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STORMWATER POLLUTION PREVENTION PLAN

Saratoga BioChar Solutions, LLC
Farnan Road
Town of Moreau, NY

February 18, 2022

DRAFT

OWNER:

Saratoga Biochar Solutions, LLC
26 F Congress St. #346
Saratoga Springs, NY 12866

CONTRACTOR:

Munter Enterprises
881 Murray Road
Middle Grove, NY 12850

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DESCRIPTION OF EXISTING SITE

The project site is comprised of two parcels located at the terminus of Farnan Road within the Moreau Industrial Park in the Town of Moreau, NY (Tax Map IDs 50.-4-22 and 50.-4-16). The site is approximately 5.89 ±acres of undeveloped land. The western portion is wooded while the eastern extremities are primarily grassed. A portion of a cul-de-sac located at the end of Farnan Road is positioned within the southeast bounds of the site. The site is zoned General Manufacturing and Industrial (M-1) in accordance with the Town of Morea Comprehensive Land Use Plan. Majority of the surrounding parcels are undeveloped with the exception of roads, a sanitary sewer pump station with perimeter fencing located at the southeast corner of the site, and a chemical manufacturing facility, Hexion, Inc., located across Farnan Road to the east of the project site.

The eastern parcel generally slopes from northwest to southeast at grades varying from ±1% to ±17% along the western confines of the existing woods, approaching Farnan Road. The site is located greater than 1,000 feet west of the Hudson River. No other water bodies or wetlands exist within proximity of the site. A stormwater sewer collection system exists within the Moreau Industrial Park for management of stormwater, with catch basins existing near the northeast corner of the site in Farnan Road.

DESCRIPTION OF EXISTING SOILS

The United States Department of Agriculture (USDA) Soil Survey obtained from the Natural Resource Conservation Service website indicates the surficial soil type on the site to be Windsor loamy sand (WnB).

The WnB series is identified by the USDA as hydrologic soil group "A" and is characterized by being excessively drained with low runoff potential when thoroughly wet. These soils typically consist of loamy sand and sand material.

A geotechnical survey was performed by Terracon Consultants-NY, Inc. to evaluate the subsurface conditions at the site, the results are summarized and provided in the report titled "Geotechnical Engineering Report, Proposed Manufacturing Facility, Farnan Road, Moreau, New York" Dated July 21, 2021 (Geotechnical Report). A total of eight soil borings and four infiltration tests were performed in the vicinity of proposed development as part of the subsurface exploration efforts. Results of the soil borings indicate site soils to consist of poorly graded sand, sandy silt and some silt clay encountered at depths greater than 22 feet below existing grade. Results of the subsurface exploration indicate that the water table exists at the elevations of 273.5 - 274.5 feet. Four infiltration tests were performed in accordance with requirements of the NYS Stormwater Management Design Manual and results indicate stabilized infiltration rates to be equal or exceeding 45 inches per hour. Results of the soil borings and infiltration tests are presented in Terracon's Geotechnical Report, provided in Appendix C of this report.

DESCRIPTION OF PROPOSED DEVELOPMENT

Proposed site development includes the construction of a new industrial facility, an asphalt parking lot, landscaping and lighting, municipal utility connections, and an extensive stormwater

management system. Existing forested areas will be preserved to the extent possible. Perimeter areas boarding the north and south property lines will be reforested or landscaped to implement screening from abutting properties. Pervious areas remaining after development will be landscaped with native plants, ornamental trees, or restored with grass, meadow, and flowering seed mixes. Proposed grading will generally preserve existing drainage patterns within the exception of new stormwater basins. Anticipated disturbance areas, pervious and impervious areas are as follows:

	Existing Conditions	Phase 1	Phase 2/3
Disturbance Area	N/A	±192,301 ft^2	±10,015 ft^2
Site Impervious	±2,340 ft^2	±111,404 ft^2	±133,684 ft^2
Site Pervious	±254,228 ft2	±145,164 ft^2	±122,884 ft^2
Total Site Permeability	99%	57%	48%

CONSTRUCTION PHASING

Construction of proposed development will proceed in three phases. Majority of development will be completed during Phase 1, including the construction of the main building, asphalt driveway, utility connections, landscaping and lighting, and stormwater controls. Phases 2 and 3 will include two building expansions extending off the eastern side of the initial building footprint. Construction will begin with clearing and grubbing in areas of proposed disturbance. Excavation and grading will proceed subsequent to clearing and grubbing, including the installation of stormwater management practices. Proposed structures will be erected, and underground utilities installed simultaneously to grading and excavation activities. Landscaping and lighting will be completed following the completion of earthwork. Silt fence shall be installed in accordance with the construction drawings prior to any disturbance of the existing ground surface. Immediately following the installation of silt fence, a stabilized construction entrance consisting of crushed stone and geotextile stabilization fabric will be installed as shown on the construction drawings. Required erosion and sediment control measures shall be installed prior to disturbance involved with each phase of construction and maintained throughout the duration of construction and resulting ground disturbance.

POLLUTION PREVENTION MEASURES

Any litter on site, including construction debris, will be picked up each day and disposed of into solid waste containers. The contractor shall provide an approved secondary containment system for all fuel and petroleum temporarily stored on site. During the placement of concrete for the building foundation, measures will be taken to ensure that fresh concrete does not enter any defined drainage paths and a concrete washout area will be provided by the contractor in accordance with the construction drawings. Topsoil and imported fill materials will be stockpiled in the protected areas indicated on the construction drawings.

SEDIMENTATION AND EROSION CONTROL

Prior to commencing any land clearing silt fence will be installed in accordance with the construction drawings, and in accordance with the New York State Stormwater Management Design Manual, January 2015 and the New York Standards and Specifications for Erosion and Sediment Control.

A stabilized temporary construction entrance(s) at the location(s) indicated on the construction drawings will be required for all construction traffic entering and leaving the site. The contractor is required to maintain all silt fences and the temporary construction entrance(s) throughout the duration of construction.

All exposed surfaces not covered with paving, structures, and similar finished surfaces will be covered with topsoil and seeded within 14-days following substantial completion of construction to establish a turf covering or will be landscaped in accordance with the construction drawings. The areas receiving seed will be mulched to minimize erosions. Silt fences shall be installed downslope of the newly seeded areas. The silt fences shall be maintained and replaced as required for the duration of construction until a well-established vegetative cover is established.

Construction activities completed upgradient of proposed stormwater practices shall be completed and stabilized in accordance with the construction drawings prior to connection to the proposed practice including the establishment of vegetative cover over all exposed pervious surfaces.

PERMANENT STORMWATER CONTROLS

Permanent stormwater controls for the proposed development will include the construction of stormwater runoff reduction and standard management practices (SMP) designed to meet water quality reduction and treatment goals. Runoff generated by the parking lot and building will be conveyed via sheet flow, catch basins, storm pipe and vegetated swales to infiltration basins. Culverts will be installed beneath the parking lot and entrance drive to facilitate conveyance of runoff to management practices.

Green infrastructure (GI) and standard stormwater management practices (SMP), sized in accordance with the New York State Department of Environmental Conservation Stormwater Management Design Manual, were applied under the proposed stormwater management system to provide a total Runoff Reduction Volume (RRv) greater than or equal to the minimum RRv generated from the proposed development. Applied GI techniques include a series of prefabricated infiltration chambers and two infiltration basins. The remaining WQv, after the application of the RRv practices, is then treated within the infiltration basins. Pre-treatment for the infiltration chambers is provided in an isolated row, wrapped in two layers of geotextile fabric to provide filtering and settling of sediment laden stormwater. Runoff entering the infiltration basins will be pre-treated via sediment forebays and stone aprons. The peak runoff discharge passing through the stormwater system for the channel protection volume (Cpv: 1 year 24-hour storm event), overbank flood (Qp:10-year storm event) and extreme storm ((Qf)h: 100-year storm event) will be attenuated to less than or equal to the pre-development flow rates at design points common to both the pre- and post-development conditions.

Based on the soil hydrologic group in the proposed construction areas, the following curve numbers were assumed for the hydrologic analyses:

Land Cover Type	Curve Number
50-75% Grass cover, Fair, HSG A	CN 49
>75% Grass cover, Good, HSG A	CN 39
Woods, Good, HSG A	CN 30
Woods/grass Combo, Good, HSG A	CN 32
Impervious surfaces	CN 98

The site was divided into six subcatchment areas based on the flow direction of runoff generated from the proposed development. Subcatchment land cover and runoff control descriptions are provided in Table 1.

Table 1. Subcatchment Area Descriptions

Subcatchment	Landcover	Stormwater Control Measures
1S	Undisturbed woods, grassed area, and a portion of the parking lot	Runoff generated from the parking lot and building will sheet flow to a series of catch basins. Flow will outlet the catch basins to the sediment forebay located along the west side of the parking lot. Overflow will discharge from the sediment forebay, FB1, to infiltration basin IF1. Excess runoff will overflow from IF1 via a stone lined weir, ultimately discharge to Design Point #1.
2S	Undisturbed woods, grassed area, parking lot area, and building roof area.	Runoff generated from the pavement and roof surface will be conveyed via sheet flow to a green space in the parking lot where it will be captured by a series of culverts. Flow will then be conveyed via culverts to a sediment forebay, IF2. Overflow will discharge from FB2 to infiltration basin, IF2. Excess runoff will overflow from the basin via a stone lined weir, ultimately discharging to Design Point #2.
3S	Parking lot area, a portion of the building roof and revegetated/landscaped areas.	Runoff generated from the building roof and pavement surface will be conveyed via sheet flow to a vegetated swale. Runoff will be conveyed by the swale to a catch basin. Captured runoff will then outlet the catch basin via storm pipe and discharge to the sediment forebay, FB3. Overflow will discharge from the

		sediment forebay to infiltration basin, IF3. Excess runoff will outlet the basin via a stone lined weir, ultimately discharging to Design Point #2.
4S	Enhanced buffer vegetated area, entrance drives, and asphalt area to be constructed during Phase 2&3 building expansions.	Runoff will primarily follow existing drainage pathways through the subcatchment area to the southeast extremities of the site where flow will be managed via natural infiltration within the enhanced grassed buffer area, and ultimately discharge to Design Point #2.
5S	Undisturbed woods	Runoff will follow existing drainage pathways through this subcatchment and ultimately discharge to Design Point #1.

Notes:
1.Refer to the Construction Drawings for permanent runoff control measure locations and details.
2. Stormwater management control measures shall be in accordance with New York State Stormwater Management Design Manual, January 2015

Design storm events were assumed to be customized storm curves based upon Extreme Precipitation Data in New York & New England available through a joint collaboration between the Northeast Regional Climate Center and Natural Resources Conservation Service for Type II, 24-hour 1-year, 25-year, and 50-year storm events. Precipitation Data for the 10-year and 100-year storm events were obtained from the New York State Stormwater Management Design Manual. Rainfall magnitudes for the storm events were determined as follows: 1-year: 2.22 inches, 10-year: 3.75" inches, 25-year: 4.54-inches, 50-year: 5.30-inches and 100-year: 6.50 inches. The runoff rates were modeled using HydroCAD version 10.0 software which calculates runoff based on the modified SCS TR-20 method. The peak runoff discharge passing through the proposed stormwater management system will be attenuated to be less than or equal to the pre-development flow rates for the 100-year 24-hour storm at established discharge design points. Peak off-site discharge rates for the channel protection volume (Cpv: 1 year 24-hour storm event), overbank flood (Qp:10-year storm event), 25-year storm event, 50-year storm event and extreme storm ((Qf)h: 100-year storm event) are summarized in the following table:

Table 2. Peak Off-site Discharge Rates

Location	1-year Storm Peak Discharge (ft^3/s)		10-year Storm Peak Discharge (ft^3/s)		25-year Storm Peak Discharge (ft^3/s)		50-year Storm Peak Discharge (ft^3/s)		100-year Storm Peak Discharge (ft^3/s)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Design Point #1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.01
Design Point #2	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.7	0.0

Water Quality volumes (WQv) were established in accordance with the New York State Department of Environmental Conservation Stormwater Management Design Manual, January

2015, with a 90% recurrence interval storm event rainfall magnitude assumed to be 1.20-inches based on site locality. The following table summarizes the RRv and treated WQv values of the Green Infrastructure Practices and Standard Management Practices used to pre-treat a RRv min.= 6,987 cubic feet and a WQv = 13,397 cubic feet.:

Table 3. Green Infrastructure and Standard Management Practice Summary

Subcatchment	Green Infrastructure/SMP Provided	Total WQv (ft^3)	Pretreatment *Req'd* (ft^3)	Pretreatment *Provided* (ft^3)	RRv *Provided* (ft^3)	WQv *Treated* (ft^3)
1S	Infiltration Basin	5743	5743	7240	5743	2591
2S	Infiltration Basin	4578	4578	5103	4124	459
3S	Infiltration Basin	2152	2152	4977	2034	1854

RRv total = 11,902 ft^3 ≥ Min. RRv; RRv + $WQv_{treated}$ = 16,806 ft^3 > WQv

SITE INSPECTIONS DURING CONSTRUCTION

A qualified inspector as defined in Appendix A of the New York State Department of Environmental Conservation SPDES General Permit for Stormwater Discharges from Construction Activity Permit No. GP-0-20-001 shall conduct construction inspections in accordance with Part IV.C of GP-0-20-001 and in accordance with requirements of the Town of Moreau Local Law 1, Chapter 120.

MAINTENANCE OF STORMWATER MANAGEMENT SYSTEM

All vegetated swales (where applicable) shall maintain a grass height of 4 to 6 inches and shall be monitored for excessive sediment build-up within the bottom of the channel. Catch basin inlets, storm pipe inlets/outlets, overflow weirs, and culverts should be periodically checked for the accumulation of debris that may constrict runoff from flowing freely at the inlet/outlet invert elevations. In addition to the maintenance of the stormwater practices described, the lawns and landscaped areas shall be maintained in good condition to prevent erosion. Any deteriorated areas of lawn shall be re-seeded, and a stable turf reestablished. In accordance with Town requirements, the property owner shall provide arrangements for the future maintenance of the post-construction stormwater control measures in accordance with the *Sample Stormwater Control Facility Maintenance Agreement*, Appendix H, to be recorded in the office of the Town Clerk or its terms shall be incorporated into covenants appearing in the deed, declarations of covenants and restrictions or other such documents to ensure that record notice of its terms is provided to future owners of the site.

RETENTION OF RECORDS

The contractor shall maintain at the project site a copy of this Storm Water Pollution Prevention Plan (SWPPP). In addition, the contractor shall maintain a site logbook which will contain all storm water and erosion control inspection reports to be prepared by the qualified professional. A current copy of the construction drawings shall also be kept in the logbook with comments that may have been added by the qualified inspector.

SWPPP Report Prepared by:

Matthew E. Huntington, PE
Principal
For
Studio A | Landscape Architecture + Engineering

APPENDIX A
PROJECT LOCATION

Figure 1. Project Location Map

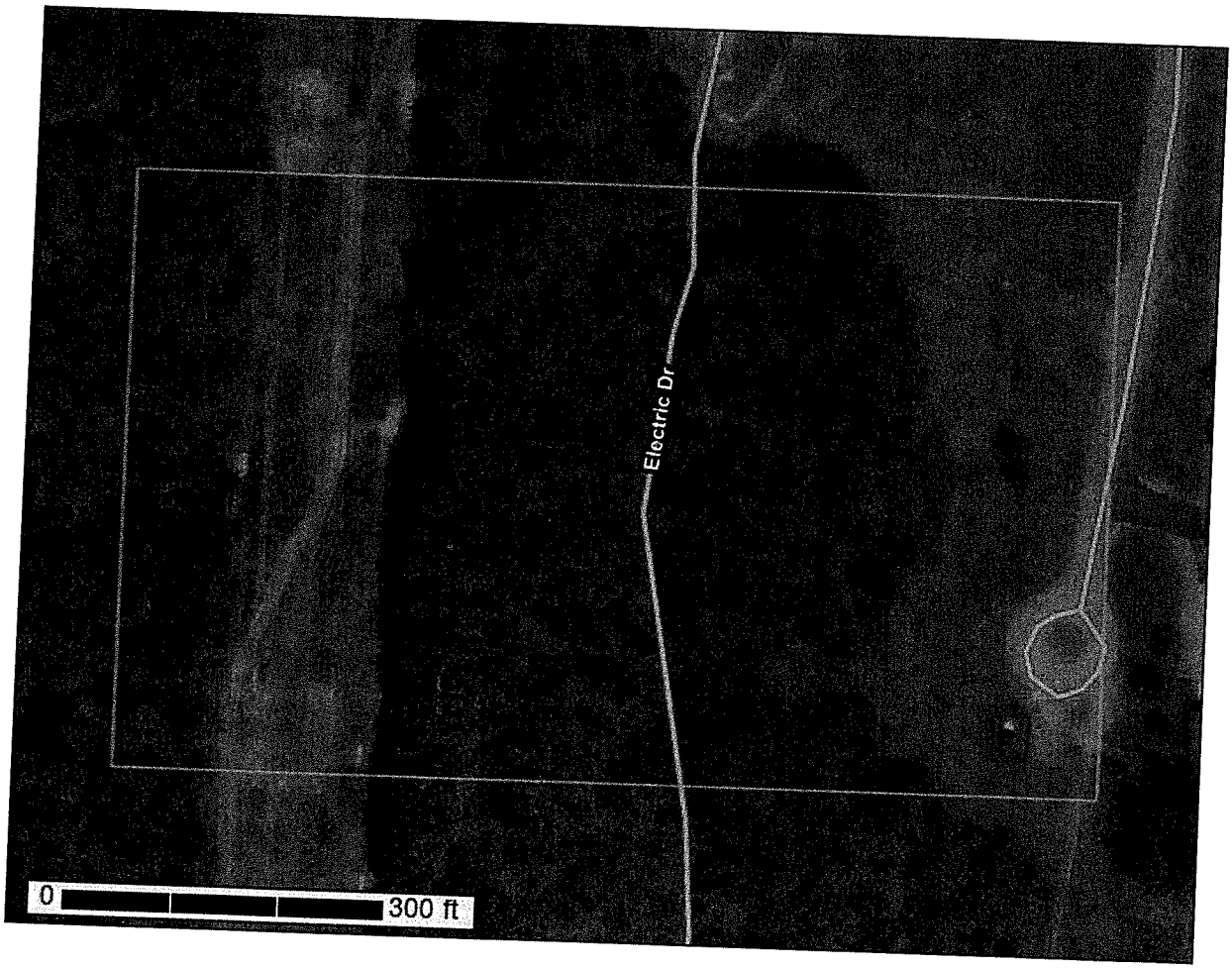
APPENDIX B
USDA SOIL SURVEY

USDA 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 Saratoga County, New York



September 15, 2021

Preface

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

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

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

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

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

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

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

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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.

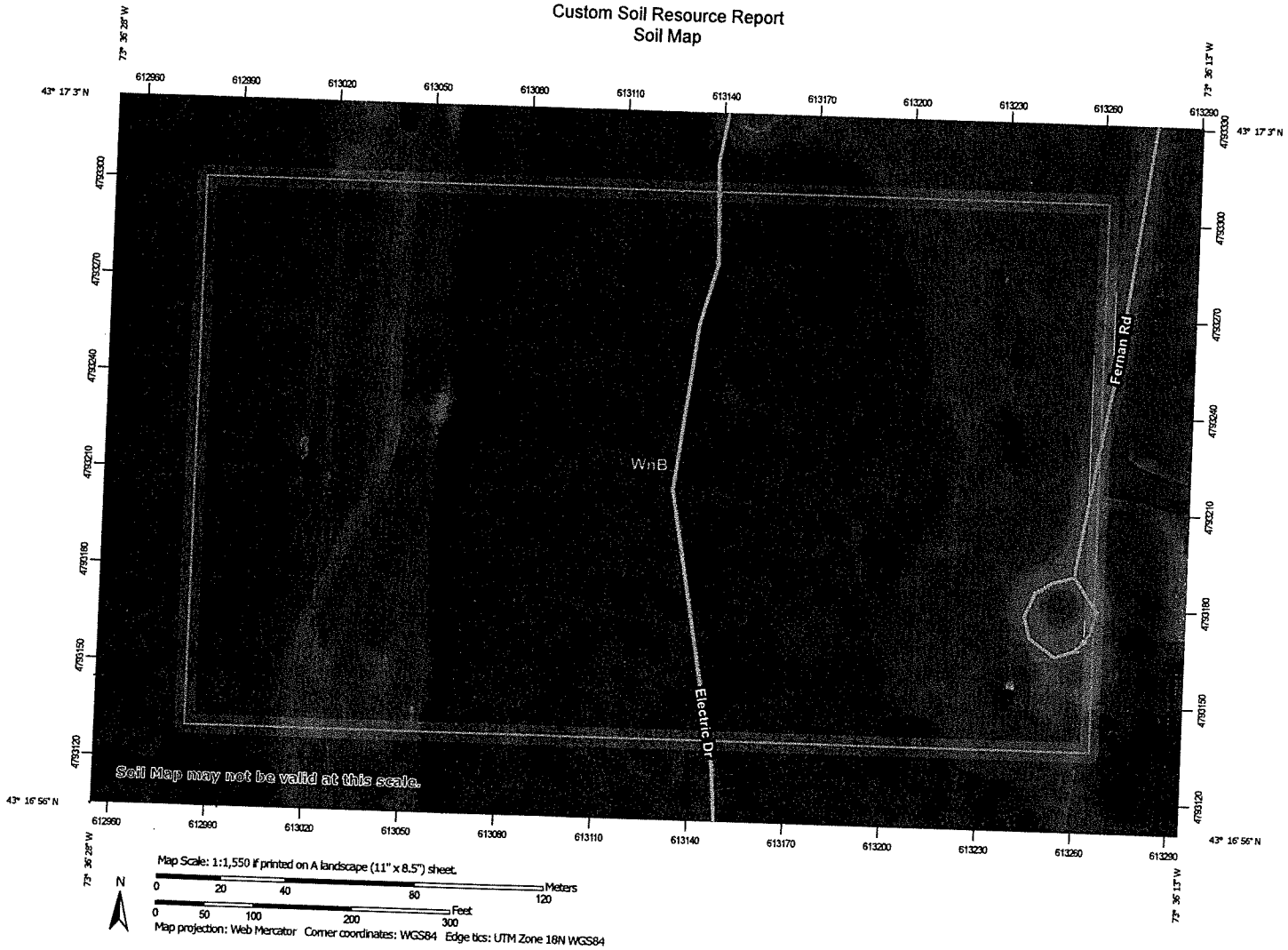
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree 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.


