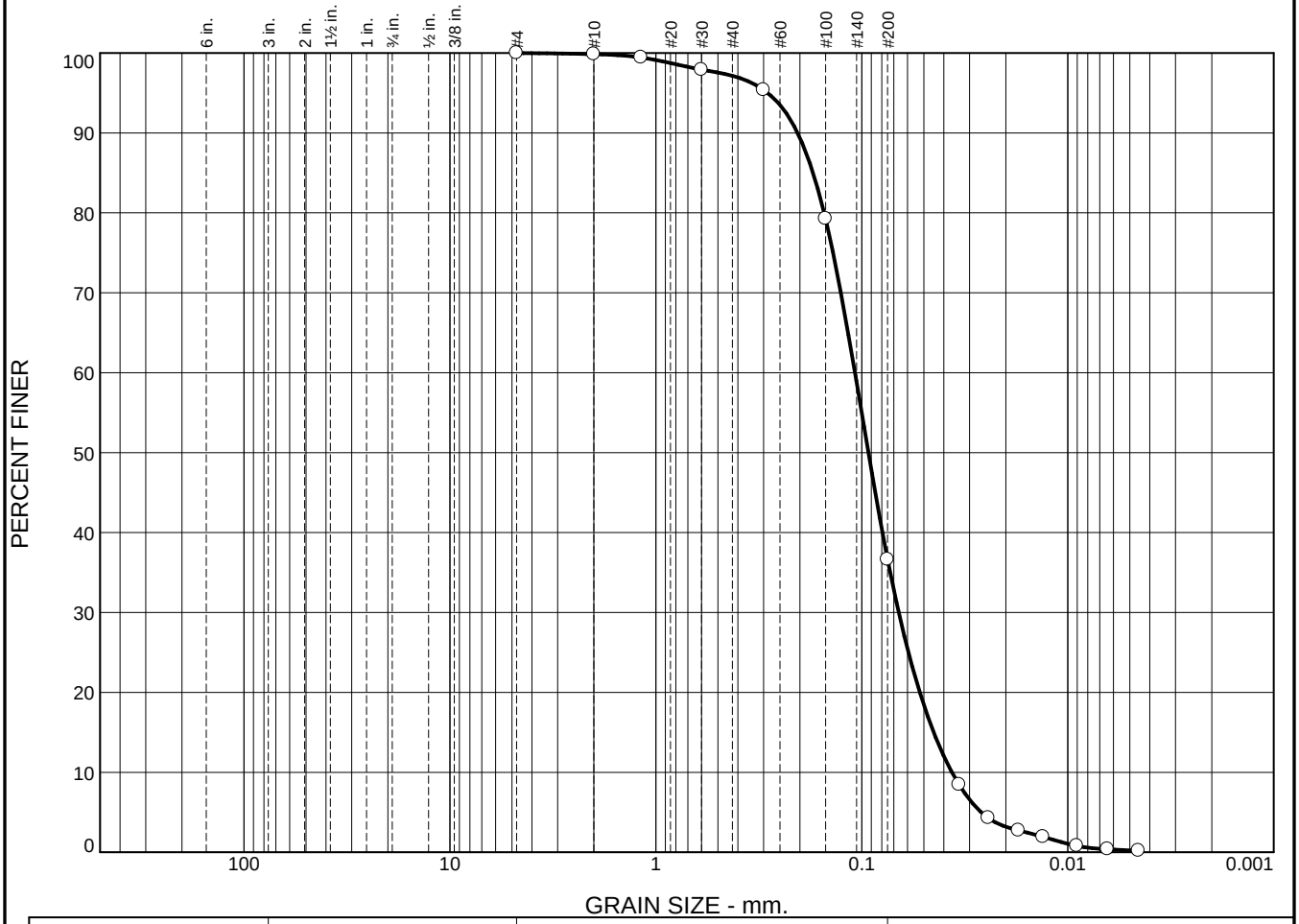
Photo 1: TP-216 at about 11'.



Photo 2: Excavated soil from TP-216.

Appendix B Laboratory Test Results

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	2.8	60.5	36.4	0.2

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_u
○			0.1725	0.1080	0.0929	0.0662	0.0448	0.0365	1.11	2.96

Material Description	USCS	AASHTO
○ Silty SAND	SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-201 **Depth:** 5-10 ft **Sample Number:** G3

Remarks:

○As Received WC=11.9%

Fines classified visually

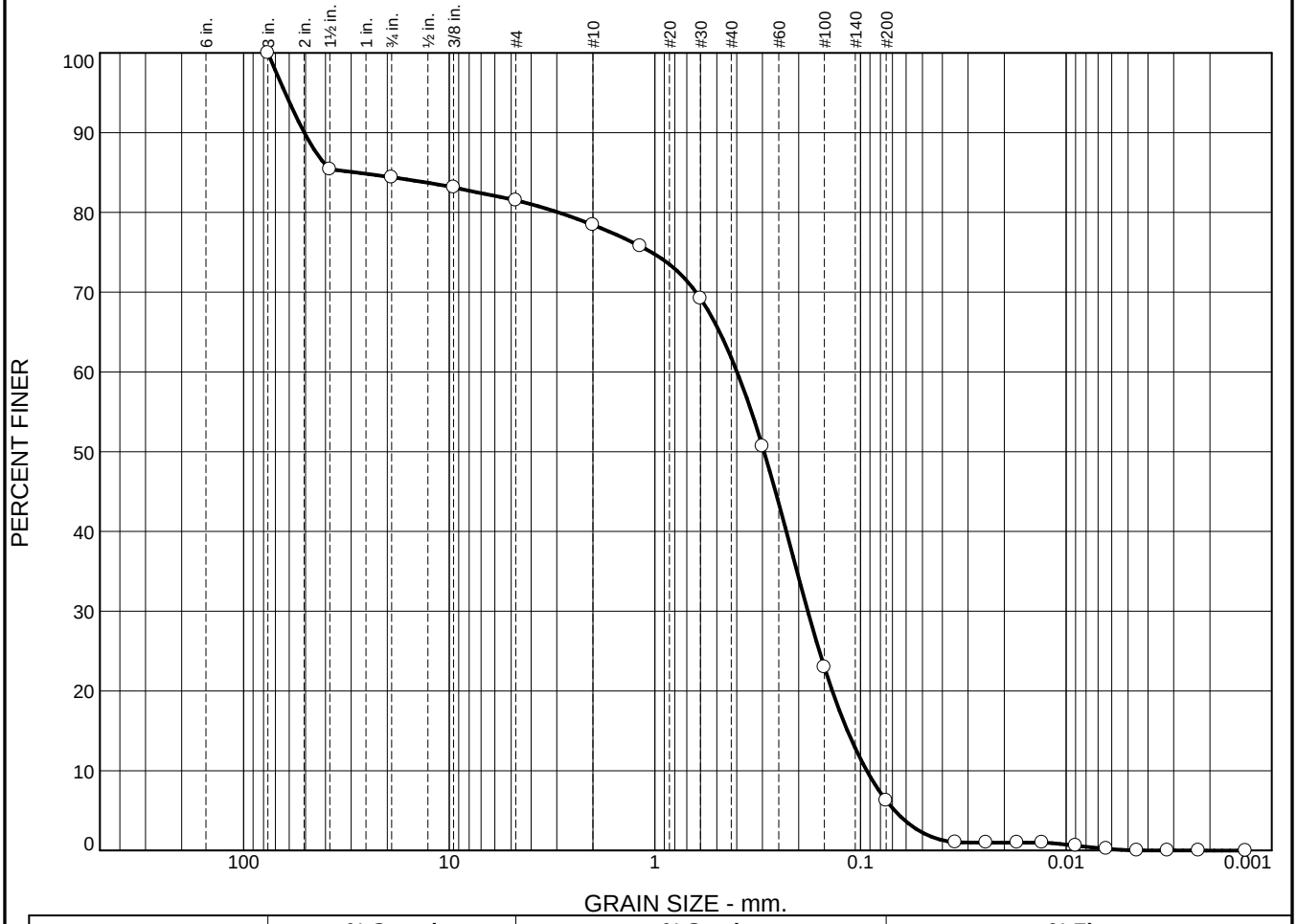
GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

GEI Consultants

Figure

Tested By: M. Alstede 7/15/24 **Checked By:** W. Lukas 7/16/24

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	15.6	2.9	3.1	16.6	55.5	6.3	0.0

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			28.1967	0.3985	0.2945	0.1803	0.1156	0.0932	0.88	4.27

Material Description	USCS	AASHTO
○ Narrowly Graded SAND with Silt and Gravel	SP-SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-202 **Depth:** 5-9 ft **Sample Number:** G2

Remarks:

○As received WC = 2.9%

Fines classified visually

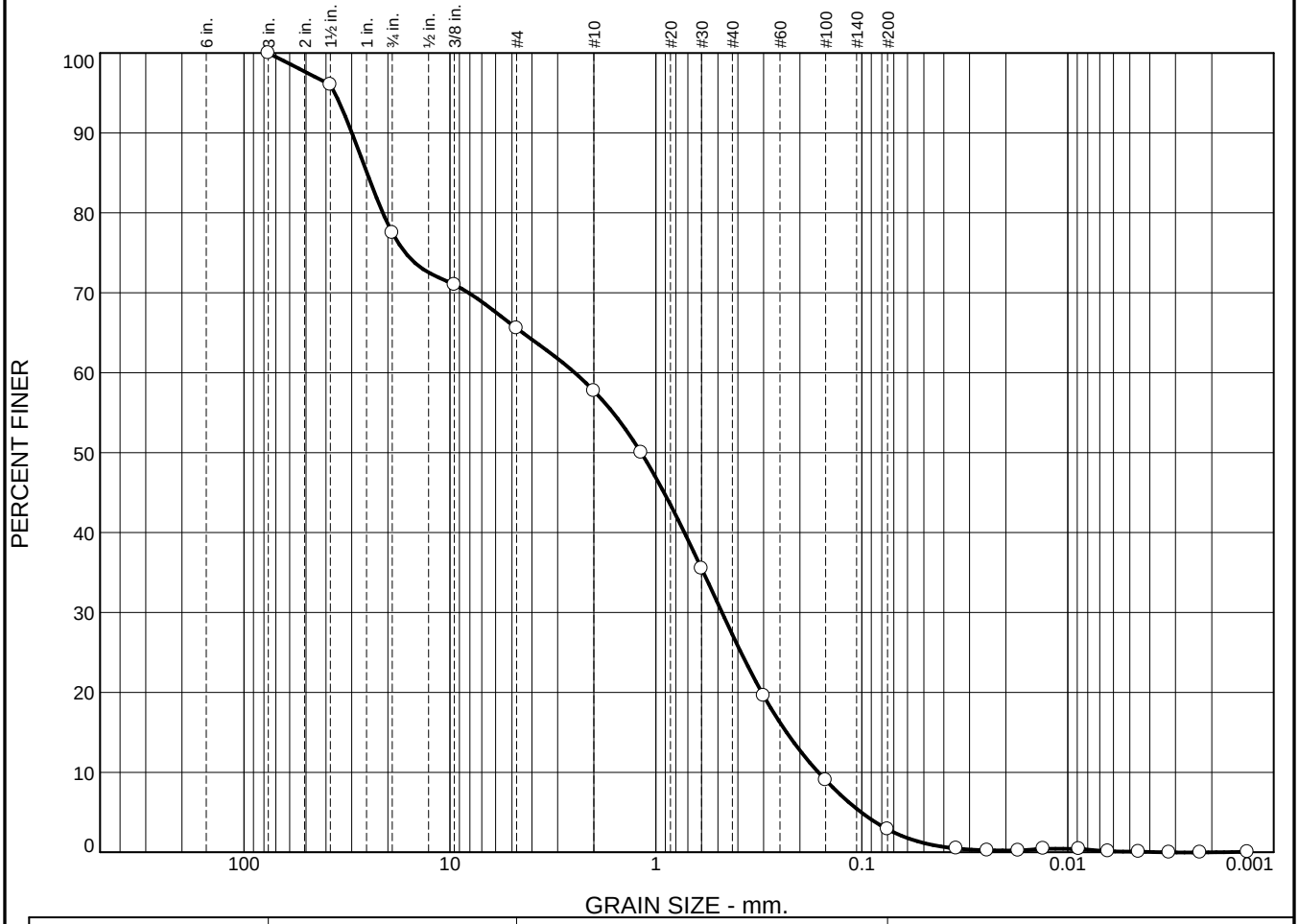
GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

GEI Consultants

Figure

Tested By: S. Larson 7/11/24 **Checked By:** M. Altede 7/12/24

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	22.5	11.9	7.9	30.5	24.3	2.8	0.1

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			25.2860	2.4761	1.1797	0.4775	0.2320	0.1626	0.57	15.23

Material Description	USCS	AASHTO
○ Narrowly Graded SAND with Gravel	SP	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-202 **Depth:** 9-12 ft **Sample Number:** G3

Remarks:

○As received WC = 1.9%

Fines classified visually

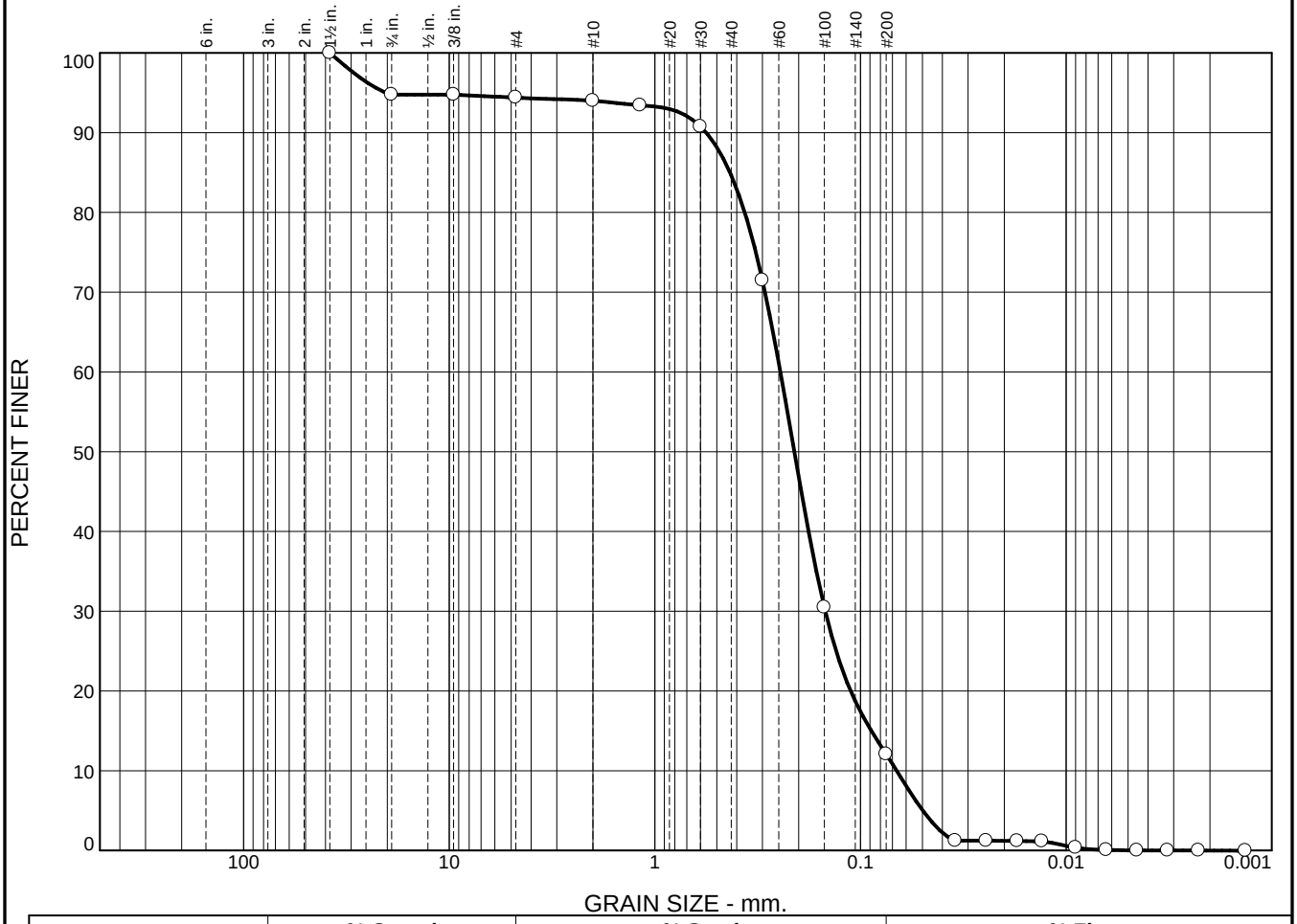
GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

GEI Consultants

Figure

Tested By: S. Larson 7/11/24 **Checked By:** M. Alstede 7/12/24

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	5.2	0.4	0.4	9.4	72.5	12.1	0.0

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.4312	0.2455	0.2098	0.1484	0.0886	0.0667	1.34	3.68

	Material Description	USCS	AASHTO
○	Silty SAND	SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-203 **Depth:** 1.3-6 ft **Sample Number:** G1

Remarks:

○As received WC = 3.3%

Fines classified visually

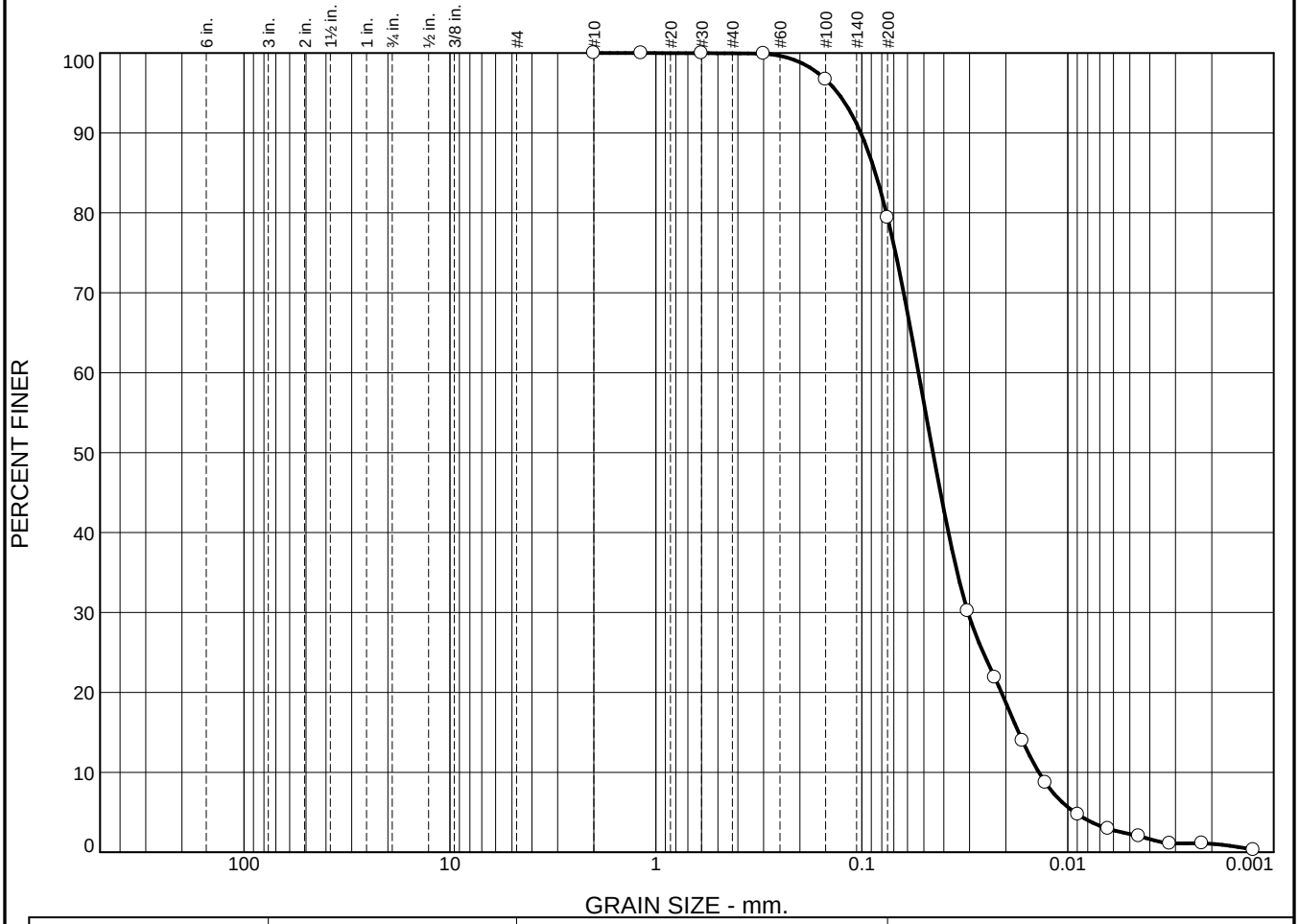
GEI Consultants, Inc.
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Woburn, MA 01801

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Figure

Tested By: S. Larson 7/11/24 **Checked By:** M. Alstede 7/12/24

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	20.6	77.1	2.3

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.0860	0.0531	0.0452	0.0305	0.0173	0.0138	1.27	3.84

Material Description	USCS	AASHTO
○ SILT with Sand	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-204 **Depth:** 3-4 ft **Sample Number:** G3

Remarks:

○As Received WC=24.8%

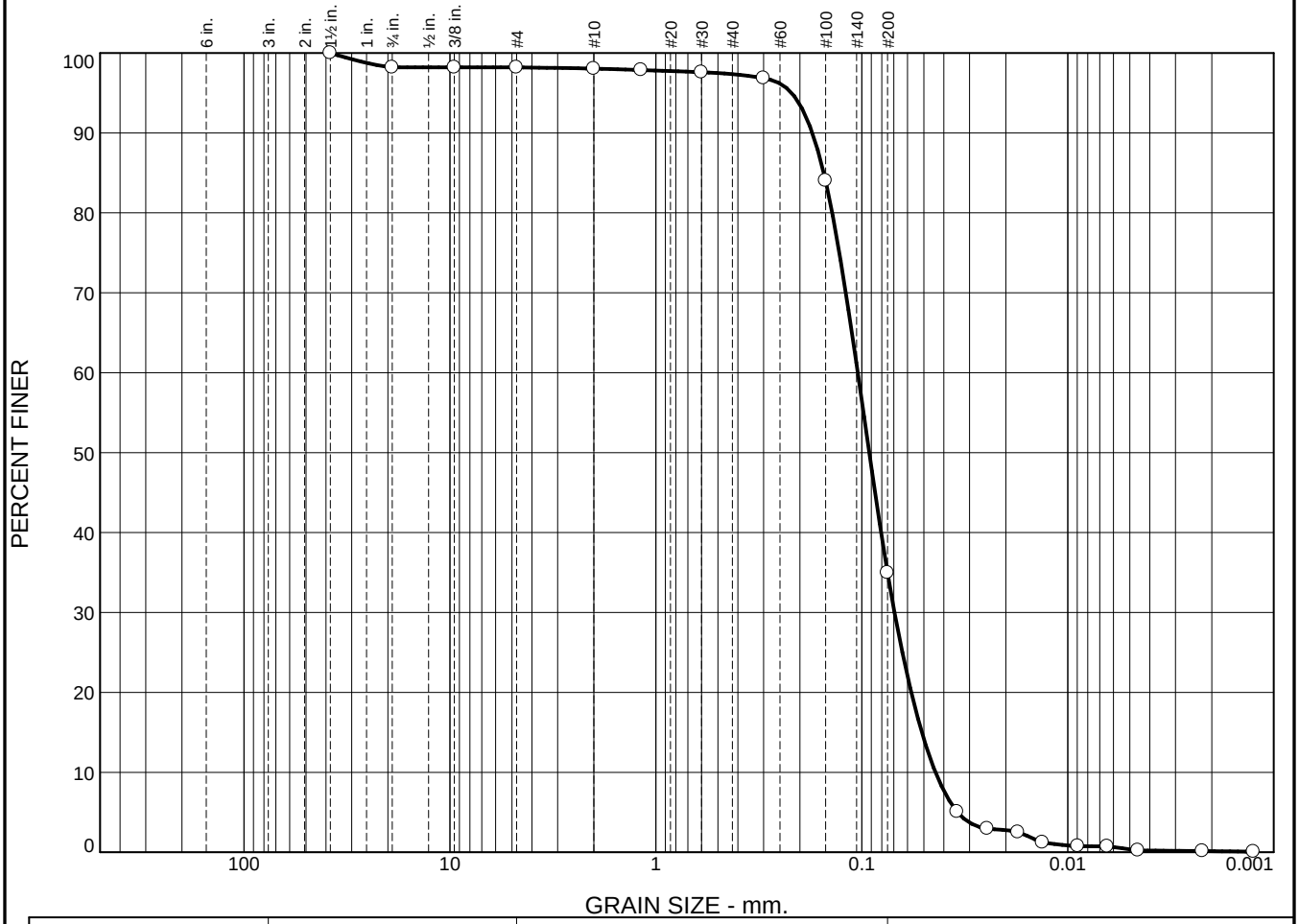
Fines classified visually

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Woburn, MA 01801

Figure

Tested By: S. Larson 7/22/24 **Checked By:** M. Alstede 7/22/24

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	1.8	0.0	0.2	0.6	62.4	34.6	0.4

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1531	0.1047	0.0921	0.0694	0.0511	0.0439	1.05	2.39

Material Description	USCS	AASHTO
○ Silty SAND	SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-204 **Depth:** 4-6 ft **Sample Number:** G4

Remarks:

○As Received WC=21.8%

Fines classified visually

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Figure

Tested By: S. Larson 7/22/24 **Checked By:** M. Alstede 7/22/24

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.3	18.0	78.4	3.3

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_u
○			0.0840	0.0396	0.0300	0.0176	0.0118	0.0096	0.81	4.12

Material Description	USCS	AASHTO
○ SILT with Sand	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-205 **Depth:** 4.5-7.5 ft **Sample Number:** G3

Remarks:

○As Received WC=30.9%

Fines classified visually

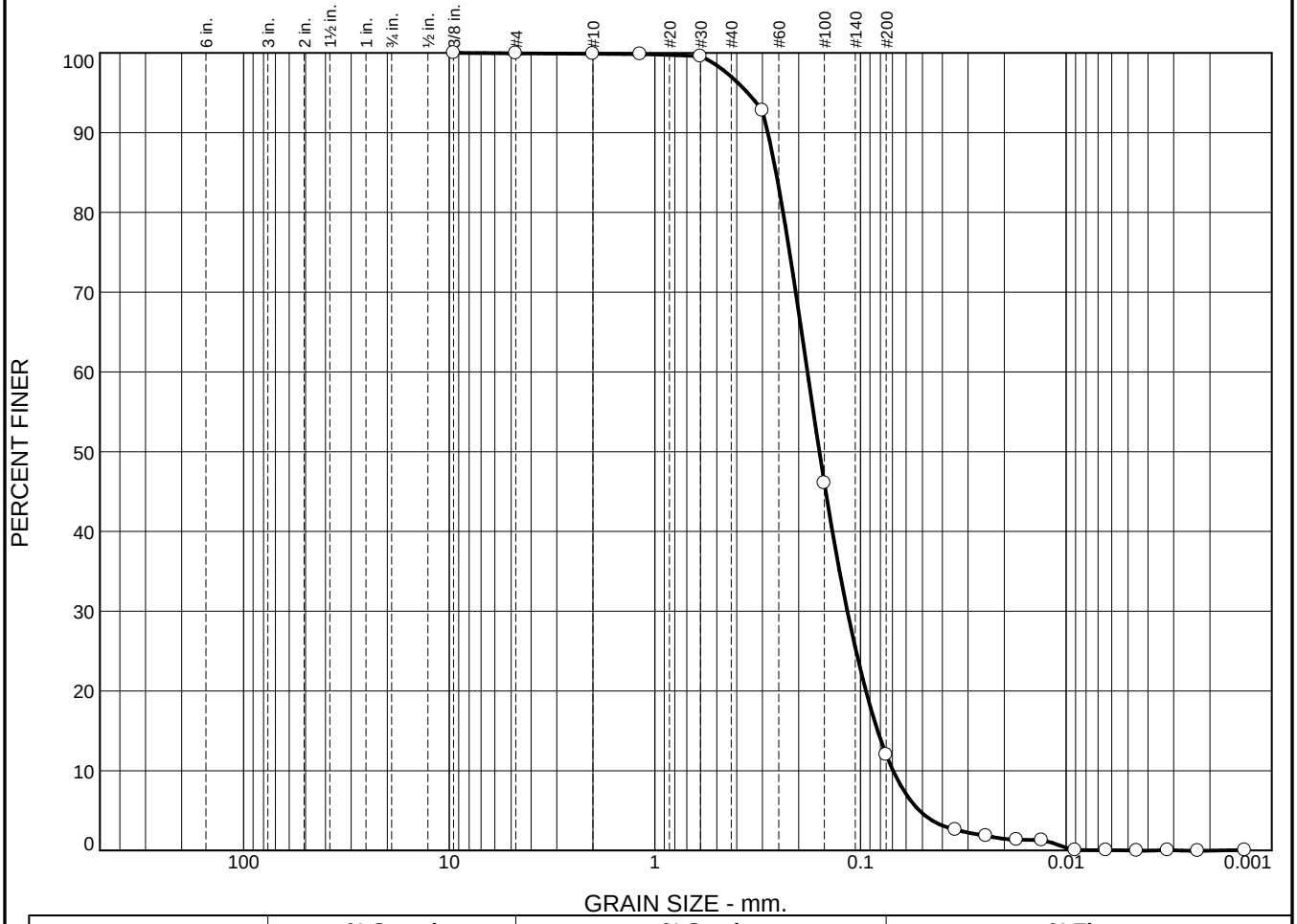
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Woburn, MA 01801

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Figure

Tested By: S. Larson 7/22/24 **Checked By:** M. Alstede 7/22/24

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.1	0.0	2.9	85.0	12.0	0.0

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.2575	0.1811	0.1585	0.1159	0.0825	0.0694	1.07	2.61

	Material Description	USCS	AASHTO
○	Narrowly Graded SAND with Silt	SP-SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-206 **Depth:** 3-7 ft **Sample Number:** G2

Remarks:

○As received WC = 21.0%

Fines classified visually

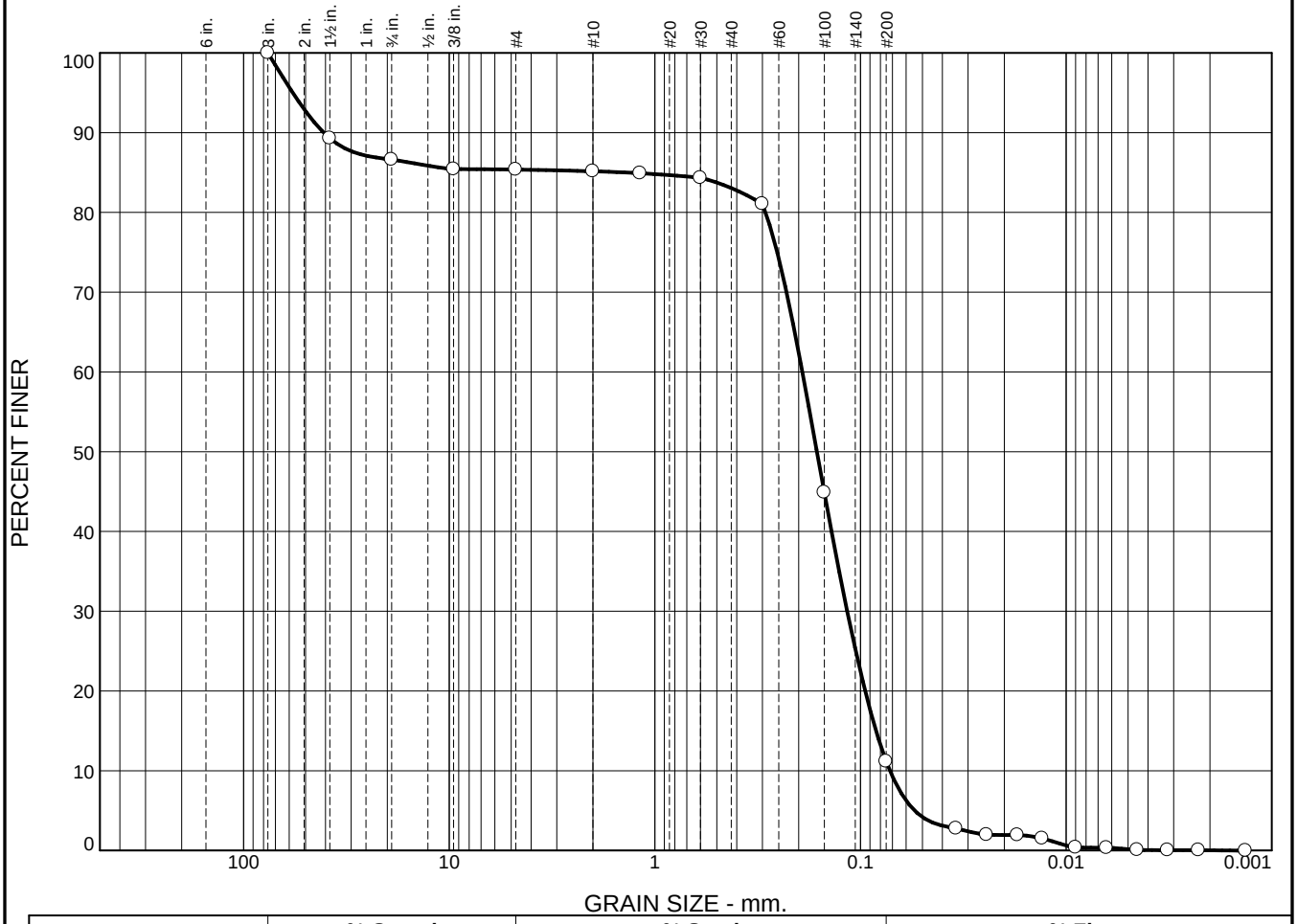
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Woburn, MA 01801

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Figure

Tested By: S. Larson 7/11/24 **Checked By:** M. Alstede 7/11/24

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	13.4	1.2	0.2	2.1	71.9	11.0	0.2

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			1.3627	0.1918	0.1629	0.1161	0.0841	0.0719	0.98	2.67

Material Description	USCS	AASHTO
○ Narrowly Graded SAND with Silt	SP-SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-207 **Depth:** 3-6 ft **Sample Number:** G2

Remarks:

○As received WC = 12.0%

Fines classified visually

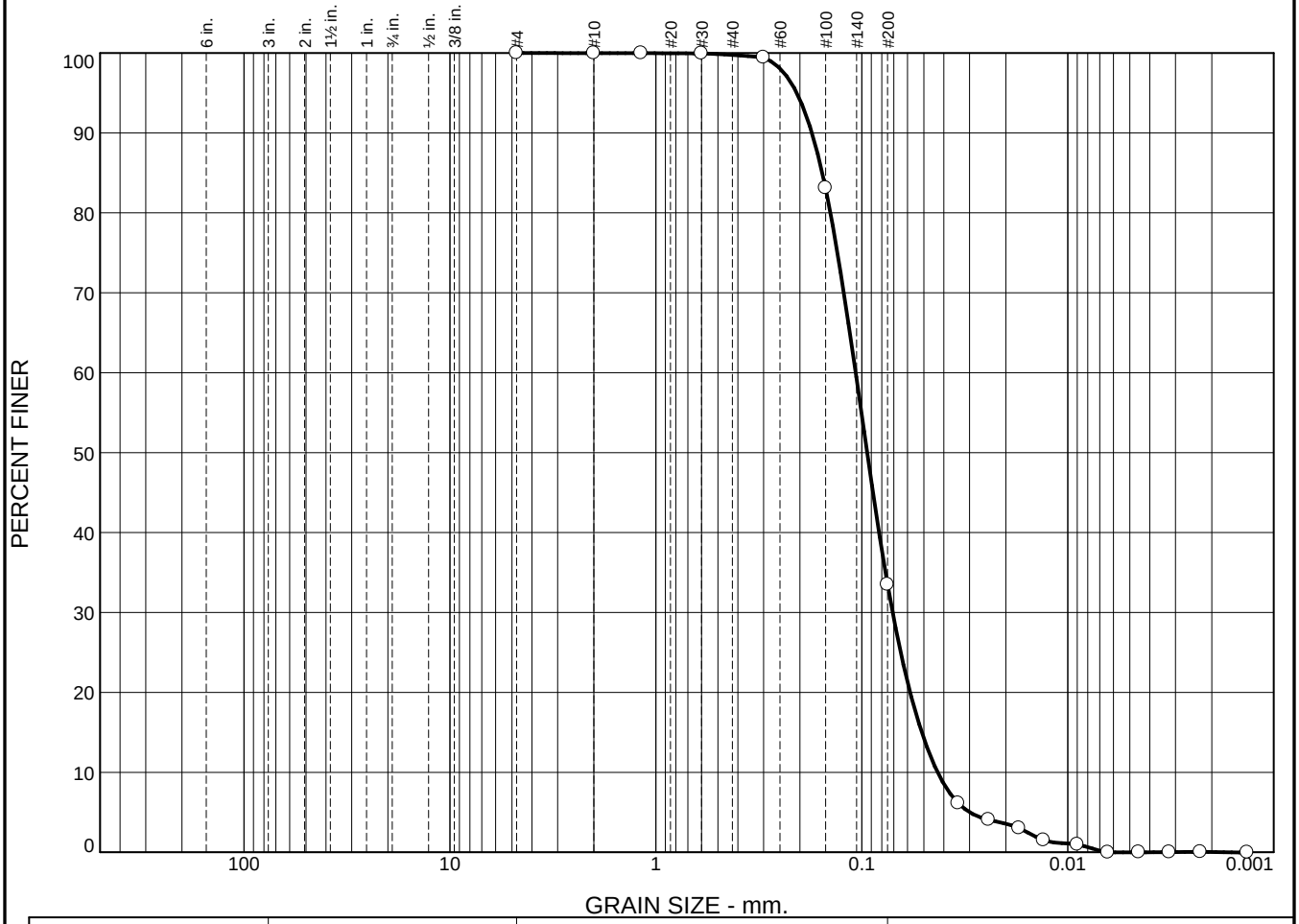
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Figure