73° 36' 28" W
73° 36' 13" W
43° 17' 3" N
43° 16' 56" N
612960
612980
613020
613050
613080
613110
613140
613170
613200
613230
613260
613290
4793300
4793270
4793240
4793210
4793180
4793150
4793120
WnB
Fernan Rd
Electric Dr
Soil Map may not be valid at this scale.
Map Scale: 1:1,550 if printed on A landscape (11" x 8.5") sheet.
N
0 20 40 80 120 Meters
0 50 100 200 300 Feet
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N 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 1:24,000.

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

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

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

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

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

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

Soil Survey Area: Saratoga County, New York
Survey Area Data: Version 20, Jun 11, 2020

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

Date(s) aerial images were photographed: Jun 10, 2015—Mar 29, 2017

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
WnB	Windsor loamy sand, 3 to 8 percent slopes	12.0	100.0%
Totals for Area of Interest		**12.0**	**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.

Saratoga County, New York

WnB—Windsor loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2svkf
Elevation: 0 to 1,210 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: Outwash terraces, deltas, outwash plains, dunes
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
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: 3 to 8 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 4.5 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

Hinckley, loamy sand

Percent of map unit: 10 percent
Landform: Outwash plains, eskers, kames, deltas
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Nose slope, side slope, crest, head slope, rise
Down-slope shape: Convex
Across-slope shape: Linear, convex
Hydric soil rating: No

Deerfield, loamy sand

Percent of map unit: 5 percent
Landform: Terraces, deltas, 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

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APPENDIX C
GEOTECHNICAL ENGINEERING REPORT

Terracon GeoReport

Geotechnical Engineering Report

Proposed Manufacturing Facility
Farnan Road
Moreau, New York
July 21, 2021
Terracon Project No. JB215105

Prepared for:
Northeastern Biochar Solutions
Saratoga Springs, New York

Prepared by:
Terracon Consultants - NY, Inc.
Albany, New York

July 21, 2021

Terracon GeoReport

Northeastern Biochar Solutions
26F Congress Street, Suite No. 346
Saratoga Springs, New York 12866

Attn: Mr. Raymond Apy
p: (518) 391 0566
e: rapy@northeasternbiochar.com

Re: Geotechnical Engineering Report
Proposed Manufacturing Facility
Farnan Road
Moreau, New York
Terracon Project No. JB215105

Dear Mr. Apy:

We have completed the Geotechnical Engineering services for the referenced project. This study was performed in general accordance with Terracon proposal no. PJB215105, as authorized by Northeastern Biochar Solutions on June 15, 2021. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs and pavements for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us at your convenience.

Sincerely,
Terracon Consultants-NY, Inc.

Jared Hall, G.I.T.
Staff Engineer

Joseph Robichaud, Jr., P.E.
Sr. Associate / Office Manager

Additional review by: John S. Hutchison, P.E.

REPORT TOPICS

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Note: This report was originally delivered in a web-based format. Orange Bold text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the ***GeoReport*** logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES
SITE LOCATION AND EXPLORATION PLANS
EXPLORATION RESULTS
SUPPORTING INFORMATION

Note: Refer to each individual Attachment for a listing of contents

Geotechnical Engineering Report
Proposed Manufacturing Facility
Farnan Road
Moreau, New York
Terracon Project No. JB215105
July 21, 2021

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed manufacturing facility in the town of Moreau, New York. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Site preparation and earthwork
- Lateral earth pressures
- Temporary excavation support
- Foundation design and construction
- Floor slab design and construction
- Seismic site classification per NYSBC
- Pavement design and construction
- Frost considerations

The geotechnical engineering scope of services for this project included the advancement of nine test borings (B-1 thru B-9) and four infiltration test borings (I-1 thru I-4) to depths ranging from 8.0 to 52.0 feet below existing site grades. Additionally, our scope included infiltration testing, the visual classification and limited laboratory testing of recovered soil samples, and preparation of this summary report.

Maps indicating the site and test boring locations are included as the attached Site Location and Exploration Plan, respectively.

SITE CONDITIONS

Existing conditions at the site are summarized in the following table:

Item	Description
Parcel Information	The project is located west of Farnan Road, at the southwest corner of its intersection with Electric Drive (currently a paper street), in the town of Moreau, New York. Approximate geographic coordinates: 43.2831 N, -73.6049 W.
Existing Improvements	None. Site is currently undeveloped.

Item	Description
Current Ground Cover	Wooded within the western portion and grassy within the eastern portion of the site.
Existing Topography	Site slopes moderately downward toward the southeast from about elevation 286 to 276 feet.
Geology	On the Surficial Geologic Map of New York, soils in the area are mapped as alluvial sand and gravel along with glaciolacustrine silt and clay.

Based upon review of available historic aerial photography, the project site appears to have been largely undisturbed from 1946 onward, with the exception of some dirt trails traversing the parcel and occasional clearing of wooded areas.

PROJECT DESCRIPTION

Our understanding of the project is summarized as follows:

Item	Description
Information Provided	■ Topographic plan entitled "Grading, Drainage, Utilities Plan", no preparer or date indicated. ■ Site layout concepts by Element Carbon dated April 30, 2021 (schematic plans) ■ Telephone and email correspondence with project team
General Description	Construction of a new manufacturing facility with associated paved and landscaped areas.
Proposed Structures	The facility will include a manufacturing building with an office, central processing area, and a receiving bay with deep pit. Also included will be a loadout area, overhead bins/hoppers, and a truck scale along the entrance roadway.
Building Construction	Assumed steel frame with metal cladding and cast-in-place concrete foundations.
Maximum Loads	No loading information provided – we assume the following: ■ Maximum column loads: 150 kips ■ Maximum wall loads: 5 kips per lineal foot (klf) ■ Maximum slab loads: 250 pounds per square foot (psf)
Finished Floor Elevation	Not provided. Assumed to be at elevation 284 feet.
Grading/Slopes	It appears that any cuts and fills required to establish proposed grades will be minor, on the order of two feet or less within the proposed building footprint. However, fills upwards of about five feet may be required in the future expansion area.

Item	Description
Below-Grade Structures	The deep receiving pit structure will extend about 25 feet below finished floor elevation. The pit will be about 50 feet long by 25 feet wide and its sides will taper inward with depth at an inclination of 4V:1H such that the width of the pit bottom will be narrower, about 12.5 feet.
Free-Standing Retaining Walls	No site retaining walls are indicated on the plans provided to us. However, the receiving pit walls will retain earth, as may walls at the loadout area.
Pavements	We understand both asphalt and gravel-paved surfaces are being considered. The site will be subjected to routine daily tractor-trailer traffic with highway legal axle loads.

If any of the above information is incorrect, please let us know so we can review the conclusions and recommendations provided in this report for applicability to the actual design and update the report as appropriate.

As the design of the project progresses and site grading plans and building loads are fully developed, we should be retained to assess this site-specific information relative to the recommendations contained herein.

SUBSURFACE CHARACTERIZATION

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical analysis and evaluation of site preparation and foundation options. Conditions encountered at each exploration point are indicated on the individual subsurface logs. The individual logs can be found in the Exploration Results and the GeoModel in the Figures sections of this report.

Subsurface Profile

The following model layers were identified within the subsurface profile. For a more detailed view of the model layers with depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
1	**Native Sand**	Predominately sand with lesser amounts of silt, generally loose to medium dense
2	**Sandy Silt**	Silt with lesser amounts of sand, along with occasional clay seams or partings, medium stiff to very stiff
3	**Silt and Clay**	Banded silt and clay with lesser amounts of sand, generally very soft to stiff

Subsurface Conditions

About 2 to 9 inches of topsoil was encountered at the ground surface at our test boring locations. The topsoil was underlain by granular native sands which in turn graded to cohesive silts and clays at depths of about 18 to 23 feet at most locations. A sandy silt deposit was encountered below the depth of about 12 feet in borehole B-3 and between the depths of about 38 and 48 feet at B-5. No soils readily identifiable as fill were found.

The native sands consisted predominately of fine to coarse sand with lesser amounts of silt and gravel. The silts and clays generally exhibited depositional banding and fine sand partings, while occasional clay seams or partings were noted in the sandy silt deposits. Based on the standard penetration N-values, the soils were generally loose to medium dense where essentially granular and very soft to stiff where essentially fine-grained.

Bedrock was not encountered within the depths explored for this study, 52 feet. For informational purposes, the Geologic Map of New York (New York State Education Department, 1970) maps bedrock underlying the project area as Canajoharie Shale. The mapping suggests that bedrock may be shallow west of the project area.

Groundwater Conditions

Groundwater was encountered in borings B-1 thru B-6 and I-3 and I-4 at depths of about 4.3 to 10.3 feet below existing grade during our drilling procedure, as tabulated below. Groundwater was not immediately observed in the remaining borings; however, "wet" soil samples were generally recovered within this vicinity indicating the water table was likely within the range of about 273.5 to 274.5 feet throughout the site at the time of our explorations.

Exploration No.	Depth to Groundwater (feet)	Approximate Groundwater Elevation (ft) [1]
B-1	10.3	274.7
B-2	9.4	274.6
B-3	9.6	274.4
B-4	9.4	273.6
B-5	9.3	274.7
B-6	4.3	274.7
I-3	4.6	273.4
I-4	4.3	273.7

1. Determined using ground surface elevations interpolated from the site-specific topographic survey plan provided for our use.

In addition, mottled soils were encountered throughout the site, generally at depths of about 4 to 9 feet; however, mottling was observed at B-7 near the ground surface (between 0 to 2 feet).

Mottling may be indicative of a seasonally high water table and/or temporarily perched water within the upper soils.

Groundwater conditions, and the extent of any perched water, should be expected to vary with seasonal fluctuations in precipitation and runoff. Additionally, grade adjustments on and around the site, as well as surrounding drainage improvements, may affect the water table. The possibility of groundwater level fluctuations should be considered when developing design and construction plans for the project.

Infiltration Testing

Infiltration tests were performed adjacent to test borings I-1 through I-4 and numbered correspondingly. The testing was conducted in general accord with the guidelines in Appendix D of the NYS Stormwater Management Design Manual. Results of this testing are presented for your use in the Exploration Results section of this report and summarized in tabular form below.

Test No.	Approximate Test Depth (feet)	Soil Classification	Infiltration Rate (in/hr) [1]
I-1	4.0	Poorly graded sand, trace silt, fine grained	>24
I-2	4.0	Poorly graded sand, trace silt, fine to medium grained	>24
I-3	2.5	Poorly graded sand, trace silt, fine to medium grained	>24
I-4	2.0	Poorly graded sand, trace silt, fine to medium grained	>24

1. Based on the final infiltration test trial.

GEOTECHNICAL OVERVIEW

The project site is considered suitable for support of the proposed facility using conventional shallow spread foundations and slab-on-grade design, although the deep receiving pit and relatively shallow groundwater will impact on planning for design and construction. Based on the conditions disclosed by our investigation, the following general conclusions.

- New foundations and floor slabs may be supported on undisturbed native soils, or on imported structural fill which is placed over the native soils after all topsoil is removed, along with any existing fill or otherwise unsuitable material which may be found.

- The sandy soils excavated onsite should generally be suitable for reuse as fill and backfill, once cleansed of any oversize particles and unsuitable debris or organics, subject to the

approval of the Geotechnical Engineer and based upon the conditions encountered at the time of construction.

- The receiving pit invert elevation will be situated well below static groundwater level at the site, as shown on the building cross-section attached to this report. For this reason, it should be expected that appreciable dewatering effort will be necessary to allow construction to proceed in relative dryness and to promote stable excavation sidewall and bottom conditions. The pit must also be designed to resist hydrostatic uplift forces (buoyancy) when complete. These considerations are discussed further in the Temporary Excavations and Uplift sections herein.

- Elsewhere (i.e., outside the receiving pit area), groundwater is expected to be below foundation excavation depths and should not be a significant factor in planning for design and construction of the building. If perched water is encountered during construction, it is expected to be limited in volume and standard sump and pump methods should be sufficient for its removal. Dewatering is a means and methods consideration for the contractor.

- It is noted that grade increases upwards of five feet may be necessary in the future expansion area. Consideration should be given to placement of whatever fill may ultimately be required in the expansion area at the time of initial facility construction, so as to allow whatever consolidation settlement may occur in the soft clays at depth under the weight of the fill to occur in advance of future construction. Otherwise, the fill should be placed at least four to six weeks in advance of any future expansion so as to limit post-construction settlement.

The following sections of this report provide more detailed recommendations to assist in planning for the geotechnical aspects of the project. We should be provided with the opportunity to review plans and specifications prior to their release for bidding to confirm that our recommendations were properly understood and implemented, and to allow us to refine our recommendations, if warranted, based upon the final design. The General Comments section provides an understanding of the report limitations.

SEISMIC CONSIDERATIONS

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site classification is required to determine the Seismic Design Category for a structure. The seismic Site Class is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC).

Seismic Site Classification

In our estimation, the Seismic Site Class is D. This determination is made based upon the results of shear wave velocity testing completed in similar subsurface profiles at several sites in the general project area, where this testing has found that average shear wave velocities in the upper 100 feet consistently exceed 600 feet per second. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth, if desired.

Liquefaction

Evaluation of the potential for soil liquefaction to occur was made using the computer software program Liquefy Pro by CivilTech Corporation. An earthquake magnitude of 6.0 was assumed, and a peak ground acceleration (PGA) of 0.10g for the project area was used, this representing a two percent probability of exceedance in 50 years (as obtained from USGS earthquake hazards mapping). Based on these parameters and site-specific conditions determined through the subsurface investigation, the calculated factor of safety against liquefaction is no less than 2. As such, liquefaction potential at the project site is considered low.

EARTHWORK

Earthwork is anticipated to include clearing and grubbing, foundation excavation and associated site fill and backfill. It should be understood that excavation and dewatering considerations with respect to the receiving pit are substantial and out of the ordinary. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered suitable in our geotechnical engineering evaluation for foundations and floor slabs.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety or the contractor's activities; such responsibility is neither implied nor shall it be inferred.

Site Preparation

Site preparation should begin with stripping of any existing topsoil, vegetation and/or root mat from the ground surface. Any existing fill or disturbed soils, if encountered, should be removed in its entirety from beneath the proposed building footprint, extending at least five feet beyond its perimeter.

Prior to placing fills to raise site grades and/or after cuts are made to the plan subgrade elevations, the subgrades should be proof-rolled using a steel drum roller with a static weight of at least 10

tons. The roller should operate in its vibratory mode, unless requested otherwise by the Geotechnical Engineer observing the work, and travel at a speed not exceeding three feet per second (two miles per hour). The roller should complete at least four passes over all subgrade surfaces in opposing directions. The method of proof-rolling may be modified by the Geotechnical Engineer based upon the conditions revealed at the time of construction.

Soft areas identified by the proof-rolling should be investigated to determine the cause and stabilized accordingly. These investigations may include the excavation of test pits. Where existing fills are found and determined by to be unsuitable by the Geotechnical Engineer, they should be removed and replaced as deemed necessary.

Fill Material Types

Imported Structural Fill should be used as fill/backfill within the proposed building area. The imported fill should consist of sand and gravel which meets the limits of gradation given below. Any imported materials should be free of recycled concrete, asphalt, bricks, glass, and pyritic shale rock.

IMPORTED STRUCTURAL FILL

Sieve Size	Percent Finer
3"	100
¼"	30 to 75
No. 40	5 to 40
No. 200	0 to 10

The reuse of excavated site soils may be considered if approved by the Geotechnical Engineer and pending the conditions encountered at the time of construction. Reuse of the onsite soils would require that excessively silty material, organics, oversized particles or unsuitable foreign matter found therein be separated and reused in landscape areas only or wasted off-site as appropriate.

Fill Compaction Requirements

Fills beneath the building pad should be placed in uniform loose layers no more than about one-foot thick where heavy vibratory compaction equipment is used. Thinner lifts should be used where hand operated equipment is required for compaction. Each lift should be compacted to no less than 95 percent of its maximum dry density as determined by the Modified Proctor Compaction Test, ASTM D1557. In landscape areas, if any, the compaction requirement may be relaxed to 90 percent of maximum dry density.

Grading and Drainage

All grades should provide effective drainage away from the building during and after construction, with such drainage maintained throughout the life of the structure. Water retained next to buildings

can result in soil movements greater than those outlined in this report, which may in turn lead to unsatisfactory differential floor slab and/or foundation displacements, cracked slabs and walls, or roof leaks.

Temporary Excavations

Excavations must be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P and its appendices, along with any state and local codes, as applicable. The contractor should be aware that slope height, slope inclination, and excavation depth should in no instance exceed OSHA regulations. Flatter slopes than those stipulated by the regulations or temporary shoring may be required depending upon the soil/groundwater conditions encountered and other external factors. OSHA regulations are strictly enforced and if they are not followed, the owner, contractor, and/or earthwork and utility subcontractor could be liable and subject to substantial penalties.

If temporary excavation bracing is required, it should be designed by a professional engineer experienced in such work. The parameters given in the Excavation Support section below may be assumed for the bracing design.

It should be understood the lower extents of the proposed receiving pit are situated well below static groundwater level, and dewatering will be required to complete the works in relatively dry conditions. Further, the sand deposit in which the receiving pit will for the most part be situated is highly permeable, and for this reason it may be necessary to dewater from closely spaced well points. Excavated grades will become unstable in the absence of adequate dewatering. Dewatering is a means and methods consideration for the contractor.

Also note that the lowest extent of the receiving pit at a depth of about 25 feet below grade will extend near or into wet, soft silt and clay soils. It should be understood these fine-grained soils are subject to weakening and softening through construction activity and foot traffic, especially when wet. Accordingly, the receiving pit subgrades should be improved/protected upon excavation with a gravel stabilization/drainage layer consisting of clean crushed stone 24 inches in thickness. The stone should be an ASTM C33 Blend 57 aggregate which is enveloped with a non-woven synthetic filter fabric meeting the requirements of NYSDOT standard specifications table 737-01C for drainage geotextile to inhibit migration of fines.

Excavation Support

Where supported excavations are required to excavate to the planned grades for the proposed receiving pit or elsewhere, the type and design of the excavation support system must be compatible with the site geometry, subsurface conditions, the planned building foundation construction, and provide adequate support for adjacent structures or utilities. Any temporary support walls to be constructed at this site and components thereof should be designed for the maximum combination of loading that may occur in each stage of excavation and bracing, and

during construction. Recommended soil parameters for use in the design of excavation support at this site are presented below.

Excavation support can be designed and bid or left to the contractor and their consultant to design and install. If the design of temporary earth support is to be performed by the contractor, it should be submitted to the design team for review. Their submittal should include assumptions made regarding soil properties, geometry of the excavation, lateral pressure diagrams, base stability of the excavation with respect to hydrostatic head/dewatering, locations and magnitudes of all surcharge loads and wall design calculations, including deflection analyses and a proposed monitoring program for the construction period. The temporary earth support should be designed and stamped by a Professional Engineer licensed in the State of New York.

The following soil parameters may be assumed for design of temporary excavation support:

Material	Approx. Elevation Range (ft)	Total Moist Unit Weight (pcf)	Angle of Internal Friction (degrees)	Cohesion (psf)
Native sand (GeoModel Layer 1)	> 261	115	30	0
Native sandy silt (GeoModel Layer 2)	Varies	115	28	0
Native silt and clay (GeoModel Layer 3)	< 261	115	26	0

* Long-term effective stress parameters as presented in the table are recommended for use

Groundwater may be assumed at a depth of 10 feet below existing grade (or at about elevation 275 feet) for the purposes of excavation support design in the proposed building area.

Construction Observation and Testing

The earthwork efforts should be monitored under the direction of the Geotechnical Engineer. Monitoring should include documentation of adequate removal of topsoil and any unsuitable fills, proof-rolling, and mitigation of any areas identified as needing improvement through proof-rolling. Each lift of new compacted fill should be tested, evaluated, and reworked, as necessary, until approved by the Geotechnical Engineer prior to placement of additional lifts.

Foundation bearing grades and subgrades for floor slabs should be evaluated under the direction of the Geotechnical Engineer. If unanticipated conditions are encountered, the Geotechnical Engineer should prescribe mitigation options.

It should be understood that subsurface conditions will be more fully known when the site is excavated. The continuation of the Geotechnical Engineer into the construction phase of the project will allow for validation of the subsurface conditions assumed to exist for this study and in

the development of the design recommendations in this report, along with assessing any variations, providing interim recommendations as necessary and reviewing associated design changes.

SHALLOW FOUNDATIONS

If the site has been prepared in accordance with the requirements noted previously in the Earthwork section and below under the **Foundation Construction Considerations**, the following design parameters may be assumed.

Design Parameters – Compressive Loads

Item	Description
Maximum Net Allowable Bearing Pressure [1, 2] **Native Sand (GeoModel Layer 1)** **Native Silt and Clay (GeoModel Layer 3)**	 3,000 pounds per square foot (psf) 2,000 psf
Required Bearing Stratum [3]	Undisturbed native soils or structural fill placed over the native soils after removal of existing fill or otherwise unsuitable material that may be found
Minimum Foundation Dimensions	Columns: 36 inches Continuous: 24 inches
Ultimate Coefficient of Sliding Friction [4]	0.25 (concrete on native silt and clay) 0.45 (concrete on native sand or imported Structural Fill)
Minimum Embedment below Finished Grade [5]	Exterior footings: 48 inches Interior footings in heated areas: 24 inches Interior footings in unheated areas: 48 inches
Estimated Total Settlement from Structural Loads [2]	Less than about one (1) inch
Estimated Differential Settlement [2, 6]	About 75% of total settlement

1. The maximum net allowable bearing pressure is the pressure which exceeds the minimum surrounding overburden pressure at the footing base elevation. An appropriate factor of safety has been applied.
2. Values provided are for maximum loads noted in Project Description. The settlements should occur relatively quickly as construction proceeds and load increments are applied.
3. The bearing grades should be prepared per the recommendations presented below in the **Foundation Construction Considerations**.
4. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions.
5. Embedment necessary to minimize the effects of frost and/or seasonal water content variations. For sloping ground, maintain depth below the lowest adjacent exterior grade within 5 horizontal feet of the structure. Interior footings in heated area may be seated at the 24-inch depth if allowed by local building codes.
6. Differential settlements are as measured over a span of 50 feet.

As site soils are relatively free-draining, and groundwater is several feet below presumed (non-receiving pit) foundation grades, the provision of a standard perimeter foundation drain is considered unnecessary.

Foundation Construction Considerations

The foundations may be seated directly on undisturbed native soils, or on imported structural fill placed over the native soils after removal of existing fill, remains of former structures or otherwise unsuitable materials that may be found. If over-excavation is required beneath the foundations to remove unsuitable material, the excavation should extend horizontally beyond each side of the foundation a distance equal to at least one-half the depth of the undercut below the final bearing grade elevation. Replacement material should meet the specification and compaction guidelines for Structural Fill as outlined herein.

Foundation bearing grades (other than those of the receiving pit, which are addressed below) should be proof-compacted using a mechanical or large reversible plate tamper to densify the soils loosened by the excavation process unless otherwise directed by the Geotechnical Engineer observing the grades. If groundwater seepage occurs, proof-compacting should be eliminated, and a minimum six-inch thick base of clean crushed stone placed over a geotextile fabric should be provided to establish a more uniform and stable base for construction and to assist in dewatering. The stone should be an ASTM C33 Blend 57 aggregate and the fabric a non-woven type meeting the requirements of NYSDOT standard specifications table 737-01C for drainage geotextile.

As previously indicated, the lowest extent of the receiving pit at a depth of about 25 feet below grade will extend near or into wet, soft silt and clay soils. It should be understood these fine-grained soils are subject to weakening and softening through construction activity and foot traffic, especially when wet. Accordingly, the receiving pit subgrades should be improved/protected upon excavation with an aggregate stabilization/drainage layer consisting of clean crushed stone 24 inches in thickness. The stone should be an ASTM C33 Blend 57 aggregate which is enveloped with a non-woven synthetic filter fabric as described above. As an alternative to over-excavation and placement of the crushed stone stabilization/drainage layer, consideration may be given to protection of the grades with a lean concrete mud mat (minimum 2 inches in thickness with *f'c* equal to or greater than 2,000 psi) placed immediately after their excavation and acceptance.

All final bearing grades should be relatively firm, stable, and free of loose soil, mud, water and frost. The Geotechnical Engineer should approve the condition of the foundation bearing grades immediately prior to placement of reinforcing steel and concrete.

UPLIFT

The receiving pit will extend some 15 feet below the water table and will therefore be subject to uplift pressures (buoyancy). As such, the structure should be made sufficiently heavy to resist uplift pressure under the worst-case design conditions (i.e., when the pit is empty). Base extensions may be used to provide additional uplift resistance. Permanent drilled-in tiedown anchors or helical anchors could also be considered to provide uplift resistance, if necessary, but the underlying soft silt and clay soils will provide limited capacity. Assume water table elevation at about 275 feet for the purposes of uplift resistance design.

FLOOR SLABS

Floor Slab Design Parameters

The floor slabs should be constructed upon a minimum six-inch thick subbase course which conforms to the requirements for NYSDOT Type 2 Subbase or ASTM C33 Blend 57 aggregate. Consideration should be given to using a thicker subbase course in areas subject to heavier loads and/or use, or those exposed to freezing temperatures.

The use of a vapor retarder along with a base course of ASTM C33 Blend 57 aggregate should be considered beneath concrete slabs-on-grade to be covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding its use and placement.

Saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual.

Floor slab subgrades should be prepared as outlined in the Earthwork section herein. Under these conditions, a modulus of subgrade reaction equal to 200 pounds per cubic inch (psi/in) may be assumed at the top of the stone base layer for slab design purposes.

Floor Slab Construction Considerations

Even with the base course recommended above, we caution that the subgrades may not support repeated heavy construction traffic or telehandlers without suffering rutting and weaving that may be especially severe during wet seasons. If the grades are to be repeatedly traversed by these types of equipment, they should be reinforced as necessary to support them. Areas which become disturbed should be excavated and stabilized accordingly.

The Geotechnical Engineer should approve the condition of the floor slab subgrades immediately prior to placement of the floor slab subbase course. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

EARTH RETAINING WALL DESIGN

All permanent earth-retaining foundation walls or structures should be designed to resist the lateral pressures generated by earth backfill and any temporary or permanent surcharge loads. Active earth pressures may be assumed for walls that are free to deflect as the backfill is placed and surcharge loads applied. At-rest earth pressures should be assumed for walls that are braced prior to backfilling or applying surcharge loads. The following design parameters are provided to assist in determining the lateral wall loads, whichever apply, and to analyze the stability of unbraced walls by sliding and overturning.

- Soil angle of internal friction - 30 degrees
- Coefficient of At-Rest earth pressure (k_o) - 0.50
- Coefficient of Active earth pressure (k_a) - 0.33
- Coefficient of Passive earth pressure (k_p) - 3.00
- Total unit weight of compacted soil - 130 pcf
- Coefficient of sliding friction - 0.25 (concrete on native silt and clay)
  0.45 (concrete on native sand or imported Structural Fill)

The recommended design parameters assume that backfill consists of imported Structural Fill as described in the Earthwork section herein, idealized non-sloping conditions on each side of the wall, and that the backfill remains permanently well-drained. Water must not be allowed to collect against the wall unless the wall is designed to accommodate the added hydrostatic pressure (as will evidently be the case with the receiving pit walls – assume water table elevation at about 275 feet in this instance). Drainage system recommendations are provided below.

Subsurface Drainage for Earth-Retaining Walls

Earth retaining structures or foundation walls above the water table should be provided with a foundation level drain which may consist of a nominal 4-inch diameter perforated PVC or corrugated HDPE pipe embedded at the base of a minimum 12-inch wide column of clean crushed stone (e.g., NYSDOT no. 1 and no. 2 size aggregate or ASTM C33 Blend 57 stone). The stone should be enveloped in an appropriate non-woven filter fabric (meeting NYSDOT standard specifications section 737-01 for drainage geotextile) to inhibit siltation. Backfill soils behind the crushed stone drainage layer should consist of imported Structural Fill. The drain line should be sloped to provide positive gravity drainage to daylight, to a stormwater system, or to a sump pit and pump.

PAVEMENTS

Pavement Design

The asphalt pavement sections presented below were developed in general accord with AASHTO procedures using a reduced subgrade strength and local experience to account for frost, and to keep the anticipated pavement heave and cracking within generally tolerable limits. A subgrade resilient modulus (M_r) equal to 5,000 psi has been assumed for design purposes.

Two conventional pavement sections were developed, a Light Duty section for automobile parking areas and a Heavy-Duty section for entrance drives or areas subject to routine truck traffic. For design purposes, it has been assumed that the pavement design life is 20 years, and that daily equivalent single axle loads (ESALs) are equal to 1 for the Light Duty section and 10 for the Heavy Duty section. If the traffic loads vary from these, we should be provided the opportunity to refine the pavement section accordingly.

All materials should meet the requirements specified in the latest edition of the New York State Department of Transportation (NYSDOT) Standard Specifications for Construction and Materials.

Flexible Pavement Design				
Layer	Material Description	NYSDOT Reference	Thickness (inches)	
			Light Duty	Heavy Duty
Top	Asphaltic Concrete	Item 402.127303	1.5	1.5
Binder	Asphaltic Concrete	Item 402.257903	2.0	3.0
Stone Subbase	Crusher-Run Stone	Section 733-04, Type 2	8	16
Geotextile	Stabilization Geotextile	Table 737-01E	Single Ply	Single Ply

Where surfaces will be gravel paved, we recommend a section consisting of a minimum 6 inches of gravel Surface Course and a minimum 16 inches of gravel Base Course as described in section 667 of the NYSDOT Standard Specifications (Local Road Gravel Surface, Base and Subbase Courses) for Heavy Duty use. A Light Duty section may consist of 4 inches of Surface Course and a minimum 8 inches of Base Course. A suitable stabilization geotextile as stipulated in the table above should be provided between the gravel base and the underlying subgrade in either case.

Where truck and equipment traffic or activity will be concentrated and/or where usage will be especially severe (e.g., areas subject to frequent stationary turning operations, heavy equipment, tracked vehicles, etc.) rigid concrete pavement may be a better alternative. Rigid pavements should be provided with a minimum eight-inch thick base of crusher-run stone (NYSDOT section 733-04, Type 2 material) placed over a suitable stabilization geotextile. The rigid pavements may

be designed assuming a modulus of subgrade reaction equal to 200 pounds per cubic inch at the top of the base layer.

Temporary Construction Access Roadways

The recommended pavement sections are not designed to support heavy construction traffic which may require thicker sections. The contractor should construct temporary haul routes and construction roadways onsite as appropriate for the weather conditions and the equipment in use, with consideration to the soil conditions encountered in specific areas.

Pavement Drainage

Accumulation of water on pavement subgrades should be avoided by grading the subgrade to a slope of at least two percent, and/or by providing underdrains. Failure to provide adequate drainage will shorten pavement life.

Pavement Maintenance

All pavements require periodic care, and preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Maintenance consists of both localized maintenance (e.g., crack and joint sealing, patching, leveling, etc.) and global maintenance (e.g., surface sealing).

Frost Considerations

Frost may penetrate beneath sidewalks and pavements and cause them to heave, and resulting displacements may be differential, particularly where sidewalks and pavements meet building doorways and along curbs. To limit the magnitude of heave and creation of such uneven joints to generally tolerable magnitudes for most winters, a 16-inch thick base of ASTM C33 Blend 57 crushed stone should be placed beneath sensitive sidewalk or pavement areas, along with an underdrain to relieve any collected waters. The crushed stone should be separated from the surrounding granular soils with a non-woven synthetic filter fabric meeting the requirements of NYSDOT standard specifications table 737-01C for drainage geotextile.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we

can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements and design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

FIGURES

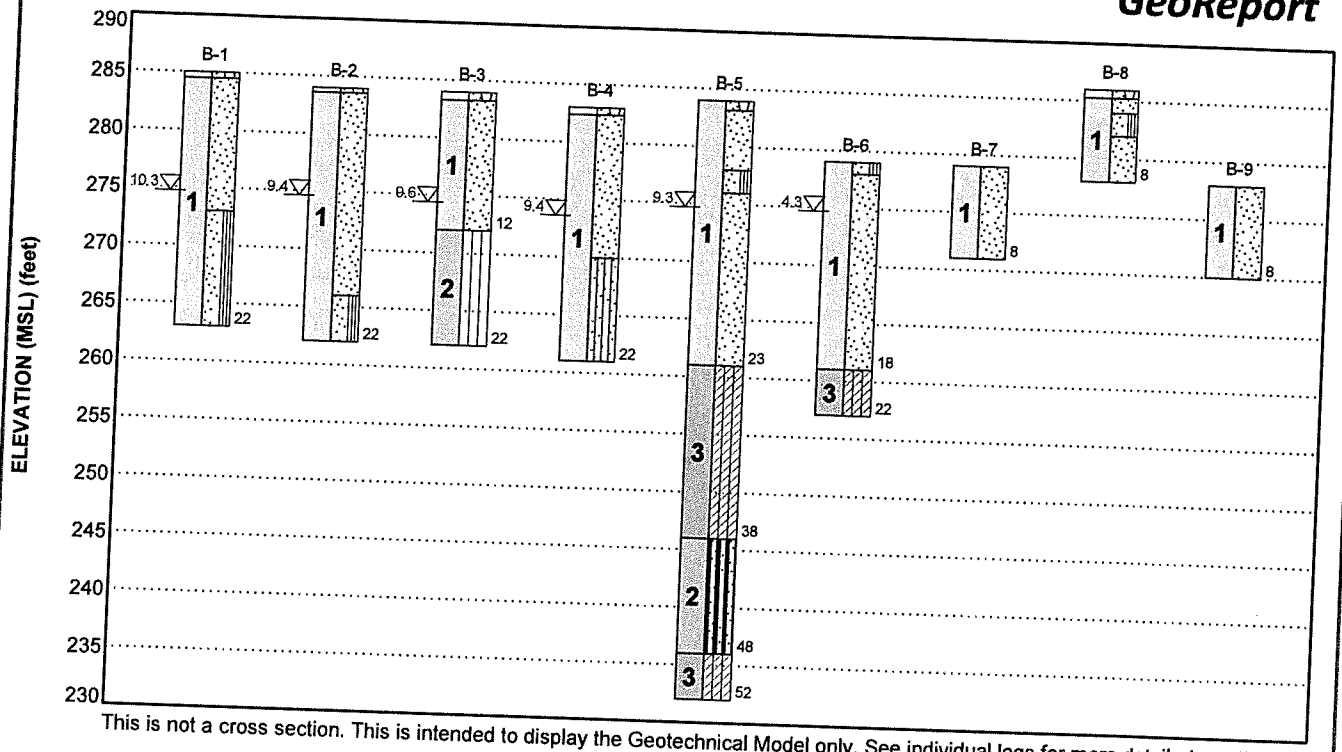
Contents:

GeoModel (2 Sheets)
Building Cross Section (1 Sheet)

GEOMODEL

Proposed Manufacturing Facility ■ Moreau, New York
Terracon Project No. JB215105

Terracon GeoReport



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	Native Sand	Predominately sand with lesser amounts of silt, generally loose to medium dense
2	Sandy Silt	Silt with lesser amounts of sand, along with occasional clay seams or partings, medium stiff to very stiff
3	Silt and Clay	Banded silt and clay with lesser amounts of sand, generally very soft to stiff

LEGEND

- Topsoil
- Poorly-graded Sand
- Poorly-graded Sand with Silt
- Silt
- Silty Sand
- Silty Clay
- Sandy Silt

▽ First Water Observation

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time. Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

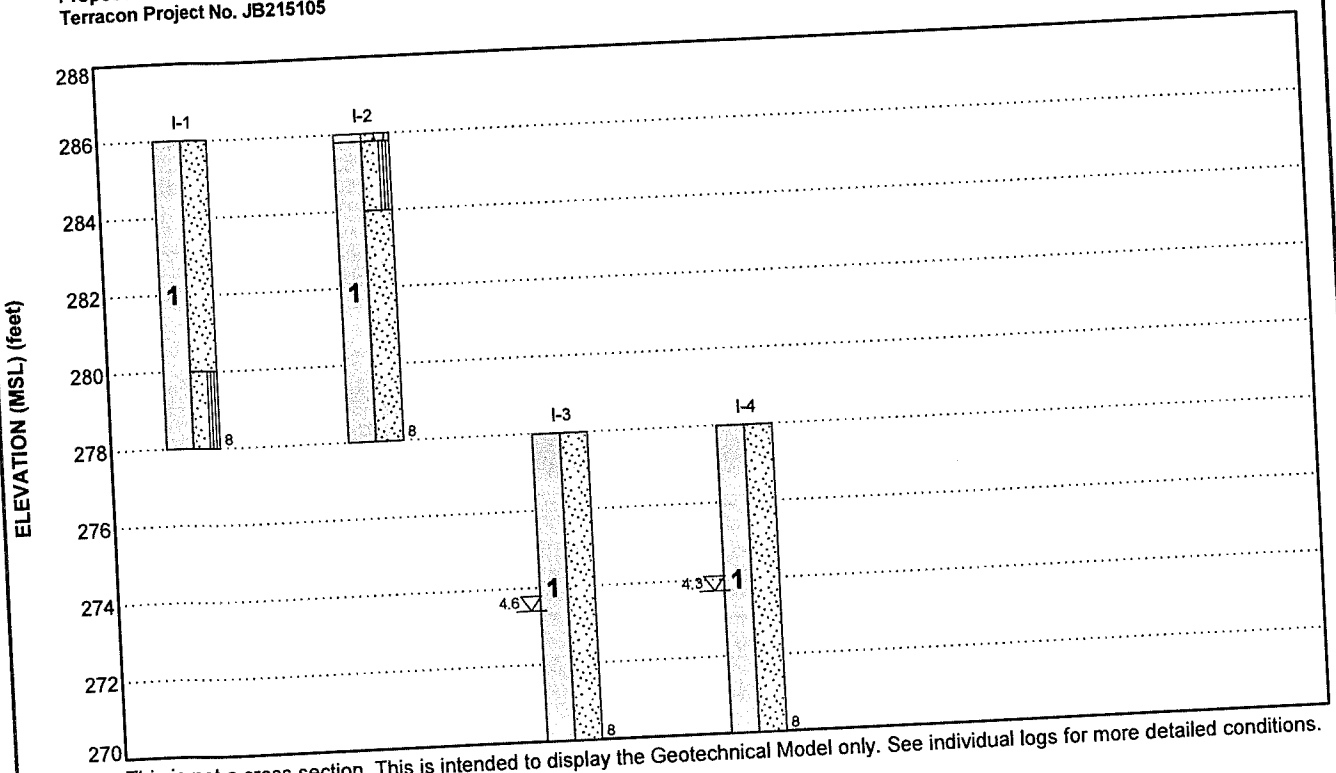
NOTES:

Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

GEOMODEL

Proposed Manufacturing Facility ■ Moreau, New York
Terracon Project No. JB215105

Terracon GeoReport



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LEGEND

- Poorly-graded Sand
- Poorly-graded Sand with Silt
- Topsoil

▽ First Water Observation

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Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

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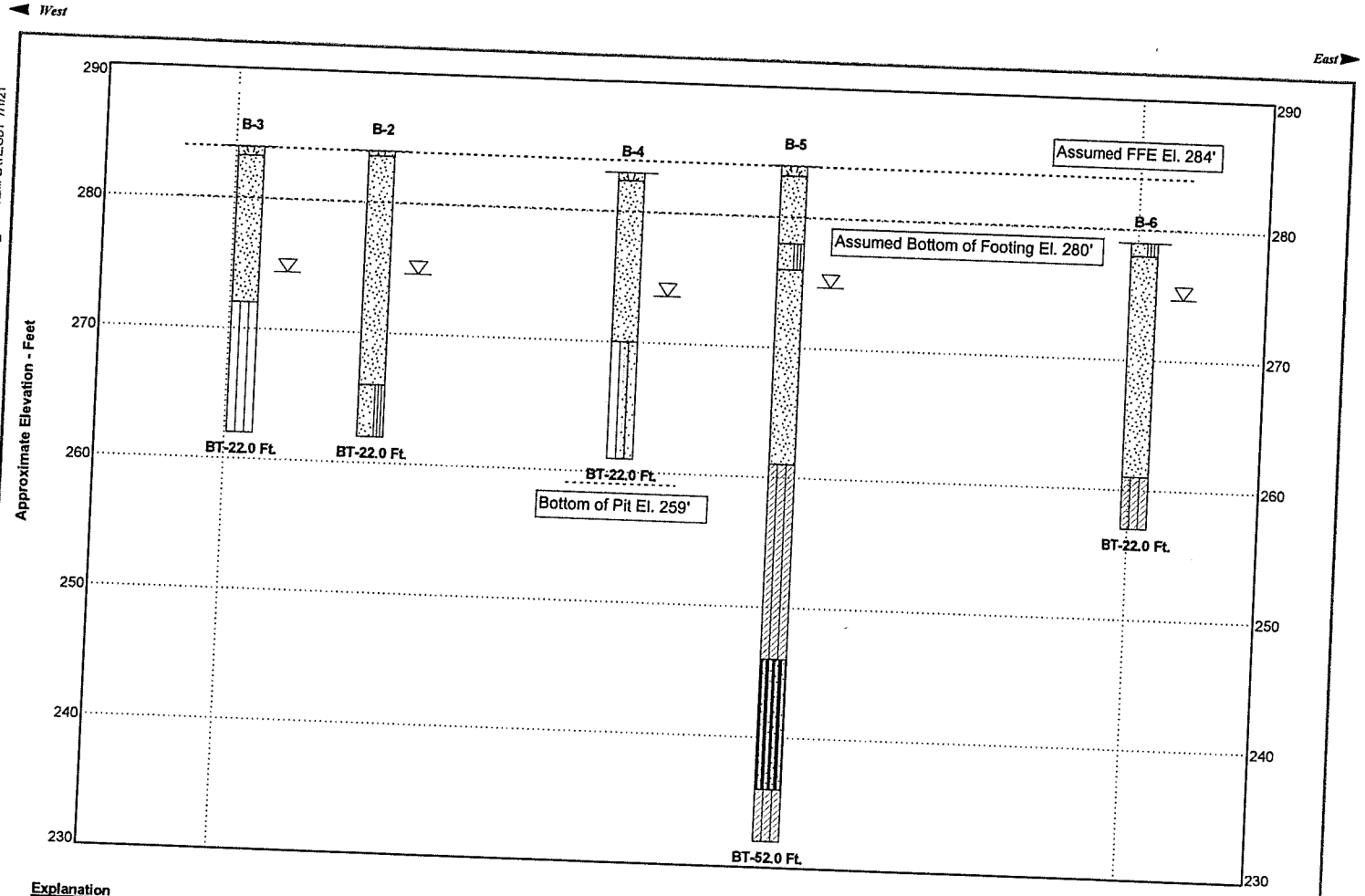


THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. SMART FENCE-8.5 X 11 JB215105 PROPOSED MANUFACT.GPJ TERRACON_DATATEMPLATE.GDT 7/1/21

Explanation

B-2 — Borehole Number
— Borehole Lithology
AR / BT — Borehole Termination Type
Water Level Reading at time of drilling.