Tested By: S. Larson 7/11/24 **Checked By:** M. Alstede 7/12/24

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	66.3	33.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1556	0.1072	0.0942	0.0709	0.0512	0.0429	1.09	2.50

Material Description	USCS	AASHTO
○ Silty SAND	SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-207 **Depth:** 6-10 ft **Sample Number:** G3

Remarks:

○As received WC = 28.2%

Fines classified visually

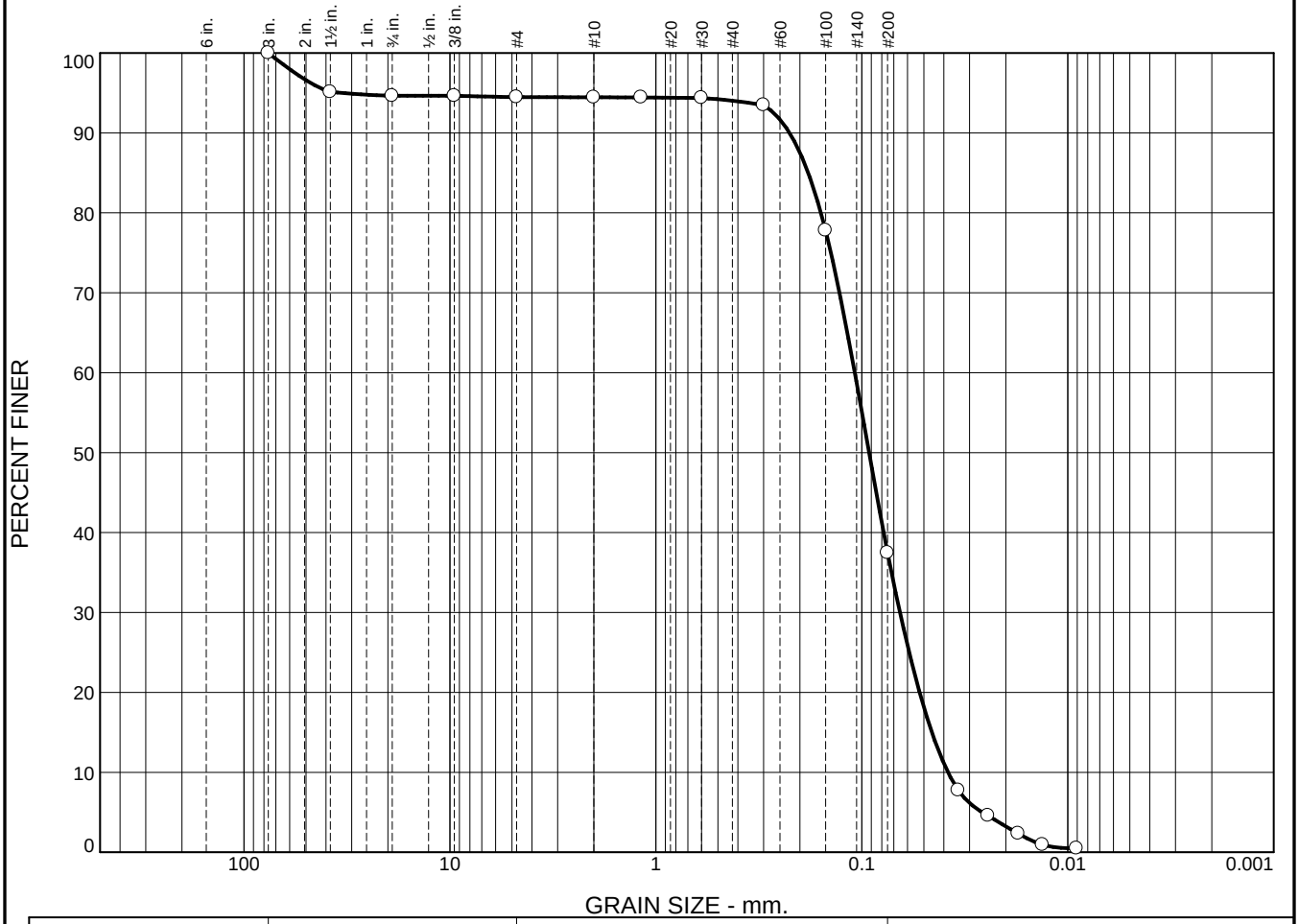
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Woburn, MA 01801

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Figure

Tested By: S. Larson 7/11/24 **Checked By:** M. Alstede 7/12/24

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	5.4	0.1	0.0	0.5	56.5	37.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1820	0.1082	0.0922	0.0653	0.0457	0.0382	1.03	2.84

Material Description	USCS	AASHTO
○ Silty SAND	SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-208 **Depth:** 6-11 ft **Sample Number:** G3

Remarks:

○As Received WC=23.8%

Fines classified visually

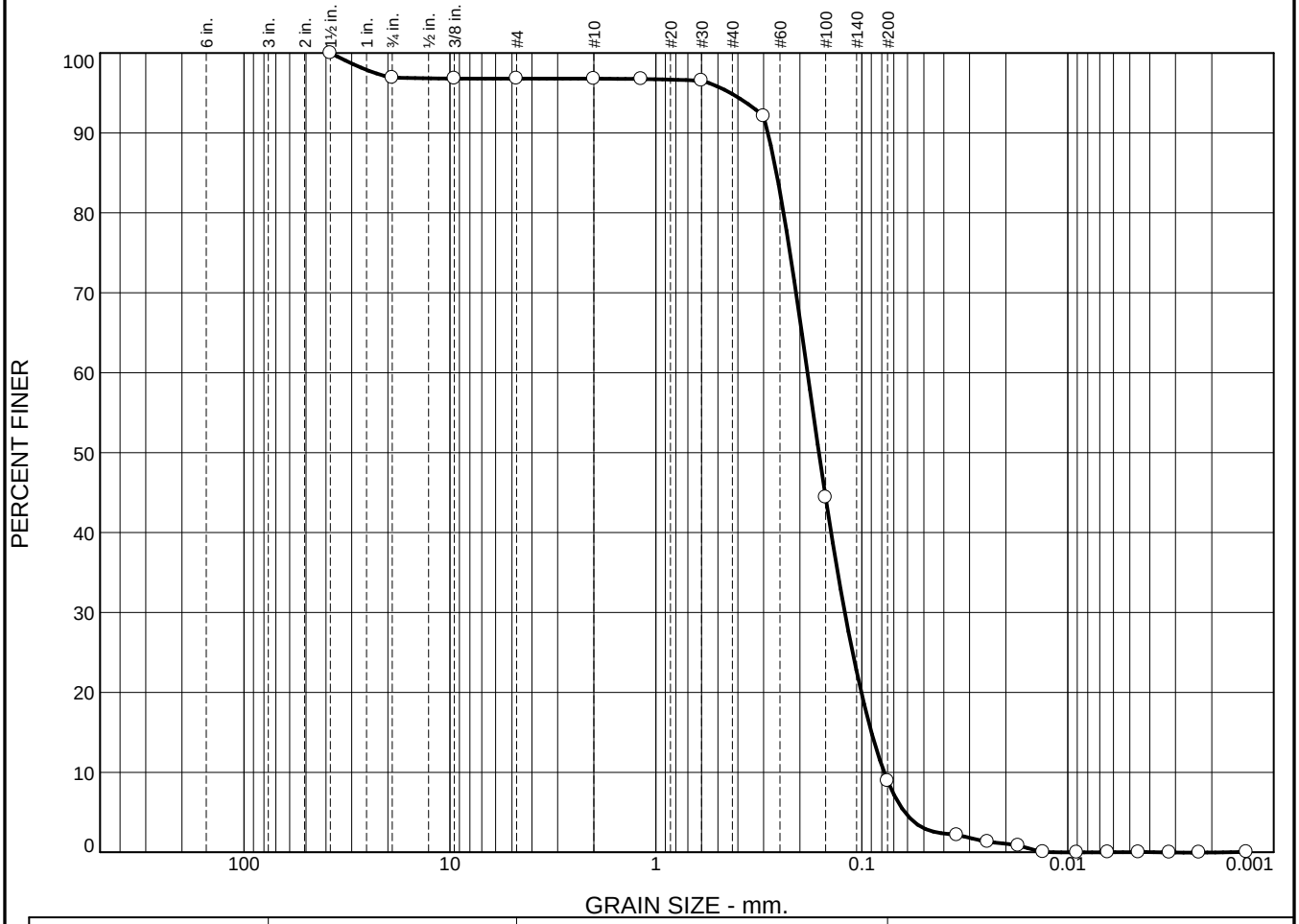
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Figure

Tested By: M. Alstede 7/15/24 **Checked By:** W. Lukas 7/16/24

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	3.1	0.1	0.0	1.9	86.0	8.9	0.0

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.2599	0.1836	0.1616	0.1210	0.0898	0.0779	1.02	2.36

Material Description	USCS	AASHTO
○ Narrowly Graded SAND with Silt	SP-SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-209 **Depth:** 2-6 ft **Sample Number:** G2

Remarks:

○As received WC = 13.7%

Fines classified visually

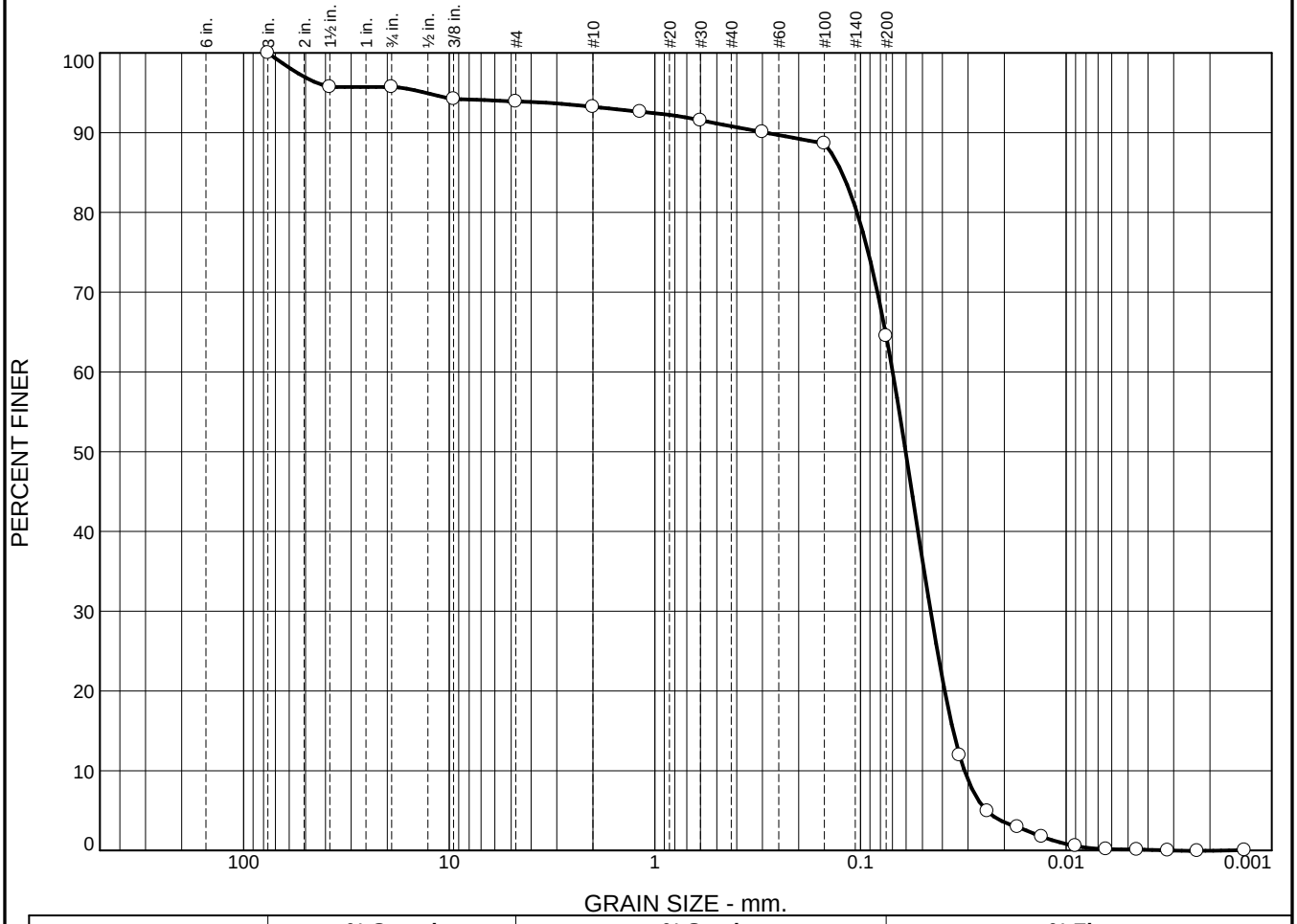
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Figure

Tested By: S. Larson 7/11/24 **Checked By:** M. Alstede 7/12/24

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	4.3	1.8	0.7	2.4	26.3	64.4	0.1

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1231	0.0698	0.0603	0.0456	0.0354	0.0312	0.95	2.23

Material Description	USCS	AASHTO
○ Sandy SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-210 **Depth:** 6-11 ft **Sample Number:** G3

Remarks:

○As received WC = 9.0%

Fines classified visually

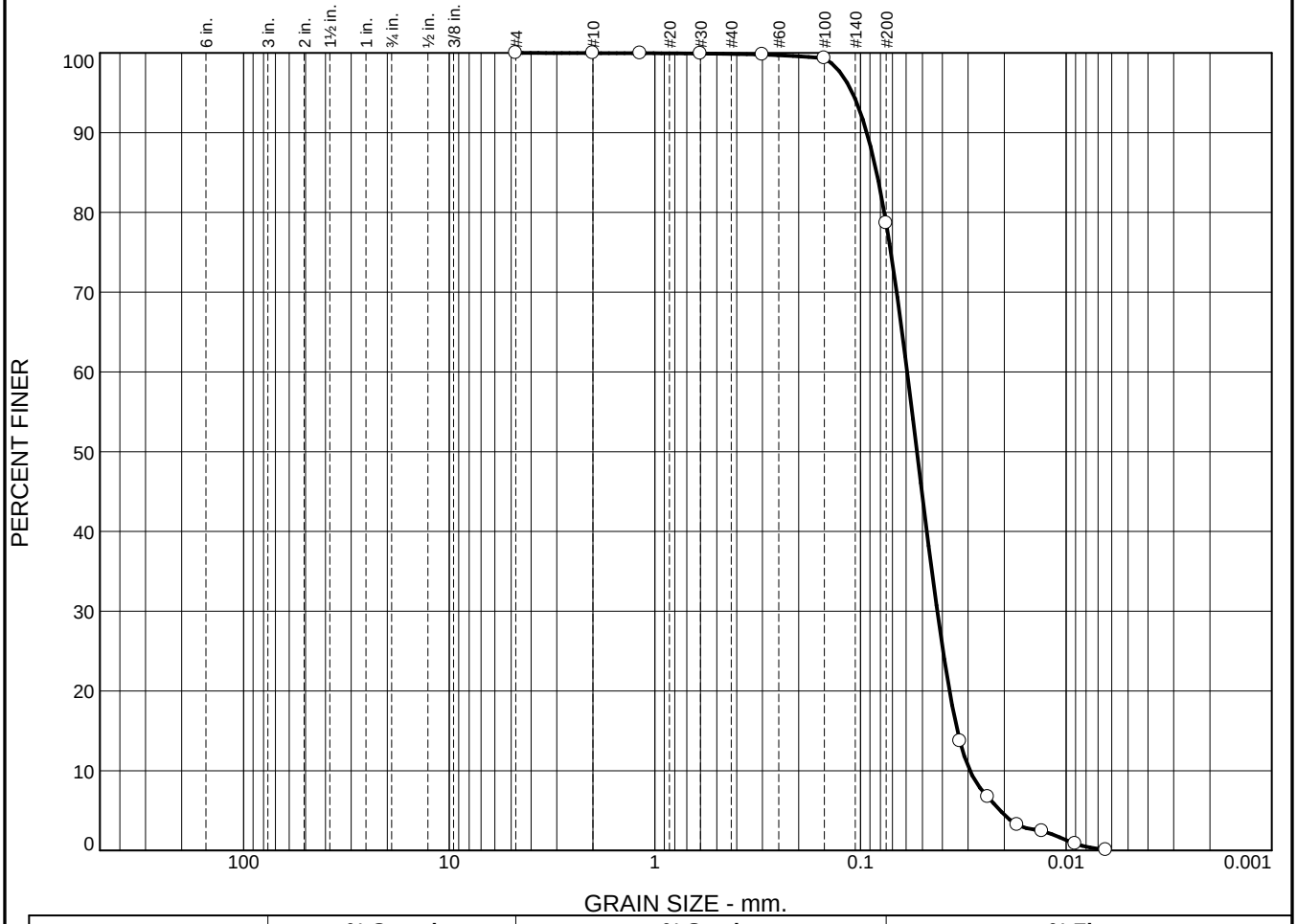
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Woburn, MA 01801

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Figure

Tested By: S. Larson 7/11/24 **Checked By:** M. Alstede 7/11/24

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	21.2	78.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.0835	0.0593	0.0532	0.0424	0.0338	0.0294	1.03	2.02

Material Description	USCS	AASHTO
○ SILT with Sand	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-211 **Depth:** 1.5-6 ft **Sample Number:** G2

Remarks:

○As Received WC=11.0%

Fines classified visually

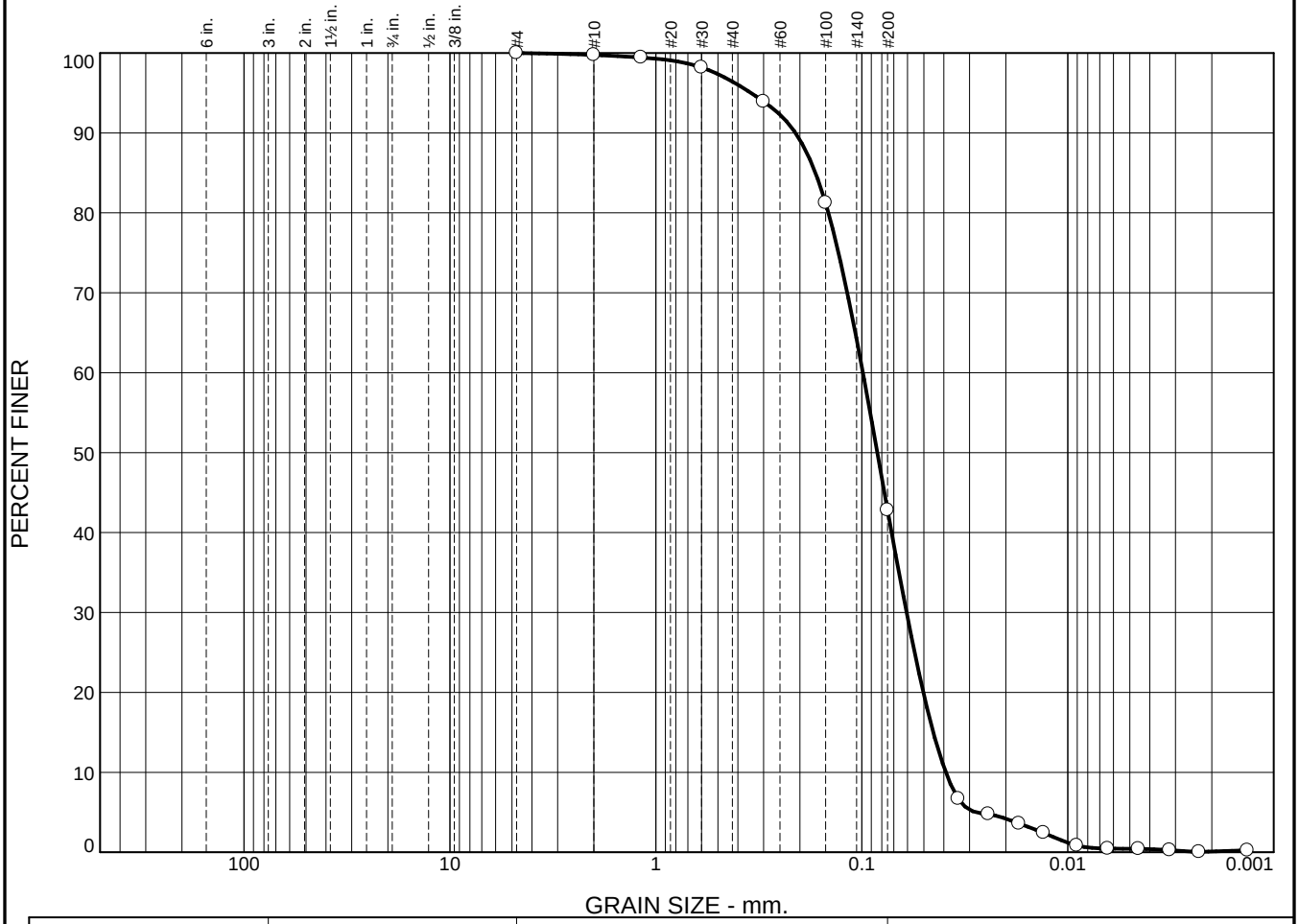
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Woburn, MA 01801

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Figure

Tested By: M. Alstede 7/15/24 **Checked By:** W. Lukas 7/16/24

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.2	3.4	53.6	42.4	0.4

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1678	0.0989	0.0841	0.0607	0.0450	0.0391	0.95	2.53

Material Description	USCS	AASHTO
○ Silty SAND	SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-211 **Depth:** 6-11 ft **Sample Number:** G3

Remarks:

○As Received WC=10.1%

Fines classified visually

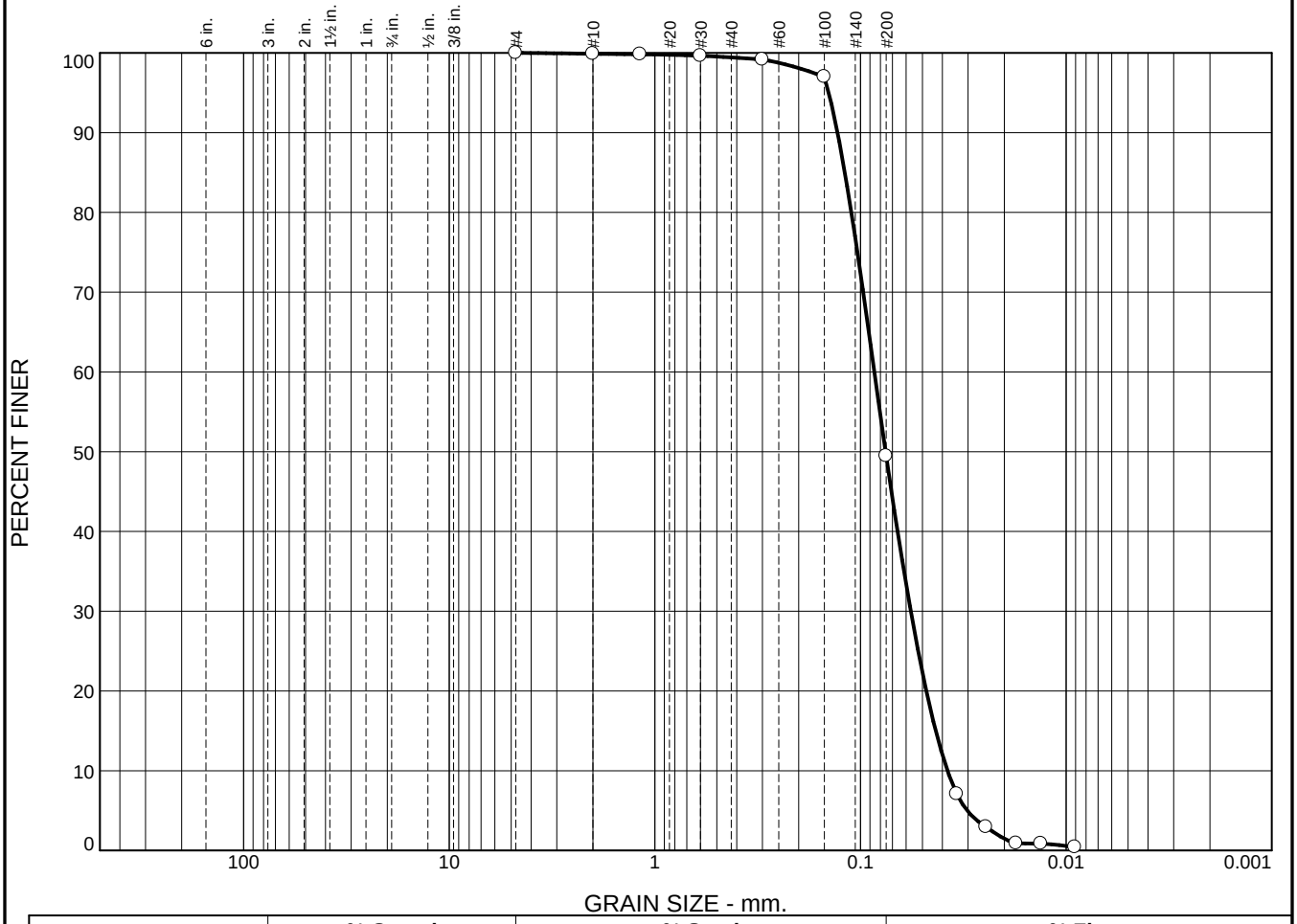
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Figure

Tested By: M. Alstede 7/15/24 **Checked By:** W. Lukas 7/16/24

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	0.5	49.9	49.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1192	0.0857	0.0755	0.0570	0.0431	0.0378	1.00	2.27

	Material Description	USCS	AASHTO
○	Silty SAND	SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-212 **Depth:** 4-8.5 ft **Sample Number:** G3

Remarks:

○As Received WC=8.4%

Fines classified visually

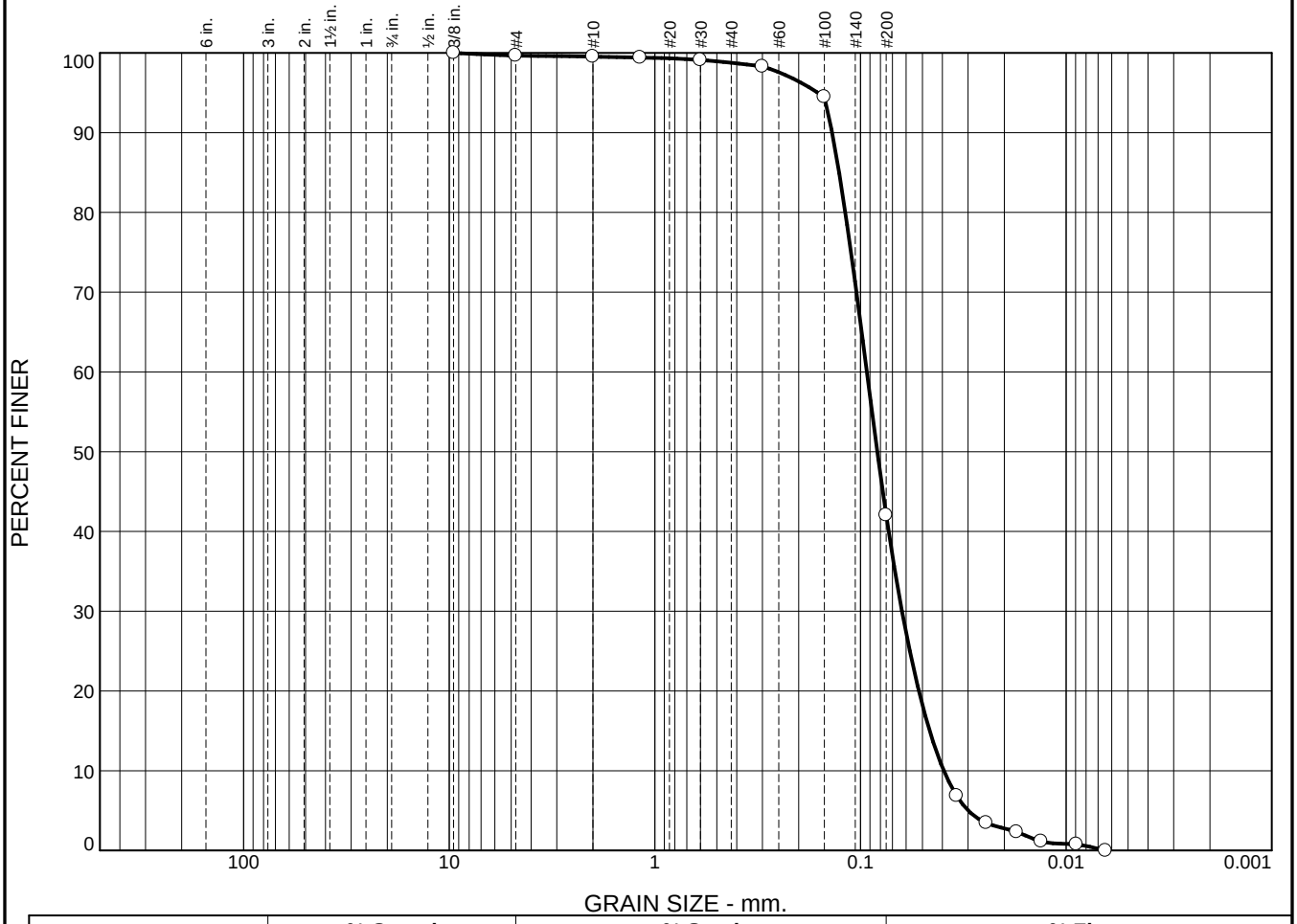
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Figure

Tested By: M. Alstede 7/15/24 **Checked By:** W. Lukas 7/16/24

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.3	0.2	0.7	56.8	42.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1270	0.0932	0.0829	0.0629	0.0461	0.0394	1.08	2.37

Material Description	USCS	AASHTO
○ Silty SAND	SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-212 **Depth:** 8.5-11 ft **Sample Number:** G4

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Remarks:

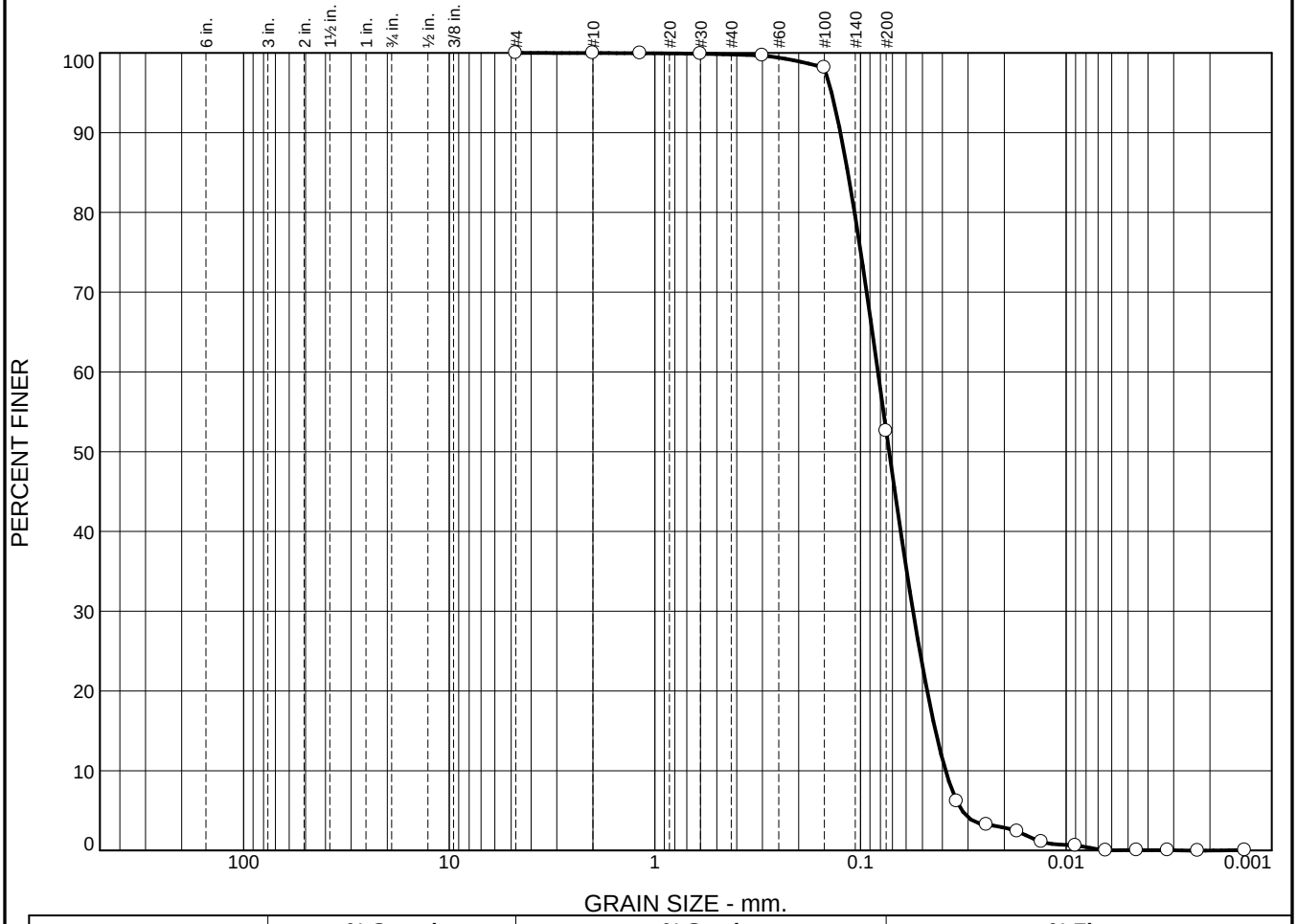
○As Received WC=9.0%

Fines classified visually

Figure

Tested By: M. Alstede 7/15/24 **Checked By:** W. Lukas 7/16/24

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	47.2	52.6	0.0

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1152	0.0823	0.0726	0.0555	0.0432	0.0386	0.97	2.13

Material Description	USCS	AASHTO
○ Sandy SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-213 **Depth:** 4-9 ft **Sample Number:** G2

Remarks:

○As received WC = 9.0%

Fines classified visually

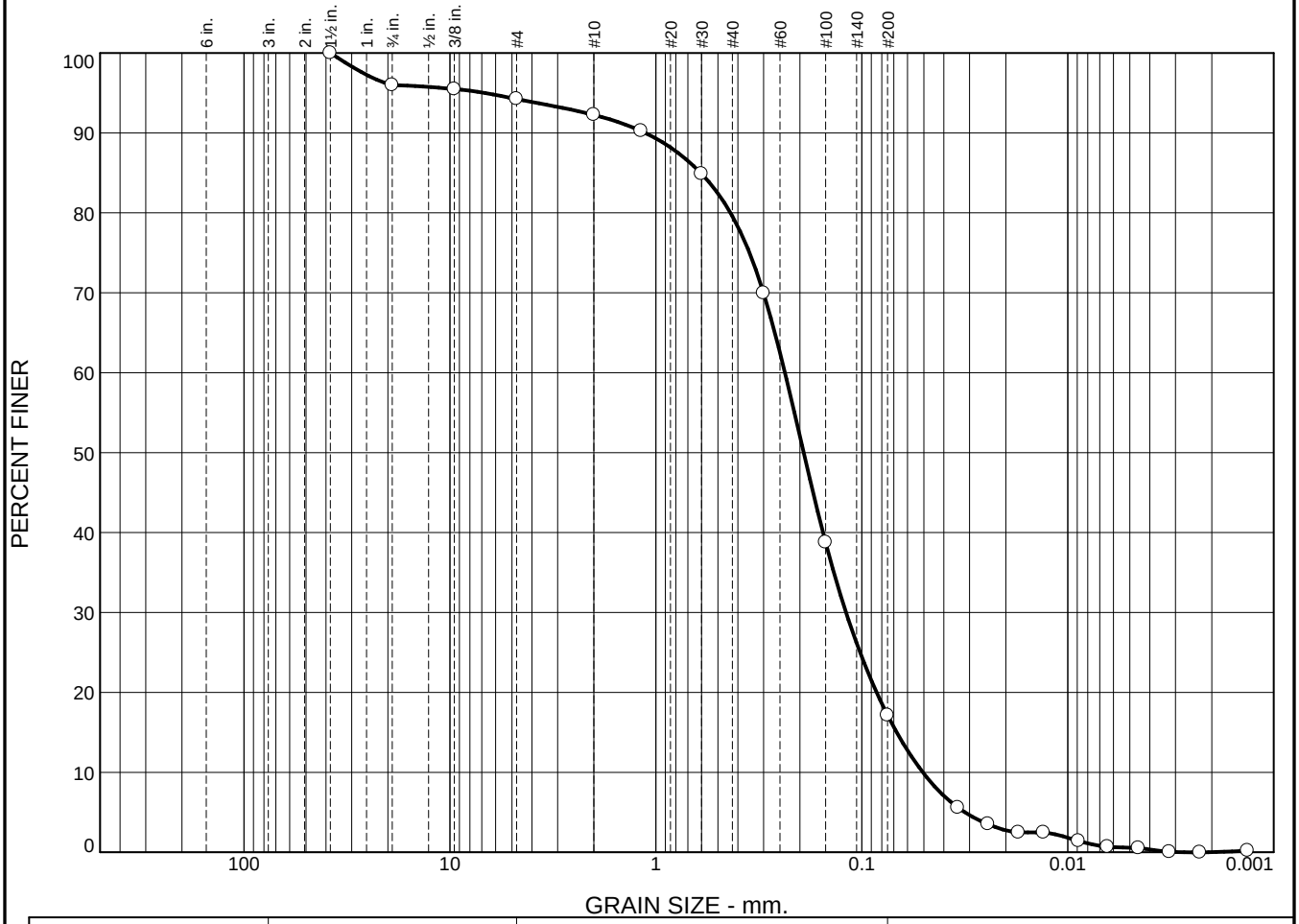
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Figure

Tested By: S. Larson 7/11/24 **Checked By:** M. Alstede 7/11/24

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	4.0	1.8	1.9	12.7	62.5	16.5	0.6

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.6068	0.2364	0.1915	0.1193	0.0677	0.0506	1.19	4.67

Material Description	USCS	AASHTO
○ Silty SAND	SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-214 **Depth:** 1.5-5.5 ft **Sample Number:** G2

Remarks:

○As Received WC=6.3%

Fines classified visually

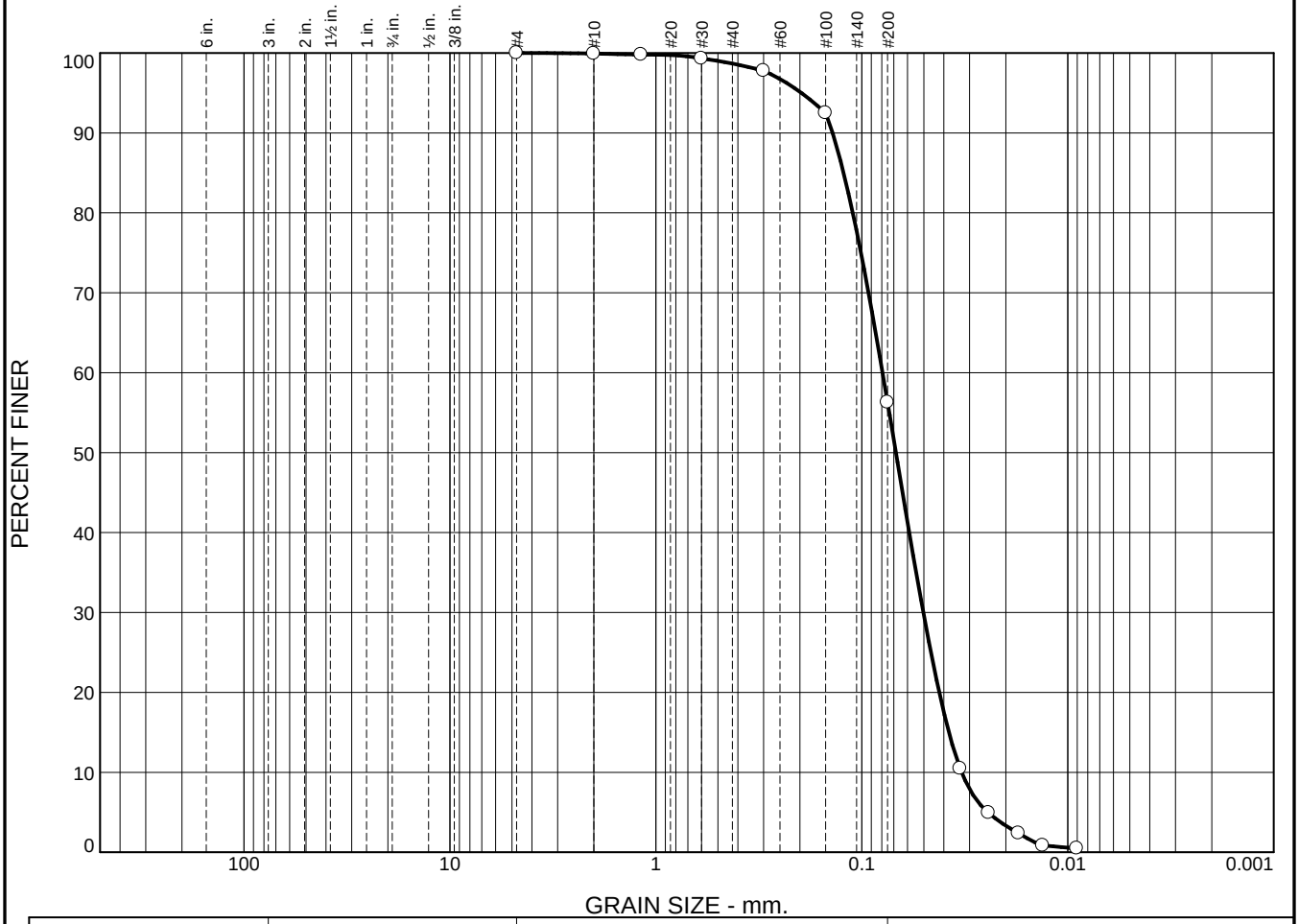
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Figure

Tested By: M. Alstede 7/15/24 **Checked By:** W. Lukas 7/16/24

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	1.2	42.4	56.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1226	0.0793	0.0683	0.0503	0.0378	0.0328	0.97	2.42

Material Description	USCS	AASHTO
○ Sandy SILT	ML	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-214 **Depth:** 9-11 ft **Sample Number:** G5

Remarks:

○As Received WC=8.7%

Fines classified visually

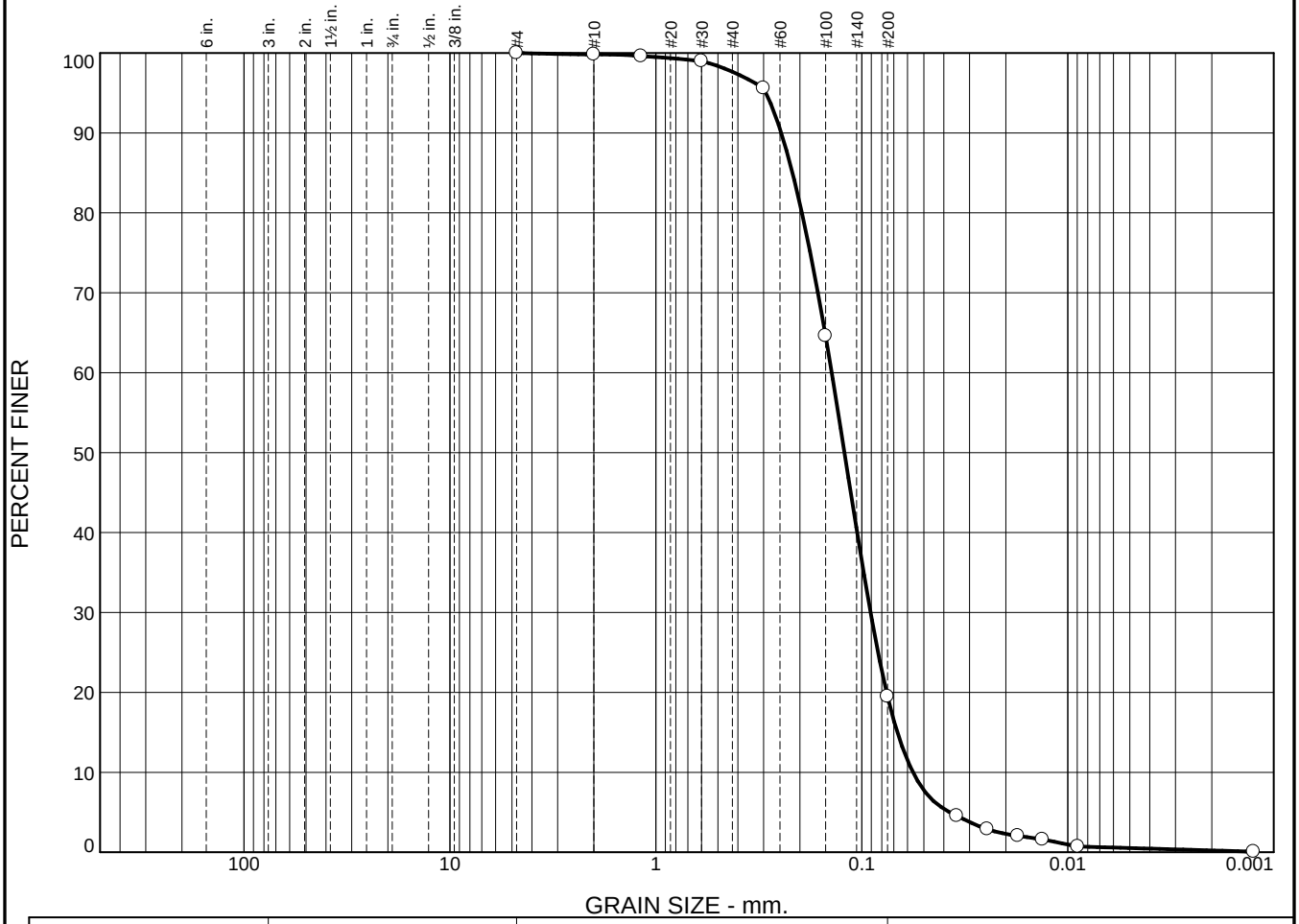
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Figure

Tested By: M. Alstede 7/15/24 **Checked By:** W. Lukas 7/16/24

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.2	2.1	78.2	19.0	0.5

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.2172	0.1400	0.1215	0.0907	0.0672	0.0565	1.04	2.48

Material Description	USCS	AASHTO
○ Silty SAND	SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-215 **Depth:** 3-6 ft **Sample Number:** G2

Remarks:

○As Received WC=19.1%

Fines classified visually

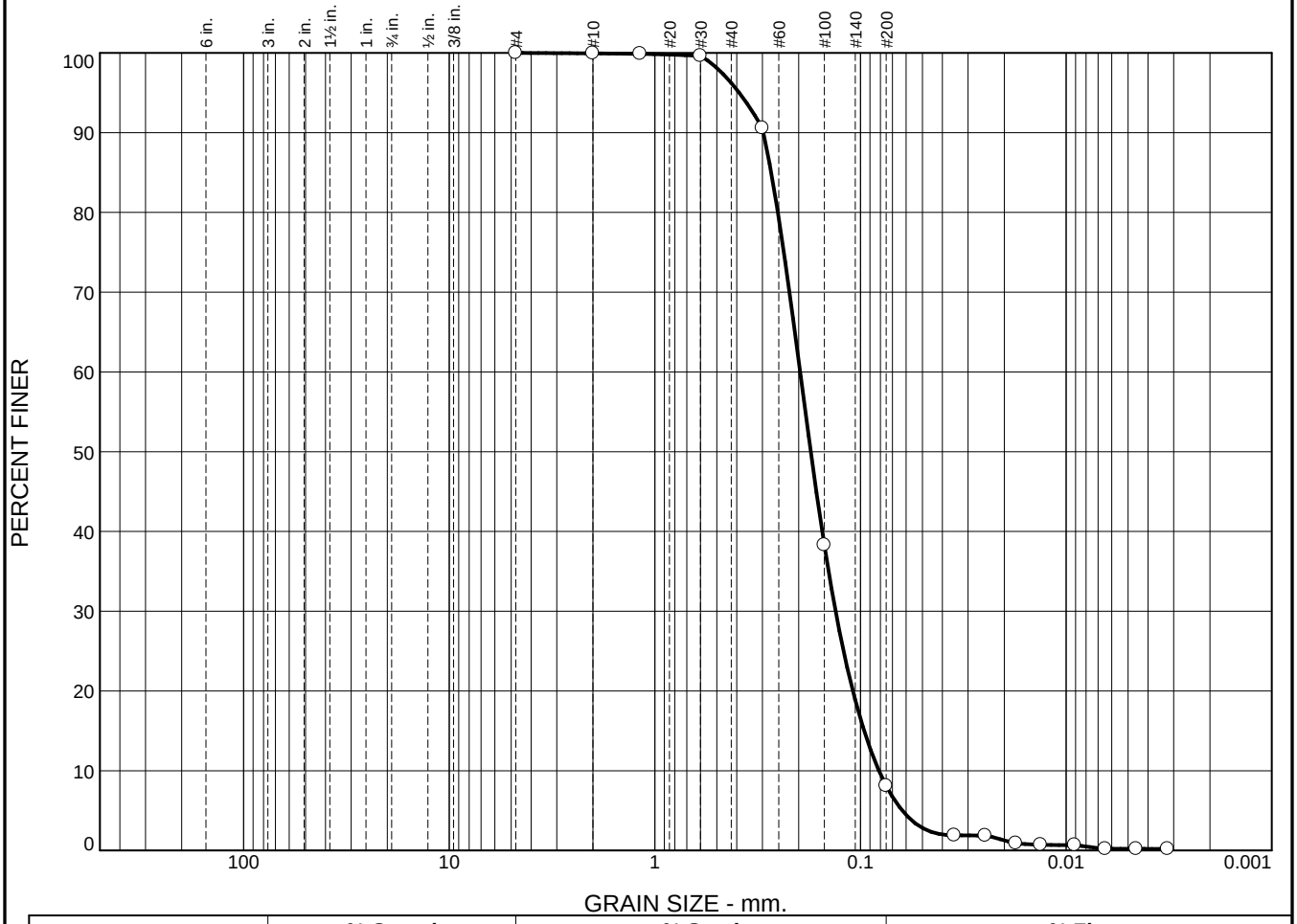
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Figure

Tested By: S. Larson 7/22/24 **Checked By:** M. Alstede 7/22/24

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	3.7	88.1	7.9	0.2

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.2718	0.1966	0.1744	0.1322	0.0960	0.0814	1.09	2.42

Material Description	USCS	AASHTO
○ Narrowly Graded SAND with Silt	SP-SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-216 **Depth:** 1.5-6 ft **Sample Number:** G2

Remarks:

○As Received WC=11.1%

Fines classified visually

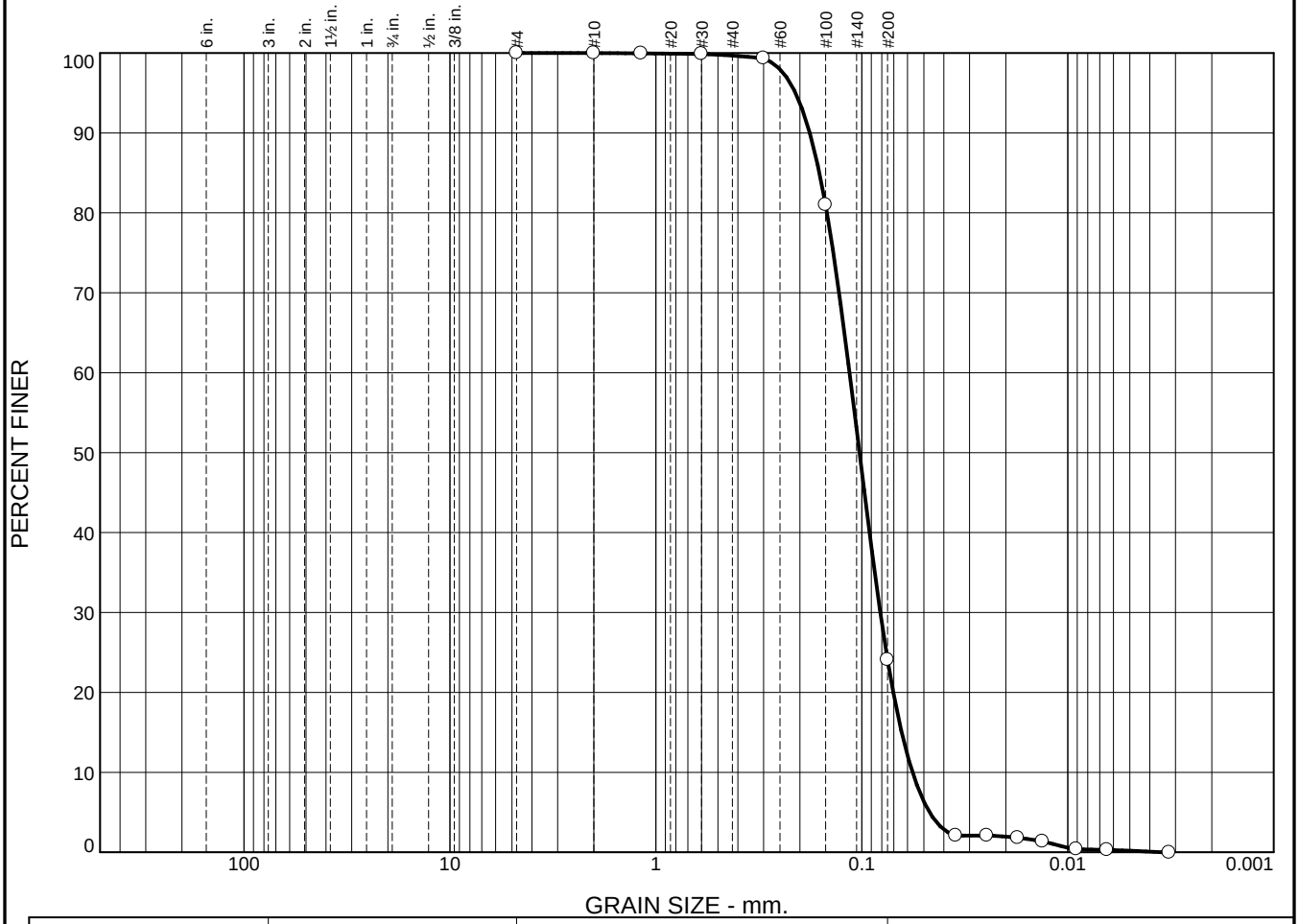
GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

GEI Consultants

Figure

Tested By: S. Larson 7/22/24 **Checked By:** M. Alstede 7/22/24

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.3	75.6	23.9	0.2

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1606	0.1148	0.1027	0.0813	0.0641	0.0567	1.02	2.02

Material Description	USCS	AASHTO
○ Silty SAND	SM	

Project No. 2300951 **Client:** Fennick McCredie Architecture

Project: Project Principio

○ **Source of Sample:** TP-216 **Depth:** 6-9 ft **Sample Number:** G3

Remarks:

○As Received WC=28.3%

Fines classified visually

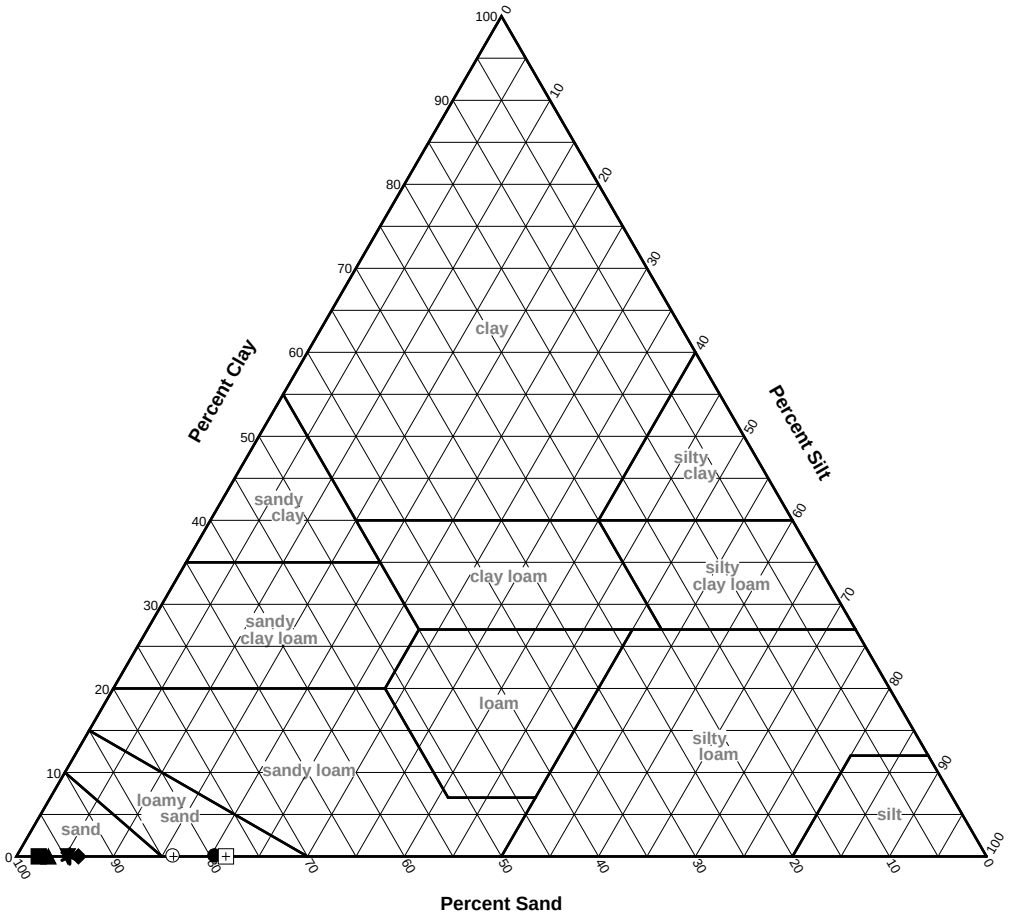
GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

GEI Consultants

Figure

Tested By: S. Larson 7/22/24 **Checked By:** M. Alstede 7/22/24

USDA Soil Classification



SOIL DATA

	Source	Sample No.	Depth	Percentages From Material Passing a #10 Sieve			Classification
				Sand	Silt	Clay	
●	TP-201	G3	5-10 ft	79.5	20.5	0.0	Loamy sand
■	TP-202	G3	9-12 ft	97.7	2.3	0.0	Sand
▲	TP-202	G2	5-9 ft	96.7	3.3	0.0	Sand
◆	TP-203	G1	1.3-6 ft	93.6	6.4	0.0	Sand
▼	TP-206	G2	3-7 ft	94.7	5.3	0.0	Sand
✱	TP-207	G2	3-6 ft	94.5	5.5	0.0	Sand
⊕	TP-207	G3	6-10 ft	83.8	16.2	0.0	Loamy sand
⊞	TP-208	G3	6-11 ft	78.4	21.6	0.0	Loamy sand

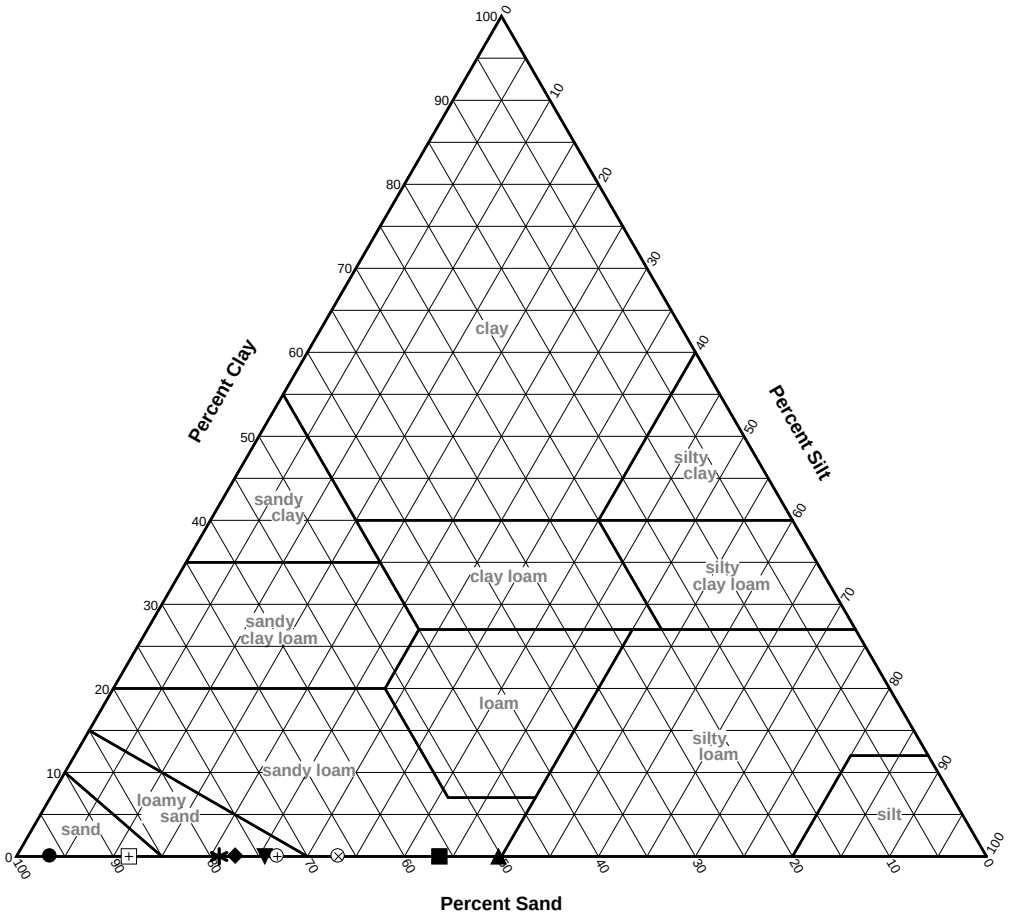
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400 Unicorn Park Drive
Woburn, MA 01801

Client: Fennick McCredie Architecture

Project: Project Principio

Project No.: 2300951 **Figure**

USDA Soil Classification



SOIL DATA							
	Source	Sample No.	Depth	Percentages From Material Passing a #10 Sieve			Classification
				Sand	Silt	Clay	
●	TP-209	G2	2-6 ft	96.5	3.5	0.0	Sand
■	TP-210	G3	6-11 ft	56.4	43.6	0.0	Sandy loam
▲	TP-211	G2	1.5-6 ft	50.3	49.7	0.0	Sandy loam
◆	TP-211	G3	6-11 ft	77.4	22.5	0.1	Loamy sand
▼	TP-212	G3	4-6 ft	74.4	25.6	0.0	Loamy sand
✱	TP-212	G4	6-11 ft	79.1	20.9	0.0	Loamy sand
⊕	TP-213	G2	4-9 ft	73.1	26.9	0.0	Loamy sand
⊞	TP-214	G2	1.5-5.5 ft	88.4	11.6	0.0	Sand
⊗	TP-214	G5	9-11 ft	66.8	33.2	0.0	Sandy loam

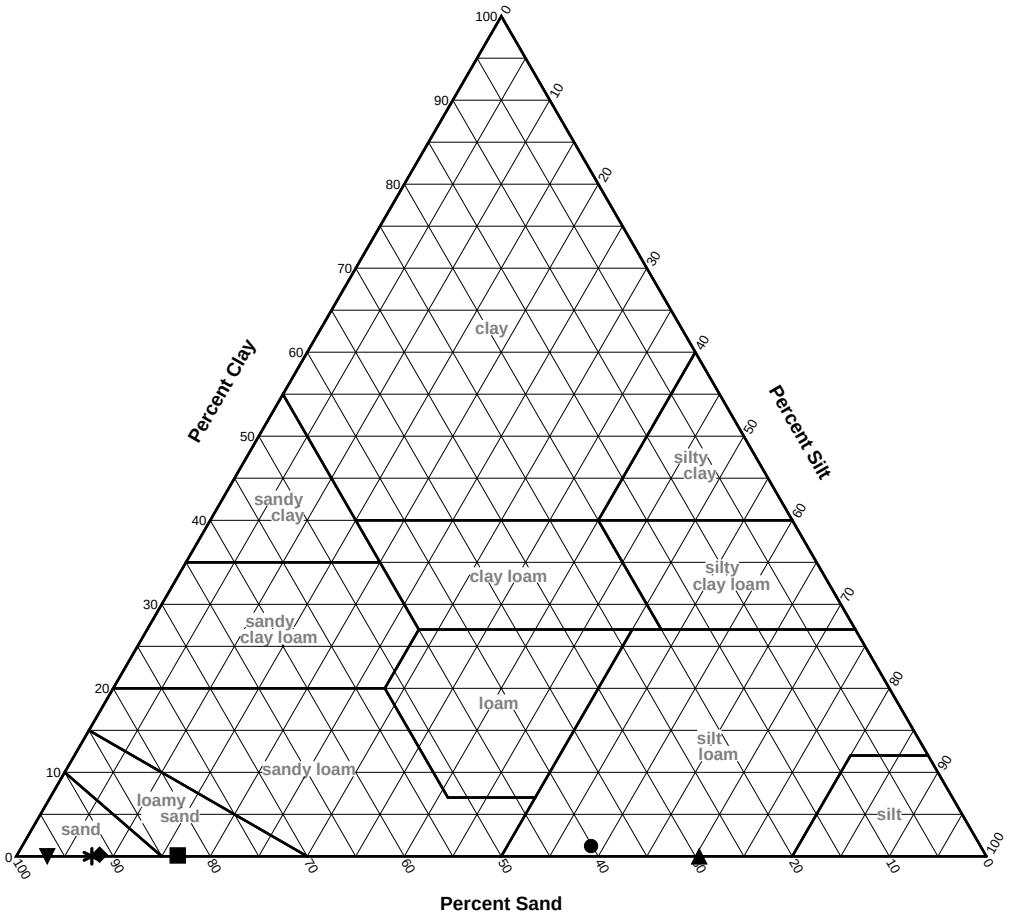
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Client: Fennick McCredie Architecture

Project: Project Principio

Project No.: 2300951 **Figure**

USDA Soil Classification



SOIL DATA							
	Source	Sample No.	Depth	Percentages From Material Passing a #10 Sieve			Classification
				Sand	Silt	Clay	
●	TP-204	G3	3-4 ft	40.1	58.8	1.1	Silt loam
■	TP-204	G4	4-6 ft	83.3	16.6	0.1	Loamy sand
▲	TP-205	G3	4.5-7.5 ft	29.6	70.4	0.0	Silt loam
◆	TP-215	G2	3-6 ft	91.3	8.5	0.2	Sand
▼	TP-216	G2	1.5-6 ft	96.8	3.2	0.0	Sand
✱	TP-216	G3	6-9 ft	92.2	7.8	0.0	Sand

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Client: Fennick McCredie Architecture

Project: Project Principio

Project No.: 2300951 **Figure**

APPENDIX H

Phosphorus Removal Calculations

PHOSPHORUS REMOVAL CALCULATIONS

Project Name: Principio Validation
Project Number: 15363
Prepared by: BJB
Checked By: MV
Date: 7/26/2024

Nitsch Engineering

Step 1 - Baseline Phosphorus Loading (Existing Land Cover Loading) (Table 1)

Land Use: Commercial/Industrial

	Existing		
	Area ac	Export Rate lbs/acre/yr	P Load lbs P/yr
Impervious Site Area	9.32	1.78	16.58
Pervious Site Area	5.86	0.12	0.70
Total Site Area	15.17		17.28

Calculate baseline phosphorus load per Appendix F, Attachment 1 of the MS4 permit. Export rate determined from Table 1-2

Step 2 - Development Phosphorus Loading (Proposed Land Cover Loading) (Table 2)

	Proposed		
	Area ac	Export Rate lbs/acre/yr	P Load lbs P/yr
Impervious Site Area	12.55	1.78	22.34
Pervious Site Area	2.62	0.12	0.31
Total Site Area	15.17		22.65

Calculate phosphorus load changes due to development per Appendix F, Attachment 1 of the MS4 Permit.
Export rate determined from Table 1-2.

Step 3 - Required Phosphorus Load Reduction (Table 3)

Phosphorus Reduction Requirement (Refer to City/Town Regulations)	60%
Phosphorus Reduction Required	10.37
Total Phosphorus Removal through Land Conversion (Ex - Pr Phosphorus Load)	-5.37
Remaining Reduction Required After Land Conversion (lbs/year)	15.74

Step 4 - Structural Stormwater Strategies (Table 4)

Calculate Phosphorus load reduction for structural BMPs in the Watershed per EPA MS4 Permit Appendix F Attachment 3 methodology.

	Surface Type	Treated Area (ac)	P Load Rate (lbs/ac/yr)	Starting P Load (lbs/yr)	Phosphorus Removal (%)	% of Year Used	P Removed (lbs/yr)
Subsurface Infiltration #1	Impervious	3.85	1.78	6.85	100%	100%	6.85
	Pervious	0.24	0.12	0.03		100%	0.03
							6.88
Subsurface Infiltration #2	Impervious	3.35	1.78	5.96	96%	100%	5.72
	Pervious	0.30	0.12	0.04		100%	0.03
							5.76
Subsurface Infiltration #4	Impervious	1.07	1.78	1.90	100%	100%	1.90
	Pervious	0.36	0.12	0.04		100%	0.04
							1.94
Silt Prison	Impervious	2.80	1.78	4.99	63%	100%	3.14
	Pervious	0.87	0.12	0.10		100%	0.07
							3.21

Phosphorus Removed through Structural Stormwater Strategies	**17.79**

Step 5 - Operational Strategies (Table 5)

Calculate Phosphorus load reduction for operational BMPs in the Watershed per EPA MS4 Permit Appendix F Attachment 2 methodology using Enhanced sweeping nutrient reduction (Table 2-4), Catch Basin Cleaning Nutrient Reduction (Table 2-5) and Enhanced Organic Waste and Leaf Litter.

Enhanced Sweeping Program

Impervious Area to be Swept (ac)	P Load Rate (lbs/ac/yr)	Sweeping Type	P Reduction Factor	Annual Frequency	P Removed (lbs/yr)
0	1.78	0	0.01	**0.08**	**0.000**

Catch Basin Cleaning Program

Impervious Area to Catch Basins (ac)	P Load Rate (lbs/ac/yr)	P Reduction Factor	P Removed (lbs/yr)
0	1.78	0.02	**0.000**

Organic Waste and Leaf Litter Collection Program

Impervious Area (ac)	P Load Rate (lbs/ac/yr)	P Reduction Factor	P Removed (lbs/yr)
0	1.78	0.05	**0.000**

Total Phosphorus Removed through Operational Strategies (lbs/year)	**0.00**

Step 6 - Phosphorus Removal Summary (Table 6)

Total Phosphorus Reduction Required	10.37
Total Phosphorus Reduction through Land Conversion	-5.37
Total Phosphorus Removal Through Structural Stormwater Strategies	17.79
Total Phosphorus Removal Through Operational Strategies	0.00
Total Phosphorus Reduction	12.42
Total Phosphorus Reduction Provided by Project (% Reduction)	**72%**

APPENDIX I

Proprietary Stormwater Information

UNIVERSITY OF MINNESOTA

ST. ANTHONY FALLS LABORATORY
Engineering, Environmental and Geophysical Fluid Dynamics

Project Report No. 586

Capture of Gross Solids and Sediment by Pretreatment Practices for Bioretention

Final Report for the Project:
Field performance assessment of sediment and gross solids removal from surface inlet pretreatment practices for bioretention

by

Andrew J. Erickson and Matt A. Hernick

St. Anthony Falls Laboratory, University of Minnesota,
2 Third Avenue SE Minneapolis, MN 55455

Prepared for
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Minnesota Stormwater Research Council
and
Anoka Conservation District

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Minneapolis, Minnesota

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- Capitol Region Watershed District
- Mississippi Watershed Management Organization
- Ramsey-Washington Metro Watershed District
- South Washington Watershed District
- Valley Branch Watershed District, and
- City of Edina

For more information about the Center and the Council, visit https://www.wrc.umn.edu/projects/storm-waste-water

Water Resources Center

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EXECUTIVE SUMMARY

The purpose of this project was to measure the performance of several pretreatment practices for bioretention, both proprietary and non-proprietary, commonly used in Minnesota using field-based performance testing. Five pretreatment practices for bioretention were assessed for capturing sediment and gross solids with field testing.

Most bioretention practices in Minnesota are designed to store the volume of runoff from a 1-inch rainfall event. Design volume tests involved measuring performance at the design storage volume (full storage volume before bypass) of the bioretention practice and were completed for four pretreatment practices. For this testing, the full design storage volume was added from a fire hydrant to the pretreatment and bioretention within 40 minutes (low intensity) or within 20 minutes (high intensity). The pretreatment and bioretention practices were not allowed to overflow or bypass during the design volume tests. Four pretreatment practices were tested, including:

- grass lined inlet (i.e., grassed buffer strip),
- Rain Guardian Bunker proprietary device,
- Rain Guardian Turret proprietary device,
- rock lined inlet (i.e., riprap).