See Exploration Plan for orientation of soil profile.
See General Notes in Supporting Information for symbols and soil classifications.
Soils profile provided for illustration purposes only.
Soils between borings may differ
AR - Auger Refusal
BT - Boring Termination

Project Manager: JH	Project No.: JB215105
Drawn by: JCH	Scale: N.T.S.
Approved by:	File Name: JB215105.1
Date: 7/1/2021	

Terracon
30 Corporate Cir Ste 201
Albany, NY
PH. 518-266-0310 FAX.

SUBSURFACE PROFILE

BUILDING CROSS SECTION SCHEMATIC
PROPOSED MANUFACTURING
FACILITY FARNAN ROAD
MOREAU, NEW YORK

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Test ID	Depth (feet)	Location
B-1 thru B-6	22.0 to 52.0	Proposed building footprint
B-7 thru B-9	8.0	Proposed pavement areas
I-1 thru I-4	8.0	Infiltration test locations

Test Boring Layout and Elevations: The test locations were selected by Terracon and were established in the field using a hand-held GPS unit, taped measurements and/or visual reference from existing site features. The borehole locations were determined on the basis of the proposed building layout described to us, within the limitations of access, existing structures and utilities.

A number of schematic plant layout configurations were under consideration at the time of this report; the layout upon which the test boring locations were selected and upon which this report is based was mutually agreed upon between Terracon and the design team at the proposal stage.

Existing ground surface elevation at each borehole location was estimated based upon our interpolation between topographic contours shown on the site plan provided to us. If more precise locations and/or elevations are desired, the as-completed test locations should be surveyed.

Subsurface Exploration Procedures: The test borings were completed using a standard rotary drill rig equipped with hollow stem augers. As the augers were advanced, the soils were sampled at intervals of five feet or less in accordance with the Standard Method for Penetration Test and Split-Barrel Sampling of Soils, ASTM D1586. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon is driven into the ground by a 140-pound automatic hammer falling 30-inches. The number of blows required to advance the sampling spoon the middle 12-inches of a normal 24-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the corresponding test depths. Upon completion of drilling the boreholes were backfilled with auger cuttings, concrete cylinders and/or sand and the surface restored in kind.

Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. The sampling depths, penetration distances, and other sampling information were recorded on the field boring logs.

The samples were placed in appropriate containers and taken to our laboratory for visual classification by a Geologist or Geotechnical Engineer. The soils were described based on the material's color, texture, plasticity and moisture Soil classifications are in general accordance with

the Unified Soil Classification System (USCS) as summarized herein. Final boring logs were prepared, and they represent the Geotechnical Engineer's interpretation based on the field logs and visual classifications, along with any laboratory testing performed.

Laboratory Testing

Selected samples recovered from the test borings were submitted for laboratory testing as part of the subsurface investigation, to confirm the visual classifications and to provide quantitative index properties for use in the geotechnical evaluation. This testing was performed in general accordance with the following standard methods:

- ASTM D2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil - and Rock by Mass (6 samples tested)
- ASTM D422 - Standard Test Method for Particle-Size Analysis of Soils (2 samples tested w/ hydrometer, 3 samples tested w/o hydrometer)
- ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils (1 sample tested)

SITE LOCATION AND EXPLORATION PLANS

Contents:

Site Location Plan
Exploration Plan

Note: All attachments are one page unless noted above

Terracon GeoReport

SITE LOCATION
Proposed Manufacturing Facility ■ Moreau, New York
July 21, 2021 ■ Terracon Project No. JB215105

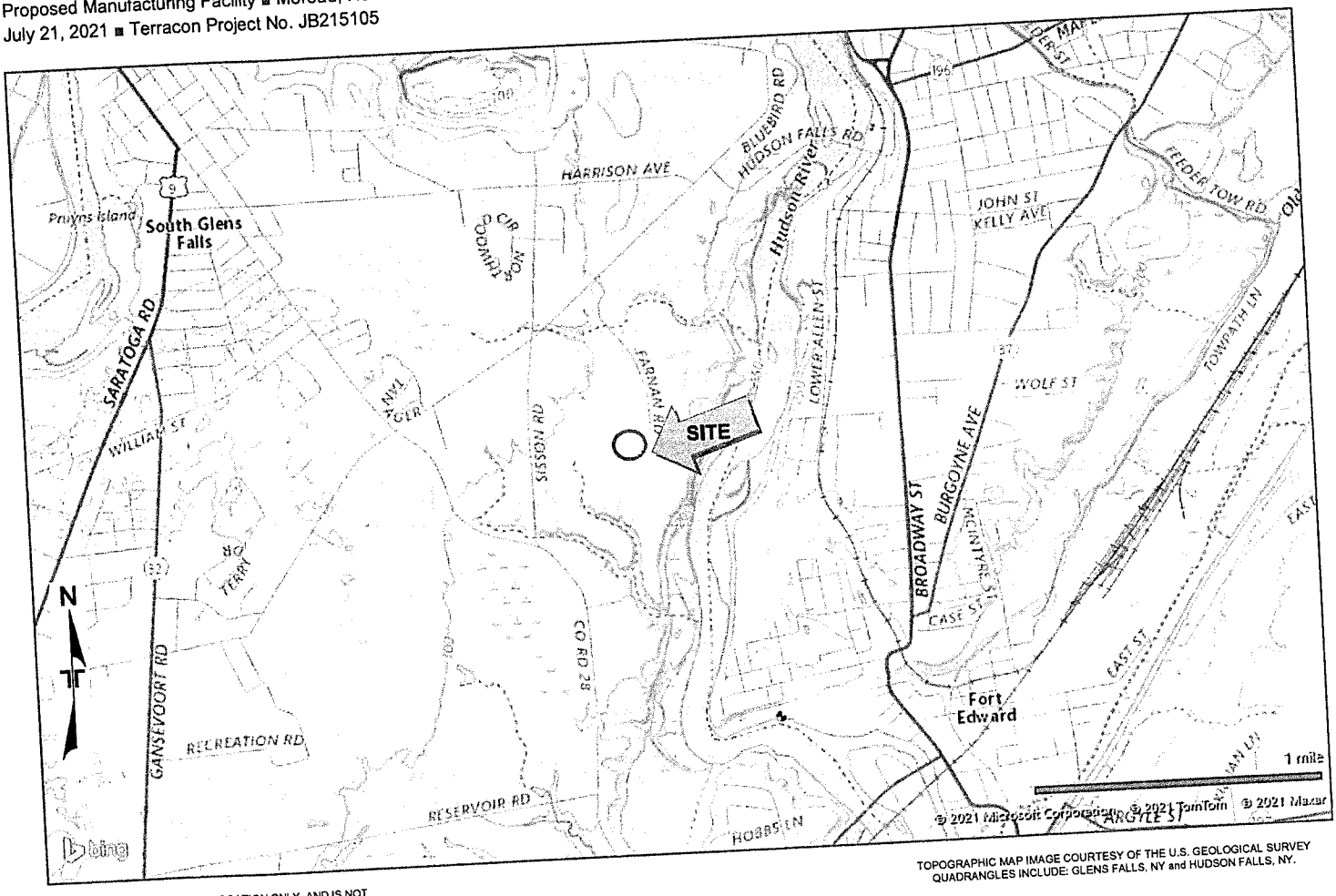


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY
QUADRANGLES INCLUDE: GLENS FALLS, NY and HUDSON FALLS, NY.

EXPLORATION PLAN
Proposed Manufacturing Facility ■ Moreau, New York
July 21, 2021 ■ Terracon Project No. JB215105

Terracon GeoReport

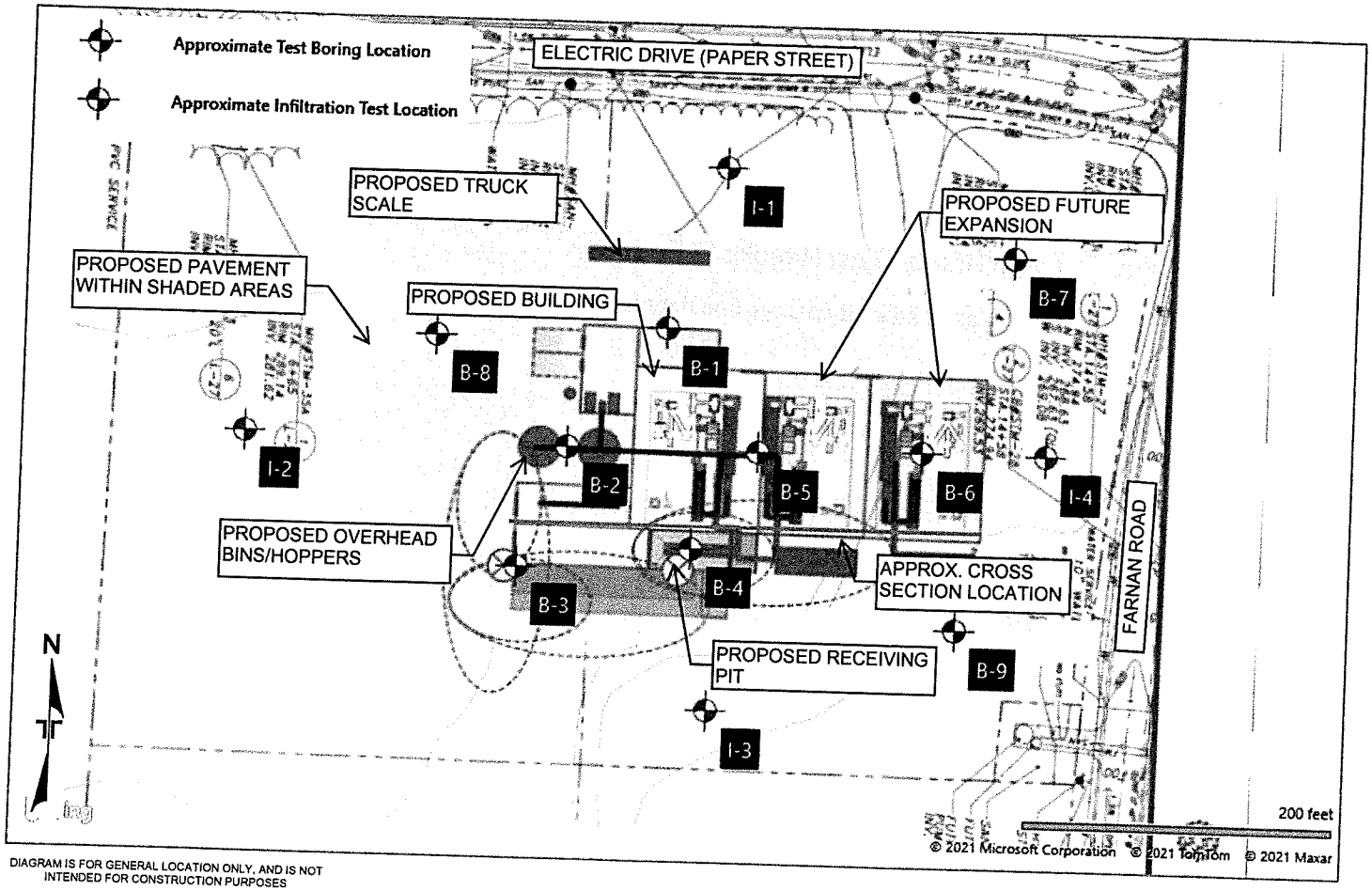


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

EXPLORATION RESULTS

Contents:

Test Boring Logs (B-1 thru B-9, I-1 thru I-4) (14 pages)
Laboratory Test Results (6 pages)
Infiltration Test Results (2 Pages)

Note: All attachments are one page unless noted above

BORING LOG NO. B-1

PROJECT: Proposed Manufacturing Facility

CLIENT: Northeastern Biochar Solutions LLC
Saratoga Springs, New York

SITE: Farnan Road
Moreau, New York

LOCATION See Exploration Plan

Latitude: 43.2834° Longitude: -73.6052°

Approximate Surface Elev.: 285 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
		0.5	284.5+/-							
			TOPSOIL							
			POORLY GRADED SAND (SP), trace silt and gravel, fine to coarse grained, brown to orange, very loose to loose							
								20	1-2-1-2 N=3	
								20	3-3-4-4 N=7	
			Trace rootlets noted from about 5 to 9 feet		5			22	2-3-2-3 N=5	
								20	2-2-2-3 N=4	6.9
1		12.0	273+/-		10	▽		22	4-3-4-5 N=7	
			POORLY GRADED SAND WITH SILT (SP-SM), fine grained, brown, loose to medium dense							
					15			24	3-3-3-3 N=6	
		22.0	263+/-		20			24	WH-6-7-4 N=13	
			Boring Terminated at 22 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation interpolated from a topographic site plan.

Notes:
Logged by: ORB
WH = Weight of Hammer

WATER LEVEL OBSERVATIONS

▽ *10.3' after 10-12' sample*

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 06-17-2021 | Boring Completed: 06-17-2021

Drill Rig: Diedrich D-50 | Driller: S. Morey

Project No.: JB215105

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL JB215105 PROPOSED MANUFACT.GPJ TERRACON_DATATEMPLATE.GDT 7/21/21

BORING LOG NO. B-2

PROJECT: Proposed Manufacturing Facility

CLIENT: Northeastern Biochar Solutions LLC
Saratoga Springs, New York

SITE: Farnan Road
Moreau, New York

LOCATION See Exploration Plan

Latitude: 43.2831° Longitude: -73.6054°

Approximate Surface Elev.: 284 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)		INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
		0.4	283.5+/-	**TOPSOIL**							
1				**POORLY GRADED SAND (SP)**, trace silt, fine grained, orange to brown, very loose to medium dense **No recovery at the 2-4' sample**					20	1-2-2-2 N=4	
									0	3-4-6-6 N=10	
						5			20	2-3-5-5 N=8	6.8
									19	3-4-5-5 N=9	
							▽				
						10			24	1-1-2-4 N=3	
						15			20	4-4-5-9 N=9	
		18.0	266+/-	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine grained, brown, medium dense		20			22	4-6-7-7 N=13	
		22.0	262+/-	***Boring Terminated at 22 Feet***							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation interpolated from a topographic site plan.

Notes:
Logged by: ORB

WATER LEVEL OBSERVATIONS

▽ *9.4' after 6-8' sample*

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 06-17-2021 | Boring Completed: 06-17-2021

Drill Rig: Diedrich D-50 | Driller: S. Morey

Project No.: JB215105

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL JB215105 PROPOSED MANUFACT.GPJ TERRACON_DATATEMPLATE.GDT 7/21/21

BORING LOG NO. B-3

PROJECT: Proposed Manufacturing Facility

CLIENT: Northeastern Biochar Solutions LLC
Saratoga Springs, New York

SITE: Farnan Road
Moreau, New York

LOCATION See Exploration Plan

Latitude: 43.2629° Longitude: -73.6055°

Approximate Surface Elev.: 284 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)		INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (in.)	FIELD TEST RESULTS	WATER CONTENT (%)
		0.7	283.5+/-	**TOPSOIL**							
1		12.0	272+/-	**POORLY GRADED SAND (SP)**, trace silt and rootlets, fine grained, orange to brown, very loose to medium dense **Slight mottling observed between 5 to 9'**		5			19	1-1-1-3 N=2	
									19	3-3-4-5 N=7	
									24	4-6-6-6 N=12	
									20	4-4-4-4 N=8	
						10	▽				
									22	2-3-3-4 N=6	
2		22.0	262+/-	**SILT WITH SAND (ML)**, with fine sand partings, brown, medium stiff to very stiff **Grades to clay partings and seams between 15 to 17'**		15			24	4-2-3-3 N=5	33.2
						20			22	6-7-10-10 N=17	
				Boring Terminated at 22 Feet							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

WATER LEVEL OBSERVATIONS

▽ *9.6' after 10-12' sample*

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation interpolated from a topographic site plan

Notes:
Logged by: ORB

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 06-18-2021 | Boring Completed: 06-18-2021

Drill Rig: Diedrich D-50 | Driller: S. Morey

Project No.: JB215105

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL JB215105 PROPOSED MANUFACT.GPJ TERRACON_DATATEMPLATE.GDT 7/21/21

BORING LOG NO. B-4

PROJECT: Proposed Manufacturing Facility

CLIENT: Northeastern Biochar Solutions LLC
Saratoga Springs, New York

SITE: Farnan Road
Moreau, New York

LOCATION See Exploration Plan
Latitude: 43.2830° Longitude: -73.6051°
Approximate Surface Elev.: 283 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	INSTALLATION DETAILS
			282.5+/-	
		0.6		**TOPSOIL**
				POORLY GRADED SAND (SP), trace silt, fine to medium grained, brown to orange, very loose to loose
				Grades to fine to coarse grained
1			270+/-	
		13.0		**SILTY SAND (SM)**, fine grained, brown, stiff to very stiff
				Clay partings noted from about 15 to 17'
			261+/-	
		22.0		***Boring Terminated at 22 Feet***

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
			19	1-1-1-1 N=2	
			20	2-3-2-3 N=5	
5			20	2-3-3-4 N=6	
			19	4-4-4-4 N=8	
	▽				
10			22	1-1-3-5 N=4	
15			22	8-10-4-4 N=14	
20			13	4-10-10-9 N=20	27.1

Hammer Type: Automatic

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

WATER LEVEL OBSERVATIONS

▽ *9.4' after 10-12' sample*

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation interpolated from a topographic site plan.

Notes:

Logged by: ORB

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 06-17-2021 | Boring Completed: 06-17-2021

Drill Rig: Diedrich D-50 | Driller: S. Morey

Project No.: JB215105

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL JB215105 PROPOSED MANUFACT.GPJ TERRACON_DATATEMPLATE.GDT 7/21/21

BORING LOG NO. B-5

PROJECT: Proposed Manufacturing Facility

CLIENT: Northeastern Biochar Solutions LLC
Saratoga Springs, New York

SITE: Farnan Road
Moreau, New York

LOCATION See Exploration Plan

Latitude: 43.2831° Longitude: -73.6050°

Approximate Surface Elev.: 284 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)		INSTALLATION DETAILS
1		0.8	283+/-	**TOPSOIL**	
1		6.0	278+/-	**POORLY GRADED SAND (SP)**, trace silt and rootlets, fine to coarse grained, brown to orange, very loose to loose **Grades to fine grained**	
1		8.0	276+/-	**POORLY GRADED SAND WITH SILT (SP-SM)**, trace rootlets, some mottling, fine grained, brown, loose	
1		23.0	261+/-	**POORLY GRADED SAND (SP)**, trace to with silt, fine to medium grained, brown, loose to medium dense	
3				**BANDED SILT AND CLAY (CL)**, with fine sand partings, gray, very soft to soft	

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
			22	1-1-2-1 N=3	
			19	2-2-2-3 N=4	
5			22	2-3-4-4 N=7	
			20	3-3-3-4 N=6	
	▽				
10			20	4-4-3-4 N=7	
15			19	5-6-8-11 N=14	
20			20	6-8-7-8 N=15	
25			24	WH/24"	

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

WATER LEVEL OBSERVATIONS

▽ *9.3' after 10-12' sample*

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation interpolated from a topographic site plan

Notes:

Logged by: ORB

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 06-15-2021 | Boring Completed: 06-15-2021

Drill Rig: Diedrich D-50 | Driller: S. Morey

Project No.: JB215105

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL JB215105 PROPOSED MANUFACT.GPJ TERRACON_DATATEMPLATE.GDT 7/21/21

BORING LOG NO. B-5

PROJECT: Proposed Manufacturing Facility

CLIENT: Northeastern Biochar Solutions LLC
Saratoga Springs, New York

SITE: Farnan Road
Moreau, New York

LOCATION See Exploration Plan

Latitude: 43.2831° Longitude: -73.6050°

Approximate Surface Elev.: 284 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH (Ft.) / ELEVATION (Ft.)		WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
3		DEPTH	**BANDED SILT AND CLAY (CL)**, with fine sand partings, gray, very soft to soft *(continued)*					
		30			X	24	WH/12"-1/12"	47.0
		35			X	24	WH-2-1-2 N=3	
		246+/-						
2		38.0	**SANDY SILT (ML)**, with clay seams, fine grained, gray, medium stiff to stiff					
		40			X	24	3-6-7-10 N=13	
		45			X	24	3-3-6-9 N=9	
		236+/-						
3		48.0	**BANDED SILT AND CLAY (CL-ML)**, gray, stiff					
		50			X	24	3-5-6-6 N=11	
		232+/-						
		52.0	***Boring Terminated at 52 Feet***					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

WATER LEVEL OBSERVATIONS

▽ *9.3' after 10-12' sample*

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation interpolated from a topographic site plan

Notes:
WH = Weight of Hammer

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 06-15-2021 | Boring Completed: 06-15-2021

Drill Rig: Diedrich D-50 | Driller: S. Morey

Project No.: JB215105

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL JB215105 PROPOSED MANUFACT.GPJ TERRACON_DATATEMPLATE.GDT 7/21/21

BORING LOG NO. B-6

PROJECT: Proposed Manufacturing Facility

CLIENT: Northeastern Biochar Solutions LLC
Saratoga Springs, New York

SITE: Farnan Road
Moreau, New York

LOCATION See Exploration Plan

Latitude: 43.2831° Longitude: -73.6046°

Approximate Surface Elev.: 279 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)		INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
1		1.0	278+/-	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine to medium grained, dark brown, medium dense							
				POORLY GRADED SAND (SP), trace silt, fine to medium grained, brown, loose to medium dense **No recovery at the 2-4' sample** **Mottling observed from 4 to 9'**				22	3-7-10-13 N=17	
							▽		0	14-14-14-14 N=28	
						5			20	3-3-4-5 N=7	
									24	3-3-5-10 N=8	25.7
						10			22	4-4-7-7 N=11	
						15			22	4-6-7-7 N=13	
3		18.0	261+/-	**BANDED SILT AND CLAY (CL-ML)**, gray, medium stiff							
		22.0	257+/-	***Boring Terminated at 22 Feet***		20			24	2-3-2-2 N=5	

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

WATER LEVEL OBSERVATIONS

▽ *4.3' after 6-8' sample*

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation interpolated from a topographic site plan.

Notes:
Logged by: ORB

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 06-18-2021 | Boring Completed: 06-18-2021
Drill Rig: Diedrich D-50 | Driller: S. Morey
Project No.: JB215105

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL JB215105 PROPOSED MANUFACT.GPJ TERRACON_DATATEMPLATE.GDT 7/21/21

BORING LOG NO. B-7

PROJECT: Proposed Manufacturing Facility

CLIENT: Northeastern Biochar Solutions LLC
Saratoga Springs, New York

SITE: Farnan Road
Moreau, New York

LOCATION See Exploration Plan

Latitude: 43.2835° Longitude: -73.6044°

Approximate Surface Elev.: 279 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
1		0						22	1-5-8-9 N=13	
								20	8-10-12-10 N=22	
					5			22	6-7-7-6 N=14	
								24	2-2-2-3 N=4	
		8.0	271+/-							

POORLY GRADED SAND (SP), trace silt, fine grained, loose to medium dense
Mottled observed from 0 to 2'

Boring Terminated at 8 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

WATER LEVEL OBSERVATIONS

No free water observed

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation interpolated from a topographic site plan

Notes:
Logged by: ORB

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 06-21-2021 | Boring Completed: 06-21-2021

Drill Rig: Diedrich D-50 | Driller: S. Morey

Project No.: JB215105

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL JB215105 PROPOSED MANUFACT.GPJ TERRACON_DATATEMPLATE.GDT 7/21/21

BORING LOG NO. B-8

PROJECT: Proposed Manufacturing Facility

CLIENT: Northeastern Biochar Solutions LLC
Saratoga Springs, New York

SITE: Farnan Road
Moreau, New York

LOCATION See Exploration Plan

Latitude: 43.2833° Longitude: -73.6058°

Approximate Surface Elev.: 286 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)		INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
		0.7	285.5+/-	**TOPSOIL**							
		2.0		**POORLY GRADED SAND (SP)**, trace silt, fine to coarse grained, brown to orange, very loose					20	2-1-2-2 N=3	
		4.0	284+/-	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine grained, brown, loose					22	3-3-3-4 N=6	
1		8.0	282+/-	**POORLY GRADED SAND (SP)**, trace silt, fine to medium grained, brown, loose		5			22	4-4-5-5 N=9	
			278+/-	***Boring Terminated at 8 Feet***					20	4-4-5-6 N=9	

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

WATER LEVEL OBSERVATIONS

No free water observed

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation interpolated from a topographic site plan.

Notes:
Logged by: ORB

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 06-17-2021 | Boring Completed: 06-17-2021

Drill Rig: Diedrich D-50 | Driller: S. Morey

Project No.: JB215105

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL JB215105 PROPOSED MANUFACT.GPJ TERRACON_DATATEMPLATE.GDT 7/21/21

BORING LOG NO. B-9

PROJECT: Proposed Manufacturing Facility

CLIENT: Northeastern Biochar Solutions LLC
Saratoga Springs, New York

SITE: Farnan Road
Moreau, New York

LOCATION See Exploration Plan
Latitude: 43.2828° Longitude: -73.6045°
Approximate Surface Elev.: 278 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
1		0	278					22	1-2-3-3 N=5	
								19	3-4-4-5 N=8	
					5			24	3-3-3-3 N=6	
								24	2-2-3-8 N=5	
		8.0	270+/-							

POORLY GRADED SAND (SP), trace silt, fine to medium grained, brown, loose

Mottling observed from about 6 to 8'

Boring Terminated at 8 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

WATER LEVEL OBSERVATIONS
No free water observed

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation interpolated from a topographic site plan.

Notes:
Logged by: ORB

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 06-21-2021
Boring Completed: 06-21-2021
Drill Rig: Diedrich D-50
Driller: S. Morey
Project No.: JB215105

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL JB215105 PROPOSED MANUFACT.GPJ TERRACON_DATATEMPLATE.GDT 7/21/21

BORING LOG NO. I-1

PROJECT: Proposed Manufacturing Facility

CLIENT: Northeastern Biochar Solutions LLC
Saratoga Springs, New York

SITE: Farnan Road
Moreau, New York

LOCATION See Exploration Plan

Latitude: 43.2836° Longitude: -73.6051°

Approximate Surface Elev.: 286 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
1				4" ID PVC installed to 4'						
								18	1-1-2-1 N=3	
								22	2-1-2-2 N=3	
					5			20	3-3-3-3 N=6	
								22	3-3-3-4 N=6	

POORLY GRADED SAND (SP), trace silt, gravel, and roots, fine to coarse grained, brown to orange, very loose to loose

Grades to fine grained

6.0 — 280+/-

POORLY GRADED SAND WITH SILT (SP-SM), trace roots, fine grained, brown to orange, loose

8.0 — 278+/-

Boring Terminated at 8 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

WATER LEVEL OBSERVATIONS

No free water observed

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation interpolated from a topographic site plan.

Notes:
Logged by: ORB

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 06-18-2021 | Boring Completed: 06-18-2021

Drill Rig: Diedrich D-50 | Driller: S. Morey

Project No.: JB215105

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL JB215105 PROPOSED MANUFACT.GPJ TERRACON_DATATEMPLATE.GDT 7/21/21

BORING LOG NO. I-2

PROJECT: Proposed Manufacturing Facility

CLIENT: Northeastern Biochar Solutions LLC
Saratoga Springs, New York

SITE: Farnan Road
Moreau, New York

LOCATION See Exploration Plan

Latitude: 43.2832° Longitude: -73.6062°

Approximate Surface Elev.: 286 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)		INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
		0.2	286+/-	**TOPSOIL**							
1		2.0	284+/-	**POORLY GRADED SAND WITH SILT (SP-SM)**, trace silt, fine grained, brown to orange, very loose	4" ID PVC installed to 4'				18	1-1-2-2 N=3	
				POORLY GRADED SAND (SP), trace silt, fine to coarse grained, brown, loose					22	2-3-4-4 N=7	
						5			22	3-4-4-4 N=8	
									20	3-3-2-2 N=5	
		8.0	278+/-	***Boring Terminated at 8 Feet***							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

WATER LEVEL OBSERVATIONS

No free water observed

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation interpolated from a topographic site plan.

Notes:
Logged by: ORB

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 06-17-2021
Boring Completed: 06-17-2021
Drill Rig: Diedrich D-50
Driller: S. Morey
Project No.: JB215105

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL JB215105 PROPOSED MANUFACT.GPJ TERRACON_DATATEMPLATE.GDT 7/21/21

BORING LOG NO. I-3

PROJECT: Proposed Manufacturing Facility

CLIENT: Northeastern Biochar Solutions LLC
Saratoga Springs, New York

SITE: Farnan Road
Moreau, New York

LOCATION See Exploration Plan

Latitude: 43.2827° Longitude: -73.6051°

Approximate Surface Elev.: 278 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)		INSTALLATION DETAILS	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
1		0	278+/-	**POORLY GRADED SAND (SP)**, trace silt, fine to coarse grained, dark brown to brown, medium dense	4" ID PVC installed to 2.5'				24	3-6-8-11 N=14	
									19	8-12-15-12 N=27	
						5	▽		24	10-8-6-8 N=14	
				Grades to trace gravel, silt partings					24	4-6-4-9 N=10	
		8.0	270+/-	***Boring Terminated at 8 Feet***							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

WATER LEVEL OBSERVATIONS

▽ *4.6' after boring completion*

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation interpolated from a topographic site plan

Notes:
Logged by: ORB

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 06-18-2021 | Boring Completed: 06-18-2021

Drill Rig: Diedrich D-50 | Driller: S. Morey

Project No.: JB215105

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL JB215105 PROPOSED MANUFACT.GPJ TERRACON_DATATEMPLATE.GDT 7/21/21

BORING LOG NO. I-4

PROJECT: Proposed Manufacturing Facility

CLIENT: Northeastern Biochar Solutions LLC
Saratoga Springs, New York

SITE: Farnan Road
Moreau, New York

LOCATION See Exploration Plan

Latitude: 43.2831° Longitude: -73.6043°

Approximate Surface Elev.: 278 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH (Ft.)	ELEVATION (Ft.)	INSTALLATION DETAILS	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	WATER CONTENT (%)
1		0	278+/-	4" ID PVC installed to 2'			22	2-3-5-7 N=8	
							22	6-7-6-6 N=13	
		5			▽		20	4-4-4-4 N=8	
							24	2-2-4-4 N=6	
		8.0	270+/-						

Boring Terminated at 8 Feet

POORLY GRADED SAND (SP), trace silt, fine to medium grained, brown/gray, loose and medium dense

DEPTH

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4 1/4" ID HSA

Abandonment Method:
Boring backfilled with soil cuttings upon completion.

WATER LEVEL OBSERVATIONS

▽ *4.3' after boring completion*

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevation interpolated from a topographic site plan.

Notes:
Logged by: ORB

Terracon
30 Corporate Cir Ste 201
Albany, NY

Boring Started: 06-18-2021 | Boring Completed: 06-18-2021

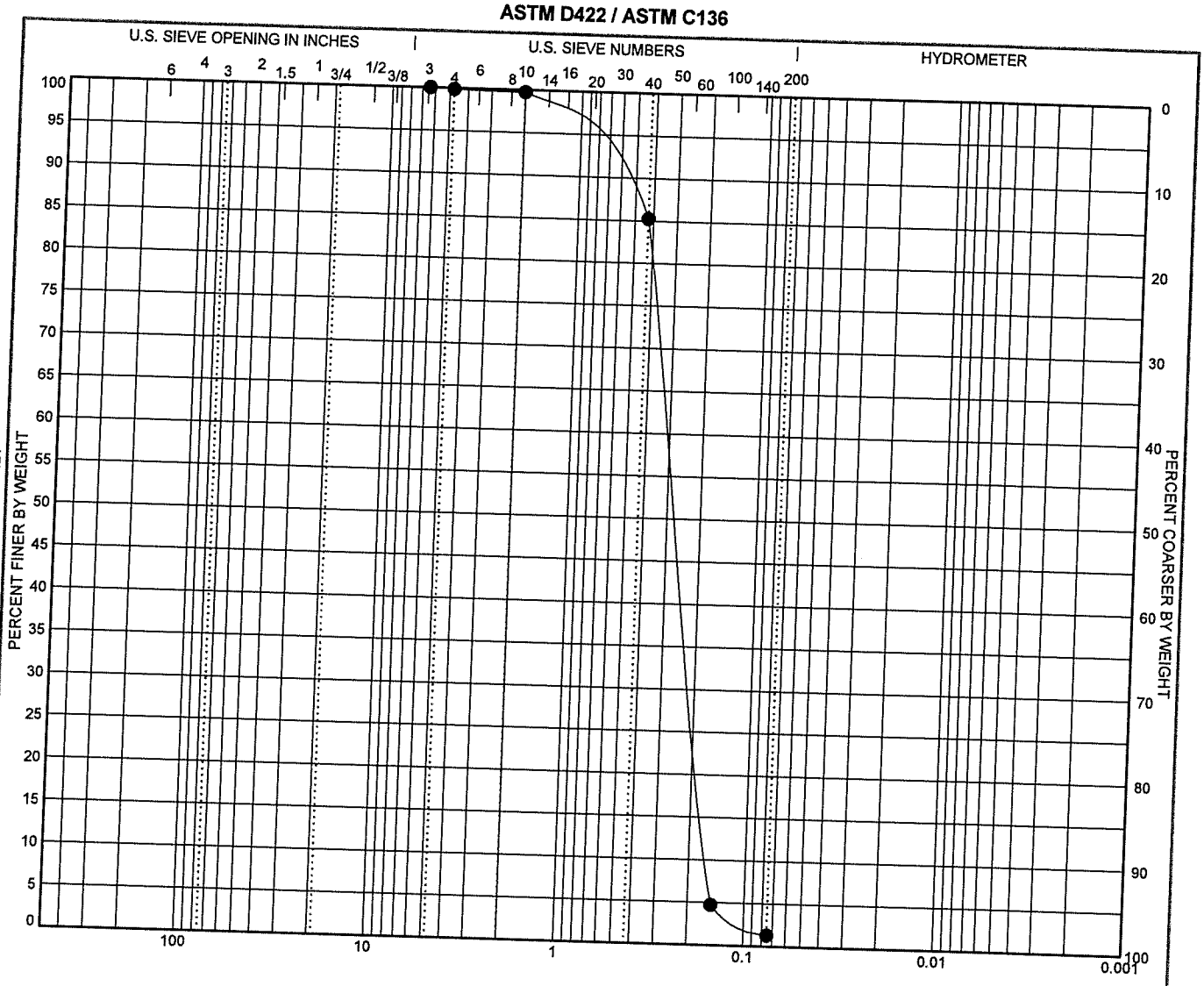
Drill Rig: Diedrich D-50 | Driller: S. Morey

Project No.: JB215105

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-WELL JB215105 PROPOSED MANUFACT.GPJ TERRACON_DATATEMPLATE.GDT 7/21/21

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	B-1	6 - 8	0.0	0.1	98.6		1.3		SP

GRAIN SIZE			
	●		
D_{60}	0.307		
D_{30}	0.208		
D_{10}	0.161		

COEFFICIENTS			
	●		
C_C	0.88		
C_U	1.91		

●					
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
1/4"	100.0				
#4	99.87				
#10	99.74				
#40	85.22				
#100	4.72				
#200	1.28				

SOIL DESCRIPTION
● POORLY GRADED SAND (SP)

REMARKS
●

PROJECT: Proposed Manufacturing Facility

SITE: Faman Road
Moreau, New York

Terracon
30 Corporate Cir Ste 201
Albany, NY

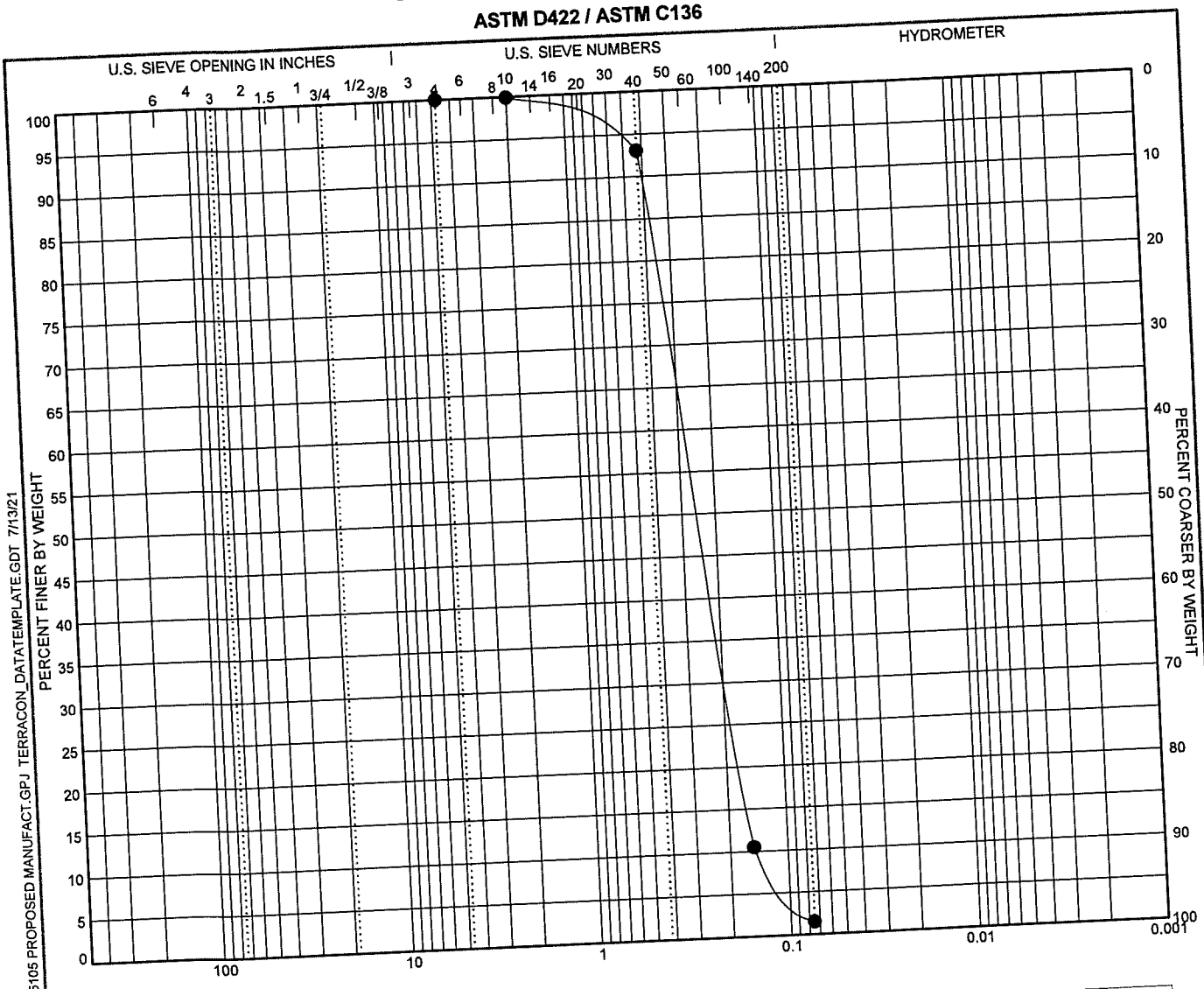
PROJECT NUMBER: JB215105

CLIENT: Northeastern Biochar Solutions LLC
Saratoga Springs, New York

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 JB215105 PROPOSED MANUFACT.GPJ TERRACON_DATATEMPLATE.GDT 7/13/21

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	B-2	4 - 6	0.0	0.0	98.5		1.5		SP

GRAIN SIZE			
	●		
D_{60}	0.28		
D_{30}	0.192		
D_{10}	0.144		

COEFFICIENTS			
	●		
C_C	0.91		
C_U	1.94		

●	Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
	#4	100.0				
	#10	99.92				
	#40	93.04				
	#100	10.49				
	#200	1.48				

SOIL DESCRIPTION	
●	POORLY GRADED SAND (SP)

REMARKS	
●	

PROJECT: Proposed Manufacturing Facility

SITE: Farnan Road
Moreau, New York

Terracon
30 Corporate Cir Ste 201
Albany, NY

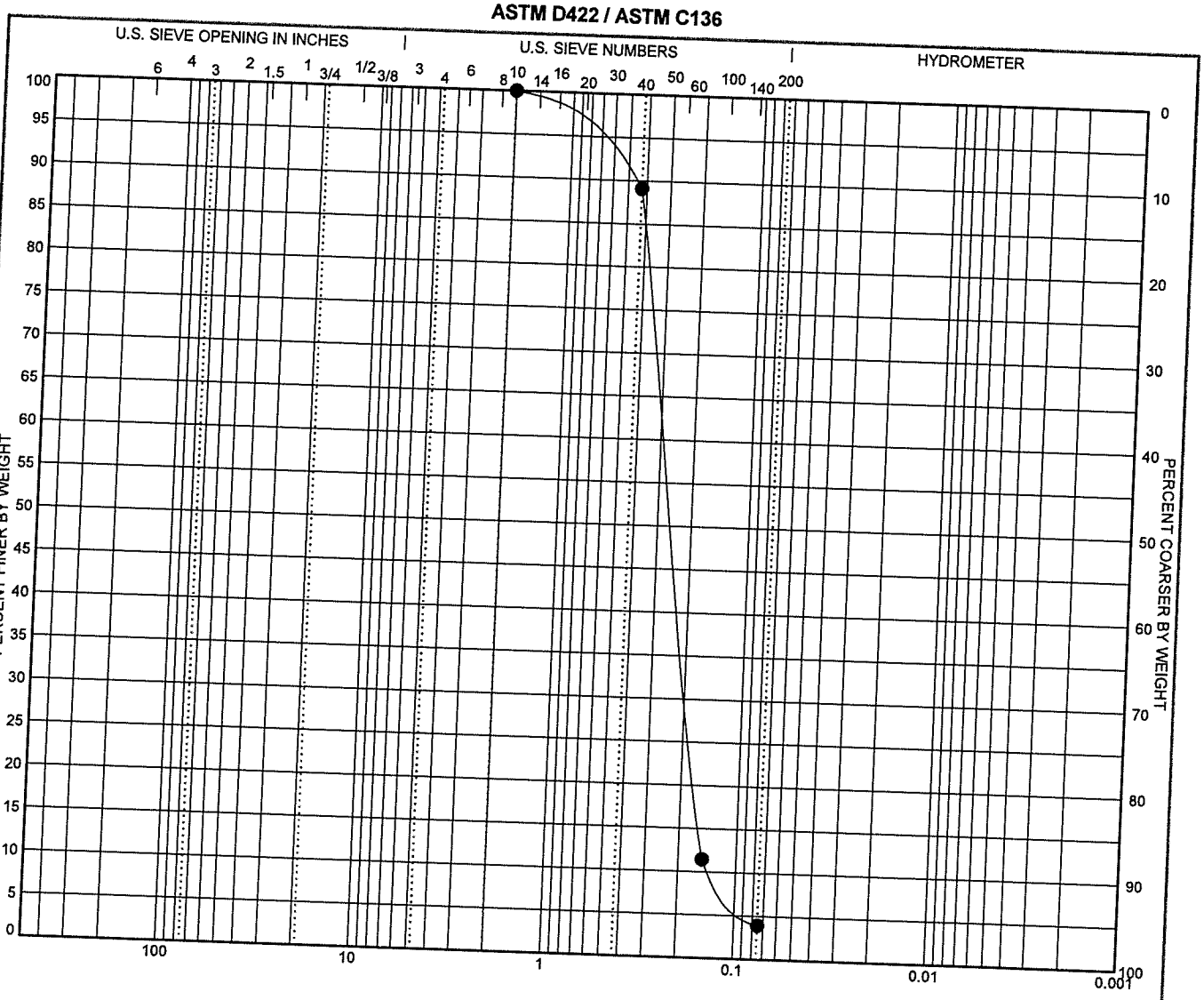
PROJECT NUMBER: JB215105

CLIENT: Northeastern Biochar Solutions LLC
Saratoga Springs, New York

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 JB215105 PROPOSED MANUFACT.GPJ TERRACON_DATATEMPLATE.GDT 7/13/21

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	B-6	6 - 8	0.0	0.0	96.1		3.9		SP