A fifth pretreatment practice, an in-line shallow sump grit chamber, was tested for performance when the design storage volume was added in 30 minutes (low intensity) and 15 minutes (high intensity). The shallow sump grit chamber was also with bypass conditions, which involved adding approximately two and a half times the design volume to the pretreatment and bioretention practice, causing the system to overflow and bypass some water and solids to the downstream conveyance system. The goal of this testing was to determine the performance of an in-line shallow sump grit chamber under bypass conditions.

Prior to testing each pretreatment practice was thoroughly cleaned. Three sediment sizes including a coarse sediment (D_{50} = 1.17mm), a medium sediment (D_{50} = 0.41mm), and a fine sediment (D_{50} = 0.12mm) and three types of gross solids (plastic forks, synthetic leaves, and wood dowels) were added to water from a fire hydrant throughout the duration of each test. After testing was complete, sediment and gross solids were collected and then analyzed at St. Anthony Falls Laboratory to determine capture performance.

Summary of Results

All five pretreatment practices captured greater than 88% of the total sediment and greater than 65% of the fine sediment fraction (D_{50} = 0.12mm) in the low intensity tests, from an initially clean condition. During the high intensity tests, all practices captured greater than 70% of the total sediment mass and greater than 30% of the fine sediment fraction, similarly from an initially clean condition. Four of the five pretreatment practices captured 75% of the gross solids during low intensity tests and more than 55% of the gross solids during high intensity tests. The grass lined inlet captured the least gross solids; 20% during low intensity and 30% during high intensity. The performance for several sequential tests and maintenance needed for long-term operation of these pretreatment practices was not measured in this project.

Bypass tests were conducted to determine the performance of an in-line shallow sump grit chamber under bypass conditions. During these tests, overall sediment captured decreased from 95% during low intensity design volume tests down to 80% capture during high intensity bypass tests. Gross solids capture decreased from greater than 80% to below 40%. Thus, bypass at these

flow rates had minimal effect on the sediment, but measurable effect on the gross solids performance.

Though at least four of the five pretreatment practices performed similarly in terms of sediment and gross solids capture, only three out of the five appear to be simple to inspect and maintain. When maintenance is required, the grass lined inlet and rock lined inlet likely require the same amount of effort and cost to maintain them as would be needed to install them. In addition, the grass lined inlet and rock lined inlet would likely become filled with sediment within a few storm events. Of the pretreatment practices tested in this study, the grass lined inlet and rock lined inlet are among the most difficult and costly to maintain.

To maintain the Rain Guardian Bunker, Rain Guardian Turret, and shallow sump, one would need to remove the top grate and either shovel or hydro-vac the collected sediment and gross solids from within the collection chamber. The Bunker and Turret are both easily visible from the street so visual inspections of accumulated sediment depth are simple. The shallow sump is hidden underground, which makes assessing sediment accumulation depth more challenging. The Bunker, Turret, and shallow sump appear to have ample storage volume for collection and retaining sediment and gross solids. Of the pretreatment practices tested in this study, the Bunker and Turret are among the easiest to maintain, and the shallow sump is moderately easy to maintain.

Partnerships

This project was funded by the Minnesota Stormwater Research Council with additional funding and in-kind support provided by Anoka Conservation District. St. Anthony Falls Laboratory conducted the field testing and laboratory analysis; Anoka Conservation District provided staff and materials to install pretreatment practices to be consistent with industry standards.

ACKNOWLEDGEMENTS

This project was supported by the University of Minnesota Water Resources Center and by the Minnesota Stormwater Research Council with financial contributions from:

- Capitol Region Watershed District
- Mississippi Watershed Management Organization
- Ramsey-Washington Metro Watershed District
- South Washington Watershed District
- Valley Branch Watershed District, and
- City of Edina

For more information about the Center and the Council, visit
https://www.wrc.umn.edu/projects/storm-waste-water

In addition, this project was supported by the Anoka Conservation District (ACD). The authors wish the thank the Water Resources Center and the Minnesota Stormwater Research Council and affiliated entities for provided funding to support this project. In addition, the authors wish to thank the ACD for provided funding and in-kind match (labor and materials) for this project.

Support and assistance from several organizations and individuals are listed below and is greatly appreciated. Support and assistance for the contracting process was provided by Jeff Peterson, John Bilotta, Ann Lewandowski, Cheryel Konate, Jenni Larson, Chris Lord, and Jared Wagner. In addition, Chris Lord, Jared Wagner, Mitch Haustein, and Jackson Miller (MN Conservation Corps Apprentice) provided in-kind support via labor and materials throughout testing conducted in Anoka. Support provided by St. Anthony Falls Laboratory (SAFL) staff and students include Rob Gabrielson, Peter Olson, Ben Erickson, Jim Tucker, Rikita Patel, Camila Merino-Franco, and Parker Brown.

The Cities of Anoka and Bloomington, MN provided staff, access to fire hydrants, and supplied water meters and hose for use in field testing. The authors wish to thank Marcus Mihelich from the City of Anoka, and Steve Gurney, Pat Conrad, and Ben Whitcomb from the City of Bloomington for their assistance. The City of Anoka donated 12,939 cubic feet of water and the City of Bloomington donated 1,560 cubic feet of water for field testing. In addition, owners of the property on which the rain gardens were located cooperated with field testing and supplied garden hose and donated water for field testing.

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ACRONYMS AND ABBREVIATIONS

ACD = Anoka Conservation District

BBP = Bloomington Bypass (Shallow sump grit chamber, nonproprietary, City of Bloomington design)

BDV = Bloomington Design Volume (Shallow sump grit chamber, nonproprietary, City of Bloomington design)

BP = Bypass

cfs = cubic feet per second

GLI = Grass Lined Inlet

MSRC = Minnesota Stormwater Research Council

RGB = Rain Guardian Bunker

RGT = Rain Guardian Turret

RLI = Rock Lined Inlet

RPD = Relative Percent Difference

SAFL = St. Anthony Falls Laboratory

TD = Total Duration

UMN = University of Minnesota

CHAPTER 1: INTRODUCTION

Bioretention practices, often called rain gardens, have become an increasingly common stormwater treatment option in Minnesota. Beyond stormwater treatment, bioretention areas have aesthetic and other benefits and may be designed in a variety of ways to fit the characteristics of a given site. A primary purpose for these practices, however, is to capture sediment from stormwater while it infiltrates into the bioretention media. This sediment can accumulate over time and eventually clog a bioretention cell. Thus, pretreatment of incoming stormwater is an integral part of the treatment process and is required for bioretention by the Minnesota Stormwater Manual, as described in "Design Criteria for Bioretention:"

> *"Warning: To prevent clogging of the infiltration or filtration system with trash, gross solids, and particulate matter, use of a pretreatment device such as a vegetated filter strip, vegetated swale, small sedimentation basin (forebay), or water quality inlet (e.g., grit chamber) to settle particulates before the stormwater discharges into the infiltration or filtration system is REQUIRED." (MPCA 2017a)*

The Minnesota Stormwater Manual also describes criteria for pretreatment (settling devices, screens, and vegetative filter strips), and provides performance recommendations:

> *"It is recommended that pretreatment practices be designed for easy maintenance and capture a minimum of 25 percent of the sediment from runoff. Pretreatment practices capture solids that are quickly settled or screened, including gross solids and most sand particles (roughly 100 microns (µm) and larger), although some pretreatment practices also capture floatables. In many watersheds, this material accounts for a large portion of the total pollutant load." (MPCA 2017b)*

Actual data on the effectiveness of pretreatment practices, whether from field studies or laboratory or field testing, is limited or varies widely in method and results. This is of limited value to designers tasked with striking the right balance of effectiveness, initial construction costs, and long-term maintenance costs for the pretreatment and treatment practice system. The performance effectiveness of small and simple above-ground pretreatment practices for bioretention is a significant knowledge gap for industry professionals.

This project encompassed field-based performance testing of several pretreatment practices, both proprietary and non-proprietary, commonly used in Minnesota. The goal of the project is to gather performance data that will assist project designers, local government maintenance forces, and others by:

- Providing a quantitative measurement of effectiveness of several pretreatment practices;
- Offering a common point of comparison for different practices, by using the same test method;
- Informing assumptions about maintenance frequency of the pretreatment practice, and the bioretention practice;
- Improving understanding of how these practices function;
- Prompting innovations or design improvements based on measured data;
- Demonstrating a test method that can be applied in other locations and to other pretreatment practices.

This final report is organized into several chapters that describe the site locations (Chapter 2), the pretreatment practices (Chapter 3), the field methods (Chapter 4), the results and discussion (Chapter 5), the conclusions (Chapter 6) and lessons learned from this project as well as suggestions for future research (Chapter 7) that would continue data collection started with this project.

CHAPTER 2: SITE LOCATIONS

Site selection is critical to the success of field testing and monitoring. For this project, criteria used for site selection included safe roadway access, a nearby water source (fire hydrant), low traffic on nearby streets, adequate retention volume for longer tests, and a nearby storm sewer. Anoka Conservation District (ACD) suggested a site in the City of Anoka for testing of the Rain Guardian Bunker. The site characteristics also allowed for testing of a grass lined inlet, Rain Guardian Turret, and rock lined inlet with modification of the pretreatment entrance, thus allowing comparison of performance within the same bioretention practice and under the same test conditions for four practices. An additional non-proprietary in-line shallow sump grit chamber that has been designed and constructed in several locations within the City of Bloomington was also recommended for testing by industry professionals. The site in Anoka could not be modified to accommodate this practice, so another site in the City of Bloomington was selected for testing this practice. The sites used for testing as part of this project are described in detail within this chapter.

2.1 ANOKA SITE

ACD identified a newly-constructed bioretention facility in the city of Anoka, Minnesota at the northeast corner of 38th Lane N and 8th Lane (Figure 1 and Figure 2) which met the desired site characteristics described above. In addition, this site was constructed in 2017 and little of the planned vegetation was installed prior to testing, allowing testing to occur without interference from or interfering with the vegetation.



Figure 1. Photo of the Anoka site in May 2018, prior to testing. Gutter flow along 38th Lane is from right to left in the photo, encountering the basin inlet before the large catch basin nearest the fire hydrant.

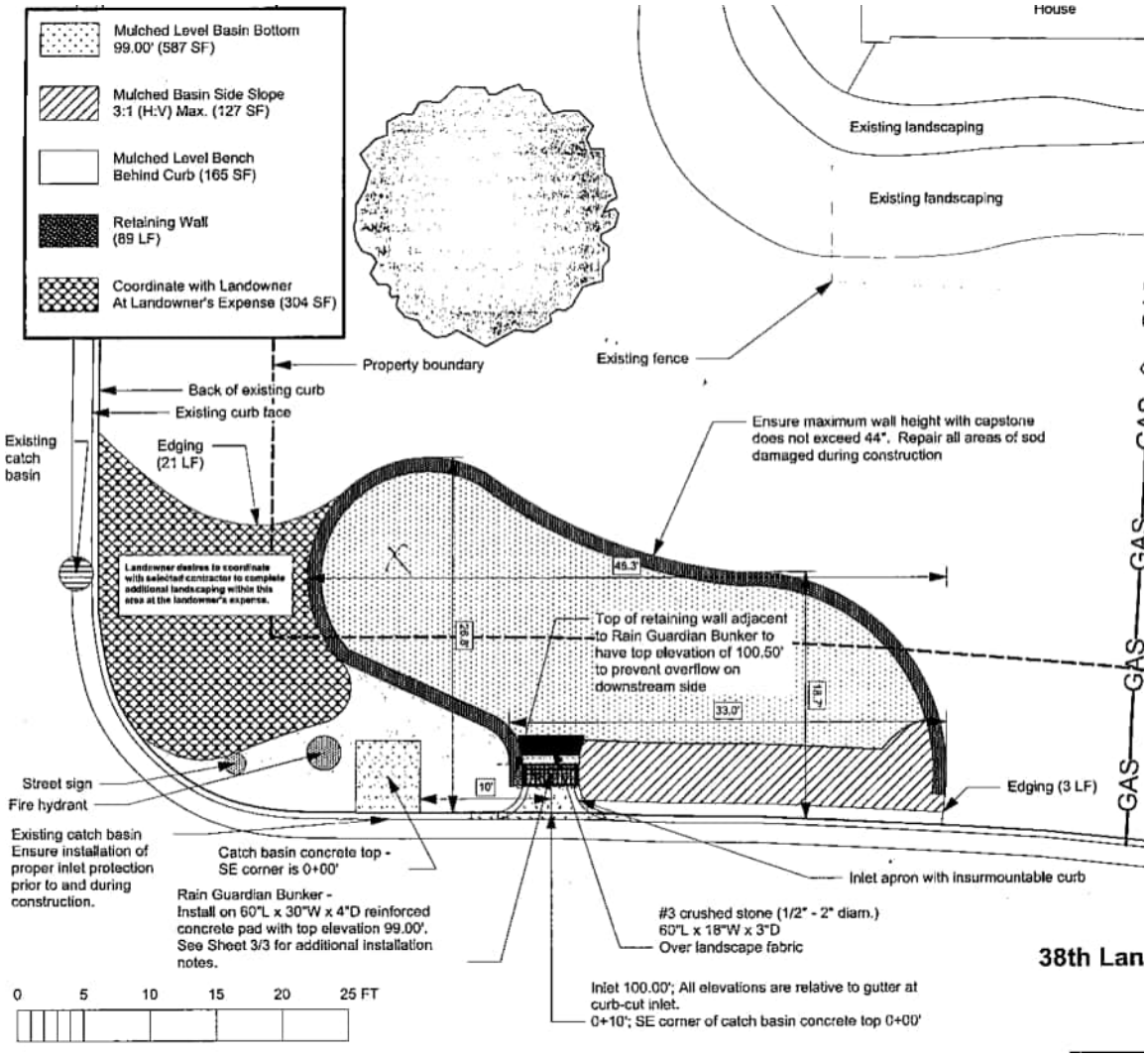


Figure 2. Site plan of the Anoka field site. (courtesy of Anoka Conservation District)

The design volume for the bioretention was 600 cubic feet (600 square feet x 1 ft deep). The watershed that drains to the bioretention is approximately 10.5 acres of low-density residential with little topographic elevation change, a portion of which is shown in Figure 3. Hydrologic modeling by ACD revealed that a 0.11-inch rainfall event on the contributing area would produce 600 cubic feet of runoff to the bioretention, which corresponds to the design volume of the bioretention. As is often the case, this bioretention was a "garden of opportunity" in which ACD was able to partner with the homeowner to build a bioretention on the property but was limited by the space available. It is the intention that more bioretention practices will be installed within the watershed to reduce the burden on this specific bioretention and increase the overall effectiveness of all bioretention practices. During testing, it was evident that infiltration was rapid (~25 inches/hr) at this basin. The bioretention is newly constructed and the subsoil at the site and in most of Anoka is sandy, which explains the rapid infiltration rate.



Figure 3. Aerial photo and topography in the vicinity of the Anoka field site, which is identified with a star. Image and contours from MnTOPO (https://www.dnr.state.mn.us/maps/mntopo/index.html)

This bioretention basin was designed to use a Rain Guardian Bunker pretreatment device, which included a concrete pad as the bottom of the structure. The Rain Guardian could be removed, leaving a combination of concrete and composite frame (Figure 4). With modification, a Rain Guardian Turret could be installed in this same location. With construction of a sloped surface, a rock lined inlet and grass lined inlet could also be installed in this location. Thus, the curb inlet and bioretention basin features remained the same for all testing conducted at the Anoka site.



Figure 4. At the Anoka site, the outer frame and concrete pad of the Rain Guardian Bunker device was left in place and adapted for all tests.

2.2 BLOOMINGTON SITE

The site in Anoka could not be modified to accommodate a shallow in-line sump grit chamber that was recommended for testing by industry professionals and used at several sites in the City of Bloomington, Minnesota. The City has installed numerous rain gardens and has developed several different pretreatment designs. One of the most recent designs was selected for testing because the site met the site selection criteria described above and because the design is different from the four pretreatment practices tested at the Anoka site.

A rain garden site located on Queen Avenue between 86th and 88th Street was chosen for field testing, as shown in Figure 5, featuring Bloomington's "new" pretreatment design. The rain garden, pretreatment, and street improvements were constructed in 2016 and the rain garden was reconstructed in 2017 due to lack of infiltration. The residential watershed area draining to the rain garden is estimated to be approximately 2.3 acres, which is visible but not outlined in Figure 6.



Figure 5. Queen Avenue rain garden in Bloomington, looking north. The inlet to the pretreatment device is through the furthest curb grate. The gutter low point is between the middle and bottom catch basins.

The typical bioretention design specified a storage volume of 150 cubic feet, though the actual volume of this bioretention basin including the pretreatment device sump was found to be ~119 cubic feet, assuming no infiltration. Using a similar hydrologic estimation process as was used on the Anoka site, it is estimated that a 0.1-inch rainfall event on the contributing area will produce 119 cubic feet of runoff for the site in Bloomington, which corresponds to the design volume of the bioretention. Similar to the Anoka site, this bioretention was a “garden of opportunity” in which the City was able to partner with the homeowner to build a bioretention on the property but was limited by the space available. It is the intention that more bioretention practices will be installed within the watershed to reduce the burden on this specific bioretention and increase the overall effectiveness of all bioretention practices.



Figure 6. Aerial photo and topography in the vicinity of the Bloomington field site, which is identified with a star. Image and contours from MnTOPO (https://www.dnr.state.mn.us/maps/mntopo/index.html)

It is important to note that white-colored turbidity may be visible in photos of water from the Bloomington tests (BDV, BBP, shallow sump grit chamber). This turbidity was visible during testing and was explained by City staff as lime residue from water treatment in the distribution pipes. The City of Bloomington does not flush their hydrants or water supply lines, so this residue can build up and become visible during "high flow" events such as our use during testing. This residue is very fine grain and was not visible in samples collected from Bloomington compared to samples collected from Anoka. It is not expected that this residue had any effect on the testing results.

CHAPTER 3: PRETREATMENT PRACTICES

Pretreatment practices are intended to reduce maintenance and prolong the lifespan of structural stormwater BMPs by removing trash, debris, organic materials, coarse sediments, and associated pollutants prior to entering structural stormwater BMPs (MPCA 2017b). The performance goal set forth by the MPCA is capture of gross solids and 25% of sediment greater than 100µm. In addition, proper pretreatment practices can provide a stable inlet into a bioretention practice that prevents erosion and minimizes disturbance of ground cover (e.g., mulch) within the bioretention.

Five pretreatment practices were tested as part of this study: grass lined inlet, Rain Guardian Bunker, Rain Guardian Turret, rock lined inlet, and in-line shallow sump grit chamber. The primary treatment mechanisms for stormwater pretreatment are screening, settling, and filtration and are described for each of the five practices tested in this project in Table 1.

Table 1. Pretreatment practices, brief description, and treatment mechanisms

Practice	Description	Treatment mechanisms
Grass Lined Inlet	Non-proprietary, grassed conveyance, sloped between curb cut and bottom of bioretention.	• settling among vegetation, • vegetative filtration
Rain Guardian Bunker	Proprietary rectangular chamber with top grate, concrete bottom, screened exit wall, and skimming debris wall.	• screening on top grate, • settling within the chamber, • screening by the screen wall • skimming of floatables by debris wall
Rain Guardian Turret	Proprietary cylindrical chamber with top grate, concrete bottom, screened exit wall, and skimming debris wall.	• screening on top grate, • settling within the chamber, • screening by the screen wall • skimming of floatables by debris wall
Rock Lined Inlet	Non-proprietary, rock-covered conveyance, sloped between curb cut and bottom of bioretention.	• settling among rocks
Shallow Sump Grit Chamber	Non-proprietary, shallow sump below gutter and connected to bioretention by three sub-surface PVC pipes.	• screening on top grate, • settling in shallow sump

Each practice was assigned a unique identifier for labeling samples as shown in Table 2. The Bloomington shallow sump grit chamber was tested in two different ways, first to the rain garden design volume (BDV), and then with a larger water volume, inducing bypass (BBP). To differentiate between tests and clarify labeling, a unique identifier combining the practice (3 letter identifier), flow rate (3 number fraction of one cfs), and replicate (sequential letter) was utilized. For example, the first replicate of the grass lined inlet at 0.5cfs would be labeled GLI-050-A, and the second replicate of the Rain Guardian Turret at 0.25cfs would be labeled RGT-025-B.

Table 2. Pretreatment practice, Unique identifier, storage and flow rate capacity, test flow rates and durations, and number of replicates. cfs = cubic feet per second.

Pretreatment Practice	ID	Flow rate and Storage Capacity	Test flow rate and duration (replicates)
Grass Lined Inlet	GLI	Storage capacity = minimal (depth of grass). Flow rate capacity = unknown.	0.25cfs for 40 minutes (2), 0.5cfs for 20 minutes (2)
Rain Guardian Bunker	RGB	Storage capacity = 2.85ft^3. Flow rate capacity = 6.11cfs.	0.25cfs for 40 minutes (2), 0.5cfs for 20 minutes (2)
Rain Guardian Turret	RGT	Storage capacity = 4.02ft^3. Flowr ate capacity = 3.45cfs.	0.25cfs for 40 minutes (2), 0.5cfs for 20 minutes (2)
Rock Lined Inlet	RLI	Storage capacity = minimal (pore space between rock). Flow rate capacity = unknown.	0.25cfs for 40 minutes (2), 0.5cfs for 20 minutes (2)
Shallow sump grit chamber (bypass)	BBP	Storage capacity = ~6ft^3. Flow rate capacity = unknown.	0.12cfs for 40 minutes (1), 0.25cfs for 20 minutes (1)
Shallow sump grit chamber (design volume)	BDV	Storage capacity = ~6ft^3. Flow rate capacity = unknown.	0.06cfs for 30 minutes (2), 0.12cfs for 15 minutes (2)

3.1 GRASS LINED INLET

A grass lined inlet (GLI) in a non-proprietary grassed conveyance that is sloped between the curb cut and the bottom of bioretention, as shown in Figure 7. It is also sometimes called a filter strip, buffer strip, or vegetative filter. GLIs capture sediment and gross solids by a combination of settling and vegetative filtration. As water, sediment and gross solids flow over the GLI, the vegetation both intercepts particles and gross solids (vegetative filtration) and reduces the flow velocity near the soil surface, which allows for settling of sediment. Sediment that settles on the soil within the vegetation is thus protected by the vegetation within a non-turbulent boundary layer.



Figure 7. Flow on grass lined inlet at 0.25 cfs (GLI-025-B). Curb cut entrance along bottom of the picture, exit into the bioretention practice at the top.

The width, length, and slope of the GLIs varies based on design parameters and site constraints. For this project, the dimensions of the GLI were approximately 48 inches wide, 52 inches long, and an elevation change of 10.5 inches which produced a slope of 5H : 1V, or 20%. This slope is greater than 8%, which is the maximum recommended by the Minnesota Stormwater Manual (MPCA 2017a). Extending the length to reduce the slope angle to 8% or less was considered, but experience and field observations of the authors and industry experts suggest ~20% slope is consistent with actual installations of GLIs.

3.2 RAIN GUARDIAN BUNKER

The Rain Guardian Bunker (RGB) is a proprietary, rectangular chamber with top grate, concrete bottom, screened exit wall, and skimmer beam, as shown in Figure 8. Water, sediment, and gross solids flow into the RGB from the curb inlet, first through the top grate which captures gross solids by screening. Water, sediment, and any uncaptured gross solids then fall into the rectangular chamber where sedimentation captures sediment and settleable gross solids. Water then exits the chamber through a screen exit wall, which screens additional sediment and gross solids. When the water level is near the top of the screen wall, a skimmer beam intercepts floatables. When the flow exceeds the capacity of the screen wall, water overtops the screen wall. A cross section of the RGB is shown in Figure 9. No modifications to the installation or design of the RGB were made for testing.



Figure 8. Overhead view of Rain Guardian Bunker (RGB) at 0.25 cfs during gross solids addition (RGB-025-B). Entrance from the curb cut comes into the RGB from the right of the picture; flow through the screen wall exiting the RGB in the center of the picture towards the left.

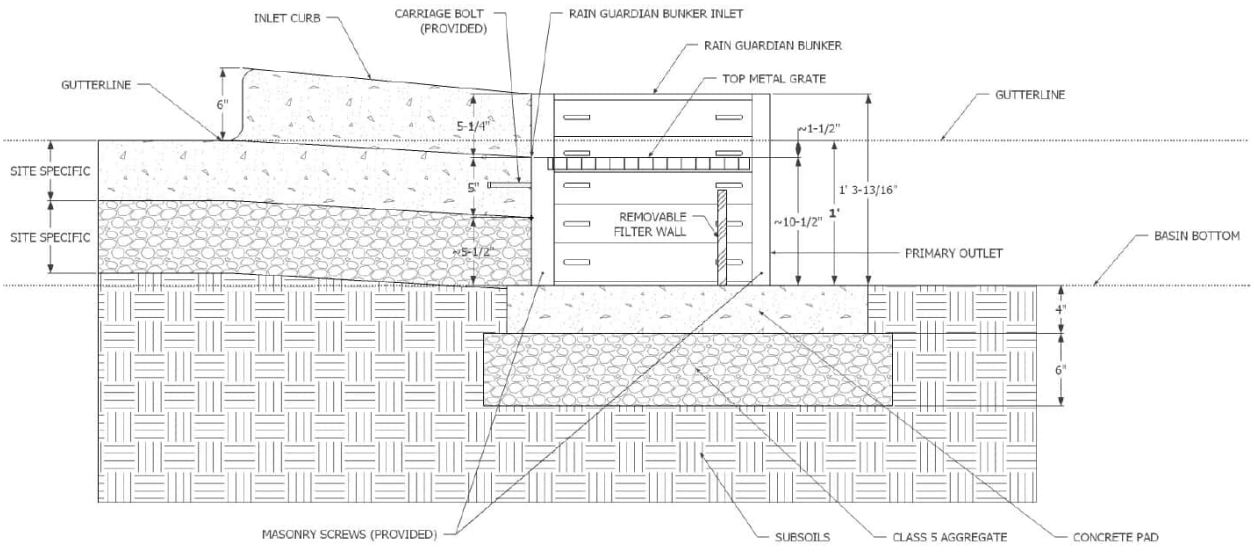


Figure 9. Cross section of Rain Guardian Bunker (flow from left to right) (http://www.rainguardian.biz/installation/downloads)

3.3 RAIN GUARDIAN TURRET

The Rain Guardian Turret (RGT) is a proprietary, cylindrical chamber with top grate, concrete bottom, screened exit wall, and skimmer beam as shown in Figure 10. Water, sediment, and gross solids flow into the RGT from the curb inlet, first through the top grate which captures gross solids by screening. Water, sediment, and any uncaptured gross solids then fall into the cylindrical chamber where sedimentation captures sediment and settleable gross solids. Water then exits the chamber through a screen exit wall, which screens additional sediment and gross solids. Compared to the Rain Guardian Bunker, the RGT has a larger grate area, larger settling chamber, and smaller screen wall area, with larger screen openings. When the water level is near the top of the screen wall, a skimmer beam intercepts floatables. When the flow exceeds the capacity of the screen wall, water overtops the screen wall. A cross section of the RGT is shown in Figure 11. To facilitate testing of the RGT, diversion plates were constructed from lightweight insulation panels (pink, shown in Figure 10) to divert flow into the opening of the RGT.



Figure 10. Rain Guardian Turret testing at 0.25 cfs (RGT-025-A). Entrance from the curb cut comes into the RGT from the right of the picture; flow through the screen wall exiting the RGT in the center of the picture towards the left.

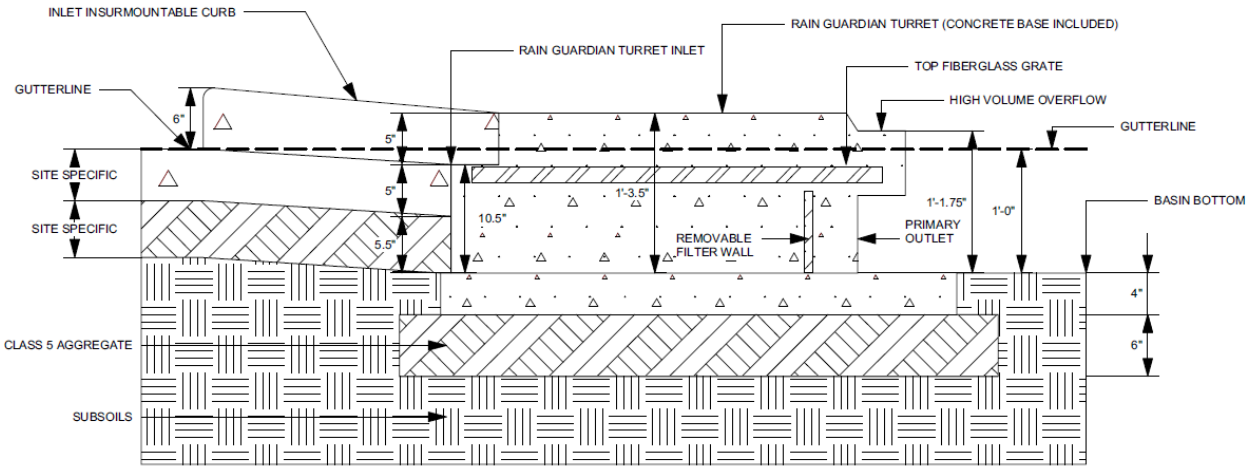


Figure 11. Rain Guardian Turret cross section (flow from left to right) (http://www.rainguardian.biz/installation/downloads)

3.4 ROCK LINED INLET

A rock lined inlet (RLI) in a non-proprietary rock-covered conveyance that is sloped between the curb cut and the bottom of bioretention, as shown in Figure 12. It is also sometimes called a riprap entrance, rock channel, or rock buffer strip. RLIs capture sediment and gross solids by settling among the rocks. As water, sediment and gross solids flow over the RLI, the rocks create roughness that intercepts sediment and gross solids and reduces the flow velocity near the rock surface, which allows for settling of sediment. Sediment that settles among the rock is thus protected by the non-turbulent boundary layer.



Figure 12. Rock lined inlet after testing at 0.50 cfs for 20 minutes. Entrance from the curb cut comes into the RLI from the right of the picture; exit into the bioretention practice at left.

The width, length, and slope of the RLIs varies based on design parameters and site constraints. For this project, the dimensions of the RLI were approximately 48 inches wide, 52.5 inches long, and an elevation change of 10.5 inches which produced a slope of 5H : 1V, or 20%. Experience and field observations of the authors and industry experts suggest ~20% slope is consistent with actual installations of RLIs.

3.5 SHALLOW SUMP GRIT CHAMBER

The in-line shallow sump grit chamber tested during this project comprises a rectangular catch basin, approximately 36 inches long by 24 inches wide with a 12-inch sump. There are five 4-inch holes in the bottom of the concrete chamber floor which allow for infiltration of water from the sump into the subsurface soils. The grit chamber is installed in-line with the gutter and has three 4-inch outlet pipes leading to the bioretention basin (Figure 13). Stormwater flows down the street gutter line and drops through the grate into the sump. When flow into the sump and through the outlet pipes is greater than the infiltration rate, the water will continue to rise in the sump and the bioretention basin simultaneously.



Figure 13. Shallow sump pretreatment with surface grate removed. This photo was taken upon arrival at the site, before cleaning the sump in preparation for testing.

When the water depth in the bioretention reaches 12 inches, the water level in the shallow sump is approximately at the elevation of the gutter (Figure 14). As the water level increases above this depth, water will begin to flow from the shallow sump grit chamber into the downstream gutter and on to the downstream conveyance. Water that flows out of the shallow sump grit chamber into the gutter is considered “bypass” because it bypasses treatment by the bioretention. During bypass conditions, water is treated by the shallow sump grit chamber and some water flows into the bioretention (assuming infiltration occurs), but sediment and gross solids may flow over the top of the grit chamber or be resuspended within the shallow sump grit chamber and allowed to flow out of the device and into the gutter. During larger rainfall and flow events, this could mobilize previously-captured sediment and release it from the shallow sump grit chamber.

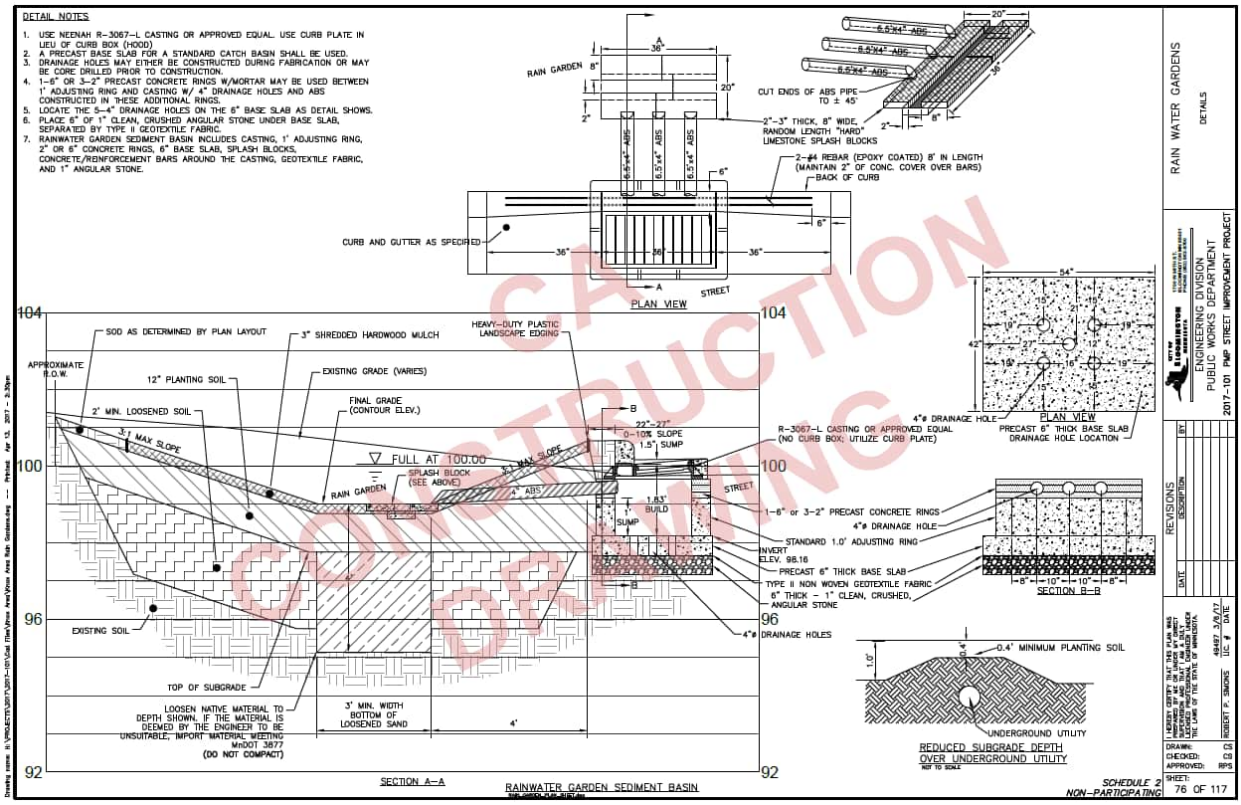


Figure 14. Shallow sump bioretention pretreatment practice design plan

CHAPTER 4: METHODS

4.1 FIELD-BASED TESTING

A field-based testing approach was used in this project because several of the available pretreatment practices are installed and easily accessible in the field. The relatively short duration of this project and the uncertainty associated with field monitoring prevented the use of long-term monitoring to measure performance. Thus, a field-testing methodology was adopted to produce repeatable results on five different pretreatment practices within a single summer season.

Field-testing allows for control of several variables associated with performance, including flow rate, volume, and duration; pollutant characteristics and amount; timing of testing during specific weather conditions; and the ability to repeat tests if results are inaccurate or errors appear. In addition, field-testing allowed for collection of all sediment captured by the pretreatment practices which were transported back to the analytical laboratory to be measured in whole. Long-term field monitoring produces sub-samples which have been shown to be inaccurate for sediment measurement (Gettel *et al.* 2011). Though field-testing was used in this study, laboratory testing can be more accurate, more cost-effective, and a better method for comparing multiple practices side-by-side under identical conditions. This is explained in more detail in Lessons Learned.

Another advantage of field testing compared to monitoring is that the testing approach is based on the design storage volume of the bioretention and is independent of the actual contributing area. As described above, both the Anoka and Bloomington sites become filled to design volume with runoff from a 0.1-inch rainfall event, which is considerably less than the recommended capture volume of a 1-inch event (MPCA 2017b). If performance was measured by monitoring, it would be evident that the bioretention (and pretreatment practices) were undersized and frequently filled beyond capacity. Field testing, however, can supply exactly the design volume in multiple replicates to measure the performance of the pretreatment practice for the volume and sediment mass for which it was designed. In general, the testing protocol was similar between both sites and all five different pretreatment practices, as follows:

1. Prepare gross solids and sediment to be used in field testing,
2. Prepare for test by gathering all field equipment and transporting it to the field site,
3. Deploy field testing equipment at the field site,
4. Prepare the site by installing the pretreatment practice to be tested,
5. Thoroughly clean the pretreatment practice prior to testing,
6. Saturate the soil of the bioretention practice prior to the first test of a testing day,
7. Conduct a test, as follows:
    a. Open gate valve at water meter to begin flow,
    b. Adjust flow until target rate is achieved,
    c. Start sediment feed and stopwatch (t = 0), and record water meter reading,
    d. Periodically feed gross solids one handful at a time,
    e. Check flow rate and make slight adjustments if necessary,
    f. Stir sediment in sediment feeder supply as needed,
    g. Periodically record water depth inside the corral area (to be defined later),
    h. Take photos and notes as needed,
    i. When test volume reaches design volume or test volume, stop sediment feed, close valve to stop water flow, and record the stop time (total duration).
8. Drain or pump out excess water from the basin,
9. Carefully collect, label, and store sediment and gross solids,

10. Set up for the next test, if applicable, until all tests for that day are complete,
11. Restore pretreatment practice to normal operating condition,
12. Collect all field equipment and transport equipment and samples back to SAFL,
13. Process collected sediment and gross solids,
14. Record and check results.