GRAIN SIZE	●
D_{60}	0.288
D_{30}	0.192
D_{10}	0.131

COEFFICIENTS	●
C_C	0.98
C_U	2.19

● Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#10	100.0				
#40	89.07				
#100	11.44				
#200	3.92				

SOIL DESCRIPTION
● POORLY GRADED SAND (SP)

REMARKS
●

PROJECT: Proposed Manufacturing Facility

SITE: Faman Road
Moreau, New York

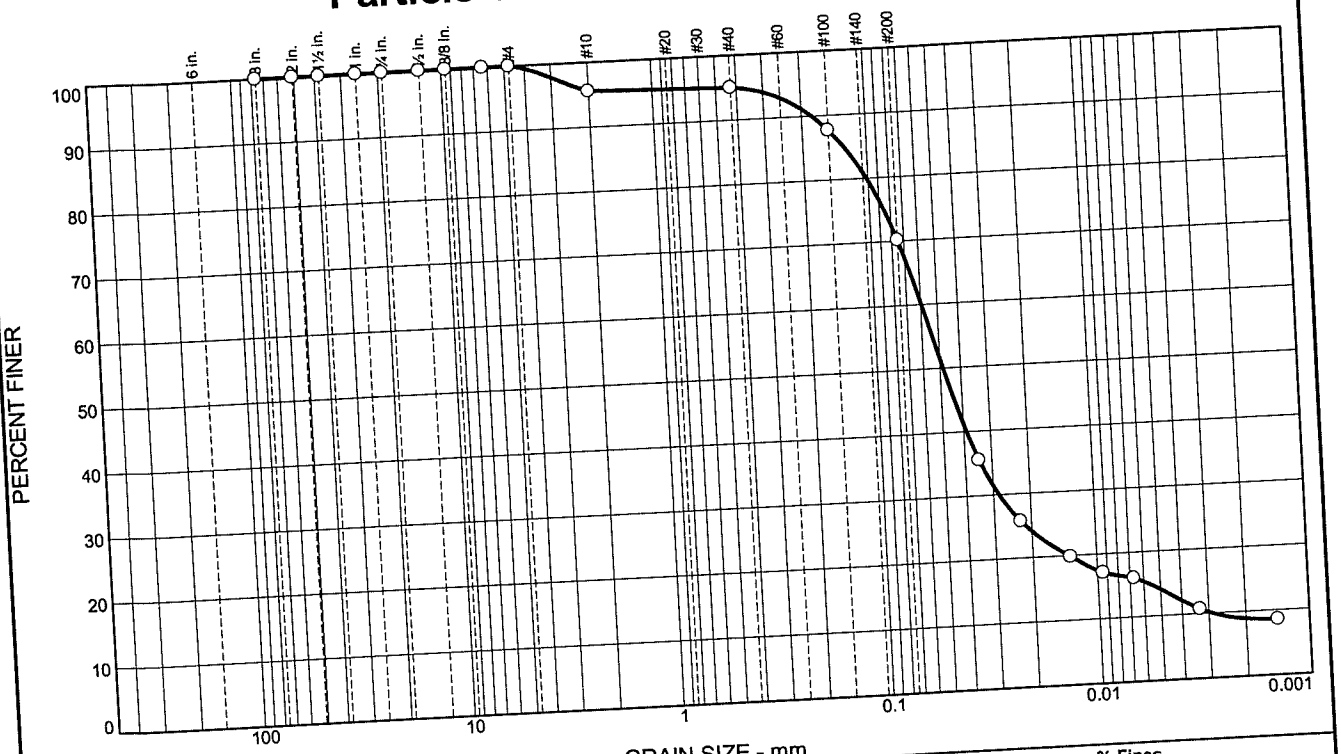
Terracon
30 Corporate Cir Ste 201
Albany, NY

PROJECT NUMBER: JB215105

CLIENT: Northeastern Biochar Solutions LLC
Saratoga Springs, New York

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 JB215105 PROPOSED MANUFACT.GPJ TERRACON_DATATEMPLATE.GDT 7/13/21

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	4.4	0.6	24.9	56.0	14.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	100.0		
0.75"	100.0		
0.5"	100.0		
0.375"	100.0		
0.25"	100.0		
#4	100.0		
#10	95.6		
#40	95.0		
#100	87.6		
#200	70.1		

* (no specification provided)

Material Description

Silt with sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.1792 D_{85}= 0.1279 D_{60}= 0.0596
D_{50}= 0.0484 D_{30}= 0.0283 D_{15}= 0.0056
D_{10}= 0.0029 C_u= 20.56 C_c= 4.64

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Per ASTM D422

Source of Sample: B-3 15'-17' **Date:** 7-7-21

Terracon Consultants-NY, Inc.

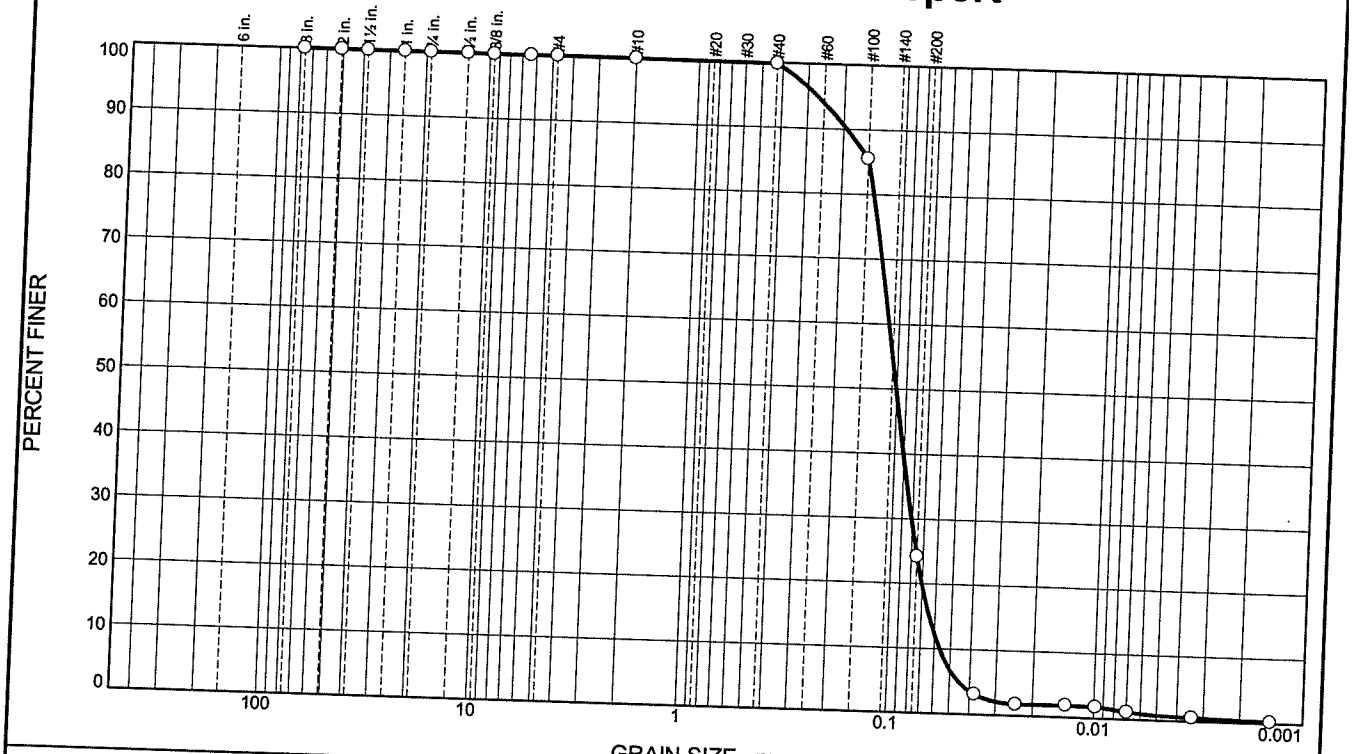
Albany, NY

Client: Northeastern Biochar Solutions LLC
Project: Proposed Manufacturing Facility
Moreau, NY
Project No: JB215105

Figure B-3 15'-17'

Tested By: AB **Checked By:** JH

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	75.7	23.5	0.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	100.0		
0.75"	100.0		
0.5"	100.0		
0.375"	100.0		
0.25"	100.0		
#4	100.0		
#10	100.0		
#40	99.9		
#100	85.5		
#200	24.2		

* (no specification provided)

Material Description

Silty sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.1927 D_{85}= 0.1489 D_{60}= 0.1116
D_{50}= 0.1008 D_{30}= 0.0810 D_{15}= 0.0641
D_{10}= 0.0566 C_u= 1.97 C_c= 1.04

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Per ASTM D422

Source of Sample: B-4 20'-22'

Date: 7-7-21

Terracon Consultants-NY, Inc.

Albany, NY

Client: Northeastern Biochar Solutions LLC

Project: Proposed Manufacturing Facility
Moreau, NY

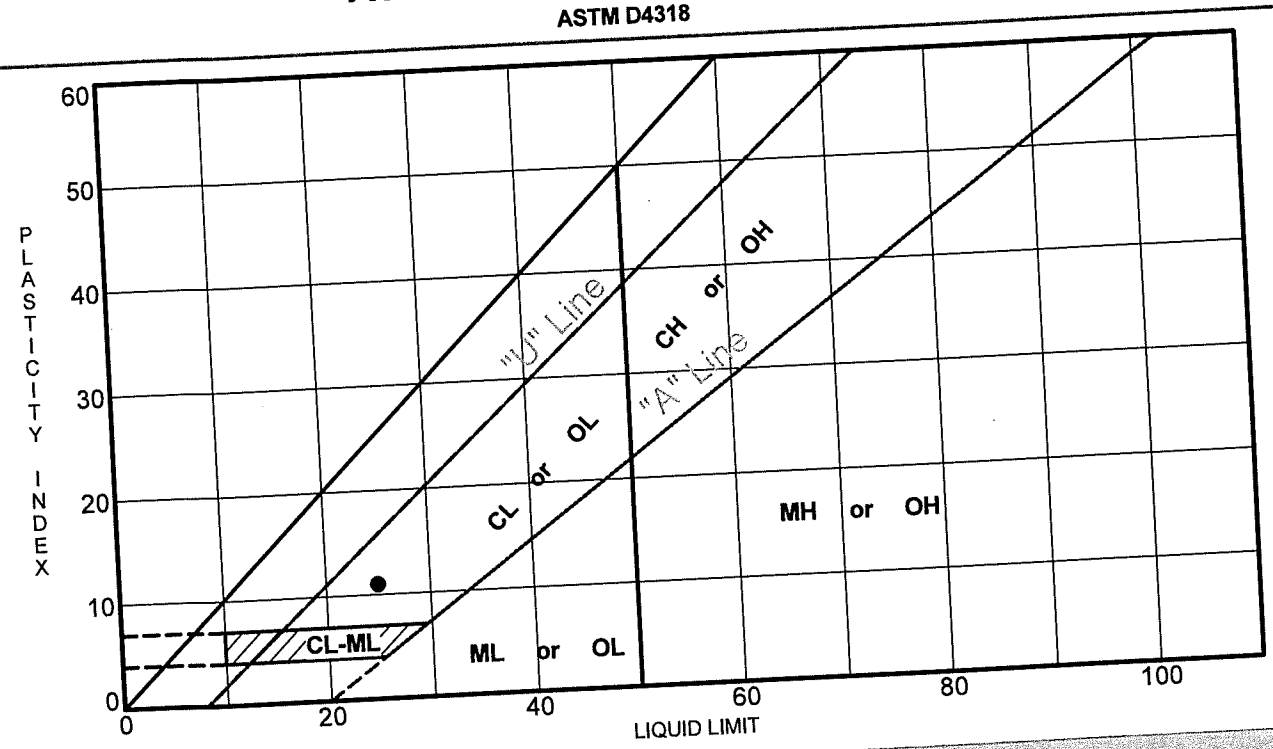
Project No: JB215105

Figure B-4 20'-22'

Tested By: AB **Checked By:** JH

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
● B-5	30 - 32	25	14	11		CL	Lean Clay

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. ATTERBERG LIMITS JB215105 PROPOSED MANUFACT.GPJ TERRACON_DATATEMPLATE.GDT 7/13/21

PROJECT: Proposed Manufacturing Facility

SITE: Faman Road
Moreau, New York

Terracon
30 Corporate Cir Ste 201
Albany, NY

PROJECT NUMBER: JB215105

CLIENT: Northeastern Biochar Solutions LLC
Saratoga Springs, New York

Terracon

INFILTRATION TEST RESULTS

PROJECT: Proposed Manufacturing Facility				**PROJECT NO.** JB215105	
PROJECT LOCATION: Moreau, New York				**TEST DATE:** 6/21/21	
WEATHER: Hot, humid, 90 degrees				**TESTER:** SM & SL	
Test Location	**Test Depth (feet)**	**Trial No.**	**Water Drop (in)**	**Elapsed Time (min)**	**Infiltration Rate (inches/hour)**
I-1	4.0	1	24	11	>24
		2	24	14	>24
		3	24	23	>24
		4	24	32	>24
		Infiltration rate for trial no. 4 = >24 inches per hour Average infiltration rate for trials nos. 1-4 = >24inches per hour			
I-2	4.0	1	24	18	>24
		2	24	20	>24
		3	24	22	>24
		4	24	25	>24
		Infiltration rate for trial no. 4 = >24 inches per hour Average infiltration rate for trials nos. 1-4 = >24 inches per hour			

Notes:

(1) Testing was conducted in general accord with the "Infiltration Testing Requirements" outlined in Appendix D of the New York State Stormwater Management Design Manual.

(2) Infiltration tests were located alongside companion test borings numbered correspondingly.

SOIL CLASSIFICATION AT TEST DEPTH

Test Location I-1: Poorly graded sand, trace silt, fine grained

Test Location I-2: Poorly graded sand, trace silt, fine to medium grained

Terracon

INFILTRATION TEST RESULTS

PROJECT: Proposed Manufacturing Facility	**PROJECT NO.** JB215105
PROJECT LOCATION: Moreau, New York	**TEST DATE:** 6/21/21
WEATHER: Hot, humid, 90 degrees	**TESTER:** SM & SL

Test Location	Test Depth (feet)	Trial No.	Water Drop (in)	Elapsed Time (min)	Infiltration Rate (inches/hour)
I-3	2.5	1	24	4	>24
		2	24	4	>24
		3	24	5	>24
		4	24	5	>24
		Infiltration rate for trial no. 4 = >24 inches per hour Average infiltration rate for trials nos. 1-4 = >24 inches per hour			
I-4	2.0	1	24	7	>24
		2	24	9	>24
		3	24	10	>24
		4	24	10	>24
		Infiltration rate for trial no. 4 = >24 inches per hour Average infiltration rate for trials nos. 1-4 = >24 inches per hour			

Notes:

(1) Testing was conducted in general accord with the "Infiltration Testing Requirements" outlined in Appendix D of the New York State Stormwater Management Design Manual.

(2) Infiltration tests were located alongside companion test borings numbered correspondingly.

SOIL CLASSIFICATION AT TEST DEPTH

Test Location I-3: Poorly graded sand, trace silt, fine to medium grained

Test Location I-4: Poorly graded sand, trace silt, fine to medium grained

SUPPORTING INFORMATION

Contents:

General Notes
Unified Soil Classification System

Note: All attachments are one page unless noted above

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS
Proposed Manufacturing Facility ■ Moreau, New York
Terracon Project No. JB215105

Terracon GeoReport

SAMPLING	WATER LEVEL	FIELD TESTS
Split Spoon	Water Initially Encountered Water Level After a Specified Period of Time Water Level After a Specified Period of Time Cave In Encountered Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	N Standard Penetration Test Resistance (Blows/Ft.) (HP) Hand Penetrometer (T) Torvane (DCP) Dynamic Cone Penetrometer UC Unconfined Compressive Strength (PID) Photo-Ionization Detector (OVA) Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

LOCATION AND ELEVATION NOTES

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	Standard Penetration or N-Value Blows/Ft.	Descriptive Term (Consistency)	Unconfined Compressive Strength Qu, (tsf)	Standard Penetration or N-Value Blows/Ft.
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

RELEVANCE OF SOIL BORING LOG

The soil boring logs contained within this document are intended for application to the project as described in this document. Use of these soil boring logs for any other purpose may not be appropriate.

UNIFIED SOIL CLASSIFICATION SYSTEM

Terracon GeoReport

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or [$Cc<1$ or $Cc>3.0$] [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or [$Cc<1$ or $Cc>3.0$] [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A"		CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OL	Organic clay [K, L, M, N] / Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K, L, M]
			PI plots below "A" line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried	< 0.75	OH	Organic clay [K, L, M, P] / Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

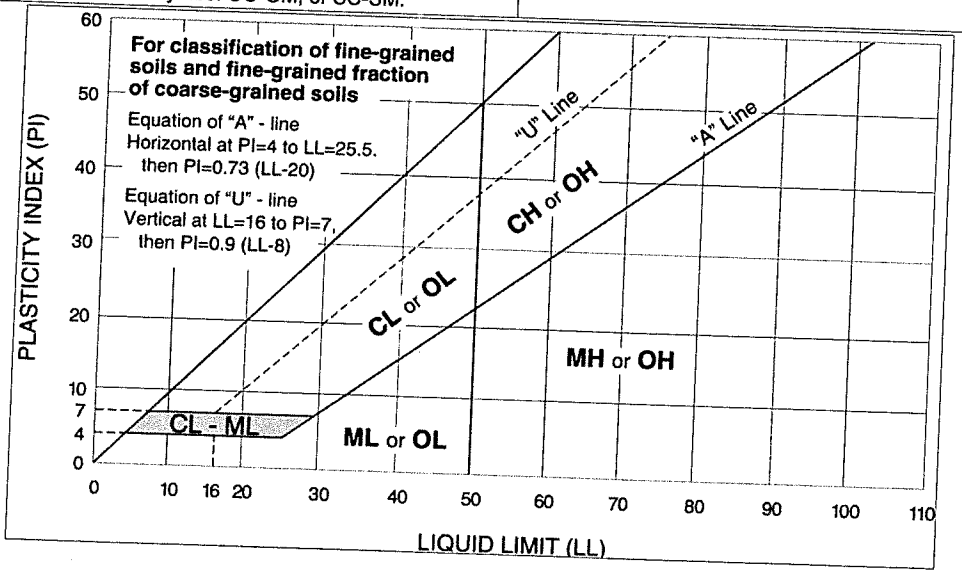
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

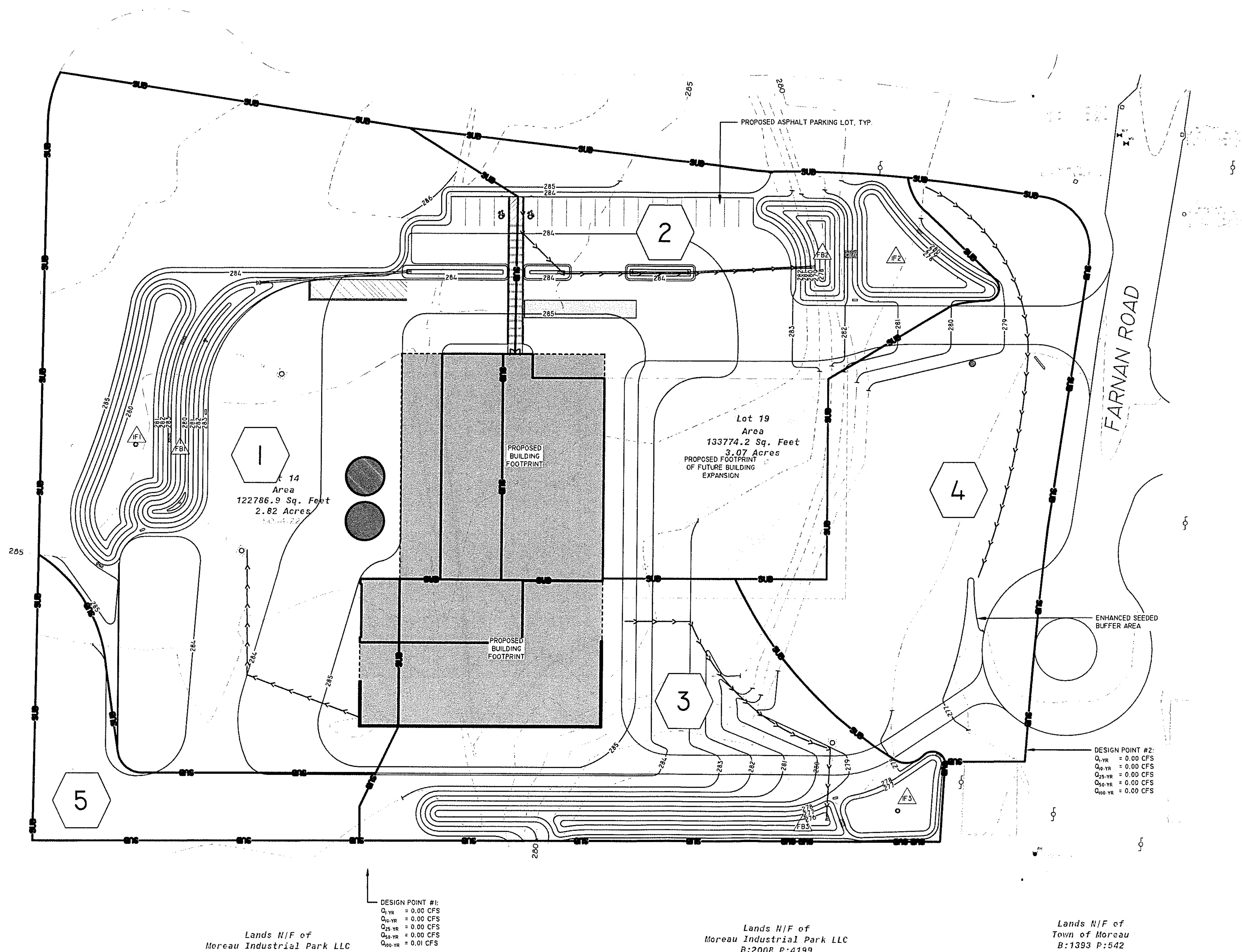
[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



APPENDIX D
SUBCATCHMENT PLANS



LEGEND

—SUB—	SUBCATCHMENT BOUNDARY
—>—>—>—	TIME OF CONCENTRATION FLOW PATH
— — - —	PROPERTY LINE
5	SUBCATCHMENT ID
8P	PROPOSED SMP ID

GRAPHIC SCALE

30 0 15 30 60

1 INCH = 30 FEET

N

MAP REFERENCE:
BASE MAP INFORMATION OBTAINED FROM "MAP OF TOPOGRAPHIC SURVEY MADE FOR NORTHEAST BIOCHAR SOLUTIONS, INC., TOWN OF MOREAU, SARATOGA COUNTY, NEW YORK" PREPARED BY VAN DUSEN & STEVES SURVEYORS, DATED JULY 28, 2021.