It is important to note that a clean water "rinse" was performed at the beginning of each testing day to ensure clean conditions and saturate the bioretention soils so that infiltration characteristics were similar for all tests. The testing process is described in further detail in the following sections.

4.2 SYNTHETIC STORMWATER

Field testing uses synthetic stormwater to control the rate, volume, duration, and pollutant characteristics throughout testing. For this project, the synthetic stormwater consisting of potable water from municipal fire hydrants and carefully chosen solids added to the water to achieve a solids concentration of 200mg/L. The volume, duration, and flow rate of synthetic stormwater were selected based on the size of the bioretention facility and the water supply limitations. The volume of water used for testing corresponded to the design storage volume of the bioretention practice (600 cubic feet for Anoka, 150 cubic feet for Bloomington). Two flow rates were selected based on the capacity of the fire hydrant and duration over which the flow rates could be achieved. A flow rate of 0.25 cubic feet per second (cfs) for 40 minutes and a flow rate of 0.5cfs for 20 minutes were selected for tests conducted at the Anoka site (GLI, RGB, RGT, RLI). Because the flow volume for these events are identical, they will be described as low intensity (0.25cfs for 40 minutes) and high intensity (0.5cfs for 20 minutes). Two replicates of all these tests were performed.

For Bloomington, the tests of the shallow sump grit chamber at the design volume (BDV) proposed to use flow rates of 0.06cfs for 40 minutes (low intensity) and 0.12cfs for 20 minutes (high intensity), both of which correspond to a volume of 150 cubic feet. Actual test duration and flow volume were determined in the field based on actual storage volume within the bioretention. Two replicates for these tests were performed.

Additional tests for the shallow sump grit chamber were added to measure the performance when the storage volume within the in-line sump grit chamber and bioretention practice were exceeded (i.e., experienced bypass). For these bypass tests (BBP), flow rates of 0.12cfs for 40 minutes (low intensity) and 0.25cfs for 20 minutes (high intensity) were used. These tests correspond to a volume of 300 cubic feet, which is approximately 2.5 times the design volume of the bioretention. Only one replicate for each of these tests were performed, due to time constraints and weather. A summary of recorded volumes, flow rates, and test times is shown in Table 7 in the Appendix.

4.2.1 Solids composition

A study of stormwater runoff in the Twin Cities Metropolitan Area found that the average event mean total suspended solids (TSS) concentration was 184mg/L, based on 520 measurements (Brezonik and Stadelmann, 2002). While there is substantial variability in reported TSS concentrations, this value was used as a basis for choosing the total solids concentration of 200mg/L.

Typically, gross solids (GS) refer to solids larger than 4.75 mm, including vegetation and trash, while sediment refers to sediment less than 4.75 mm. For this project, a ratio of 80% sediment and 20% gross solids by mass was used to create the total solids at a concentration of 200 mg/L. From Kalinosky (2015), recovered solids from street sweeping were classified as fine solids (assumed to

be principally sediment) or coarse organics (size > 2mm). Typical of many Minnesota watersheds, the proportion of coarse organics increased significantly in the autumn (September-November), while fine sediments peaked during early spring (February to April). The overall average proportion was approximately 80% fine solids and 20% coarse organics. Thus, a total solids concentration consisting of 80% sediment and 20% gross solids by mass was selected for testing in this project, as shown in Figure 15.



Figure 15. Synthetic stormwater solids composition. The height of each labeled box (left) is mass-proportional to the amount used in testing. The picture at right shows approximately the volume used of each component.

An adequate amount of sediment and gross solids had to be used in each test to ensure any error in the sample processing (collection, drying, weighing, etc.) would be minimal compared to the total mass measured. Given a total solids concentration of 200mg/L and a ratio of 80% sediment and 20% gross solids, the mass needed for each test was calculated based on the design volume for both the Anoka (600 cubic feet) and Bloomington field sites (150 cubic feet), as listed in Table 3.

Table 3. Target mass of sediment and gross solids for total solids loading of 200mg/L.

Solids type (% of Total)	Anoka (600 ft^3 design volume)		Bloomington (150 ft^3 design volume)	
	Mass (g)	**Mass (lb)**	**Mass (g)**	**Mass (lb)**
Sediment (80%)	2,718.4	5.99	679.6	1.50
Coarse Sand D_{50}=1.17 mm (26.7%)	226.5	0.50	56.6	0.12
Medium Sand D_{50}=0.41 mm (26.7%)	226.5	0.50	56.6	0.12
Fine Sand D_{50}=0.12 mm (26.7%)	226.5	0.50	56.6	0.12
Gross Solids (20%)	679.6	1.50	169.9	0.37
Forks (6.7%)	1,132.7	2.50	283.2	0.62
Leaves (6.7%)	1,132.7	2.50	283.2	0.62
Dowels (6.7%)	1,132.7	2.50	283.2	0.62
Total solids (100%)	3,398.0	7.49	849.5	1.87

4.2.2 Gross solids

Three types of gross solid (GS) material were chosen for testing: artificial leaves, wood dowels, and polypropylene forks. These items were chosen because they had properties similar to documented stormwater debris as summarized by McIntire *et al.* (2012), were cleanable and re-usable for multiple tests, non-degrading in water, stable during oven drying, amenable to handling, and readily available. Several other materials were evaluated and ultimately eliminated from use in testing because they did not meet the above criteria. Actual leaves and other organic materials (grass clippings, etc.), when used in testing, break apart into smaller particles and do not remain a consistent mass between wetting and drying cycles. Thus, the materials used in testing to represent gross solids and properties thereof are listed in Table 4.

Table 4. Properties of gross solids materials used in testing.

	Artificial Leaves	**Dowels**	**Forks**
Mass per piece	0.25 g	1.2 g	2.6 g
Dimensions	3.25" x 2.75"	5/16" dia x 1.5" length	5.75" length x 1" width
Material	polypropylene	hardwood	polypropylene
Name (source)	Gresorth (Amazon.com)	Fluted wood dowel pins (McMaster-Carr)	Medium weight forks (Litin's Party Value, Minneapolis)
Observed buoyancy	Initially float until saturated, then slowly sink except when suspended by air bubbles	Initially float, become neutrally buoyant or sink when fully waterlogged	Slowly sink except where suspended by air bubbles (rare)

Artificial leaves represent vegetation and are also similar in form to plastic or paper trash. The slight surface texture, jagged leaf-like edges, buoyancy, and flexibility mimic some properties of actual leaves. Wood dowels were chosen to represent cigarette butts, small organic debris (i.e., wood sticks), and floatables. Forks represent plastic debris, trash, or waterlogged (slightly sinking) sticks. Polystyrene utensils were tested but melted during drying and thus could not be used.

Polypropylene forks were found to be flexible and oven stable. Figure 16 shows a bag of synthetic gross solids next to actual gross solids recovered from the Bloomington field site during pre-cleaning.



Figure 16. A bag of synthetic gross solids used in testing (leaves, dowels, and forks) next to actual maple leaves and a cigarette butt recovered from the Bloomington site.

4.2.3 Sediment

Pretreatment for bioretention is primarily intended to capture particles greater than 100µm, as represented in Figure 17 (MPCA 2017b). To represent this range, the sediment portion of the synthetic stormwater solids consisted of a blend of one-third of each of three sizes of silica sand (Figure 18), each having a relatively narrow particle size distribution (Figure 19). Using a blend of three distinct sizes enabled sediment removal efficiency analysis for each size class as well as overall removal efficiency. The coarse sand (Agsco 12-20, D_{50} ~1170µm) and medium sand (Agsco 35-50, D_{50} ~410µm) were purchased in 50-lb bags from Agsco Corporation, Wheeling, IL (www.agsco.com). The fine sand (Agsco 120-200, D_{50} ~120µm) was a custom blend produced by Agsco.

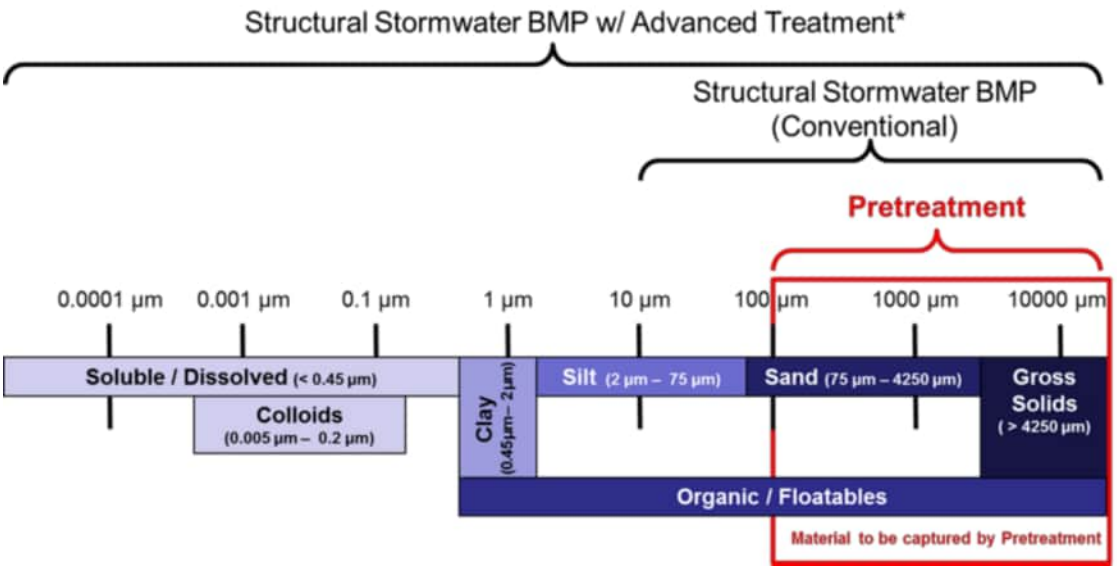


Figure 17. Pretreatment is intended to capture a portion of particles greater than 100µm (MPCA 2017b).

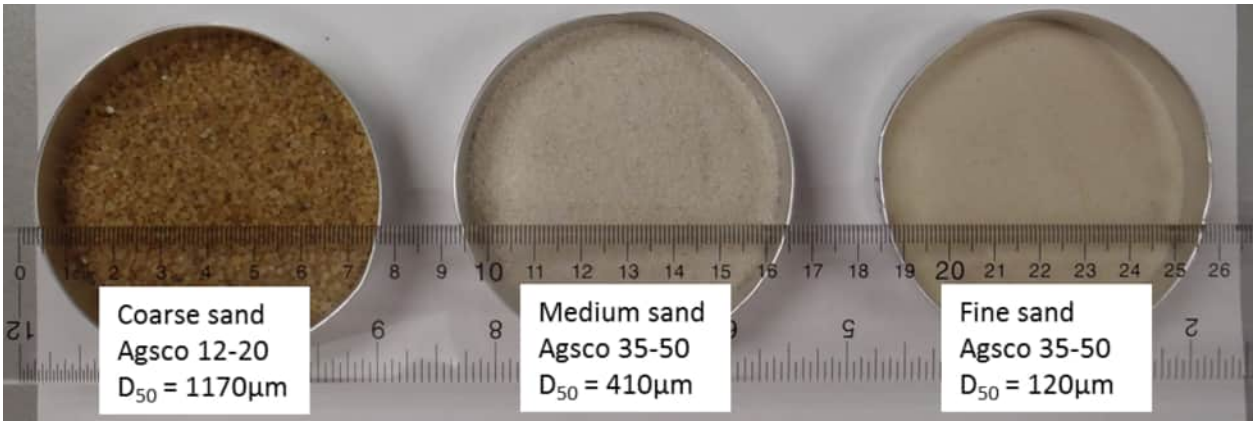


Figure 18. The three silica sands were blended in equal proportions by mass to create the sediment mix.

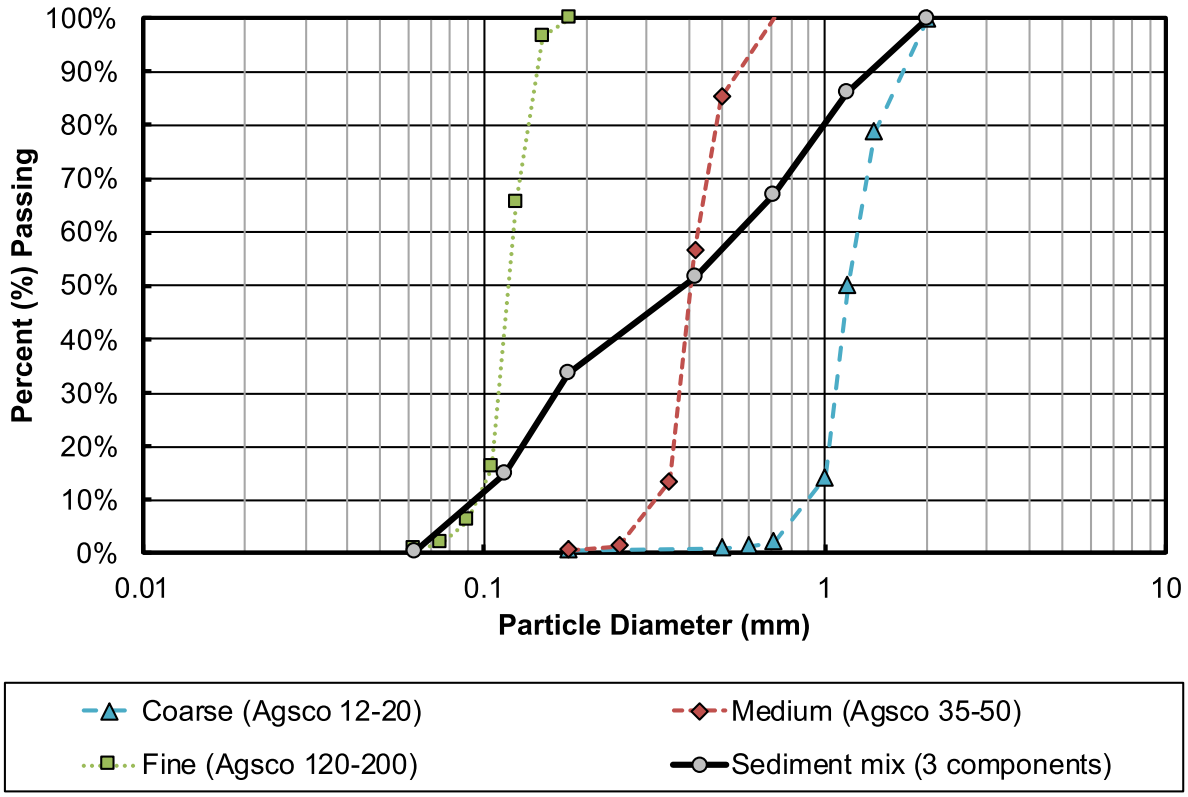


Figure 19. Particle size distribution chart of sand used in testing. Data from SAFL sieve testing.

Sieve analysis of the sediment was done at the SAFL sediment lab using standard 8-inch sieves. A Cole-Parmer Symmetry model S-PT 4202I balance with readability of 0.01g (10mg) was calibrated and used to measure mass of sediment, sieves, and gross solids. Comparison testing established there was no appreciable mass difference between oven-dry sediment and sediment taken from the supply bags, which were stored in the sediment lab. Therefore, masses for oven dry sediment taken from pretreatment devices were compared directly to initial masses taken from the stored sediment. Prior to each day of field testing, sediment was weighed and proportioned into labeled plastic zip top bags.

When sediment was collected from the pretreatment practices following testing, a sieve analysis was used to separate the coarse, medium, and fine sizes for comparison to the input values. After several trials, a set of 6 sieves was found to adequately characterize the sediment, with divisions between size classes shown in Table 5.

Table 5. Sieve analysis of whole sediment mix and division of sediment classes

US Std. Sieve #	Opening size (mm)	Percent passing	Sediment Retained
10	2.00	100.0%	Foreign material
16	1.17	86.2%	Coarse
25	0.71	67.1%	Coarse
40	0.42	51.5%	Medium
80	0.18	33.5%	Medium
(140 or 120)	0.12	14.9%	Fine
Pan	--	--	Fine

4.3 TEST EQUIPMENT

A substantial amount of equipment was needed to conduct field testing for this project, as shown in Figure 20. The equipment can be separated into several categories:

- Equipment was needed to control and deliver water to the pretreatment practice (hydrant, hose, and water meter supplied by the City of Anoka and City of Bloomington, respectively)
- Equipment to dissipate the energy from flow out of a fire hose and spread the flow evenly across the entire width of entrance into the pretreatment practice (barrel and flow spreader constructed by SAFL staff)
- Equipment to add sediment and gross solids at a constant rate throughout the duration of the tests (calibrated sediment feeder and SAFL staff adding gross solids by hand)
- Equipment to prevent sediment and gross solids from entering the bioretention practice ("corral" constructed of wire mesh and geotextile fabric, wire ties, stapler)
- Equipment to collect sediment and gross solids during grass lined inlet testing (new geotextile fabric large enough to fully capture any sediment and gross solids deposited in the corral)
- Equipment to draw water from within the bioretention cell after a test is complete (gas-powered pump, hose, intake screen, shovel and rake)
- Equipment to collect sediment and gross solids captured during tests (gas-powered generator, wet-dry vac equipped with custom-designed filter screen, garden hose and rinsing nozzles, clean buckets and tubs, custom-designed rinse rack for washing rock during rock lined inlet testing)
- Equipment to store and transport collected samples back to SAFL for analysis (clean buckets and zip top bags)
- Equipment to install and change pretreatment practice (wooden sloped frame, sod, rock, proprietary devices, battery-powered drills and screws, hammer, wrenches, stapler)
- Equipment to restore the site to operating condition (rake, shovel, hose and spray nozzle)



Figure 20. Field equipment used at Anoka field site.

4.3.1 Water supply and distribution

The City of Anoka Public Works water and sewer division supported the research by providing a hydrant flow meter, HPM model FHM03, with gate valve and a 2.5-inch hose for water supply. The City of Bloomington provided a 3-inch Sensus Omni H2/V2 water meter with gate valve and a long hose to reach from a nearby hydrant to the pretreatment practice. The hose end was secured to a hole near the top of a blue 55-gallon plastic barrel that dissipated turbulence from the high-pressure jet from the hose. At the bottom of the barrel, a 4-inch diameter pipe stub carried water to the flow distributor and level spreader. The flow distributor was constructed from wood and sheet metal to spread the incoming water to an even depth across 24 inches of width, to represent typical curb inlet flow. For tests conducted at the Anoka site, the edge of the flow distributor was located 18 inches upstream from the pretreatment practice lip and the distributor was centered in the curb inlet to the pretreatment practice. For tests conducted at the Bloomington site, the flow distributor was directed down the gutter line and into the grate (Figure 21). The flow distributor was modified to narrow the flow width to match the grate width.



Figure 21. Bloomington field site during pre-wetting flow. Flow enters the shallow sump through the curb grate and emerges into the fenced area of the rain garden through pipes, shown in a subsequent photo.

4.3.2 Sediment feeder and gross solids

A steady rate of sediment was supplied via an auger-type Accurate model 302 sediment feeder with a one-inch diameter nozzle and solid flight auger, which was powered by a small portable generator. The feed rate settings were calibrated at SAFL with the sediment mix on the basis of grams per minute. The feeder was mounted so that sediment fell in the center of the flow distributor and was carried downstream into the pretreatment practice by the flow (Figure 22). A metal plate was used in the first test to spread the falling sediment across the flow distributor, but moisture on the plate during testing begin to accumulate sediment by cohesion. Thus, the plate was rinsed and removed during the test to ensure all sediment discharged from the feeder was added to the distributor, and the pretreatment practice. The plate was not used in subsequent tests.



Figure 22. Sediment feeder and flow distributor.

Prior to each test, the sediment feeder was filled with the appropriate amount of pre-weighed and pre-mixed sediment blend. An additional 100g of sediment mix was added to the feeder to compensate for sediment remaining in the feeder and auger tube at the end of a given test. At the end of each test, sediment was carefully removed from the sediment feeder and auger tube by physically dumping it out from the top and sides of the feeder. This sediment was stored in a zip top bad and labeled “Not Fed” for analysis.

Prior to each test, the appropriate amount of pre-weighed gross solids was mixed into a bucket of clean water to allow the gross solids to become saturated and better represent gross solids that would be carried in stormwater to a pretreatment practice. Throughout the duration of each test, gross solids were carefully added by hand to the flow immediately downstream of the flow distributor.

During the field tests in Anoka, a clean geotextile fabric was placed on top of the concrete apron between the flow distributor and the pretreatment practice to ensure sediment or gross solids were not captured on the concrete apron prior to entering the pretreatment practice. The geotextile also prevented entrainment of any sediment, concrete, or gross solids that was on the apron, which would bias the results of the testing. This geotextile was observed throughout the duration of each test to ensure sediment and gross solids did not accumulate on its surface.

4.3.3 Downstream sediment and gross solids collection

To simplify cleanup and restoration, a “corral” was constructed to contain sediment and gross solids that flowed out of the pretreatment practice and into the bioretention. In addition, the corral

was used to measure performance of the grass lined inlet, as described in section 4.5 below. The corral was constructed of hardware mesh with ½-inch square holes, attached to steel fence posts set into the ground. For testing in Anoka, the corral area was approximately 28 square feet, expanding from 48 inches wide at the bottom of the pretreatment practice to 67 inches wide, and was approximately 70 inches long. Geotextile fabric was clipped or clamped to the hardware mesh around the edges and weighted against floatation with clean stones at the bottom. The hardware mesh and geotextile were attached to the pretreatment practice frame so as to not allow flow through gaps.

The geotextile fabric would clog over time so that the water level inside the corral was higher than in the water level in the bioretention basin outside the corral. Thus, an overflow outlet was created in the fabric sides to prevent water from fully submerging the pretreatment practice and backing up into the curb inlet. Water levels were periodically measured inside the corral, referenced to the base slab (see Figure 4).

For the tests conducted in Bloomington, the corral was made of hardware mesh with ¼-inch openings and was approximately two feet wide and three feet long and did not include the geotextile fabric (Figure 23). This is because the bioretention was fully established with vegetation, and the corral could not be larger without impacting vegetation.



Figure 23. Gross solids containment area at Bloomington field site. Flow from the shallow sump box enters the bioretention basin through the three pipes at right.

4.3.4 Drain pump

To allow for as many tests as possible in each testing day, the water within the bioretention practice was removed using a three-inch gas-powered semi-trash pump. The pump intake was installed within a five-gallon plastic bucket that was placed in an excavated hole in the bottom of the bioretention at the Anoka site. In Bloomington, a smaller pump was used and placed directly on the

bottom of the bioretention basin. Fencing was used to control the movement of floating wood mulch toward the pump, but raking was still required to redistribute the mulch after testing. A small electric submersible pump was also used during some tests to dewater the area immediately adjacent to the pretreatment practice.

4.3.5 Field collection of sediment and gross solids

Gross solids were collected by hand in all tests and transferred directly to a properly labeled storage containers. Hands were washed prior to gross solids collection, and hands and any other items contacting the gross solids and sediment were carefully rinsed after collection into the appropriate location so as not to misallocate mass.

A device was needed to collect sediment from within the pretreatment practices, but that would allow the collected sediment to be quickly and easily separated and stored for transport back to SAFL for analysis. A standard wet-dry vacuum could collect wet sediment, but fine sediment could become trapped within the filter cartridge or mesh filter screen within the vacuum. To overcome this limitation, a secondary filter bucket (Figure 24) was constructed to capture and contain collected sediment. A nozzle and green flexible hose were connected to an inlet pipe, which were attached with a gasket to the lid of a standard 5-gallon bucket. A fine screen (#270 mesh, 53μm) was wrapped around a mesh cylinder within the bucket, which also sealed to the 5-gallon bucket lid and connected to a standard 5-hp Shop-Vac wet-dry vacuum via a black outlet pipe. The lid was then attached to a clean 5-gallon bucket. When the wet-dry vacuum was running, suction would collect wet sediment through the nozzle and into the 5-gallon bucket, but the #270 mesh screen would prevent sediment from leaving the bucket or entering the wet-dry vacuum. Thus, sediment was collected within the 5-gallon bucket.

When wet sediment was difficult to collect within a pretreatment practice, a plastic squeeze bottle with clean water was used to mobilize sediment as the wet-dry vacuum collected it. In addition, this bucket-collection system was most efficient when using two pre-cleaned buckets. Once the first bucket was partially filled with a water/sediment mix, the lid with attached hoses was carefully switched to a second bucket to continue vacuuming. Meanwhile, water from the first bucket was poured through a #325 sieve (US Standard mesh, 44μm) to separate collected sediment from the water. Once all sediment water collected from the pretreatment practice, the nozzle, hose, filter, and second bucket were thoroughly rinsed into a single bucket and partly decanted through the sieve so that all sediment was captured in a single bucket. This bucket was then sealed, properly labeled, and transported back to SAFL for analysis.



Figure 24. A filter bucket was designed to trap sediment in the 5-gallon bucket (right), with suction provided by a wet-dry vac (left).

4.3.6 Sample storage

Sediment collected during field testing was stored in clean 5-gallon plastic buckets with lids, sealed with duct tape, and labeled prior to transportation back to SAFL for analysis. Gross solids were collected by hand and stored in clean, clear, zip top bags, then sealed and labeled prior to transportation back to SAFL for analysis. For tests in which geotextile fabric was used to collect sediment and/or gross solids, the fabric was carefully folded to retain solids, stored inside a large zip top bag, labeled, and placed inside a clean 5-gallon bucket for transportation.

4.4 SAMPLE PROCESSING AND ANALYTICAL METHODS

Labeled containers of gross solids and sediment, sealed zip top plastic bags or sealed 5-gallon buckets, were transported to SAFL at the end of each testing day and stored until processing could be completed. For the first few runs, sediment and foreign material was rinsed from the gross solids under running water on coarse mesh over a watertight bin (Figure 25). All water from the bins was poured through coarse (US standard #10, 2mm opening) and then very fine (US standard #325, 44µm opening) sieves (Figure 26). The #10 was chosen because the openings are larger than any sediment that was used in field testing and thus anything captured on this sieve is foreign material that was not part of the testing. Material retained on the coarse sieve such as grass blades and seeds were gently rinsed to remove any sediment, then discarded. Sediment retained on the #325 sieve was rinsed into pans for oven drying and processing. Because the #325 sieve is finer than any sediment used in testing, any material passing this sieve was discarded.



Figure 25: Rinsing gross solids on a mesh box over a watertight bin. This method was later revised (see Figure 27).



Figure 26. The rinse bin was poured carefully through a #325 sieve to retain sediment particles.

A more effective and efficient method was developed using two 5-gallon buckets (Figure 27). A bag of gross solids was emptied into a clean bucket then rinsed to remove any sediment clinging to the bag. The bucket with gross solids was filled about three-quarters full with clean water. A second clean bucket was also filled about three-quarters full with clean water. Small, loosely held handfuls of gross solids were gently swirled and shaken while underwater in the first bucket, then carefully removed and placed into the second bucket. Once all the gross solids were transferred to the second bucket, the water from the first bucket was poured through the #10 sieve to exclude foreign materials larger than 2mm and through a #325 sieve to retain test sediment. In addition, the bucket was rinsed, and rinse water was also passed through the sieves. Any sediment retained on the #325 sieve was added to a sediment drying tray and properly labeled.



Figure 27. Two bucket rinse method of cleaning sediment from gross solids. The grey mesh wastebasket (lower left) was used to dry gross solids in the oven.

Using the same submerged swirling process, gross solids were moved from the second bucket to a labeled drying bin (wire mesh wastebasket) for drying in a large sediment oven. The second bucket was then poured through the sieves, and the sediment was added to the collected sediment tray. There were typically only a few grains of sediment in the second bucket; if more was apparent, a third rinse cycle was added. After fully drying in the oven at 200°F for at least 24 hours, the gross solids were sorted and weighed by type (leaves, dowels, forks).

Captured sediment was transferred from buckets or bags to labeled metal pans for oven drying. Excess water was removed from the sediment using a #325 sieve (Figure 28). Sediment was dried in the oven at 200°F for at least 24 hours and then sieved to determine particle size distribution. When necessary, the dry captured sediment was split into several portions to be sieved sequentially. Weights were recorded on paper sheets (Figure 29), and then input into a spreadsheet for calculations of percent passing each sieve. All of the sequential portions were totaled. The pre-sieve total mass was compared to the sum of the sequential portions and samples were re-sieved if error was significant. The small amount of “not fed” sediment removed from the feeder was sieved

and weighed in the same manner as the captured sediment. The average percent error for all sieved samples was 0.29% (n = 74).



Figure 28. Rinsing sediment from a sieve into a pan for oven drying.

Sieve Analysis Data Sheet
ASTM D422-63(2007)

Project Name: Pretreatment Tested By: P.O. Date: 6/26/18
Sample No.: Rep 6/6 Checked By: MAH Date: 7/12/18
Sample Desc.: RLI050A - captured

Weight of Container (g): 38.07 A
Weight of Container & Soil (g): 334.27 B
Weight of Total Dry Sample (g): 296.20 C = B - A

1st sieve $J_1 = 100 - I_1$, all others $J_2 = J_1 - I_2$.

D	E	F	G	H = G - F	I = H / C x 100	
Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
10		474.13	474.38			
16		351.48	419.72			
25		406.02	494.12			
40		342.98	383.02			
80		342.78	367.46			
120		530.44	560.89			
Pan		362.97	369.53			
			TOTAL:			

Figure 29. Sample sieve analysis data sheet.

4.5 GRASS LINED INLET

4.5.1 Testing setup and cleanup

To install a GLI within the bioretention site in Anoka, a wooden frame was constructed to support the GLI, simulate infiltration of water through the GLI, and capture of sediment and gross solids on the surface of the GLI. The wood frame was constructed by ACD as a sloped plywood surface that

was attached to the outer frame of the original Rain Guardian Bunker at the Anoka site (Figure 30). Several small holes were drilled along horizontally-oriented shallow grooves in the plywood (T1-11 siding) to simulate infiltration into the subsoil. The frame was constructed so that the top of the sod was approximately level with the curb inlet edge at the entrance, and approximately level with the bioretention bottom elevation at the exit of the GLI.



Figure 30. Wood frame and slope used for rock- and grass-lined inlet testing.

Commercially grown bluegrass sod was purchased and installed on the day of testing (Figure 31). The sections of sod were rolled out perpendicular to the flow direction and seams were closed as tightly as possible to prevent water flow between sections and under the sod. In addition, the sod was attached to the wooden frame with standard wood screws through the root mat (approximately 1-inch thick). Fresh sod was used for each test. After the first test, sod was wrapped up the sides of the box to minimize turbulence and lifting of the edges of the sod.



Figure 31. Preparing the grass lined inlet with fresh sod.

As described previously, sediment and gross solids are captured on the surface of a GLI. When removing this sediment after a test, however, it is likely that grass and organic soil associated with the sod would also be collected. Separating test sediment from solids contributed by the sod would be challenging and time consuming. Thus, performance was measured by comparing the influent sediment to the amount of sediment that was NOT captured by the GLI, but rather was delivered to the bioretention. Also, because fresh sod was used for each test of the GLI, a clean water rinse of approximately 300 cubic feet was passed over the GLI to wash away any loose grass clippings or soil material prior to testing.

As previously described, a “corral” was constructed to capture gross solids and sediment that flowed out of the pretreatment practices during testing. For the GLI tests, a new, seamless piece of nonwoven geotextile (Propex Geotex 801) was added to the corral for each test run. Prior to field testing, this geotextile was tested in the laboratory to ensure it allowed water to pass through but retained the sediment used in field testing. Clean rocks were used to weigh the fabric to prevent floating (Figure 32).



Figure 32. Grass lined inlet with fabric lined corral, after rinsing, ready for a test.

Figure 33 is a photograph taken during the GLI-025-B (grass lined inlet, 0.25 cfs flow rate, replicate B) test run. At the end of each test, the water was drained from the bioretention as described above and any gross solids resting on or in the grass were collected, properly stored, and labeled "captured." In the corral area, sediment was rinsed off the weight stones onto the geotextile. Then, excess geotextile that was clearly not touched by sediment was cut off and the remaining sediment-laden geotextile was carefully folded to retain sediment and gross solids and stored for lab processing. After all samples were collected, the site was prepared for a subsequent test or restored to an operational condition.



Figure 33. Flow on grass lined inlet at 0.25 cfs (GLI-025-B).

4.5.2 Sample processing

At the laboratory, the geotextile containing the non-captured (passing) sediment and gross solids was spread out on a plastic sheet. Gross solids were removed by hand (Figure 34) and rinsed to remove and retain sediment as described above. The geotextile was cut with a heavy scissors into pieces approximately 4 ft by 6 ft for ease of handling. Then, each piece of fabric was thoroughly rinsed with clean water over a watertight bin (Figure 34). This process required one person to hold and manipulate the fabric and one person to spray sediment down the fabric into the bin. Beyond this, samples were processed as described above.



Figure 34. For the grass lined inlet, solids passing the pretreatment and landing in the geotextile were processed and weighed. Gross solids were removed from the geotextile at SAFL (left) and sediment was rinsed from the fabric (right).

4.6 RAIN GUARDIAN BUNKER

4.6.1 Testing setup and cleanup

Testing setup for the RGB required no additional setup because the site was originally designed and constructed with an RGB. Thus, the site simply needed to be cleaned prior to testing. Figure 35 is a photo taken during RGB testing. After a test was complete, gross solids were carefully removed from the top grate by hand and sediment was rinsed from the grate into a bin and decanted through a #325 sieve. The chamber area below the grate and upstream of the screen wall (sometimes noted as pre-screen) was cleared of gross solids by hand. Then sediment was removed from the chamber using the custom filter bucket described above. Gross solids were removed from the screen wall, which was then disassembled and rinsed in a bin (Figure 36) to remove sediment from the screen, backing, and aluminum rails. ACD provided a new screen wall assembly for each of the four tests to eliminate the possibility of cross-contamination and allow for quick re-assembly of the Bunker between tests. Sediment was also collected from the small area of slab just beyond the screen wall and counted as captured because this area is also part of the surface prescribed for maintenance by ACD. All of the capture locations were combined for reporting. After all samples were collected, the site was prepared for a subsequent test or restored to an operational condition.



Figure 35. Rain Guardian Bunker at 0.5cfs test flow (RGB-050-A)



Figure 36. Rinsing the partially disassembled Rain Guardian Bunker screen wall in a bin (foreground) and vacuuming captured sediment from the bunker (background).

4.6.2 Sample processing

Sediment and gross solids were collected separately from several "captured" locations (grate, chamber, screen wall, immediately downstream of screen wall), and separate processing was maintained for each of these locations. Gross solids recovered from the corral area were cleaned and dried as described but not weighed or quantified. Beyond this, samples were processed as described above.

4.7 RAIN GUARDIAN TURRET

4.7.1 Testing setup and cleanup

The RGT is made of concrete and weights slightly over 1,000 lbs, precluding easy installation and removal at the Anoka bioretention site. Instead, ACD supplied a dimensionally accurate lightweight replica of the Turret (Figure 37) which was used for testing in conjunction with normal grates and screen wall. To form the base, a short plywood box with a top elevation the same as the Bunker concrete base slab was overlain by a piece of geotextile fabric with a 1/8th inch sheet of clear polycarbonate plastic on top. Weatherstripping on the underside of the Turret model allowed a sediment-tight seal with the clear plastic sheet. The Turret was held in place by the weight of the top grates (~160 lb) and a ratchet strap to the Bunker frame. Waterproof tape was used to seal slight gaps at the curb inlet lip transition, which was overlain by a piece of geotextile fabric positioned under the flow distributor as described above.



Figure 37. A special lightweight replica of the Rain Guardian Turret was used in testing at the Anoka site.

The test procedure as described above was followed. Figure 38 and Figure 39 show the RGT during testing. After testing, the heavy grates required two people to lift off and suspend over a bin to rinse down any attached sediment. Figure 40 is an example of the cleanout process for the RGT. Similar to the RGB, sediment was collected from the area directly in downstream of the screen wall according to manufacturer's maintenance guidance. After all samples were collected, the site was prepared for a subsequent test or restored to an operational condition.



Figure 38. Rain Guardian Turret testing at 0.25cfs (RGT-025-A).



Figure 39. Rain Guardian Turret testing at 0.50cfs at a high water level (RGT-050-B).



Figure 40. Cleanout gross solids and sediment from the Rain Guardian Turret.

4.7.2 Sample processing

Sediment and gross solids were collected separately from several "captured" locations (grate, chamber, screen wall, immediately downstream of screen wall), and separate processing was maintained for each of these locations. Beyond this, samples were processed as described above.

4.8 ROCK LINED INLET

4.8.1 Testing setup and cleanup

To install a RLI within the bioretention site in Anoka, a wooden frame was constructed to support the RLI, simulate infiltration of water through the RLI, and capture of sediment and gross solids within the RLI. This wood frame was identical to the wood frame constructed for the GLI and described in section 4.5.1 above, but installed slightly lower in elevation such that the top of the rock was approximately level with the curb inlet edge at the entrance, and approximately level with the bioretention bottom elevation at the exit of the RLI. The end of the slope extended several inches below the grade of the mulch layer on the basin floor and rocks were held in place by a short vertical piece of wire mesh with half inch openings. The frame was covered with geotextile fabric shingled horizontally at a seam and extending up the frame walls. The fabric also extended under the water distribution pan such that no sediment could escape from the system through small cracks or gaps.

Round, pre-washed cobbles 3 – 5 inches in diameter were then placed on the fabric and approximately leveled. Although an effort was made to remove unsound rocks before any testing, a number of rocks showed wear or chipped pieces in the first test. These rocks were removed from further testing and the pieces removed where possible in post-test processing. Figure 41 shows the

RLI with water beginning to flow, immediately prior to the start of sediment feed at t=0. Figure 42 illustrates the post-test condition for two tests.



Figure 41. Beginning of flow on RLI, just prior to the start of a test. Gross solids and sediment are ready to be fed.

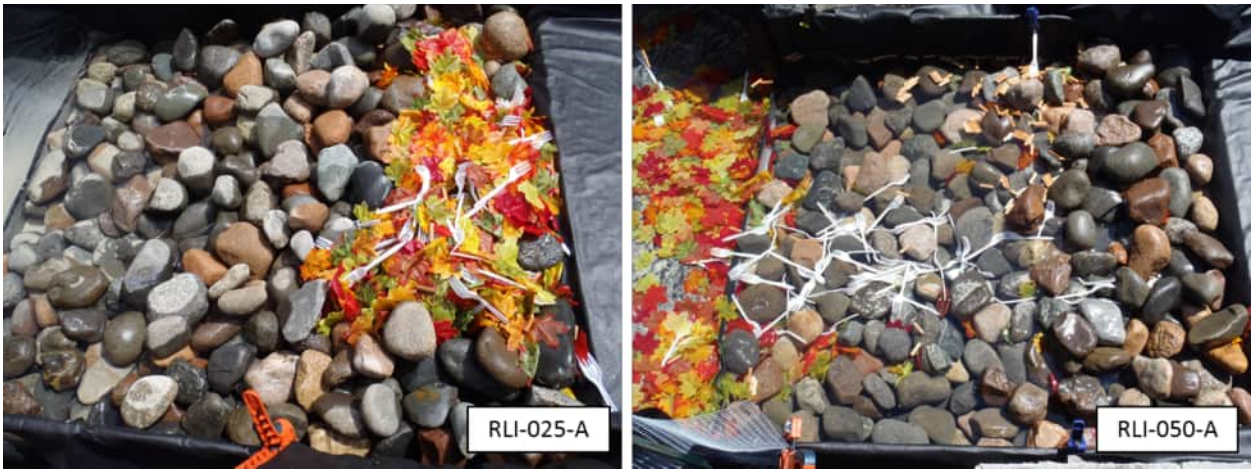


Figure 42. Rock lined inlet after testing at 0.25 cfs for 40 minutes (left) and 0.50 cfs for 20 minutes (right).

Immediately following each test, water was drained down and gross solids were removed from the surface of the rocks and placed in a labeled container (Figure 43) for processing at the lab. Stones were then removed and thoroughly rinsed onsite (Figure 44) with a hose and sprayer over a watertight bin. The bin was periodically decanted through a #10 sieve (2mm openings) and a #325 sieve, as described above. Sediment from the sieve was then transferred to a labeled container for processing at the lab. After all rocks were rinsed, the bin was thoroughly rinsed with all rinse water passing through the sieves. After the rocks were removed, a considerable amount of sediment remained on the geotextile fabric below (Figure 45). The fabric was cut and carefully folded to contain sediment, then transferred to a labeled container for processing at the lab. After all samples were collected, the site was prepared for a subsequent test or restored to an operational condition.



Figure 43. Removal of gross solids from the rock lined inlet.



Figure 44. Rinsing rocks from the rock lined inlet.



Figure 45. Sediment remaining on geotextile when rocks were removed from RLI.

4.8.2 Sample processing

At the laboratory, the geotextile containing the captured sediment that was present under the rocks was rinsed into a water tight bin and processed as described above. Beyond this, samples were processed as described above.

4.9 SHALLOW SUMP GRIT CHAMBER (DV)

4.9.1 Testing setup and cleanup

Testing at the in-line shallow sump grit chamber in Bloomington was slightly different than testing at the sites in Anoka, as described above. In addition, some specific modifications to the practice or site were made to accommodate testing. The base slab of the shallow sump grit chamber has five (5), four-inch diameter holes designed for infiltration, which were plugged with red plumbing test plugs to limit the loss of test solids into the holes (Figure 46). During testing it was observed that water could seep into the chamber around some plugs and in the gap between the base slab and walls. It is unclear whether sediment or water were lost through these unsealed seams.



Figure 46. A wet-dry vac was used to remove sediment from the bottom of the Bloomington sump. The red plugs were inserted to seal infiltration holes in the slab to limit sediment loss.

After setting up the flow distributor along the curb line (Figure 21), the pretreatment practice and bioretention basin was flushed with water, and then pumped down. The grate was thoroughly rinsed. The connecting pipes were then sprayed out and the sump was hosed down and cleaned. For testing at this site, cleaning the sump after rinsing was necessary before every test.

For the first test at the design volume (BDV), water flow rate adjustment was done before beginning the sediment feed at t=0. However, due to the small basin volume, subsequent tests started

sediment feed at t=0 as soon as water began to flow through the distributor. Flow rate was the adjusted in the first few minutes of the test. For the design volume tests (BDV), each test was run until just before overflow of water to the downstream gutter, when the water elevation was at the top of the grate. This occurred at staff gauge elevation of approximately 12 inches above the bottom of the bioretention basin. When this water elevation was reached, the sediment feeder was shut down, the water was turned off, and the stop time was recorded. Test duration was approximately 15 minutes for the 0.06 cfs flow rate and 30 minutes for the 0.12 flow rate, compared to the proposed test duration of 20 minutes and 40 minutes, respectively.

Collection of sediment and gross solids was similar to collection from the chambers of the RGB and RGT but was complicated by the presence of standing water in the sump. The first step after flow was shut off was to slowly pump the water out of the bioretention basin. The drain rate was slow enough that sediment and gross solids were not observed to move. After the water receded to the invert level of the pipes connecting the sump to the bioretention, the grate surface was gently rinsed into the sump, then raised in place and rinsed again to remove any sediment, then removed and placed out of the way. There was typically very little accumulation of gross solids and sediment on the grate. Gross solids were then removed by hand from the sump and placed in labeled containers for lab processing.

Clear water in the sump was pumped away with a suspended, small submersible pump to within about three inches of the sediment surface so as not to entrain sediment. The remaining water was vacuumed off using a wet-dry vacuum and filter bucket as described in Section 4.3.5 . This water was passed through the #325 sieve to retain any sediment. Vacuuming then continued to remove all the captured sediment (Figure 46) as described above. This was complicated by the gap between the bottom slab and wall; applying too much suction near the wall tended to draw in fine organic particles (Figure 47), which were excluded where possible. Captured sediment from the filter bucket was labeled and stored for lab processing. Any sediment in the connecting pipes was rinsed into the bioretention basin and was not counted as captured. The corral was cleaned of gross solids, which was bagged and taken to the lab for cleaning but was not counted or weighed. After all samples were collected, the site was prepared for a subsequent test or restored to an operational condition.



Figure 47. Fine organic material retained on sieve.

4.9.2 Sample processing

Samples were processed as described above.

4.10 SHALLOW SUMP GRIT CHAMBER (BYPASS)

4.10.1 Testing setup and cleanup

To measure the performance of the shallow sump grit chamber during bypass conditions, sediment and gross solids had to be collected in additional locations: in the gutter downstream of the sump and in a second downstream catch basin, which is connected to the city's storm sewer system. This was accomplished by fitting the downstream catch basin with a geotextile basket to capture solids (Figure 48), and thoroughly cleaning the 6 feet of gutter between the two catch basins by flushing and vacuuming before testing. The grate of the downstream catch basin was also thoroughly rinsed. The geotextile fabric was secured below the grate of the downstream catch basin and all gaps were sealed or covered with waterproof tape. The flow distributor was also sealed to the frame of the pretreatment practice inlet to prevent sediment or gross solids from backing up the curb line during elevated water due to bypass flows.

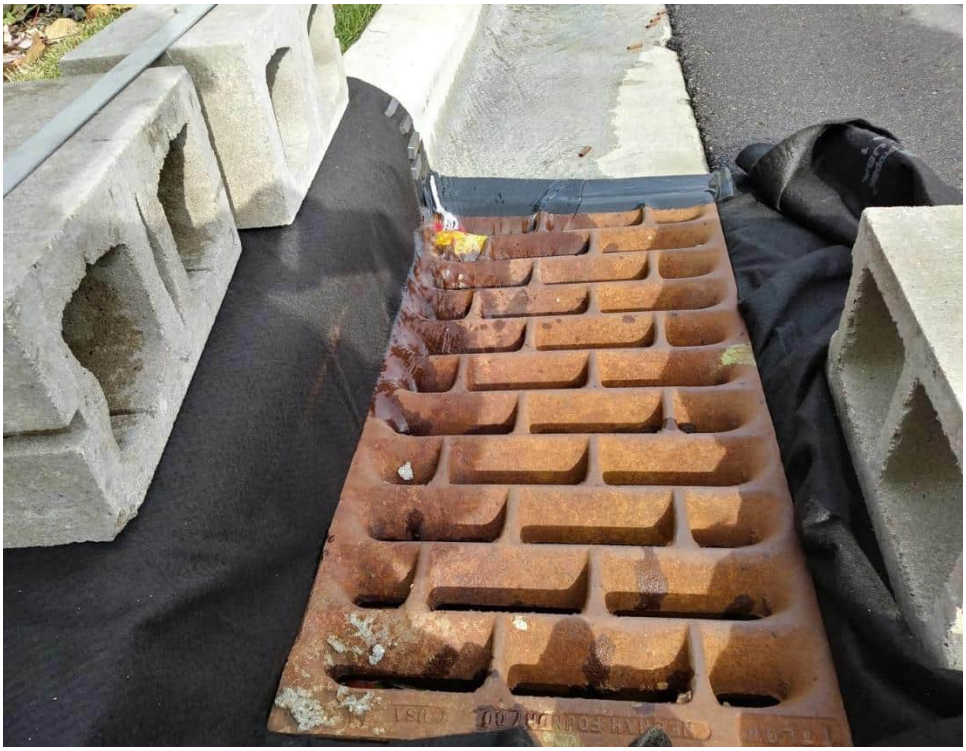


Figure 48. For the bypass tests of the Bloomington pretreatment practice, the downstream catchbasin was lined with a geotextile basket to capture sediment and gross solids bypassing and/or washing out of the pretreatment practice.

As previously described, the bypass tests used approximately twice the design volume to induce bypass of the pretreatment practice, as shown in Figure 49. At the highest flow rate (BBP-025), the test was stopped slightly early (test duration = 30 minutes) because the geotextile basket in the downstream catch basin was on the verge of bypassing.

At the conclusion of the test, water was shut off and the surcharged bioretention basin was allowed to drain down before being pumped out. Sediment and gross solids in the shallow sump grit chamber were collected as described above. Collection of sediment and gross solids that had bypassed the pretreatment consisted of thoroughly vacuuming the street gutter between the pretreatment inlet and the downstream catch basin and collecting the geotextile fabric basket from the downstream catch basin. The catch basin grate was rinsed down into the fabric with clean water, then the grate was raised and rinsed further before removal (Figure 50). Excess fabric was cut off and then the fabric with sediment and gross solids was carefully removed and placed in a labeled container for lab processing. After all samples were collected, the site was prepared for a subsequent test or restored to an operational condition.



Figure 49. Flow in the gutter during bypass (BBP-025-A).



Figure 50. Gross solids and slight amount of sediment captured on geotextile fabric in the downstream catch basin frame (BBP-012-A).

4.10.2 Sample processing

Samples were processed as described above.

4.11 CALCULATIONS

The calculation of solids removal is shown in the following mass balance equation and is the same for both sediment and gross solids. The captured dry mass is the material captured by the pretreatment practice that has been oven dried and weighed; and the net initial dry mass is the mass fed to the system minus any mass not fed.

$$Removal = (captured\ dry\ mass)/(net\ initial\ dry\ mass)$$

For the gross solids, the net initial dry mass was the pre-weighed amount prepared at the laboratory minus any gross solids not fed to the system. In all but one replicate, the complete amount of gross solids was fed during the tests. For the sediment, the net initial dry mass is the pre-weighed amount prepared at the laboratory minus the "not fed" amount recovered from the sediment feeder. This calculation was repeated for each sediment fraction and type of gross solid, and then combined for a grand total for each test run. The following is an example calculation for the smallest sediment size (D_{50}~120µm, designated as) for test RLI-050-A:

$$Removal\ of\ D_{50}120\mu m = \frac{captured\ dry\ mass}{net\ initial\ dry\ mass} = \frac{311.76g}{939.47g - 29.06g} = 0.342 \times 100\% = 34.2\%$$

A similar example calculation for artificial leaves, designated as part of the gross solids mix, also for test RLI-050-A:

$$Removal\ of\ leaves = \frac{captured\ dry\ mass}{net\ initial\ dry\ mass} = \frac{226.47g}{79.64g - 0g} = 0.351 \times 100\% = 35.1\%$$

An example calculation for the total of all sediment in RLI-050-A:

$$Removal\ of\ total\ sediment = \frac{2162.63g}{2818.34g - 46.56g} = 0.780 \times 100\% = 78.0\%$$

This same process is also used for the bypass tests (BBP) because the net initial dry mass and captured dry mass are measured directly. The additional mass collected as bypass is reported to illustrate the potential for resuspension.

For the GLI, the mass of solids retained within the GLI was not measured and thus the above calculation is not possible. For the GLI test data, a modified removal calculation was used:

$$Removal = \frac{net\ initial\ dry\ mass - untreated\ dry\ mass}{net\ initial\ dry\ mass}$$

The net initial dry mass is the same as above and is equal to the mass fed to the system minus any mass not fed. The untreated dry mass is the material that passed untreated through the pretreatment practice and was captured downstream in the corral and has been oven dried and weighed. An example calculation is below with data from test run GLI-050-A for the intermediate sediment, identified as D_{50}~410µm. A total of 939.47g of the intermediate sediment was placed in

the feeder, 21.35g were collected from the feeder after the test as not fed, and 179.93g was collected in the corral (untreated):

$$Removal\ of\ \ D_{50}410\mu m\ = \frac{(939.47g - 21.35g) - 179.93g}{939.47g - 21.35g} = 0.804 \times 100\% = 80.4\%$$

It is important to note that the calculations for the RGB, RGT, RLI, BDV, and BBP all calculate performance efficiency directly from the mass captured within the pretreatment practice, whereas the calculation for the GLI is based on the difference between input and untreated mass. Thus, any error associated with the measurements are mathematically included in the performance of the GLI and omitted from the performance of the other pretreatment practices. In general, this would bias the performance of the GLI to be larger (i.e., better) than the actual performance by the amount of the error. The error is discussed in Section 5.3 Error and Uncertainty.

Calculations were repeated for each flow rate and replicate. Actual calculations were performed in a spreadsheet. Results are reported in CHAPTER 9: Appendix.

Precision was calculated using the Relative Percent Difference (RPD) to determine how much two or more data replicates are in agreement with each other. For this project, two replicates (A & B) were conducted for each pretreatment practice for each flow rate tested (except for the bypass tests). From this data, the Relative Percent Difference (RPD) was calculated as follows:

RPD = (A – B) ÷ ((A + B) / 2) x 100

where A is the larger of the two duplicate sample values and B is the smaller value.

CHAPTER 5: RESULTS AND DISCUSSION

5.1 ANOKA SITE: GRASS LINED INLET, RAIN GUARDIAN BUNKER, RAIN GUARDIAN TURRET, AND ROCK LINED INLET

5.1.1 Sediment Capture

5.1.1.1 Low intensity (Q = 0.25cfs for 40 minutes)

Sediment capture for the tests designed to simulate the design storage volume of the bioretention practice (600 cubic feet for Anoka) for the low intensity flow conditions is shown in Figure 51. In general, all pretreatment practices captured at least 95% of the coarse sediment fraction (D_{50} = 1.17mm) mass and the medium sediment fraction (D_{50} = 0.41mm) mass. The pretreatment practices also captured 65 – 80% of the fine sediment fraction (D_{50} = 0.12mm).

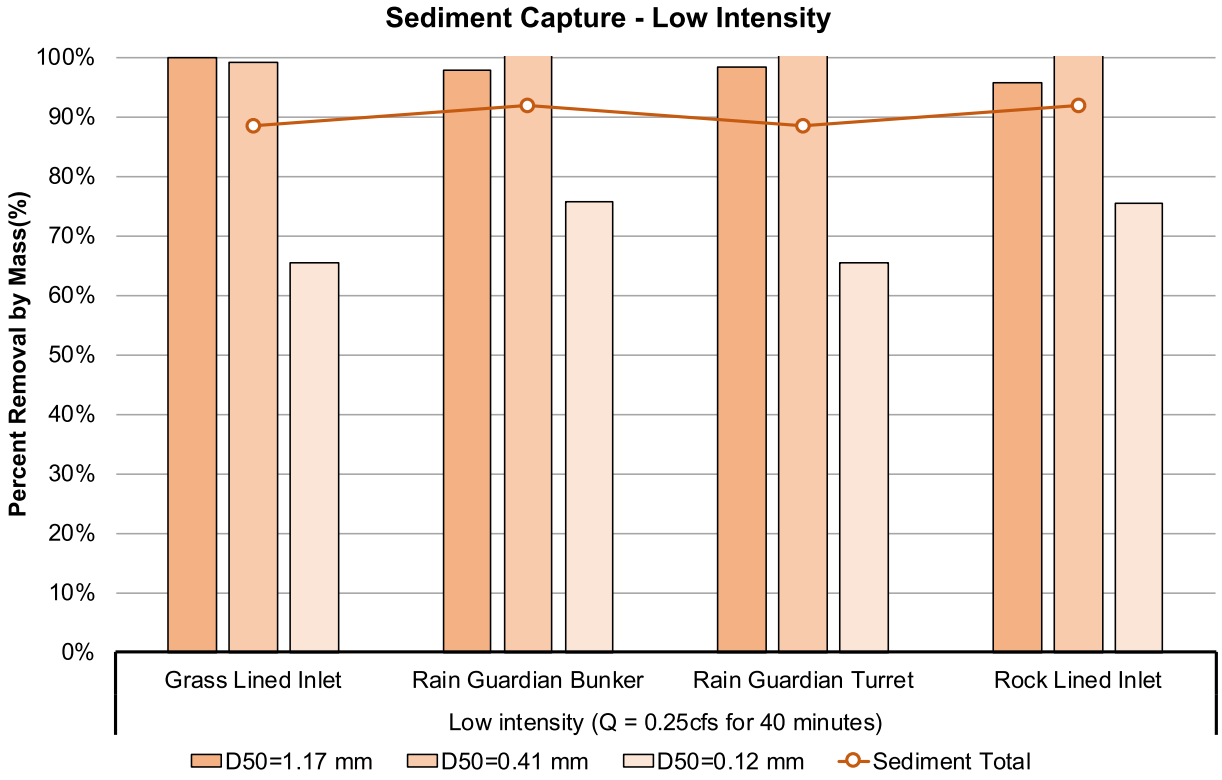


Figure 51: Sediment capture by percent for design volume low intensity tests (Q = 0.25cfs, duration = 40 minutes).

The purpose of pretreatment is to reduce the maintenance burden on primary treatment practices (i.e., bioretention) by capturing gross solids and 25% of the sediment > 100µm (MPCA 2017a). As shown in Figure 19, approximately 90% of the fine sediment fraction used in testing is between than 0.1mm (100 µm) and 0.2 mm. As shown in Figure 51, 65 – 80% of this fine sediment fraction was captured by all four pretreatment practices for low intensity tests. When all three sediment fractions are summed, 88 – 95% of the sediment mass was captured by the pretreatment practices.

Thus, these pretreatment practices exceed the goal set by the MPCA for these simulated flow conditions.

Due to the high velocity of the water, and short length and flexibility of the grass, it was unclear whether the GLI would be able to capture sediment effectively. As shown in Figure 51, over 90% of the total sediment was captured in the GLI for low intensity tests. This data was corroborated by visual observations of a significant accumulation of sediment on the grass during testing (Figure 52). This accumulation was most evident near the seam between sod sections, but sediment accumulation was observed throughout the GLI.



Figure 52. Sediment accumulation near the horizontal seam between sod sections in the GLI. Flow was right to left.

The Rain Guardian Bunker and Turret both captured approximately 90% of the test sediment, most of which was captured within the chamber of the devices (data in Appendix A). Some sediment was also captured on the surface grate in association with gross solids (primarily leaves), and some sediment was deposited downstream of the screen wall on the concrete base pad. The sediment downstream of the screen wall likely didn't flow through the screen, but rather flowed over the screen water during high water conditions and settled on the pad.

5.1.1.2 High intensity (Q = 0.50cfs for 20 minutes)

Sediment capture for the tests designed to simulate the design storage volume of the bioretention practice (600 cubic feet for Anoka) for high intensity flow conditions is shown in Figure 53. In general, all pretreatment practices captured at least 95% of the coarse sediment fraction (D_{50} = 1.17mm) mass and the medium sediment fraction (D_{50} = 0.41mm) mass, except for the grass lined inlet (GLI) which only captured 80% of the medium sediment fraction (D_{50} = 0.41mm). The pretreatment practices also captured 30 – 40% of the fine sediment fraction (D_{50} = 0.12mm).

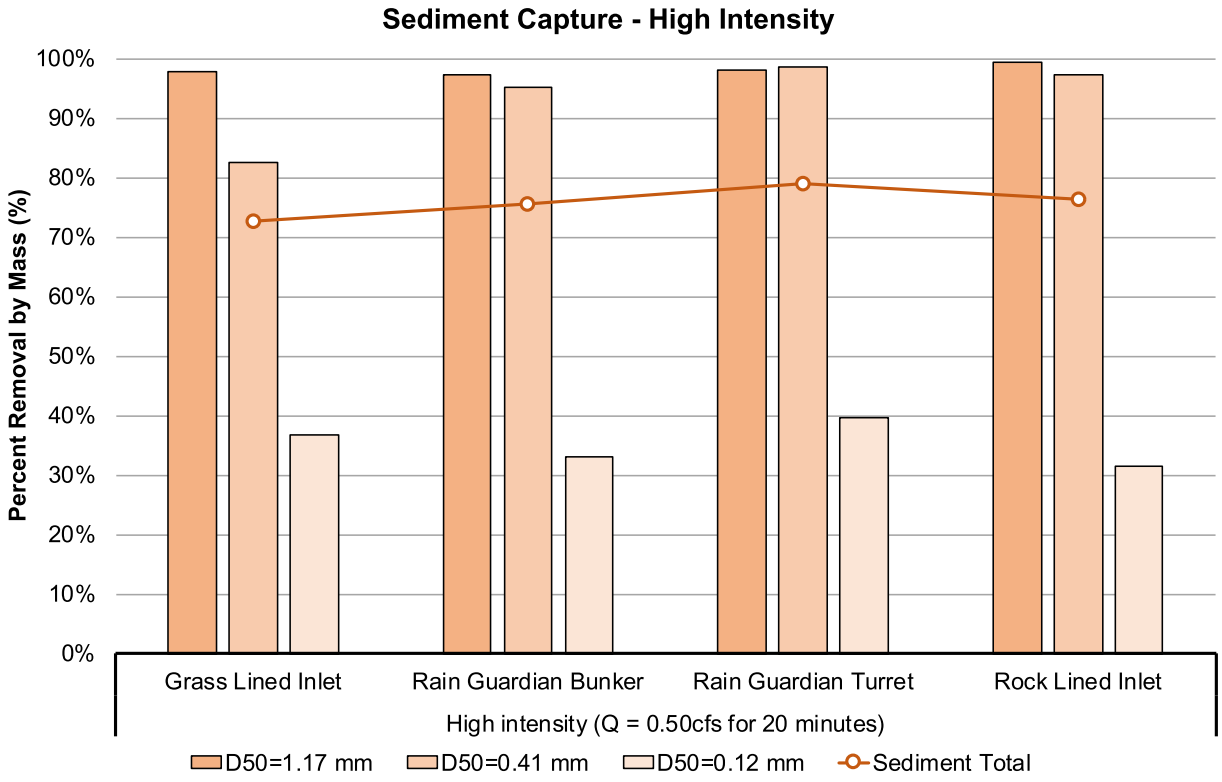


Figure 53: Sediment capture by percent for design volume high intensity tests (Q = 0.50cfs, duration = 20 minutes).

For all practices and all sediment fractions, less sediment was captured in the high intensity tests (Figure 53) compared to the low intensity tests (Figure 51). This is expected because higher flow creates more turbulence, more mixing, and shorter residence time within the pretreatment practice, and likely causes more overflow from the pretreatment practice into the primary practice (i.e., bioretention). All practices did, however, capture greater than 30% of the fine sediment fraction and at least 70% of the total sediment mass, which exceeds the goal of 25% capture of sediment > 100µm (MPCA 2017a).

5.1.2 Gross Solids Capture

5.1.2.1 Low Intensity (Q = 0.25cfs for 40 minutes)

Gross solids capture for the design volume low intensity test is shown in Figure 54. The RGB, RGT, and RLI captured over 98% of the mass of forks and leaves. The GLI, however, only captured 8% of the forks and 3% of the leaves. For the wood dowels, approximately 40% of the mass was captured by the GLI and the RGB; approximately 60% by the RGT; and over 80% captured by the RLI. Of the gross solids used in this testing, the wood dowels best represent floatables because they remained floating on the water surface throughout the duration of most tests. Overall, gross solids were captured at 20% (GLI), 80% (RGB), 85% (RGT), or 95% (RLI).

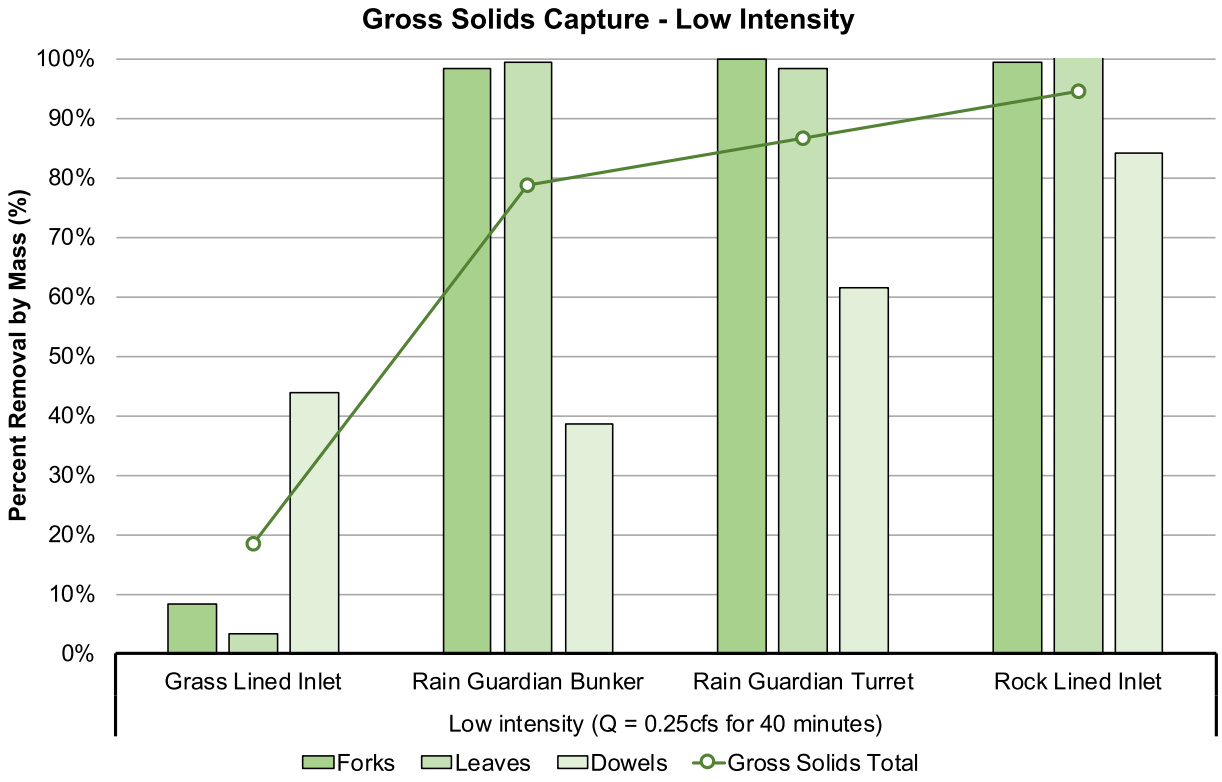


Figure 54: Gross solids capture by percent for design volume low intensity tests (Q = 0.25cfs, duration = 40 minutes).

While the GLI was shown to capture sediment (Figure 51 & Figure 53), it is evident from Figure 54 that GLIs are not effective at capturing gross solids. This is consistent with the design of GLIs in that there is no physical mechanism for gross solids to be captured. The short length and flexibility of lawn grass is not enough to capture and retain debris. While it appears from Figure 54 that the GLI captured over 40% of the wood dowels, field observations revealed that these dowels were floating on the water surface and deposited on the GLI as the water in the bioretention was drained (Figure 55). Without the corral, it is likely these dowels would have been dispersed throughout the bioretention and would not have been "captured" by the GLI.

The Rain Guardian Bunker and Turret captured 80% and 85% of the gross solids, respectively (Figure 54). Most of the gross solids were captured on the surface grate and nearly all of the remaining gross solids were captured within the chamber (data in Appendix A). A small fraction (2 – 4%) of gross solids were captured on the concrete pad downstream of the screen wall (data in Appendix A).



Figure 55: Capture of gross solids on grass lined inlet. Note wood dowels floating on water surface above the GLI near the downstream boundary with the corral. These dowels were deposited on the GLI during drawdown and counted as "captured."

5.1.2.2 High Intensity (Q = 0.50cfs for 20 minutes)

Gross solids capture by the pretreatment practices during the high intensity test is shown in Figure 56. The RGB and RGT captured over 95% of the forks, 55 – 75% of the leaves, and 30 – 45% of the dowels in high intensity tests. The RLI captured 80% of the forks, 25% of the leaves, and 65% of the dowels. The GLI captured 10% of the forks, less than 5% of the leaves, and 70% of the wood dowels. Overall, gross solids were captured at 30% (GLI), 60% (RGB and RLI), and 70% (RGT).

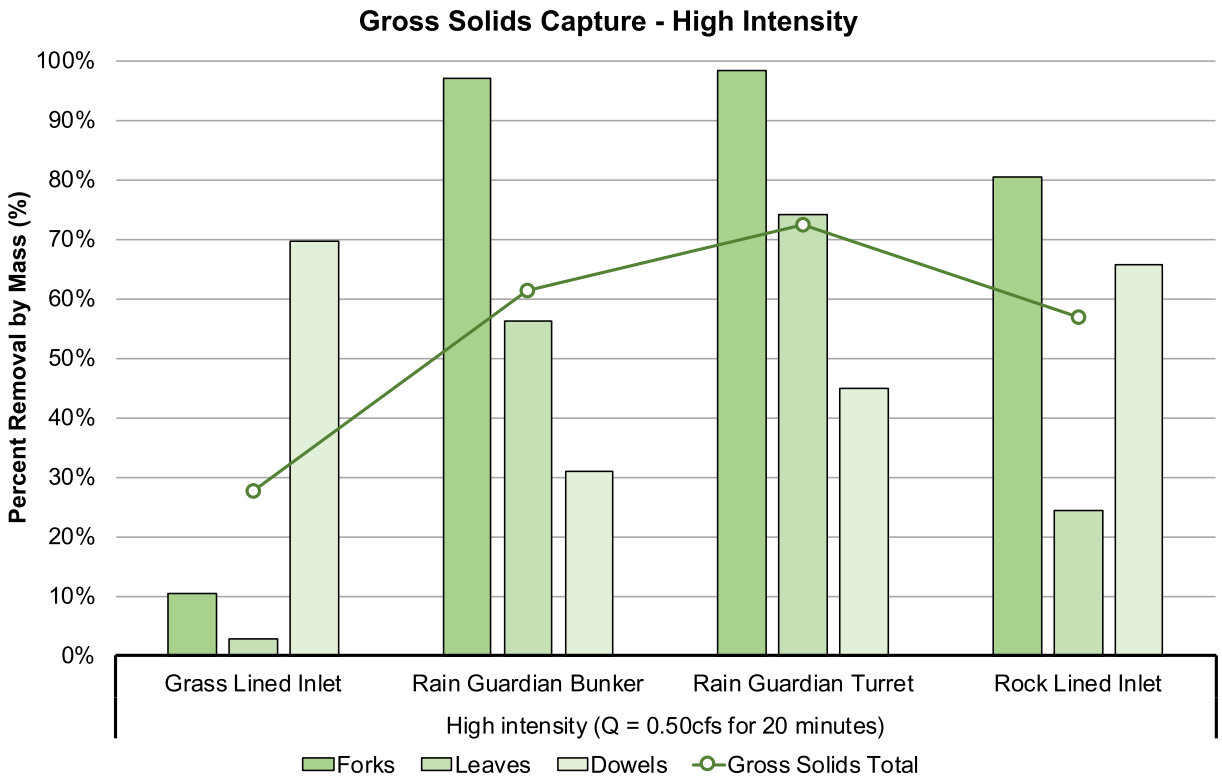


Figure 56: Gross solids capture by percent for design storage volume tests, Q = 0.50cfs, duration = 20 minutes.

In addition to the flow rate (and likely flow velocity), a primary difference between the low intensity and high intensity tests at the Anoka site (GLI, RGB, RGT, RLI) is the water depth within the bioretention cell, and subsequently the proportion of the pretreatment practice that was inundated by backwater. For the sloped practices (GLI, RLI), this meant that water, sediment, and gross solids that were carried into the practice by high velocity supercritical flow were intercepted by a standing pool at some point along the slope of the pretreatment practice. This point occurred near the bottom edge of the GLI and RLI for the low intensity tests, and near the upper edge during the high intensity tests. In other words, the GLI and RLI were mostly exposed during low intensity such that rocks and even some grass were emergent through the flow. Conversely, most of the rock and grass were fully submerged during high intensity flow. Thus, emergent rocks were able to intercept and capture gross solids during the low intensity tests but gross solids were carried further downstream during the high intensity tests, as shown in Figure 57. During the low intensity tests on the RLI, it was observed that the accumulation of gross solids (Figure 57) also created a “debris filter” that intercepted and captured sediment among the gross solids.

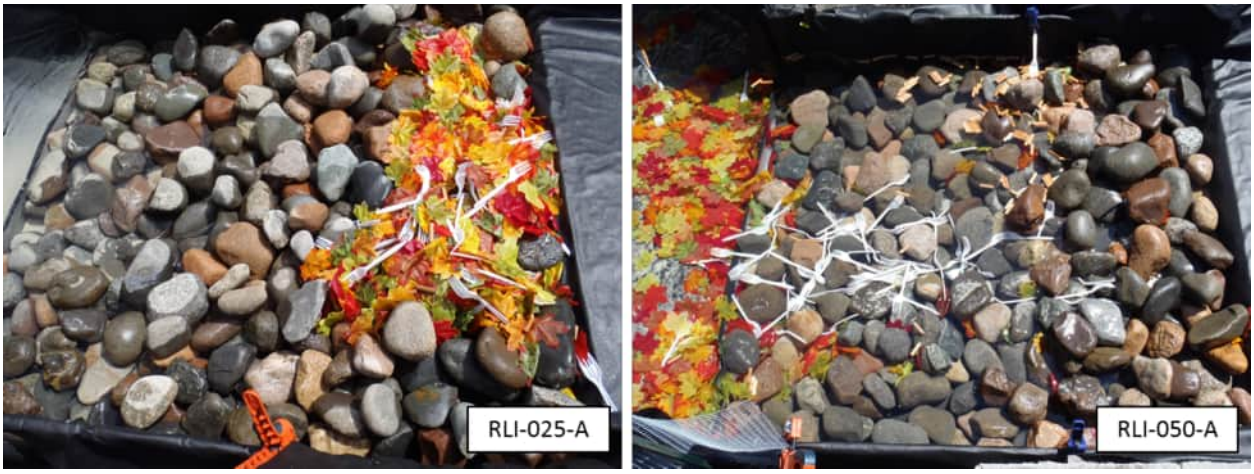


Figure 57. Rock lined inlet after testing at 0.25cfs for 40 minutes (left) and 0.50cfs for 20 minutes (right).