DIG SAFE NOTE:
THIS PLAN SET WAS DRAFTED WITHOUT THE BENEFIT OF "DIG SAFE" MARKINGS. UTILITIES SHOWN ARE NOT WARRANTED TO BE EXACT OR COMPLETE. THE CONTRACTOR SHALL CONTACT "DIG SAFE" AT 811 BEFORE COMMENCING ANY WORK AND SHALL PRESERVE EXISTING UTILITIES WHICH ARE NOT SPECIFIED TO BE REMOVED IN THIS PLAN SET.

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DRAWINGS NOT FOR CONSTRUCTION

REVISIONS	
DATE	DESCRIPTION

northeastern BIOCHAR SOLUTIONS — WASTE NOT —

PREPARED FOR
SARATOGA BIOCHAR SOLUTIONS, LLC
26 F CONGRESS ST. #346
SARATOGA SPRINGS, NY 12866

PROJECT
SARATOGA BIOCHAR SOLUTIONS, LLC

DRAWING TITLE
POST- CONSTRUCTION SUBCATCHMENT PLAN

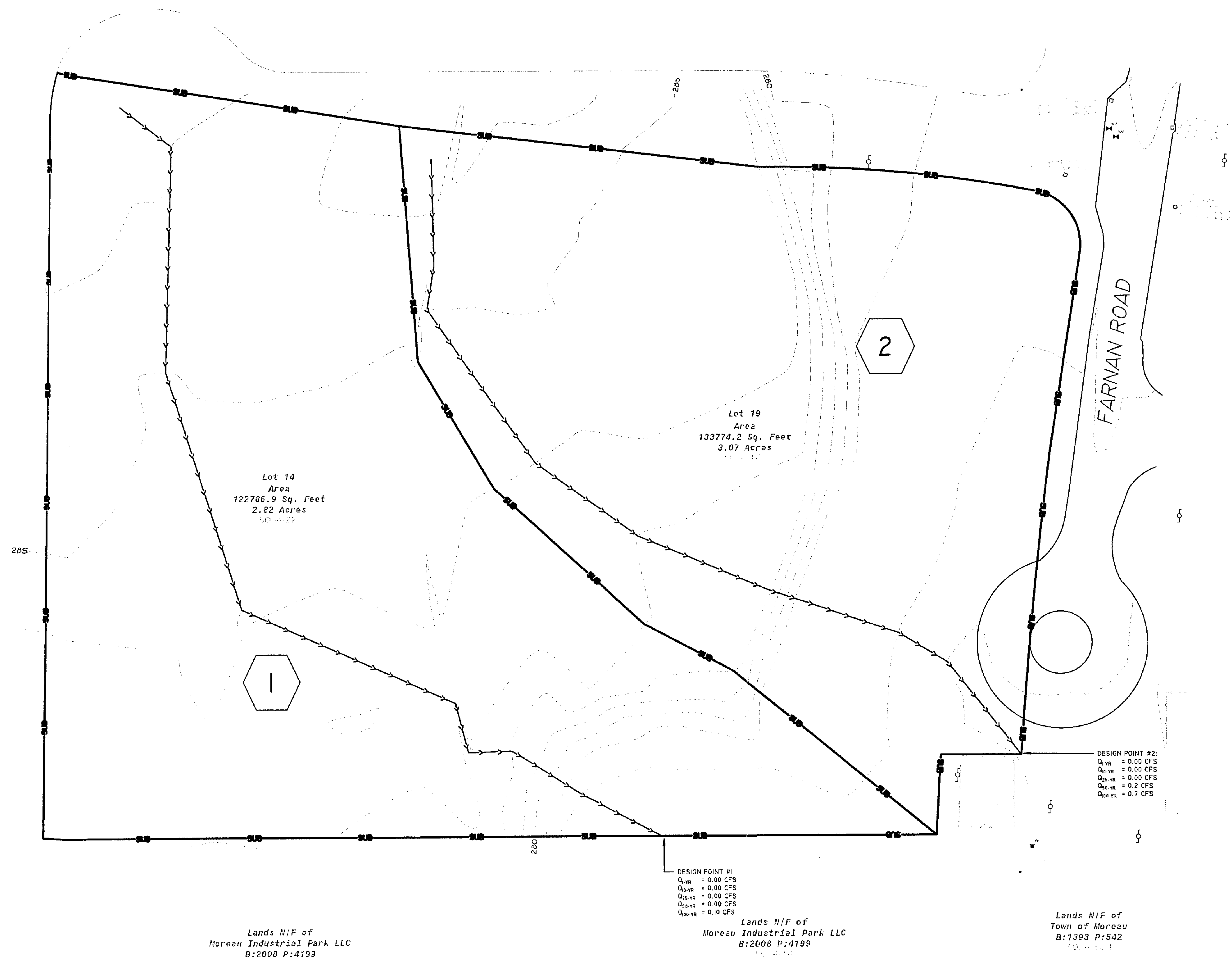
DATE: 02/15/2022

PROJECT NO.
20019

DRAWING NO.
SC-2

DWG 2 OF 2

DESIGN BY: #### DRAWN BY: #### CHECKED BY: ####



LEGEND

- SUB — SUBCATCHMENT BOUNDARY
- TIME OF CONCENTRATION FLOW PATH
- PROPERTY LINE
- (2) SUBCATCHMENT ID

GRAPHIC SCALE

30 0 15 30 60

1 INCH = 30 FEET

N

MAP REFERENCE:
BASE MAP INFORMATION OBTAINED FROM "MAP OF TOPOGRAPHIC SURVEY MADE FOR NORTHEAST BIOCHAR SOLUTIONS, INC., TOWN OF MOREAU, SARATOGA COUNTY, NEW YORK" PREPARED BY VAN DUSEN & STEVES SURVEYORS, DATED JULY 28, 2021.

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DRAWINGS NOT FOR CONSTRUCTION

REVISIONS	
DATE	DESCRIPTION

northeastern BIOCHAR SOLUTIONS
WASTE NOT

PREPARED FOR
SARATOGA BIOCHAR SOLUTIONS, LLC
26 F CONGRESS ST. #346
SARATOGA SPRINGS, NY 12866

PROJECT
SARATOGA BIOCHAR SOLUTIONS, LLC

DRAWING TITLE
PRE- CONSTRUCTION SUBCATCHMENT PLAN

DATE: 10/29/2021

PROJECT NO.
20019

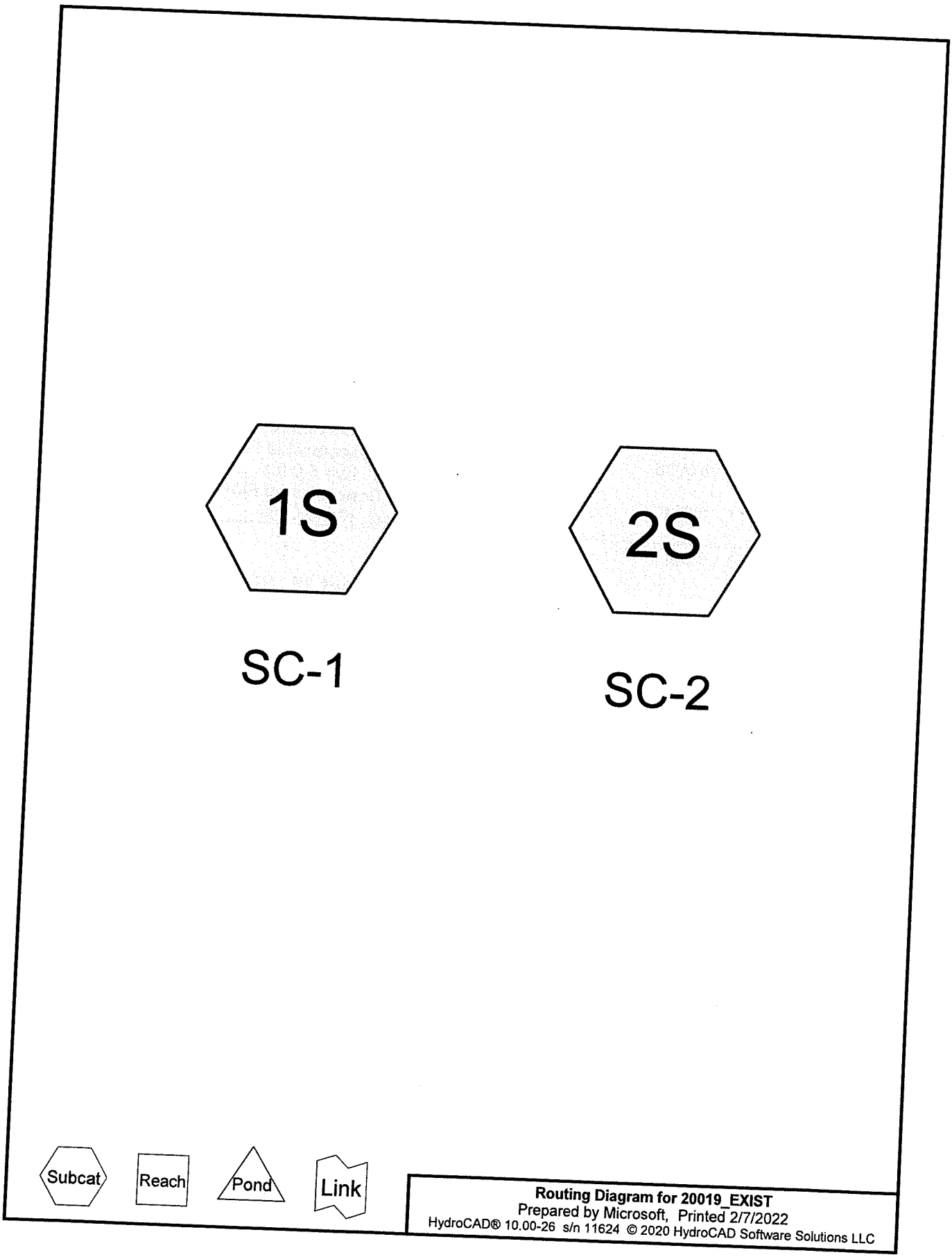
DRAWING NO.
SC-1

DWG 1 OF 2

DESIGN BY: #### DRAWN BY: #### CHECKED BY: ####

APPENDIX E
STORMWATER CALCULATIONS

PRE-DEVELOPMENT



Routing Diagram for 20019_EXIST
Prepared by Microsoft, Printed 2/7/2022
HydroCAD® 10.00-26 s/n 11624 © 2020 HydroCAD Software Solutions LLC

Summary for Subcatchment 1S: SC-1

Runoff = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 1-yr Rainfall=2.22"

Area (sf)	CN	Description
151,171	30	Woods, Good, HSG A
151,171		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.4	75	0.0133	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.58"
16.8	467	0.0086	0.46		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.6	111	0.0540	1.16		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
40.8	653	Total			

Summary for Subcatchment 2S: SC-2

Runoff = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 1-yr Rainfall=2.22"

Area (sf)	CN	Description
69,302	30	Woods, Good, HSG A
2,340	98	Paved parking, HSG A
50,593	49	50-75% Grass cover, Fair, HSG A
122,235	39	Weighted Average
119,895		98.09% Pervious Area
2,340		1.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	13	0.0105	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.58"
12.0	368	0.0105	0.51		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	16	0.1875	2.17		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.2	177	0.0170	0.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
21.4	574	Total			

Summary for Subcatchment 1S: SC-1

Runoff = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 25-yr Rainfall=4.54"

Area (sf)	CN	Description
151,171	30	Woods, Good, HSG A
151,171		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.4	75	0.0133	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.58"
16.8	467	0.0086	0.46		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.6	111	0.0540	1.16		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
40.8	653	Total			

Summary for Subcatchment 2S: SC-2

Runoff = 0.1 cfs @ 13.62 hrs, Volume= 0.027 af, Depth= 0.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 25-yr Rainfall=4.54"

Area (sf)	CN	Description
69,302	30	Woods, Good, HSG A
2,340	98	Paved parking, HSG A
50,593	49	50-75% Grass cover, Fair, HSG A
122,235	39	Weighted Average
119,895		98.09% Pervious Area
2,340		1.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	13	0.0105	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.58"
12.0	368	0.0105	0.51		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	16	0.1875	2.17		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.2	177	0.0170	0.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
21.4	574	Total			

Summary for Subcatchment 1S: SC-1

Runoff = 0.0 cfs @ 23.98 hrs, Volume= 0.005 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 50-yr Rainfall=5.30"

Area (sf)	CN	Description
151,171	30	Woods, Good, HSG A
151,171		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.4	75	0.0133	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.58"
16.8	467	0.0086	0.46		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.6	111	0.0540	1.16		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
40.8	653	Total			

Summary for Subcatchment 2S: SC-2

Runoff = 0.2 cfs @ 12.72 hrs, Volume= 0.062 af, Depth= 0.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 50-yr Rainfall=5.30"

Area (sf)	CN	Description
69,302	30	Woods, Good, HSG A
2,340	98	Paved parking, HSG A
50,593	49	50-75% Grass cover, Fair, HSG A
122,235	39	Weighted Average
119,895		98.09% Pervious Area
2,340		1.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	13	0.0105	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.58"
12.0	368	0.0105	0.51		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	16	0.1875	2.17		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.2	177	0.0170	0.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
21.4	574	Total			

Summary for Subcatchment 1S: SC-1

Runoff = 0.0 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 10-YR 10-YR-DS Rainfall=3.75"

Area (sf)	CN	Description
151,171	30	Woods, Good, HSG A
151,171		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.4	75	0.0133	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.58"
16.8	467	0.0086	0.46		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.6	111	0.0540	1.16		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
40.8	653	Total			

Summary for Subcatchment 2S: SC-2

Runoff = 0.0 cfs @ 21.52 hrs, Volume= 0.006 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 10-YR 10-YR-DS Rainfall=3.75"

Area (sf)	CN	Description
69,302	30	Woods, Good, HSG A
2,340	98	Paved parking, HSG A
50,593	49	50-75% Grass cover, Fair, HSG A
122,235	39	Weighted Average
119,895		98.09% Pervious Area
2,340		1.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	13	0.0105	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.58"
12.0	368	0.0105	0.51		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	16	0.1875	2.17		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.2	177	0.0170	0.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
21.4	574	Total			

Summary for Subcatchment 1S: SC-1

Runoff = 0.1 cfs @ 13.92 hrs, Volume= 0.039 af, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 100-YR 100-YR-DES Rainfall=6.50"

Area (sf)	CN	Description
151,171	30	Woods, Good, HSG A
151,171		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.4	75	0.0133	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.58"
16.8	467	0.0086	0.46		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
1.6	111	0.0540	1.16		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
40.8	653	Total			

Summary for Subcatchment 2S: SC-2

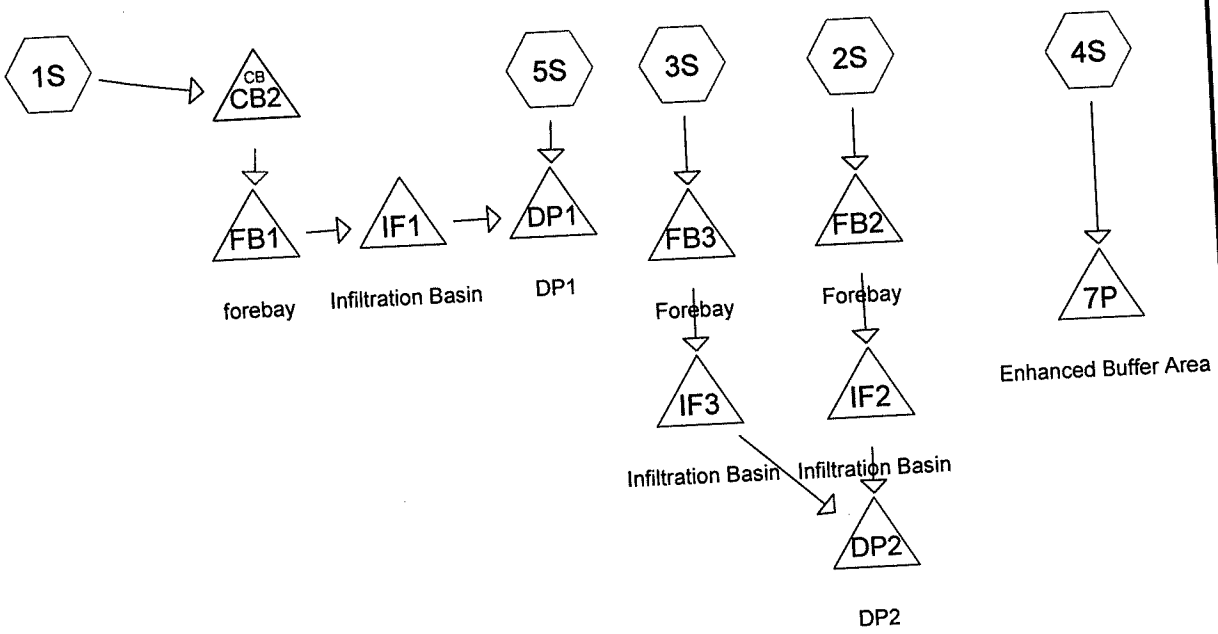
Runoff = 0.7 cfs @ 12.48 hrs, Volume= 0.140 af, Depth= 0.60"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 100-YR 100-YR-DES Rainfall=6.50"

Area (sf)	CN	Description
69,302	30	Woods, Good, HSG A
2,340	98	Paved parking, HSG A
50,593	49	50-75% Grass cover, Fair, HSG A
122,235	39	Weighted Average
119,895		98.09% Pervious Area
2,340		1.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	13	0.0105	0.04		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.58"
12.0	368	0.0105	0.51		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
0.1	16	0.1875	2.17		**Shallow Concentrated Flow,** Woodland Kv= 5.0 fps
3.2	177	0.0170	0.91		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
21.4	574	Total			

POST-CONSTRUCTION



Subcat Reach Pond Link

Routing Diagram for 20019_POST

Prepared by {enter your company name here}, Printed 2/18/2022

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Summary for Subcatchment 1S:

Runoff = 0.65 cfs @ 12.01 hrs, Volume= 0.055 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 1-yr Rainfall=2.22"

	Area (sf)	CN	Description
*	46,880	98	PAVEMENT
	27,367	30	Woods, Good, HSG A
	20,575	32	Woods/grass comb., Good, HSG A
*	11,190	98	ROOF
	106,012	68	Weighted Average
	47,942		45.22% Pervious Area
	58,070		54.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.0200	1.24		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.58"
0.2	33	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.5	133	Total			

Summary for Subcatchment 2S:

Runoff = 2.02 cfs @ 12.00 hrs, Volume= 0.100 af, Depth= 0.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 1-yr Rainfall=2.22"