It was also observed during testing that sediment was deposited (likely by settling) in the RLI just downstream of the point of inundation, likely due to the energy dissipation caused by the pool. The effect of this inundation from backwater is further illustrated by the apparent increase in dowel capture by the GLI from the low intensity tests (45% dowel capture) to the high intensity tests (70% dowel capture). As previously discussed, dowels "captured" by the GLI were actually deposited on the GLI during the drawdown phase after the tests were complete, not as a result of the GLI physically retaining the dowels. Because more of the GLI was inundated by backwater during the high intensity tests, more dowels were deposited during drawdown.

During the high intensity tests, the Rain Guardian Bunker and Turret captured 60% and 70% gross solids, respectively. Similar to the low intensity tests, most of the gross solids were captured on the surface grate and nearly all of the remaining gross solids were captured within the chamber (data in Appendix A).

5.2 BLOOMINGTON SITE: IN-LINE SHALLOW SUMP GRIT CHAMBER

A primary difference between the Anoka and Bloomington field sites is the size of the primary treatment, the bioretention practice. In Anoka, the bioretention practice could hold approximately 600 cubic feet of runoff, whereas the bioretention in Bloomington could hold approximately 119 cubic feet of runoff. Thus, the Bloomington bioretention required a lesser flow rate (Q = 0.06cfs, duration = 30 minutes for low intensity; Q = 0.12cfs, duration = 15 minutes for high intensity) to allow for tests with a similar test duration as Anoka. Subsequently, less sediment and gross solid mass were used so that the solids concentration was similar between tests. Though every effort was made to create field tests that would be comparable between the different sites, the results from Anoka are not directly comparable to the results from Bloomington.

Field testing in Bloomington included additional tests beyond the design volume, inducing bypass of the pretreatment practice. Because the shallow sump grit chamber installed in Bloomington is constructed in-line, it is expected that performance will be affected under bypass conditions because turbulence could resuspend previously captured sediment and gross solids, allowing them to exit the pretreatment chamber and be delivered downstream. By contrast, the sites in Anoka were all designed as off-line systems such that if the flow volume exceeded the design volume,

then excess water, sediment, and gross solids would simply pass by the pretreatment and bioretention without interacting with previously captured sediment or gross solids, which is an advantage of the off-line design.

Sediment capture by the shallow sump grit chamber for the design volume tests and the bypass tests is shown in Figure 58. For the design volume tests ((a) and (b) in Figure 58), the overall sediment capture decreases from 95% to 90% primarily because fine sediment (D_{50} = 0.12mm) capture decreases from 80% to 65%. As previously discussed, this is not surprising because as the intensity increases the residence time decreases and thus more sediment is carried through the pretreatment practice into the bioretention. From test (b) to (c), the flow rate remains the same, but the duration is doubled to allow in-line bypass of the pretreatment practice to occur. As noted in Figure 58, bypass began at 15 minutes after the test began and continued through the full duration (40 minutes). The performance is nearly identical between the design volume test (b) and the bypass test (c) at the same flow rate. Thus, in-line bypass of the pretreatment practice at this flow rate does not appear to affect sediment capture performance.

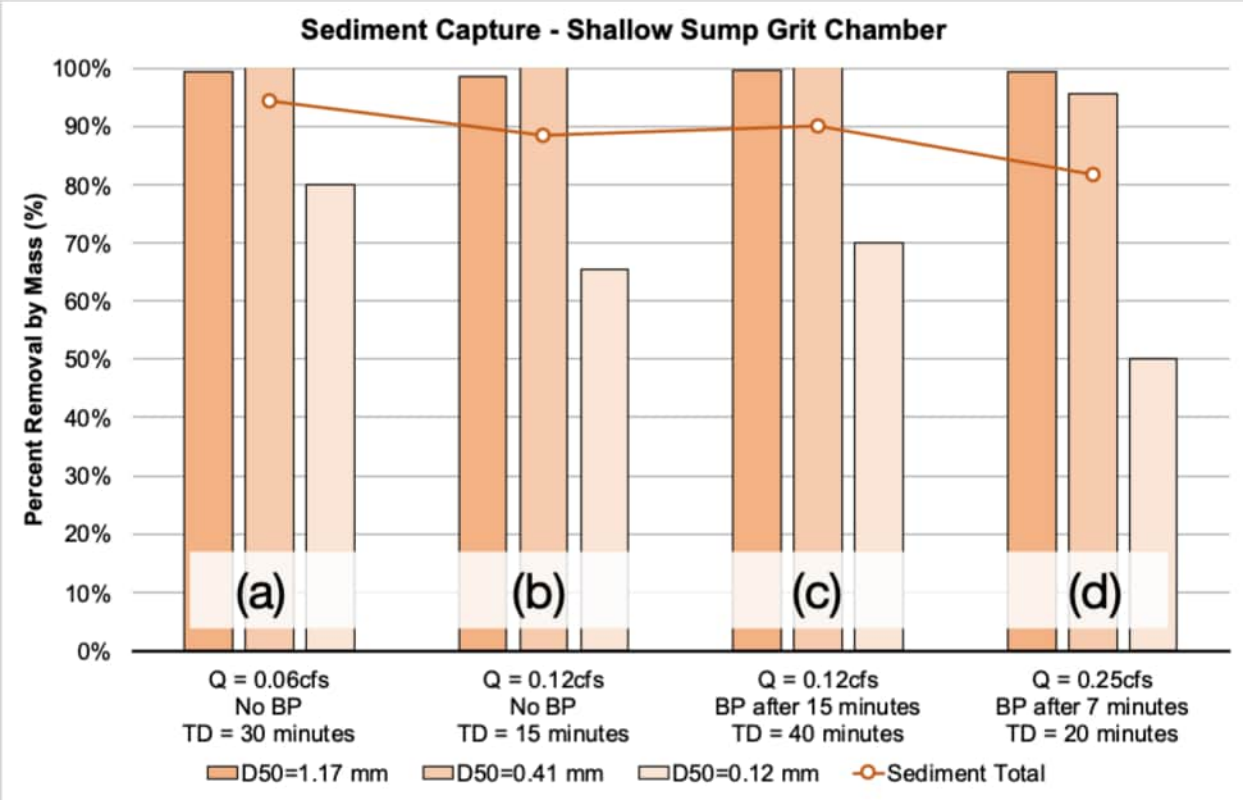


Figure 58: Sediment capture by the shallow sump grit chamber for two design volume tests (a) Q = 0.06cfs for 30 minutes and (b) Q = 0.12cfs for 15 minutes; and two bypass tests (c) Q = 0.12cfs for 40 minutes and (d) Q = 0.25cfs for 20 minutes. BP = Bypass; TD = Total Duration.

The increase in intensity from (c) to (d) resulted in a decrease in performance from 90% overall sediment capture to 80%, which can be associated with a decrease in medium sediment (D_{50} = 0.41mm) capture (100% to 95%) and fine sediment (D_{50} = 0.12mm) capture (70% to 50%). This was expected due to a reduction in residence time within the pretreatment practice and an increase in turbulence which could resuspend previously captured sediment.

Approximately 75% of fine sediment (D_{50} = 0.12mm) was either captured in the shallow sump grit chamber or not fed for the design volume and bypass tests for the same flow rate (Q = 0.12cfs) while 25% was either delivered to the bioretention or bypassed the in-line shallow sump grit chamber in the bypass test (10%), as shown in Figure 59. In the test of the shallow sump grit chamber with the highest flow rate (Q = 0.25cfs), approximately 16% of the fine sediment bypassed the in-line chamber.

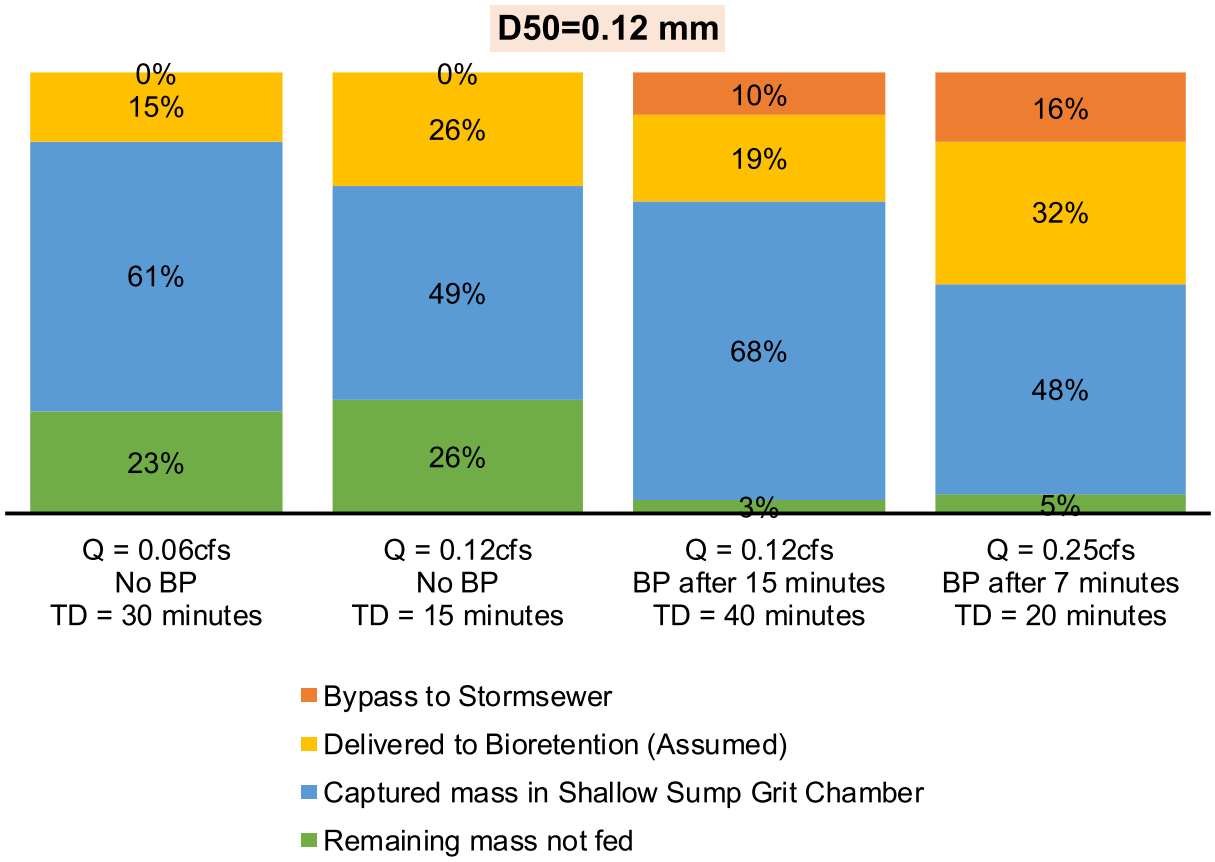


Figure 59: Fine sediment (D_{50} = 0.12mm) capture and bypass by the shallow sump grit chamber for four tests.

Gross solids capture by the shallow sump grit chamber for the design volume tests and the bypass tests is shown in Figure 60. The decrease in gross solids capture between the low and high intensity design volume tests ((a) and (b) in Figure 60) is expected due to the increase in mixing and decrease in residence time within the shallow sump grit chamber, resulting in export of gross solids from the pretreatment and into the bioretention. Capture performance for forks remained nearly the same, but leaf capture decreased from 90% to 65% and dowel capture decreased from 55% to 45%. Inducing bypass in the shallow sump grit chamber by increasing the duration but maintaining the same flow ((b) to (c)) resulted in a decrease of gross solids capture from 70% to 60%, primarily because dowel capture decreased from 45% capture in the design volume test (no bypass) to 15% in the bypass test (Figure 60). When the intensity of the bypass test was increased (test (c) to (d)), gross solids captured decreased again from 60% overall capture to below 40% capture due to reduction in capture efficiency for all three gross solids types.

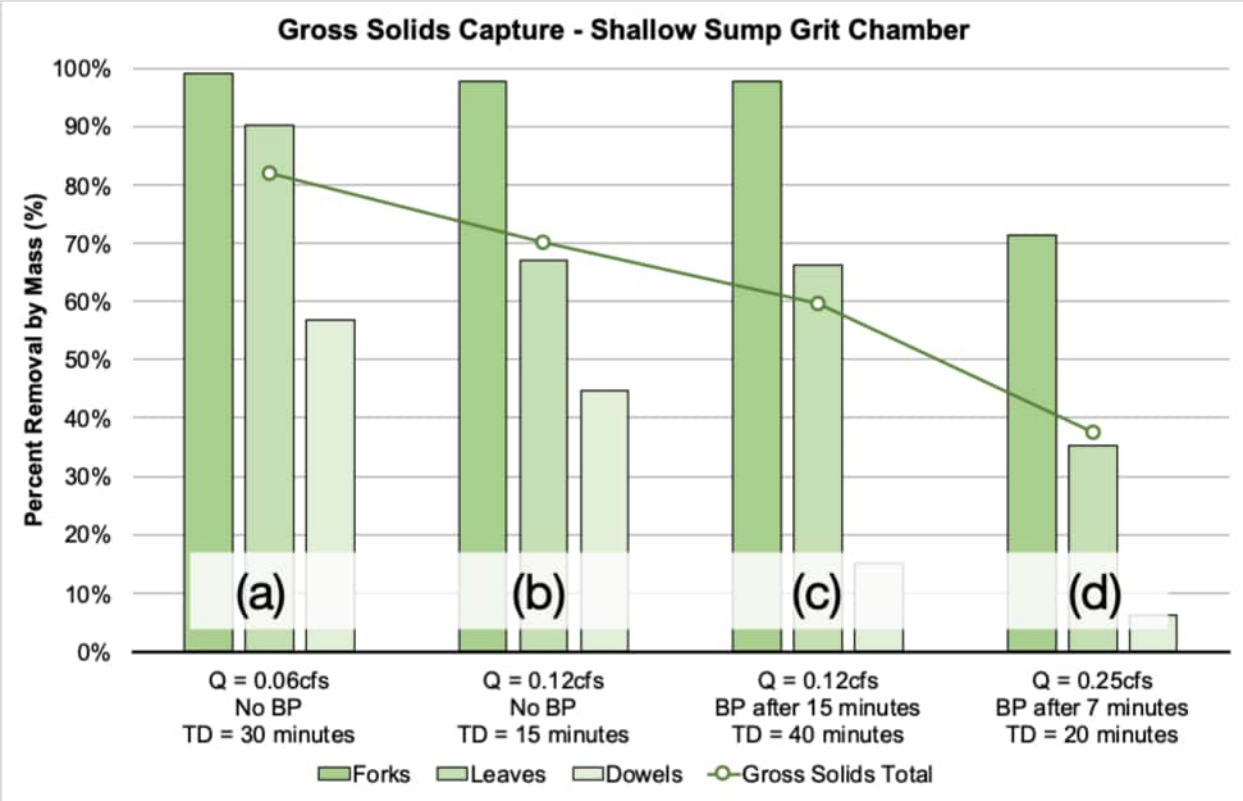


Figure 60: Gross solids by the shallow sump grit chamber for two design volume tests* (a) *Q = 0.06cfs for 30 minutes and* (b) *Q = 0.12cfs for 15 minutes; and two bypass tests* (c) *Q = 0.12cfs for 40 minutes and* (d) *Q = 0.25cfs for 20 minutes. BP = Bypass; TD = Total Duration.

Approximately 66-67% of the leaves were captured in the shallow sump grit chamber during the design volume and bypass tests for the same flow rate (Q = 0.12cfs), as shown in Figure 61. Of the remaining 33-34% of leaves that was untreated, 21% bypassed the in-line shallow sump grit chamber in the bypass test. The amount that bypassed increased to 74% for wooden dowels (data not shown) because there is no mechanism within the in-line shallow sump grit chamber to capture floatables. Thus most of the dowels flowed over the top of the grate when the water level was above the grate elevation.

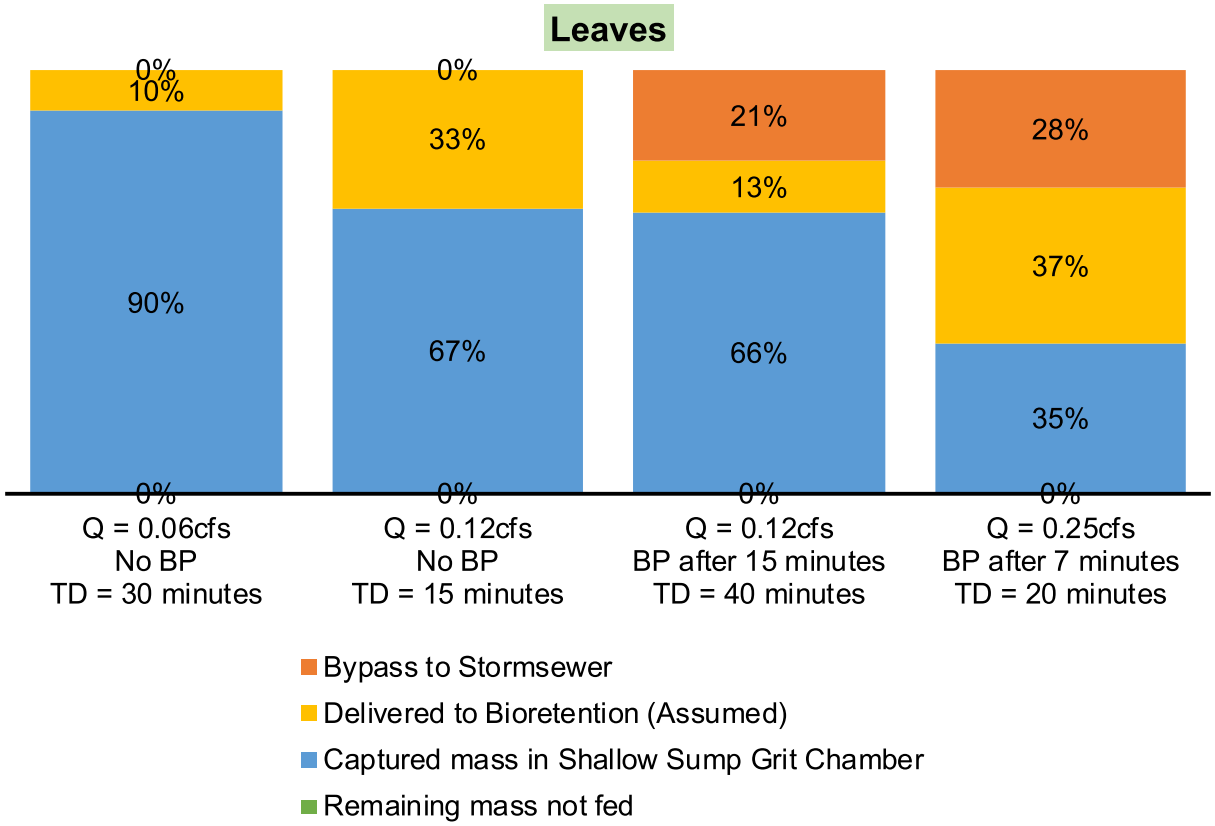


Figure 61: Leaves capture and bypass by the shallow sump grit chamber for four tests.

5.3 ERROR AND UNCERTAINTY

The nature of field testing is such that not all components or uncertainty can be measured. For this project, the sediment that was delivered to the bioretention was only quantified for tests of the GLI. However, the sediment that was captured on the GLI was not quantified, and thus a mass balance could not be completed. For all other tests, the sediment delivered to the bioretention was not quantified, and thus a mass balance could not be completed. For gross solids, the use of the corral and collection of gross solids from all locations allowed for a mass balance to be completed for some tests. Mass balance errors for gross solids were less than 5%.

In addition, precision was quantified using the relative percent difference (RPD) calculation as described above. The RPD was calculated for all tests in which two replicate tests were conducted (see Table 2). The average RPD for these ten pairs of replicates are reported for each sediment fraction and gross solids type used in testing, as shown in Table 6.

Table 6: Average Relative Percent Difference (RPD) for sediment and gross solids tests (n = 10).

	Initial Mass added to Pretreatment	Captured Mass in Pretreatment	Percent Removal
D50=1.17 mm	2.9%	3.2%	1.4%
D50=0.41 mm	2.4%	5.0%	2.8%
D50=0.12 mm	2.6%	20.4%	19.0%
Sediment Total =	2.4%	5.9%	4.6%
Forks	0.6%	22.7%	22.8%
Leaves	0.1%	24.5%	24.5%
Dowels	0.3%	26.0%	26.1%
Gross Solids Total =	0.2%	10.5%	10.4%
Sediment + Gross Solids =	1.9%	4.5%	3.6%

5.4 MAINTENANCE CONSIDERATIONS

This project was limited by time and funding to measure the sediment and gross solids capture performance of five pretreatment practices for bioretention, each at two flow intensities and two replicates for each test. To provide an adequate comparison between practices, each practice was freshly installed and cleaned prior to every test and replicate. Thus, the accumulation of sediment and gross solids from multiple sequential tests was not measured as part of this project. Further research is needed to determine the recommended maintenance frequency based on performance. However, the following observations can be made from the testing that was conducted.

5.4.1 Grass Lined Inlet (GLI)

The GLI did not capture gross solids, so maintenance to remove gross solids from the pretreatment is expected to be minimal. These gross solids are expected to accumulate within the bioretention practice, however, and maintenance would be necessary to remove them. The GLI collected a substantial amount of sediment during the tests. It is expected that this sediment would continue to accumulate, effectively increasing the soil elevation wherever sediment is deposited. If the GLI is mowed as part of maintenance, the grass height will be determined by the soil elevation, and thus the GLI is expected to increase in elevation over time as sediment accumulates. The amount of sediment that was accumulated was approximately equal to ½ of the grass height. Thus, it is possible that only a few storms could "fill" the capacity of the GLI. This phenomenon has been observed by stormwater professionals, resulting in a common design practice of including a 2 to 4-inch drop in elevation from the back of curb to the top of the GLI to allow for sediment accumulation. To maintain a GLI, the grass, sediment, and likely the topsoil will need to be removed and replaced to restore the GLI to the original design elevation. This level of maintenance is effectively the same cost as constructing a brand new GLI. Of the pretreatment practices tested in this study, the GLI is likely among the most difficult and costly to maintain.

5.4.2 Rain Garden Bunker (RGB)

The RGB collected sediment and gross solids in all tests. Collecting the sediment and gross solids to calculate performance was similar to the maintenance recommendations for the RGB, though the

test sediment and gross solids were carefully collected for quantification. The accumulation of sediment and gross solids within the RGB was minimal compared to the storage capacity. Also, the chamber and screen wall design of the RGB suggest that gross solids and sediment would be protected from resuspension during high intensity flow conditions, though data to support this was not collected as part of this study.

Access to the sediment and gross solids within the RGB was simple, and accumulation of sediment and gross solids with the RGB is easily visible from the road. This is an advantage because visual inspection of the RGB is quick and could be completed by homeowners, or by staff from a vehicle. In addition, the permeable screen wall allows stored water to filter out of the bunker when runoff ceases, resulting in a dry chamber between runoff events. This prevents mosquito breeding and obnoxious odors and allows the bunker to be cleaned with a shovel by homeowners or minimally trained staff.

It is anticipated that the RGB could collect and store several storms of sediment and gross solids before maintenance is needed, though it is impossible to predict from this project how frequently maintenance will be needed and the capture performance as sediment and gross solids accumulate. Of the pretreatment practices tested in this study, the RGB is likely among the easiest to maintain.

5.4.3 Rain Garden Turret (RGT)

Similar to the RGB, the RGT collected sediment and gross solids in all tests. Collecting the sediment and gross solids to calculate performance was similar to the maintenance recommendations for the RGT, though the test sediment and gross solids were carefully collected for quantification. The accumulation of sediment and gross solids within the RGT was minimal compared to the storage capacity. Also, the chamber and screen wall design of the RGT suggest that gross solids and sediment would be protected from resuspension during high intensity runoff events, though data to support this was not collected as part of this study.

Access to the sediment and gross solids was not as simple as the RGB because the top grates of the RGT used during testing were larger and heavier than those of the RGB. Since testing, the grates used on the RGT have been replaced with fiberglass grates that are substantially less weight. Thus maintenance of the RGT is expected to be at least as simple as the RGB. Accumulation of sediment and gross solids with the RGT is easily visible from the road. This is an advantage because visual inspection of the RGT is quick and could be completed by homeowners, or by staff from a vehicle. In addition, the permeable screen wall allows stored water to filter out of the turret when runoff ceases, resulting in a dry chamber between runoff events. This prevents mosquito breeding and obnoxious odors and allows the turret to be cleaned with a shovel by homeowners or minimally trained staff.

It is anticipated that the RGT could collect and store several storms of sediment and gross solids before maintenance is needed, though it is impossible to predict from this project how frequently maintenance will be needed and the capture performance as sediment and gross solids accumulate. Of the pretreatment practices tested in this study, the RGT is likely among the easiest to maintain.

5.4.4 Rock Lined Inlet (RLI)

The RLI captured sediment and gross solids in all tests, though fewer gross solids were captured in the high intensity test. It was apparent from the field tests that the RLI does not have much capacity

to store captured gross solids (see Figure 62), though sediment could accumulate in the large pore spaces between the individual rocks (see Figure 63).



Figure 62. Rock lined inlet after testing at 0.25 cfs for 40 minutes (left) and 0.50 cfs for 20 minutes (right).



Figure 63. Sediment remaining on geotextile when rocks were removed from RLI.

Sediment that is collected within the pore spaces of the RLI may be protected from high intensity storms, but the storage capacity within the pores is minimal and may become filled within a few storms. In addition, it is expected that gross solids that may be captured during low intensity storms would become mobilized and potentially washed out of the RLI during high intensity runoff events. There is no mechanism to protect collected gross solids.

Maintenance of the RLI consists of removing the rocks and either washing them onsite or installing new washed rocks as replacement. In addition, sediment and gross solids that may have accumulated within the RLI need to be removed. During testing, the rocks needed to be washed and the geotextile fabric beneath the rocks needed to be cleaned so that all the captured sediment

could be quantified. Field maintenance of a RLI is anticipated to be similarly time and labor intensive. This level of maintenance is effectively the same cost as constructing a brand new RLI. Of the pretreatment practices tested in this study, the RLI is likely among the most difficult and costly to maintain.

5.4.5 Shallow Sump Grit Chamber (BDV and BBP)

The shallow sump grit chamber collected sediment and gross solids in all tests, including tests in which bypass was induced (though not as well). Collecting the sediment and gross solids to calculate performance was similar to the maintenance procedures for the shallow sump, though the test sediment and gross solids were carefully collected for quantification. The accumulation of sediment and gross solids within the shallow sump was minimal compared to the storage capacity. Though the shallow sump is relatively similar in dimension to the RGB, sediment and gross solids collected in the shallow sump are less protected compared to the off-line design of the RGB because the shallow sump is installed in-line with the gutter. Bypass tests were not conducted on both devices, so a quantitative comparison of bypass conditions cannot be made. During bypass testing of the shallow sump, however, sediment was captured while gross solids were released and delivered downstream.

Access to the sediment and gross solids within the shallow sump was simple, though the shallow sump is not easily visible from the surface and could be easily missed or forgotten. Visual inspection therefore requires access to the sump, likely removal of the surface grate, and inspection of the accumulated sediment. In addition, the saturated nature of the sump makes visual observation of the sediment depth challenging. It is possible that sediment depth could be measured with a staff gauge through the slots in the grate, though this method may be inaccurate. It is anticipated that the shallow sump could collect and store several storms of sediment and gross solids before maintenance is needed, though it is impossible to predict from this project how frequently maintenance will be needed and the capture performance as sediment and gross solids accumulate. Of the pretreatment practices tested in this study, the shallow sump is likely to be moderately easy to maintain.

CHAPTER 6: CONCLUSIONS

Though little guidance is available for pretreatment practices, many are installed throughout our urban landscapes because they are required as part of installation for many primary treatment practices. A benchmark for performance is set forth by the Minnesota Pollution Control Agency: capture of gross solids and 25% of sediment greater than 100µm. Five pretreatment practices for bioretention were assessed for sediment and gross solids capture by field testing at the design storage volume and two different intensities. Three sediment sizes, a coarse sediment (D_{50} = 1.17mm), a medium sediment (D_{50} = 0.41mm), and a fine sediment (D_{50} = 0.12mm) and three types of gross solids (plastic forks, synthetic leaves, and wood dowels) were added throughout the duration of each test.

All five pretreatment practices captured greater than 88% of the total sediment and greater than 65% of the fine sediment fraction (D_{50} = 0.12mm) in the low intensity tests (design volume filled in 40 minutes). During the high intensity tests (design volume filled in 20 minutes), all practices captured greater than 70% of the total sediment mass and greater than 30% of the fine sediment fraction, which exceeds the criterion of 25% of sediment greater than 100µm. Thus, all five pretreatment practices were able to achieve the goal when tested from a clean initial condition. The performance and maintenance needed for long-term operation of these pretreatment practices was not measured in this project.

Four of the five pretreatment practices captured 75% of the gross solids during low intensity tests and more than 55% of the gross solids during high intensity tests. The grass lined inlet captured the least gross solids; 20% during low intensity and 30% during high intensity. Inundation of the grass lined inlet during the high intensity tests resulted in floating wood dowels being deposited on the grass lined inlet surface after the test was complete. Though these are reported as “capture” as part of this study, these would likely not be captured during actual operation of a grass lined inlet.

Additional design volume and bypass tests were conducted on an in-line shallow sump grit chamber to determine if resuspension of sediment and gross solids could be measured. During these tests, overall sediment captured decreased from 95% during low intensity design volume tests down to 80% capture during high intensity bypass tests. Gross solids capture decreased from greater than 80% to below 40%. Thus, bypass at these flow rates had minimal effect on the sediment, but measurable effect on the gross solids performance.

Though at least four of the five pretreatment practices performed similarly in terms of sediment and gross solids capture, only three out of the five appear to be simple to inspect and maintain. When maintenance is required, the grass lined inlet and rock lined inlet likely require the same amount of effort and cost to maintain them as would be needed to install them (i.e., initial construction cost = maintenance cost). The grass lined inlet and rock lined inlet are likely among the most difficult and costly to maintain.

To maintain the Rain Guardian Bunker, Rain Guardian Turret, and shallow sump grit chamber, one would need to remove the top grate and either shovel or hydro-vac the collected sediment and gross solids from within the collection chamber. The Bunker and Turret are both easily visible from the street and the permeable screen wall in the bunker and the turret allows for a dry chamber between runoff events. The shallow sump grit chamber is hidden underground, which makes assessing sediment accumulation depth more challenging. Of the pretreatment practices tested in this study, the Bunker and Turret are likely among the easiest to maintain, and the shallow sump grit chamber is likely to be moderately easy to maintain.

CHAPTER 7: LESSONS LEARNED & FUTURE RESEARCH

Though the authors have conducted field testing prior to this study, the uniqueness of the practices (pretreatment for bioretention) and site conditions produced many unknowns and several lessons were learned through the field-testing process. The primary lesson learned is that compared to field testing, laboratory testing can be more accurate, more cost-effective, and a better method for comparing multiple practices side-by-side under identical conditions. Below are several reasons to support this observation:

- **Laboratory testing is not weather dependent:** field testing can only be conducted during dry-weather conditions, with an antecedent dry period prior to testing. Several opportunities for testing were lost, and results delayed due to poor weather conditions. Laboratory testing could have been completed on consecutive days, regardless of weather or season.
- **Field testing requires more pre-test preparation and post-test cleanup:** Field testing required gathering, loading, transporting, and deploying numerous pieces of equipment prior to any tests being conducted. In addition, the site needed to be prepared and cleaned prior to testing. After testing was complete, the site had to be restored to operating condition and all equipment had to be gathered, loaded, transported back to and stored at St. Anthony Falls Laboratory. The amount of time necessary for pre-test prep and post-test cleanup for field testing is equivalent to at least one additional test per test day.
- **Laboratory testing is more accurate:** Testing in the laboratory can be controlled more accurately than field testing. Water flow rate, volume, water level control, sediment and gross solid application, and sediment and gross solid collection are all more consistent and more accurate from test-to-test and device to device with laboratory testing. One key benefit of laboratory testing for this type of project is that every component of the water and pollutant mass balance can be measured effectively, accurately, and efficiently. Thus, error can be accurately assessed and reported with all measurements.
- **Laboratory testing is a more direct comparison:** Laboratory testing allows for different devices to be tested under identical conditions with the ability to conduct multiple test replicates. In addition to identical input conditions, laboratory testing allows for scaling of devices so that each device is the appropriate size in comparison to other devices.
- **Laboratory testing is more robust:** Laboratory testing is rarely limited by water supply, sediment feed rate, or gross solids application. Laboratory testing for pretreatment practices could be conducted with any number of storm events up to and exceeding the 100-year event. In addition, laboratory testing can be conducted to simulate infiltration and backwater conditions to exactly mimic field conditions but are more consistent and repeatable between tests and devices compared to field testing.
- **Laboratory testing is more efficient:** Typically in laboratory testing all the equipment is on-hand, all staff and personnel are on-site, and the analytical facilities are in-house. Thus, conducting experiments, repeating replicates, analyzing samples, and changing test conditions are all more time- and cost-efficient.

There are several specific observations from this project that may improve future field or laboratory testing of pretreatment practices:

- The gas powered three-inch semi-trash pump that was used to drain the basin was difficult to regulate because of its size, constant need to be adjusted, and intermittent flow operation for the basin that was studied.
- During testing of the grass lined inlet, grass blades and very fine soil particles made processing solids samples challenging. Pre-rinsing removed most of these organics, but

they could not be eliminated. Synthetic grass may have been more manageable, repeatable, and easier to clean.
- For the grass lined inlet and rock lined inlet testing, processing the geotextile and associated sediment and gross solids was time-consuming and challenging. It required removing, re-setting, and processing and required more labor than processing the samples from other practices.
- For the grass lined inlet testing, sediment built up near the centerline and along the seam of the sod. If the test were repeated without cleanout or replacing the sod, the settling patterns would likely be different as the capacity is filled. Between storms, roots may grow up into the deposited sediment, changing the shape of the inlet as well.
- For the rock lined inlet testing, sediment (coarse and medium) accumulated under and around the rocks. If multiple tests were performed sequentially without cleanout, the space under and between rocks would fill quickly.
- For the bypass testing, pre-cleaning and collecting sediment from the gutter, and setting up, sealing, and removing the geotextile basket in the downstream catch basin added significantly to the time required to run a test. These tests required approximately twice as much time as the other tests.

These lessons learned inform future research about field testing, laboratory testing, and pretreatment practices. While this project produced a quantitative performance comparison of pretreatment practices for bioretention, there are several other questions about the performance and maintenance of pretreatment practices that still need to be addressed, potentially as future research:

- **How frequently should pretreatment practices be maintained?** It was clear that all five pretreatment practices in this study captured sediment and gross solids. How quickly these practices fill with sediment and solids, or how performance is affected by accumulated sediment and gross solids was not measured. Thus, the optimal frequency of maintenance is still unknown. A study using several sequential “storms” could be used to determine when maintenance is most cost-effective for each practice.
- **How should pretreatment practices be designed or sized?** This study showed that all five pretreatment practices captured more than 30% of sediment greater than 100µm, but it did not determine if the sizing and design of these practices is optimal. Often, pretreatment practices are “sized” based on the space available or are a one-size-fits-all device. With an understanding of treatment mechanisms and performance, a study on various sizes and aspect ratios for several different pretreatment practices could determine optimal sizing criteria that would balance cost, storage capacity for sediment and gross solids, and maintenance frequency.
- **How do other pretreatment practices compare?** These five pretreatment practices are just a few of the most common practices in Minnesota, but there are others here and from other parts of the world. A study to compare the short and long-term performance of these various pretreatment practices could provide a robust pretreatment toolbox for stormwater professionals to use.
- **Are pretreatment practices cost-effective?** A common assumption is that pretreatment practices reduce the overall life-cycle costs of stormwater treatment practices by simplifying maintenance and reducing the maintenance needed in primary treatment practices (e.g., bioretention). While this study has shown that pretreatment practices are effective at capturing sediment and gross solids, it is unclear how the long-term life-cycle costs of maintaining pretreatment practices compares to the life-cycle costs of maintaining primary treatment practices. In addition, it is unknown how the use of pretreatment practices actually reduces the maintenance of primary treatment practices. For example, a

small pretreatment chamber that is effective at capturing sediment and gross solids may need more frequent maintenance. A study is needed to compare the estimated costs of maintaining primary treatment practices against the estimated costs of maintaining pretreatment practices in combination with primary treatment practices.

CHAPTER 8: REFERENCES

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CHAPTER 9: APPENDIX

9.1 PROCEDURE

Prep at lab

1. Pre-weigh, package, and label dry sediment and gross solids
2. Set and record sediment feeder rate
3. Ready supplies and tools and load into truck

Setup in field

1. Set up meter and hose. For the first run, find the valve setting (number of turns) to get the target flow rate.
2. Place flow distributor and break tank.
3. Set up generator and sediment feeder, fuel and test.
4. Place pre-weighed sediment in feeder, feed sediment to the tube end, set feed rate, and cover feeder, check feed rate if needed.
5. Place gross solids in clean water 5-gallon bucket to hydrate.
6. Prepare notebook, camera, video camera
7. Set up staff gauge(s)
8. Set up drain sump, pump intake, and discharge to storm drain.
9. Clean pretreatment entrance
10. For the first run of the day, run total volume of clear water to saturate the bioretention basin. (A flushing run was used after each new sod installation for the grass lined inlet).

Test Run

1. Record time when water flow begins
2. Record time when sediment begins (feeder on)
3. Feed sediment at determined rate
4. Feed gross solids by hand from bucket, approximately paced
5. Periodically check flow rate and adjust if needed
6. Periodically record depth on staff gauge
7. Take photos and/or video
8. Stop sediment feed and water at volume target (600 cubic feet in Anoka), OR maximum water level (bypass level) reached. Record time.

Cleanup in field

1. Possible sediment locations are Not Fed (in feeder or bucket or transition area between feeder and basin), Pretreatment Area (captured), Beyond Pretreatment (passed, not captured).
2. Label all collected material with date, run number, collector's initials
3. Collect floating gross solids if they are likely to move
4. Drain or pump out rain garden at a rate low enough so that materials do not move from the pretreatment device.
5. Collect accessible gross solids by hand, into clean storage container. Label storage container or bag with date, time, run number, or other identifying information.

6. Collect accessible sediment with a scoop, rinse through screen to capture gross solids, place sediment into container.
7. Use wet-dry vac with rinse water from a hose or sprayer to clean up remaining sediment, rinse vac through screen into container
8. Decant clear water from sediment storage container by tipping to side over a #325 sieve, being very careful not to lose any sediment grains.
9. Prepare for next test or restore pretreatment and bioretention basin.

Processing at lab

1. Carefully rinse off and collect sand from gross solids, geotextiles, bags, buckets, etc.
2. Maintain labeling through process – keep Not Fed separate from Captured in pretreatment separate from Passing
3. Transfer sediment to drying pans, place in oven overnight
4. Place screens with gross solids in oven overnight
5. Weigh gross solids batch
6. Separate and weigh gross solids components
7. Weigh sediment batch
8. Sieve and weigh sediment components
9. Label and store sediment for further analysis or discard

9.2 TEST DATA

Table 7: Raw flow, volume, and water depth data from field testing.

Designation	Date	Start Time	[1]Sediment Feed Duration (minutes)	[2]Pre-flush + Flowrate Adjustment (ft^3)	Total Volume (ft^3)	Average Flowrate (cfs)	[3,4]Estimated Maximum Water Depth (nearest 5mm)
GLI-025-A	6/12/18	11:21	39.57	364.2	599.6	0.253	140
GLI-025-B	6/15/18	11:25	39.97	322.4	600.0	0.250	140
GLI-050-A	6/12/18	13:57	20.10	339.9	601.0	0.498	180
GLI-050-B	6/15/18	9:29	20.18	346.0	600.6	0.496	200
RGB-025-A	6/29/18	9:58	39.45	323.0	600.5	0.254	175
RGB-025-B	7/16/18	12:09	40.03	39.7	600.0	0.250	180
RGB-050-A	6/29/18	11:56	20.97	36.2	601.1	0.478	245
RGB-050-B	6/29/18	13:41	19.72	56.9	581.5	0.492	255
RGT-025-A	7/10/18	12:45	39.27	38.9	599.5	0.254	200
RGT-025-B	7/16/18	10:04	39.45	339.7	600.3	0.254	215
RGT-050-A	7/10/18	11:02	20.22	400.7	601.1	0.496	230
RGT-050-B	7/10/18	14:27	20.70	70.5	600.4	0.483	265
RLI-025-A	5/31/18	11:37	40.33	1.5	609.2	0.252	no data
RLI-025-B	6/4/18	13:31	39.40	41.1	604.3	0.256	205
RLI-050-A	6/4/18	9:36	20.80	404.5	601.0	0.482	240
RLI-050-B	6/4/18	11:40	20.10	203.0	600.9	0.498	290
BDV-006-A	10/23/18	14:09	28.51	362.6	108.2	0.063	305
BDV-006-B	10/24/18	9:34	30.73	175.2	115.5	0.063	305
BDV-012-A	10/24/18	11:20	14.82	4.4	112.5	0.127	305
BDV-012-B	10/24/18	12:42	15.11	3.7	113.6	0.125	305
BBP-012-A	10/30/18	11:19	40.27	259.7	303.0	0.125	380
BBP-025-A	10/30/18	14:11	19.66	7.5	296.6	0.251	395

[1]Bypass (full basin) time 15.18 minutes BBP-012-A, 7.25 minutes BBP-025-A

[2]Larger flushing volumes were typical of the first test in any day to pre-wet the basin.

[3]Reference point for Anoka (RLI, GLI, RGB, RGT) is concrete base slab = basin bottom.

[4]Reference point for Bloomington (BDV, BBP) is estimated basin bottom, ~1 inch below pipe inverts.

Table 8: Raw mass data for Grass Lined Inlet (GLI) field tests

Mass data for GLI-025-A

	(a)	(b)	(c)	(d)	(e)	(f)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Untreated by Pretreatment (Captured in Bioretention) (g)**	**Captured in Pretreatment (Assumed) (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	939.39	56.33	883.06	0.95	882.11	99.9%
[2] D50=0.41 mm	939.44	33.62	905.82	2.87	902.95	99.7%
[3] D50=0.12 mm	939.39	63.74	875.65	176.37	699.28	79.9%
Sediment Total =	2818.22	153.69	2664.53	180.19	2484.34	93.2%
[A] leaves	226.61	0	226.61	218.14	8.47	3.7%
[B] dowels	226.03	0	226.03	139.57	86.46	38.3%
[C] forks	227.43	0	227.43	216.72	10.71	4.7%
Gross Solids Total =	680.07	0	680.07	574.43	105.64	15.5%
Sediment + Gross Solids =	3498.29	153.69	3344.6	754.62	2589.98	77.4%

Mass data for GLI-025-B

	(a)	(b)	(c)	(d)	(e)	(f)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Untreated by Pretreatment (Captured in Bioretention) (g)**	**Captured in Pretreatment (Assumed) (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	939.4	33.39	906.01	0.65	905.36	99.9%
[2] D50=0.41 mm	939.46	40.84	898.62	12.63	885.99	98.6%
[3] D50=0.12 mm	939.48	59.81	879.67	428.67	451	51.3%
Sediment Total =	2818.34	134.04	2684.3	441.95	2242.35	83.5%
[A] leaves	226.65	0	226.65	220.26	6.39	2.8%
[B] dowels	226.53	0	226.53	113.96	112.57	49.7%
[C] forks	225.88	0	225.88	199.28	26.6	11.8%
Gross Solids Total =	679.06	0	679.06	533.5	145.56	21.4%
Sediment + Gross Solids =	3497.4	134.04	3363.36	975.45	2387.91	71.0%

Mass data for Average of two replicates (GLI-025-A & GLI-025-B)

	(a)	(b)	(c)	(d)	(e)	(f)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Untreated by Pretreatment (Captured in Bioretention) (g)**	**Captured in Pretreatment (Assumed) (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	939.395	44.86	894.535	0.8	893.735	99.9%
[2] D50=0.41 mm	939.45	37.23	902.22	7.75	894.47	99.1%
[3] D50=0.12 mm	939.435	61.775	877.66	302.52	575.14	65.5%
Sediment Total =	2818.28	143.865	2674.415	311.07	2363.345	88.4%
[A] leaves	226.63	0	226.63	219.2	7.43	3.3%
[B] dowels	226.28	0	226.28	126.765	99.515	44.0%
[C] forks	226.655	0	226.655	208	18.655	8.2%
Gross Solids Total =	679.565	0	679.565	553.965	125.6	18.5%
Sediment + Gross Solids =	3497.845	143.865	3353.98	865.035	2488.945	74.2%

Note: ***a - b = c*** ***c - d = e*** ***e ÷ c = f***

Table 8: Raw mass data for Grass Lined Inlet (GLI) field tests (cont'd)

Mass data for GLI-050-A

	(a)	(b)	(c)	(d)	(e)	(f)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Untreated by Pretreatment (Captured in Bioretention) (g)**	**Captured in Pretreatment (Assumed) (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	939.4	26.61	912.79	35.41	877.38	96.1%
[2] D50=0.41 mm	939.47	21.35	918.12	179.93	738.19	80.4%
[3] D50=0.12 mm	939.46	42.92	896.54	546.4	350.14	39.1%
Sediment Total =	2818.33	90.88	2727.45	761.74	1965.71	72.1%
[A] leaves	226.53	0	226.53	217.11	9.42	4.2%
[B] dowels	226.9	0	226.9	76.82	150.08	66.1%
[C] forks	226.01	0	226.01	215.37	10.64	4.7%
Gross Solids Total =	679.44	0	679.44	509.3	170.14	25.0%
Sediment + Gross Solids =	3497.77	90.88	3406.89	1271.04	2135.85	62.7%

Mass data for GLI-050-B

	(a)	(b)	(c)	(d)	(e)	(f)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Untreated by Pretreatment (Captured in Bioretention) (g)**	**Captured in Pretreatment (Assumed) (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	939.39	26.57	912.82	7.39	905.43	99.2%
[2] D50=0.41 mm	939.43	22.48	916.95	138.82	778.13	84.9%
[3] D50=0.12 mm	939.5	40.35	899.15	588.9	310.25	34.5%
Sediment Total =	2818.32	89.4	2728.92	735.11	1993.81	73.1%
[A] leaves	226.5	0	226.5	223.21	3.29	1.5%
[B] dowels	227	0	227	60.52	166.48	73.3%
[C] forks	226.65	0	226.65	189.82	36.83	16.2%
Gross Solids Total =	680.15	0	680.15	473.55	206.6	30.4%
Sediment + Gross Solids =	3498.47	89.4	3409.07	1208.66	2200.41	64.5%

Mass data for Average of two replicates (GLI-050-A & GLI-050-B)

	(a)	(b)	(c)	(d)	(e)	(f)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Untreated by Pretreatment (Captured in Bioretention) (g)**	**Captured in Pretreatment (Assumed) (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	939.395	26.59	912.805	21.4	891.405	97.7%
[2] D50=0.41 mm	939.45	21.915	917.535	159.375	758.16	82.6%
[3] D50=0.12 mm	939.48	41.635	897.845	567.65	330.195	36.8%
Sediment Total =	2818.325	90.14	2728.185	748.425	1979.76	72.6%
[A] leaves	226.515	0	226.515	220.16	6.355	2.8%
[B] dowels	226.95	0	226.95	68.67	158.28	69.7%
[C] forks	226.33	0	226.33	202.595	23.735	10.5%
Gross Solids Total =	679.795	0	679.795	491.425	188.37	27.7%
Sediment + Gross Solids =	3498.12	90.14	3407.98	1239.85	2168.13	63.6%

Note: $a - b = c$ $c - d = e$ $e \div c = f$

Table 9: Raw mass data for Rain Guardian Bunker (RGB) field tests

Mass data for RGB-025-A

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Captured on Surface Grate (g)**	**Captured in Chamber (g)**	**Captured on Screen wall (g)**	**Deposited Downstream of Screen Wall (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	939.39	49.13	890.26	52.43	813.06	0	1.6	867.09	97.4%
[2] D50=0.41 mm	939.4	46.91	892.49	64.19	824.66	1.16	13.74	903.75	101.3%
[3] D50=0.12 mm	939.41	71.2	868.21	106.06	387.36	17.96	181.21	692.59	79.8%
Sediment Total =	2818.2	167.24	2650.96	222.68	2025.08	19.12	196.55	2463.43	92.9%
[A] leaves	226.58	0	226.58	144.96	80.94	0	0.24	226.14	99.8%
[B] dowels	226.66	0	226.66	41.52	34.36	1.16	15.79	92.83	41.0%
[C] forks	226.17	0	226.17	157.86	68.2	0	0	226.06	100.0%
Gross Solids Total =	679.41	0	679.41	344.34	183.5	1.16	16.03	545.03	80.2%
Sediment + Gross Solids =	3497.61	167.24	3330.37	567.02	2208.58	20.28	212.58	3008.46	90.3%

Mass data for RGB-025-B

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Captured on Surface Grate (g)**	**Captured in Chamber (g)**	**Captured on Screen wall (g)**	**Deposited Downstream of Screen Wall (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	939.39	43.87	895.52	11.34	864.42	0.01	1.27	877.04	97.9%
[2] D50=0.41 mm	939.44	44.11	895.33	10.03	876.91	2.01	20.49	909.44	101.6%
[3] D50=0.12 mm	939.44	68	871.44	14.59	419.35	22.66	167.99	624.59	71.7%
Sediment Total =	2818.27	155.98	2662.29	35.96	2160.68	24.68	189.75	2411.07	90.6%
[A] leaves	226.58	0	226.58	86.43	137.83	0	0	224.26	99.0%
[B] dowels	226.14	0	226.14	10.84	20.65	18.98	31.82	82.29	36.4%
[C] forks	226.14	0	226.14	144.38	74.75	0	0	219.13	96.9%
Gross Solids Total =	678.86	0	678.86	241.65	233.23	18.98	31.82	525.68	77.4%
Sediment + Gross Solids =	3497.13	155.98	3341.15	277.61	2393.91	43.66	221.57	2936.75	87.9%

Mass data for Average of two replicates (RGB-025-A & RGB-025-B)

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Captured on Surface Grate (g)**	**Captured in Chamber (g)**	**Captured on Screen wall (g)**	**Deposited Downstream of Screen Wall (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	939.39	46.5	892.89	31.885	838.74	0.005	1.435	872.065	97.7%
[2] D50=0.41 mm	939.42	45.51	893.91	37.11	850.785	1.585	17.115	906.595	101.4%
[3] D50=0.12 mm	939.425	69.6	869.825	60.325	403.355	20.31	174.6	658.59	75.7%
Sediment Total =	2818.235	161.61	2656.625	129.32	2092.88	21.9	193.15	2437.25	91.7%
[A] leaves	226.58	0	226.58	115.695	109.385	0	0.12	225.2	99.4%
[B] dowels	226.4	0	226.4	26.18	27.505	10.07	23.805	87.56	38.7%
[C] forks	226.155	0	226.155	151.12	71.475	0	0	222.595	98.4%
Gross Solids Total =	679.135	0	679.135	292.995	208.365	10.07	23.925	535.355	78.8%
Sediment + Gross Solids =	3497.37	161.61	3335.76	422.315	2301.245	31.97	217.075	2972.605	89.1%

Note: $a - b = c$ $d + e + f + g = h$ $h \div c = i$

Table 9: Raw mass data for Rain Guardian Bunker (RGB) field tests (cont'd)

Mass data for RGB-050-A

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Captured on Surface Grate (g)**	**Captured in Chamber (g)**	**Captured on Screen wall (g)**	**Deposited Downstream of Screen Wall (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	939.42	5.81	933.61	7.26	866.56	0.92	34.84	909.58	97.4%
[2] D50=0.41 mm	939.42	7.81	931.61	3.43	815.62	4.81	85.67	909.53	97.6%
[3] D50=0.12 mm	939.41	28.72	910.69	10.55	194.38	31.24	99.19	335.36	36.8%
Sediment Total =	2818.25	42.34	2775.91	21.24	1876.56	36.97	219.7	2154.47	77.6%
[A] leaves	226.51	0	226.51	95.91	18.28	0	6.48	120.67	53.3%
[B] dowels	226.54	0	226.54	31.99	39.23	2.49	10.2	83.91	37.0%
[C] forks	226.93	0	226.93	158.44	52.84	0	13.08	224.36	98.9%
Gross Solids Total =	679.98	0	679.98	286.34	110.35	2.49	29.76	428.94	63.1%
Sediment + Gross Solids =	3498.23	42.34	3455.89	307.58	1986.91	39.46	249.46	2583.41	74.8%

Mass data for RGB-050-B

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Captured on Surface Grate (g)**	**Captured in Chamber (g)**	**Captured on Screen wall (g)**	**Deposited Downstream of Screen Wall (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	939.39	29.68	909.71	4.96	817.57	0.85	61.72	885.1	97.3%
[2] D50=0.41 mm	939.39	30.72	908.67	3.21	681.73	6.55	151.81	843.3	92.8%
[3] D50=0.12 mm	939.42	56.82	882.6	9.69	121.11	26.33	99.59	256.72	29.1%
Sediment Total =	2818.2	117.22	2700.98	17.86	1620.41	33.73	313.12	1985.12	73.5%
[A] leaves	226.55	0	226.55	109.64	14.29	0	10.53	134.46	59.4%
[B] dowels	225.38	0	225.38	22.97	11.35	0	21.41	55.73	24.7%
[C] forks	225.55	0	225.55	145.74	53.3	0	15.87	214.91	95.3%
Gross Solids Total =	677.48	0	677.48	278.35	78.94	0	47.81	405.1	59.8%
Sediment + Gross Solids =	3495.68	117.22	3378.46	296.21	1699.35	33.73	360.93	2390.22	70.7%

Mass data for Average of two replicates (RGB-050-A & RGB-050-B)

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Captured on Surface Grate (g)**	**Captured in Chamber (g)**	**Captured on Screen wall (g)**	**Deposited Downstream of Screen Wall (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	939.405	17.745	921.66	6.11	842.065	0.885	48.28	897.34	97.4%
[2] D50=0.41 mm	939.405	19.265	920.14	3.32	748.675	5.68	118.74	876.415	95.2%
[3] D50=0.12 mm	939.415	42.77	896.645	10.12	157.745	28.785	99.39	296.04	33.0%
Sediment Total =	2818.225	79.78	2738.445	19.55	1748.485	35.35	266.41	2069.795	75.6%
[A] leaves	226.53	0	226.53	102.775	16.285	0	8.505	127.565	56.3%
[B] dowels	225.96	0	225.96	27.48	25.29	1.245	15.805	69.82	30.9%
[C] forks	226.24	0	226.24	152.09	53.07	0	14.475	219.635	97.1%
Gross Solids Total =	678.73	0	678.73	282.345	94.645	1.245	38.785	417.02	61.4%
Sediment + Gross Solids =	3496.955	79.78	3417.175	301.895	1843.13	36.595	305.195	2486.815	72.8%

Note: ***a - b = c*** ***d + e + f + g = h*** ***h ÷ c = i***

Table 10: Raw mass data for Rain Guardian Turret (RGT) field tests

Mass data for RGT-025-A

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Captured on Surface Grate (g)**	**Captured in Chamber (g)**	**Captured on Screen wall (g)**	**Deposited Downstream of Screen Wall (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	939.4	49.6	889.8	41.89	830.44	0.06	0.4	872.79	98.1%
[2] D50=0.41 mm	939.38	42.75	896.63	53.55	850.01	0.53	1.04	905.13	100.9%
[3] D50=0.12 mm	939.45	66.17	873.28	66.26	423.99	9.86	40.05	540.16	61.9%
Sediment Total =	2818.23	158.52	2659.71	161.7	2104.44	10.45	41.49	2318.08	87.2%
[A] leaves	226.44	0	226.44	156.02	68.56	0	0	224.58	99.2%
[B] dowels	226.53	0	226.53	33.84	102.76	0	7.81	144.41	63.7%
[C] forks	226.63	0	226.63	163.25	63.34	0	0	226.59	100.0%
Gross Solids Total =	679.6	0	679.6	353.11	234.66	0	7.81	595.58	87.6%
Sediment + Gross Solids =	3497.83	158.52	3339.31	514.81	2339.1	10.45	49.3	2913.66	87.3%

Mass data for RGT-025-B

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Captured on Surface Grate (g)**	**Captured in Chamber (g)**	**Captured on Screen wall (g)**	**Deposited Downstream of Screen Wall (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	939.4	39.48	899.92	37.74	847.07	0	0.04	884.85	98.3%
[2] D50=0.41 mm	939.4	50.78	888.62	40.19	853.52	0.76	2.34	896.81	100.9%
[3] D50=0.12 mm	939.43	74.66	864.77	56.32	455.93	13.98	68.81	595.04	68.8%
Sediment Total =	2818.23	164.92	2653.31	134.25	2156.52	14.74	71.19	2376.7	89.6%
[A] leaves	226.63	0	226.63	148.04	73.37	0	0	221.41	97.7%
[B] dowels	226.56	0	226.56	51.14	61.56	0	22	134.7	59.5%
[C] forks	226.74	0	226.74	195.38	31.28	0	0	226.66	100.0%
Gross Solids Total =	679.93	0	679.93	394.56	166.21	0	22	582.77	85.7%
Sediment + Gross Solids =	3498.16	164.92	3333.24	528.81	2322.73	14.74	93.19	2959.47	88.8%

Mass data for Average of two replicates (RGT-025-A & RGT-025-B)

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Captured on Surface Grate (g)**	**Captured in Chamber (g)**	**Captured on Screen wall (g)**	**Deposited Downstream of Screen Wall (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	939.4	44.54	894.86	39.815	838.755	0.03	0.22	878.82	98.2%
[2] D50=0.41 mm	939.39	46.765	892.625	46.87	851.765	0.645	1.69	900.97	100.9%
[3] D50=0.12 mm	939.44	70.415	869.025	61.29	439.96	11.92	54.43	567.6	65.3%
Sediment Total =	2818.23	161.72	2656.51	147.975	2130.48	12.595	56.34	2347.39	88.4%
[A] leaves	226.535	0	226.535	152.03	70.965	0	0	222.995	98.4%
[B] dowels	226.545	0	226.545	42.49	82.16	0	14.905	139.555	61.6%
[C] forks	226.685	0	226.685	179.315	47.31	0	0	226.625	100.0%
Gross Solids Total =	679.765	0	679.765	373.835	200.435	0	14.905	589.175	86.7%
Sediment + Gross Solids =	3497.995	161.72	3336.275	521.81	2330.915	12.595	71.245	2936.565	88.0%

Note: ***a - b = c*** ***d + e + f + g = h*** ***h ÷ c = i***

Table 10: Raw mass data for Rain Guardian Turret (RGT) field tests (cont'd)

Mass data for RGT-050-A

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Captured on Surface Grate (g)**	**Captured in Chamber (g)**	**Captured on Screen wall (g)**	**Deposited Downstream of Screen Wall (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	939.41	29.75	909.66	0.62	893.67	0.12	0.21	894.62	98.3%
[2] D50=0.41 mm	939.41	49.28	890.13	0.41	848.9	5.45	17.35	872.11	98.0%
[3] D50=0.12 mm	939.42	63.97	875.45	1.81	264.01	13.09	15.33	294.24	33.6%
Sediment Total =	2818.24	143	2675.24	2.84	2006.58	18.66	32.89	2060.97	77.0%
[A] leaves	226.66	0	226.66	106.01	70.33	0	0	176.34	77.8%
[B] dowels	226.01	0	226.01	68.96	48.46	0	3.69	121.11	53.6%
[C] forks	227.28	0	227.28	179.27	47.96	0	0	227.23	100.0%
Gross Solids Total =	679.95	0	679.95	354.24	166.75	0	3.69	524.68	77.2%
Sediment + Gross Solids =	3498.19	143	3355.19	357.08	2173.33	18.66	36.58	2585.65	77.1%

Mass data for RGT-050-B

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Captured on Surface Grate (g)**	**Captured in Chamber (g)**	**Captured on Screen wall (g)**	**Deposited Downstream of Screen Wall (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	939.39	6.47	932.92	0.08	909.56	0.06	0.35	910.05	97.5%
[2] D50=0.41 mm	939.4	9.54	929.86	0.6	907.4	2.82	10.26	921.08	99.1%
[3] D50=0.12 mm	939.42	31.88	907.54	8.17	346.17	11.08	48.43	413.85	45.6%
Sediment Total =	2818.21	47.89	2770.32	8.85	2163.13	13.96	59.04	2244.98	81.0%
[A] leaves	226.55	0	226.55	121.14	37.82		0.69	159.65	70.5%
[B] dowels	226.5	0	226.5	58.62	10.77	1.09	11.26	81.74	36.1%
[C] forks	226.94	0	226.94	189.97	21.25		7.89	219.11	96.5%
Gross Solids Total =	679.99	0	679.99	369.73	69.84	1.09	19.84	460.5	67.7%
Sediment + Gross Solids =	3498.2	47.89	3450.31	378.58	2232.97	15.05	78.88	2705.48	78.4%

Mass data for Average of two replicates (RGT-050-A & RGT-050-B)

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Captured on Surface Grate (g)**	**Captured in Chamber (g)**	**Captured on Screen wall (g)**	**Deposited Downstream of Screen Wall (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	939.4	18.11	921.29	0.35	901.615	0.09	0.28	902.335	97.9%
[2] D50=0.41 mm	939.405	29.41	909.995	0.505	878.15	4.135	13.805	896.595	98.5%
[3] D50=0.12 mm	939.42	47.925	891.495	4.99	305.09	12.085	31.88	354.045	39.7%
Sediment Total =	2818.225	95.445	2722.78	5.845	2084.855	16.31	45.965	2152.975	79.1%
[A] leaves	226.605	0	226.605	113.575	54.075	0	0.345	167.995	74.1%
[B] dowels	226.255	0	226.255	63.79	29.615	0.545	7.475	101.425	44.8%
[C] forks	227.11	0	227.11	184.62	34.605	0	3.945	223.17	98.3%
Gross Solids Total =	679.97	0	679.97	361.985	118.295	0.545	11.765	492.59	72.4%
Sediment + Gross Solids =	3498.195	95.445	3402.75	367.83	2203.15	16.855	57.73	2645.565	77.7%

Note: $a - b = c$ $d + e + f + g = h$ $h \div c = i$

Table 11: Raw mass data for Rock Lined Inlet (RLI) field tests

Mass data for RLI-025-A

	(a)	(b)	(c)	(d)	(e)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	939.44	11.04	928.4	852.8	91.9%
[2] D50=0.41 mm	939.44	14.18	925.26	988.41	106.8%
[3] D50=0.12 mm	939.42	41.08	898.34	551.64	61.4%
Sediment Total =	2818.3	66.3	2752	2392.85	86.9%
[A] leaves	225.87	0	225.87	228.31	101.1%
[B] dowels	226.65	0	226.65	223.77	98.7%
[C] forks	227.32	2.71	224.61	224.7	100.0%
Gross Solids Total =	679.84	2.71	677.13	676.78	99.9%
Sediment + Gross Solids =	3498.14	69.01	3429.13	3069.63	89.5%

Mass data for RLI-025-B

	(a)	(b)	(c)	(d)	(e)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	939.44	43.59	895.85	890.27	99.4%
[2] D50=0.41 mm	939.4	38.17	901.23	906.71	100.6%
[3] D50=0.12 mm	939.42	76.36	863.06	776.8	90.0%
Sediment Total =	2818.26	158.12	2660.14	2573.78	96.8%
[A] leaves	226.48	0	226.48	225.54	99.6%
[B] dowels	226.82	0	226.82	157.55	69.5%
[C] forks	227.15	0	227.15	224.5	98.8%
Gross Solids Total =	680.45	0	680.45	607.59	89.3%
Sediment + Gross Solids =	3498.71	158.12	3340.59	3181.37	95.2%

Mass data for Average of two replicates (RLI-025-A & RLI-025-B)

	(a)	(b)	(c)	(d)	(e)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	939.44	27.315	912.125	871.535	95.5%
[2] D50=0.41 mm	939.42	26.175	913.245	947.56	103.8%
[3] D50=0.12 mm	939.42	58.72	880.7	664.22	75.4%
Sediment Total =	2818.28	112.21	2706.07	2483.315	91.8%
[A] leaves	226.175	0	226.175	226.925	100.3%
[B] dowels	226.735	0	226.735	190.66	84.1%
[C] forks	227.235	1.355	225.88	224.6	99.4%
Gross Solids Total =	680.145	1.355	678.79	642.185	94.6%
Sediment + Gross Solids =	3498.425	113.565	3384.86	3125.5	92.3%

Note: $a - b = c$ $d \div c = e$

Table 11: Raw mass data for Rock Lined Inlet (RLI) field tests (cont'd)

Mass data for RLI-050-A

	(a)	(b)	(c)	(d)	(e)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	939.42	7.83	931.59	924.06	99.2%
[2] D50=0.41 mm	939.45	9.67	929.78	926.81	99.7%
[3] D50=0.12 mm	939.47	29.06	910.41	311.76	34.2%
Sediment Total =	2818.34	46.56	2771.78	2162.63	78.0%
[A] leaves	226.97	0	226.97	79.64	35.1%
[B] dowels	225.99	0	225.99	121.98	54.0%
[C] forks	226.31	0	226.31	194.69	86.0%
Gross Solids Total =	679.27	0	679.27	396.31	58.3%
Sediment + Gross Solids =	3497.61	46.56	3451.05	2558.94	74.1%

Mass data for RLI-050-B

	(a)	(b)	(c)	(d)	(e)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	939.4	55.48	883.92	877.56	99.3%
[2] D50=0.41 mm	939.42	38.38	901.04	853.68	94.7%
[3] D50=0.12 mm	939.45	50.72	888.73	256.66	28.9%
Sediment Total =	2818.27	144.58	2673.69	1987.9	74.4%
[A] leaves	226.54	0	226.54	30.98	13.7%
[B] dowels	225.79	0	225.79	174.85	77.4%
[C] forks	224.68	0	224.68	168.46	75.0%
Gross Solids Total =	677.01	0	677.01	374.29	55.3%
Sediment + Gross Solids =	3495.28	144.58	3350.7	2362.19	70.5%

Mass data for Average of two replicates (RLI-050-A & RLI-050-B)

	(a)	(b)	(c)	(d)	(e)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	939.41	31.655	907.755	900.81	99.2%
[2] D50=0.41 mm	939.435	24.025	915.41	890.245	97.3%
[3] D50=0.12 mm	939.46	39.89	899.57	284.21	31.6%
Sediment Total =	2818.305	95.57	2722.735	2075.265	76.2%
[A] leaves	226.755	0	226.755	55.31	24.4%
[B] dowels	225.89	0	225.89	148.415	65.7%
[C] forks	225.495	0	225.495	181.575	80.5%
Gross Solids Total =	678.14	0	678.14	385.3	56.8%
Sediment + Gross Solids =	3496.445	95.57	3400.875	2460.565	72.4%

Note: ***a - b = c*** ***d ÷ c = e***

Table 12: Raw mass data for Shallow Sump Grit Chamber Design Volume (BDV) field tests

Mass data for BDV-006-A

	(a)	(b)	(c)	(d)	(e)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	259.91	46.19	213.72	212.4	99.4%
[2] D50=0.41 mm	259.93	48.51	211.42	221.12	104.6%
[3] D50=0.12 mm	259.99	56.15	203.84	166.19	81.5%
Sediment Total =	779.83	150.85	628.98	599.71	95.3%
[A] leaves	56.56	0	56.56	51.68	91.4%
[B] dowels	56.41	0	56.41	24.03	42.6%
[C] forks	55.79	0	55.79	55.77	100.0%
Gross Solids Total =	168.76	0	168.76	131.48	77.9%
Sediment + Gross Solids =	948.59	150.85	797.74	731.19	91.7%

Mass data for BDV-006-B

	(a)	(b)	(c)	(d)	(e)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	259.91	65.02	194.89	193.53	99.3%
[2] D50=0.41 mm	259.87	66.29	193.58	199.66	103.1%
[3] D50=0.12 mm	259.99	64.99	195	152.5	78.2%
Sediment Total =	779.77	196.3	583.47	545.69	93.5%
[A] leaves	56.52	0	56.52	50.24	88.9%
[B] dowels	56.34	0	56.34	40.13	71.2%
[C] forks	56.62	0	56.62	55.58	98.2%
Gross Solids Total =	169.48	0	169.48	145.95	86.1%
Sediment + Gross Solids =	949.25	196.3	752.95	691.64	91.9%

Mass data for Average of two replicates (BDV-006-A & BDV-006-B)

	(a)	(b)	(c)	(d)	(e)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	259.91	55.605	204.305	202.965	99.3%
[2] D50=0.41 mm	259.9	57.4	202.5	210.39	103.9%
[3] D50=0.12 mm	259.99	60.57	199.42	159.345	79.9%
Sediment Total =	779.8	173.575	606.225	572.7	94.5%
[A] leaves	56.54	0	56.54	50.96	90.1%
[B] dowels	56.375	0	56.375	32.08	56.9%
[C] forks	56.205	0	56.205	55.675	99.1%
Gross Solids Total =	169.12	0	169.12	138.715	82.0%
Sediment + Gross Solids =	948.92	173.575	775.345	711.415	91.8%

Note: $a - b = c$ $d \div c = e$

Table 12: Raw mass data for Shallow Sump Grit Chamber Design Volume (BDV) field tests (cont'd)

Mass data for BDV-012-A

	(a)	(b)	(c)	(d)	(e)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	259.95	55.47	204.48	199.91	97.8%
[2] D50=0.41 mm	259.92	56.29	203.63	206.53	101.4%
[3] D50=0.12 mm	259.81	72.99	186.82	122.23	65.4%
Sediment Total =	779.68	184.75	594.93	528.67	88.9%
[A] leaves	56.53	0	56.53	36.83	65.2%
[B] dowels	56.16	0	56.16	25.84	46.0%
[C] forks	58.54	0	58.54	58.52	100.0%
Gross Solids Total =	171.23	0	171.23	121.19	70.8%
Sediment + Gross Solids =	950.91	184.75	766.16	649.86	84.8%

Mass data for BDV-012-B

	(a)	(b)	(c)	(d)	(e)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	259.91	57.86	202.05	200.41	99.2%
[2] D50=0.41 mm	259.95	54.5	205.45	203.89	99.2%
[3] D50=0.12 mm	260.02	61.74	198.28	130.12	65.6%
Sediment Total =	779.88	174.1	605.78	534.42	88.2%
[A] leaves	56.6	0	56.6	39.02	68.9%
[B] dowels	56.87	0	56.87	24.68	43.4%
[C] forks	57.82	0	57.82	55.2	95.5%
Gross Solids Total =	171.29	0	171.29	118.9	69.4%
Sediment + Gross Solids =	951.17	174.1	777.07	653.32	84.1%

Mass data for Average of two replicates (BDV-012-A & BDV-012-B)

	(a)	(b)	(c)	(d)	(e)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	259.93	56.665	203.265	200.16	98.5%
[2] D50=0.41 mm	259.935	55.395	204.54	205.21	100.3%
[3] D50=0.12 mm	259.915	67.365	192.55	126.175	65.5%
Sediment Total =	779.78	179.425	600.355	531.545	88.5%
[A] leaves	56.565	0	56.565	37.925	67.0%
[B] dowels	56.515	0	56.515	25.26	44.7%
[C] forks	58.18	0	58.18	56.86	97.7%
Gross Solids Total =	171.26	0	171.26	120.045	70.1%
Sediment + Gross Solids =	951.04	179.425	771.615	651.59	84.4%

Note: ***a - b = c*** ***d ÷ c = e***

Table 13: Raw mass data for Shallow Sump Grit Chamber Bypass (BBP) field tests

Mass data for BBP-012

	(a)	(b)	(c)	(d)	(e)	(f)	(g)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Deposited on Bypass Gutter (g)**	**Captured in Downstream Bypass Grate (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	486.4	6.1	480.3	0.0	0.1	478.2	99.6%
[2] D50=0.41 mm	486.4	5.3	481.1	0.1	0.6	483.3	100.4%
[3] D50=0.12 mm	486.8	16.2	470.6	23.2	23.3	329.1	69.9%
Sediment Total =	**1,459.6**	**27.6**	**1,432.0**	**23.3**	**24.0**	**1,290.6**	**90.1%**
[A] leaves	113.4	0.0	113.4	0.0	24.2	75.1	66.2%
[B] dowels	113.5	0.0	113.5	0.0	83.8	17.1	15.1%
[C] forks	114.4	0.0	114.4	0.0	2.6	111.8	97.7%
Gross Solids Total =	**341.4**	**0.0**	**341.4**	**0.0**	**110.5**	**204.0**	**59.8%**
Sediment + Gross Solids =	***1,801.0***	***27.6***	***1,773.4***	***23.3***	***134.5***	***1,494.6***	***84.3%***

Mass data for BBP-025

	(a)	(b)	(c)	(d)	(e)	(f)	(g)
	Initial Mass (g)	**Mass Not Fed (g)**	**Influent to Pretreatment (g)**	**Deposited on Bypass Gutter (g)**	**Captured in Downstream Bypass Grate (g)**	**Captured in Pretreatment (g)**	**Percent Removal (%)**
[1] D50=1.17 mm	486.4	26.0	460.4	0.1	0.1	457.8	99.4%
[2] D50=0.41 mm	486.4	17.7	468.7	0.4	3.1	447.7	95.5%
[3] D50=0.12 mm	486.4	22.4	464.1	20.8	55.4	232.1	50.0%
Sediment Total =	**1,459.2**	**66.0**	**1,393.2**	**21.3**	**58.6**	**1,137.6**	**81.7%**
[A] leaves	113.2	0.0	113.2	0.0	31.6	39.9	35.2%
[B] dowels	113.7	0.0	113.7	0.0	84.1	7.0	6.2%
[C] forks	112.4	0.0	112.4	0.0	29.5	80.1	71.3%
Gross Solids Total =	**339.3**	**0.0**	**339.3**	**0.0**	**145.1**	**127.0**	**37.4%**
Sediment + Gross Solids =	***1,798.5***	***66.0***	***1,732.5***	***21.3***	***203.7***	***1,264.6***	***73.0%***

Note: ***a - b = c*** ***d + e = f*** ***f ÷ c = g***