Area (sf)	CN	Description
26,469	98	Roofs, HSG A
20,819	98	Paved parking, HSG A
14,328	32	Woods/grass comb., Good, HSG A
61,616	83	Weighted Average
14,328		23.25% Pervious Area
47,288		76.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	60	0.0200	1.12		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.58"
0.1	43	0.0100	4.91	3.86	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.1	76	0.0300	8.51	6.69	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
1.1	179	Total			

Summary for Subcatchment 3S:

Runoff = 0.03 cfs @ 12.22 hrs, Volume= 0.011 af, Depth= 0.12"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 1-yr Rainfall=2.22"

	Area (sf)	CN	Description
*	11,640	98	ROOF
*	8,476	98	paving
	26,422	32	Woods/grass comb., Good, HSG A
	46,538	61	Weighted Average
	26,422		56.78% Pervious Area
	20,116		43.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	76	0.0200	1.17		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.58"
1.6	137	0.0440	1.47		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	40	0.0150	6.02	4.73	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
2.8	253	Total			

Summary for Subcatchment 4S:

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 1-yr Rainfall=2.22"

	Area (sf)	CN	Description
*	8,210	98	paving
	37,122	32	Woods/grass comb., Good, HSG A
	45,332	44	Weighted Average
	37,122		81.89% Pervious Area
	8,210		18.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	100	0.0750	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.58"
0.1	24	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.6	150	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
17.8	274	Total			

Summary for Subcatchment 5S:

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 1-yr Rainfall=2.22"

Area (sf)	CN	Description
13,908	30	Woods, Good, HSG A
13,908		100.00% Pervious Area

Summary for Pond 7P: Enhanced Buffer Area

Inflow Area = 1.041 ac, 18.11% Impervious, Inflow Depth = 0.00" for 1-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 277.00' @ 0.00 hrs Surf.Area= 1,653 sf Storage= 0 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	277.00'	7 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
277.00	1,653	0.0	0	0
277.01	1,653	40.0	7	7

Device	Routing	Invert	Outlet Devices
#1	Discarded	277.00'	**45.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=277.00' (Free Discharge)
↑**1=Exfiltration** (Passes 0.00 cfs of 1.72 cfs potential flow)

Summary for Pond CB2:

Inflow Area = 2.434 ac, 54.78% Impervious, Inflow Depth = 0.27" for 1-yr event
Inflow = 0.65 cfs @ 12.01 hrs, Volume= 0.055 af
Outflow = 0.65 cfs @ 12.01 hrs, Volume= 0.055 af, Atten= 0%, Lag= 0.0 min
Primary = 0.65 cfs @ 12.01 hrs, Volume= 0.055 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 280.87' @ 12.01 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	280.50'	**24.0" Round Culvert** L= 43.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 280.50' / 280.00' S= 0.0116 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Secondary	283.50'	**30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=0.65 cfs @ 12.01 hrs HW=280.87' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 0.65 cfs @ 1.63 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=280.50' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond DP1: DP1

Inflow Area = 2.753 ac, 48.42% Impervious, Inflow Depth = 0.00" for 1-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond DP2: DP2

Inflow Area = 2.483 ac, 62.32% Impervious, Inflow Depth = 0.00" for 1-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond FB1: forebay

Inflow Area = 2.434 ac, 54.78% Impervious, Inflow Depth = 0.27" for 1-yr event
Inflow = 0.65 cfs @ 12.01 hrs, Volume= 0.055 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 281.90' @ 24.09 hrs Surf.Area= 2,191 sf Storage= 2,414 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	279.50'	7,240 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
279.50	30	41.0	0	0	30
280.00	358	306.0	82	82	7,348
281.00	1,304	325.0	782	864	8,353
282.00	2,307	344.0	1,782	2,646	9,418
283.00	3,367	363.0	2,820	5,466	10,544
283.50	3,733	369.0	1,774	7,240	10,939

Device	Routing	Invert	Outlet Devices
#1	Primary	282.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Primary	282.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=279.50' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)
2=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond FB2: Forebay

Inflow Area = 1.415 ac, 76.75% Impervious, Inflow Depth = 0.85" for 1-yr event
Inflow = 2.02 cfs @ 12.00 hrs, Volume= 0.100 af
Outflow = 0.04 cfs @ 18.22 hrs, Volume= 0.019 af, Atten= 98%, Lag= 373.5 min
Primary = 0.04 cfs @ 18.22 hrs, Volume= 0.019 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 281.77' @ 18.22 hrs Surf.Area= 1,907 sf Storage= 3,569 cf

Plug-Flow detention time= 537.0 min calculated for 0.019 af (19% of inflow)
Center-of-Mass det. time= 376.6 min (1,238.0 - 861.5)

Volume	Invert	Avail.Storage	Storage Description
#1	278.00'	5,103 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
278.00	208	91.0	0	0	208
279.00	530	118.0	357	357	669
280.00	943	148.0	727	1,083	1,318
281.00	1,462	183.0	1,193	2,276	2,255
282.00	2,052	205.0	1,749	4,025	2,961
282.50	2,260	212.0	1,078	5,103	3,216

Device	Routing	Invert	Outlet Devices
#1	Primary	281.75'	**5.0' long x 3.0' breadth Broad-Crested Rectangular Weir**

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50
Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.03 cfs @ 18.22 hrs HW=281.77' (Free Discharge)
↑—1=Broad-Crested Rectangular Weir (Weir Controls 0.03 cfs @ 0.34 fps)

Summary for Pond FB3: Forebay

Inflow Area =	1.068 ac,	43.22% Impervious,	Inflow Depth =	0.12"	for 1-yr event
Inflow =	0.03 cfs @	12.22 hrs, Volume=	0.011 af		
Outflow =	0.00 cfs @	0.00 hrs, Volume=	0.000 af,	Atten= 100%,	Lag= 0.0 min
Primary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af		

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 276.60' @ 24.17 hrs Surf.Area= 1,093 sf Storage= 468 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	276.00'	4,977 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
276.00	513	345.0	0	0	513
277.00	1,608	372.0	1,010	1,010	2,095
278.00	3,069	535.0	2,299	3,309	13,868
278.50	3,608	542.0	1,667	4,977	14,526

Device	Routing	Invert	Outlet Devices
#1	Primary	277.75'	**5.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=276.00' (Free Discharge)
↑—1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond IF1: Infiltration Basin

Inflow Area =	2.434 ac,	54.78% Impervious,	Inflow Depth =	0.00"	for 1-yr event
Inflow =	0.00 cfs @	0.00 hrs, Volume=	0.000 af		
Outflow =	0.00 cfs @	0.00 hrs, Volume=	0.000 af,	Atten= 0%,	Lag= 0.0 min
Discarded =	0.00 cfs @	0.00 hrs, Volume=	0.000 af		
Primary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af		

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 280.00' @ 0.00 hrs Surf.Area= 2,382 sf Storage= 0 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	280.00'	15,076 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
280.00	2,382	343.0	0	0	2,382
281.00	3,452	367.0	2,901	2,901	3,784
282.00	4,589	388.0	4,007	6,908	5,101
283.00	5,783	407.0	5,175	12,082	6,367
283.50	6,194	414.0	2,994	15,076	6,868

Device	Routing	Invert	Outlet Devices
#1	Primary	282.50'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	280.00'	**45.000 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=280.00' (Free Discharge)
└**2=Exfiltration** (Passes 0.00 cfs of 2.48 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=280.00' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond IF2: Infiltration Basin

Inflow Area = 1.415 ac, 76.75% Impervious, Inflow Depth = 0.16" for 1-yr event
Inflow = 0.04 cfs @ 18.22 hrs, Volume= 0.019 af
Outflow = 0.04 cfs @ 18.23 hrs, Volume= 0.019 af, Atten= 0%, Lag= 0.5 min
Discarded = 0.04 cfs @ 18.23 hrs, Volume= 0.019 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 278.00' @ 18.23 hrs Surf.Area= 1,833 sf Storage= 1 cf

Plug-Flow detention time= 0.4 min calculated for 0.019 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (1,238.4 - 1,238.0)

Volume	Invert	Avail.Storage	Storage Description
#1	278.00'	6,812 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
278.00	1,833	207.0	0	0	1,833
279.00	2,535	241.0	2,175	2,175	3,066
280.00	3,312	265.0	2,915	5,089	4,065
280.50	3,580	271.0	1,723	6,812	4,353

Device	Routing	Invert	Outlet Devices
#1	Primary	279.50'	**4.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	278.00'	**45.000 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=1.91 cfs @ 18.23 hrs HW=278.00' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 1.91 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=278.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond IF3: Infiltration Basin

Inflow Area = 1.068 ac, 43.22% Impervious, Inflow Depth = 0.00" for 1-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 277.00' @ 0.00 hrs Surf.Area= 1,555 sf Storage= 0 cf

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

Volume	Invert	Avail.Storage	Storage Description
#1	277.00'	2,915 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
277.00	1,555	171.0	0	0	1,555
278.00	2,097	190.0	1,819	1,819	2,130
278.50	2,289	196.0	1,096	2,915	2,338

Device	Routing	Invert	Outlet Devices
#1	Primary	277.75'	**5.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	277.00'	**45.000 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=0.00 cfs @ 0.00 hrs HW=277.00' (Free Discharge)
↑—**2=Exfiltration** (Passes 0.00 cfs of 1.62 cfs potential flow)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=277.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Subcatchment 1S:

Runoff = 5.70 cfs @ 12.00 hrs, Volume= 0.316 af, Depth= 1.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 25-yr Rainfall=4.54"

	Area (sf)	CN	Description
*	46,880	98	PAVEMENT
	27,367	30	Woods, Good, HSG A
	20,575	32	Woods/grass comb., Good, HSG A
*	11,190	98	ROOF
	106,012	68	Weighted Average
	47,942		45.22% Pervious Area
	58,070		54.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.0200	1.24		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.58"
0.2	33	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.5	133	Total			

Summary for Subcatchment 2S:

Runoff = 6.11 cfs @ 12.00 hrs, Volume= 0.325 af, Depth= 2.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 25-yr Rainfall=4.54"

Area (sf)	CN	Description
26,469	98	Roofs, HSG A
20,819	98	Paved parking, HSG A
14,328	32	Woods/grass comb., Good, HSG A
61,616	83	Weighted Average
14,328		23.25% Pervious Area
47,288		76.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	60	0.0200	1.12		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.58"
0.1	43	0.0100	4.91	3.86	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.1	76	0.0300	8.51	6.69	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
1.1	179	Total			

Summary for Subcatchment 3S:

Runoff = 1.55 cfs @ 12.02 hrs, Volume= 0.098 af, Depth= 1.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 25-yr Rainfall=4.54"

	Area (sf)	CN	Description
*	11,640	98	ROOF
*	8,476	98	paving
	26,422	32	Woods/grass comb., Good, HSG A
	46,538	61	Weighted Average
	26,422		56.78% Pervious Area
	20,116		43.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	76	0.0200	1.17		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.58"
1.6	137	0.0440	1.47		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	40	0.0150	6.02	4.73	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
2.8	253	Total			

Summary for Subcatchment 4S:

Runoff = 0.08 cfs @ 12.60 hrs, Volume= 0.023 af, Depth= 0.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 25-yr Rainfall=4.54"

	Area (sf)	CN	Description
*	8,210	98	paving
	37,122	32	Woods/grass comb., Good, HSG A
	45,332	44	Weighted Average
	37,122		81.89% Pervious Area
	8,210		18.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	100	0.0750	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.58"
0.1	24	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.6	150	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
17.8	274	Total			

Summary for Subcatchment 5S:

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 25-yr Rainfall=4.54"

Area (sf)	CN	Description
13,908	30	Woods, Good, HSG A
13,908		100.00% Pervious Area

Summary for Pond 7P: Enhanced Buffer Area

Inflow Area = 1.041 ac, 18.11% Impervious, Inflow Depth = 0.27" for 25-yr event
Inflow = 0.08 cfs @ 12.60 hrs, Volume= 0.023 af
Outflow = 0.08 cfs @ 12.60 hrs, Volume= 0.023 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.08 cfs @ 12.60 hrs, Volume= 0.023 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 277.00' @ 12.60 hrs Surf.Area= 1,653 sf Storage= 0 cf

Plug-Flow detention time= 0.0 min calculated for 0.023 af (100% of inflow)
Center-of-Mass det. time= 0.0 min (979.4 - 979.4)

Volume	Invert	Avail.Storage	Storage Description
#1	277.00'	7 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
277.00	1,653	0.0	0	0
277.01	1,653	40.0	7	7

Device	Routing	Invert	Outlet Devices
#1	Discarded	277.00'	**45.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.72 cfs @ 12.60 hrs HW=277.00' (Free Discharge)
1=Exfiltration (Exfiltration Controls 1.72 cfs)

Summary for Pond CB2:

Inflow Area = 2.434 ac, 54.78% Impervious, Inflow Depth = 1.56" for 25-yr event
Inflow = 5.70 cfs @ 12.00 hrs, Volume= 0.316 af
Outflow = 5.70 cfs @ 12.00 hrs, Volume= 0.316 af, Atten= 0%, Lag= 0.0 min
Primary = 5.70 cfs @ 12.00 hrs, Volume= 0.316 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 281.69' @ 12.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	280.50'	**24.0" Round Culvert** L= 43.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 280.50' / 280.00' S= 0.0116 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Secondary	283.50'	**30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=5.68 cfs @ 12.00 hrs HW=281.69' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 5.68 cfs @ 2.93 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=280.50' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond DP1: DP1

Inflow Area = 2.753 ac, 48.42% Impervious, Inflow Depth = 0.00" for 25-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond DP2: DP2

Inflow Area = 2.483 ac, 62.32% Impervious, Inflow Depth = 0.00" for 25-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond FB1: forebay

Inflow Area = 2.434 ac, 54.78% Impervious, Inflow Depth = 1.56" for 25-yr event
Inflow = 5.70 cfs @ 12.00 hrs, Volume= 0.316 af
Outflow = 3.73 cfs @ 12.11 hrs, Volume= 0.256 af, Atten= 35%, Lag= 6.3 min
Primary = 3.73 cfs @ 12.11 hrs, Volume= 0.256 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 282.25' @ 12.11 hrs Surf.Area= 2,548 sf Storage= 3,240 cf

Plug-Flow detention time= 118.5 min calculated for 0.256 af (81% of inflow)
Center-of-Mass det. time= 38.4 min (886.7 - 848.3)

Volume	Invert	Avail.Storage	Storage Description
#1	279.50'	7,240 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
279.50	30	41.0	0	0	30
280.00	358	306.0	82	82	7,348
281.00	1,304	325.0	782	864	8,353
282.00	2,307	344.0	1,782	2,646	9,418
283.00	3,367	363.0	2,820	5,466	10,544
283.50	3,733	369.0	1,774	7,240	10,939

Device	Routing	Invert	Outlet Devices
#1	Primary	282.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Primary	282.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=3.71 cfs @ 12.11 hrs HW=282.24' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 1.85 cfs @ 1.26 fps)
└—**2=Broad-Crested Rectangular Weir** (Weir Controls 1.85 cfs @ 1.26 fps)

Summary for Pond FB2: Forebay

Inflow Area = 1.415 ac, 76.75% Impervious, Inflow Depth = 2.76" for 25-yr event
Inflow = 6.11 cfs @ 12.00 hrs, Volume= 0.325 af
Outflow = 4.46 cfs @ 12.02 hrs, Volume= 0.244 af, Atten= 27%, Lag= 1.5 min
Primary = 4.46 cfs @ 12.02 hrs, Volume= 0.244 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 282.24' @ 12.02 hrs Surf.Area= 2,149 sf Storage= 4,523 cf

Plug-Flow detention time= 136.9 min calculated for 0.244 af (75% of inflow)
Center-of-Mass det. time= 51.4 min (860.5 - 809.1)

Volume	Invert	Avail.Storage	Storage Description
#1	278.00'	5,103 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
278.00	208	91.0	0	0	208
279.00	530	118.0	357	357	669
280.00	943	148.0	727	1,083	1,318
281.00	1,462	183.0	1,193	2,276	2,255
282.00	2,052	205.0	1,749	4,025	2,961
282.50	2,260	212.0	1,078	5,103	3,216

Device	Routing	Invert	Outlet Devices
#1	Primary	281.75'	**5.0' long x 3.0' breadth Broad-Crested Rectangular Weir**

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50
Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=4.45 cfs @ 12.02 hrs HW=282.24' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 4.45 cfs @ 1.83 fps)

Summary for Pond FB3: Forebay

Inflow Area =	1.068 ac, 43.22% Impervious, Inflow Depth = 1.10"			for 25-yr event
Inflow =	1.55 cfs @ 12.02 hrs, Volume=	0.098 af		
Outflow =	0.09 cfs @ 14.54 hrs, Volume=	0.039 af,	Atten= 94%,	Lag= 151.7 min
Primary =	0.09 cfs @ 14.54 hrs, Volume=	0.039 af		

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 277.79' @ 14.54 hrs Surf.Area= 2,717 sf Storage= 2,690 cf

Plug-Flow detention time= 357.8 min calculated for 0.039 af (39% of inflow)
Center-of-Mass det. time= 213.9 min (1,083.8 - 869.9)

Volume	Invert	Avail.Storage	Storage Description
#1	276.00'	4,977 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
276.00	513	345.0	0	0	513
277.00	1,608	372.0	1,010	1,010	2,095
278.00	3,069	535.0	2,299	3,309	13,868
278.50	3,608	542.0	1,667	4,977	14,526

Device	Routing	Invert	Outlet Devices
#1	Primary	277.75'	**5.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.08 cfs @ 14.54 hrs HW=277.79' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 0.08 cfs @ 0.46 fps)

Summary for Pond IF1: Infiltration Basin

Inflow Area =	2.434 ac, 54.78% Impervious, Inflow Depth = 1.26"			for 25-yr event
Inflow =	3.73 cfs @ 12.11 hrs, Volume=	0.256 af		
Outflow =	2.72 cfs @ 12.15 hrs, Volume=	0.256 af,	Atten= 27%,	Lag= 2.8 min
Discarded =	2.72 cfs @ 12.15 hrs, Volume=	0.256 af		
Primary =	0.00 cfs @ 0.00 hrs, Volume=	0.000 af		

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 280.17' @ 12.15 hrs Surf.Area= 2,546 sf Storage= 410 cf

Plug-Flow detention time= 0.8 min calculated for 0.256 af (100% of inflow)
Center-of-Mass det. time= 0.8 min (887.5 - 886.7)

Volume	Invert	Avail.Storage	Storage Description
#1	280.00'	15,076 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
280.00	2,382	343.0	0	0	2,382
281.00	3,452	367.0	2,901	2,901	3,784
282.00	4,589	388.0	4,007	6,908	5,101
283.00	5,783	407.0	5,175	12,082	6,367
283.50	6,194	414.0	2,994	15,076	6,868

Device	Routing	Invert	Outlet Devices
#1	Primary	282.50'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	280.00'	**45.000 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=2.72 cfs @ 12.15 hrs HW=280.17' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 2.72 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=280.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond IF2: Infiltration Basin

Inflow Area =	1.415 ac,	76.75% Impervious,	Inflow Depth =	2.07" for 25-yr event
Inflow =	4.46 cfs @	12.02 hrs, Volume=	0.244 af	
Outflow =	2.53 cfs @	12.17 hrs, Volume=	0.244 af,	Atten= 43%, Lag= 8.6 min
Discarded =	2.53 cfs @	12.17 hrs, Volume=	0.244 af	
Primary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 278.50' @ 12.17 hrs Surf.Area= 2,170 sf Storage= 999 cf

Plug-Flow detention time= 2.0 min calculated for 0.244 af (100% of inflow)
Center-of-Mass det. time= 2.0 min (862.5 - 860.5)

Volume	Invert	Avail.Storage	Storage Description
#1	278.00'	6,812 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
278.00	1,833	207.0	0	0	1,833
279.00	2,535	241.0	2,175	2,175	3,066
280.00	3,312	265.0	2,915	5,089	4,065
280.50	3,580	271.0	1,723	6,812	4,353

Device	Routing	Invert	Outlet Devices
#1	Primary	279.50'	**4.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	278.00'	**45.000 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=2.53 cfs @ 12.17 hrs HW=278.50' (Free Discharge)
└**2=Exfiltration** (Exfiltration Controls 2.53 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=278.00' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond IF3: Infiltration Basin

Inflow Area = 1.068 ac, 43.22% Impervious, Inflow Depth = 0.43" for 25-yr event
Inflow = 0.09 cfs @ 14.54 hrs, Volume= 0.039 af
Outflow = 0.09 cfs @ 14.55 hrs, Volume= 0.039 af, Atten= 0%, Lag= 0.3 min
Discarded = 0.09 cfs @ 14.55 hrs, Volume= 0.039 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 277.00' @ 14.55 hrs Surf.Area= 1,555 sf Storage= 1 cf

Plug-Flow detention time= 0.2 min calculated for 0.039 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (1,084.0 - 1,083.8)

Volume	Invert	Avail.Storage	Storage Description
#1	277.00'	2,915 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
277.00	1,555	171.0	0	0	1,555
278.00	2,097	190.0	1,819	1,819	2,130
278.50	2,289	196.0	1,096	2,915	2,338

Device	Routing	Invert	Outlet Devices
#1	Primary	277.75'	**5.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	277.00'	**45.000 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=1.62 cfs @ 14.55 hrs HW=277.00' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 1.62 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=277.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Subcatchment 1S:

Runoff = 7.60 cfs @ 12.00 hrs, Volume= 0.425 af, Depth= 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 50-yr Rainfall=5.30"

	Area (sf)	CN	Description
*	46,880	98	PAVEMENT
	27,367	30	Woods, Good, HSG A
	20,575	32	Woods/grass comb., Good, HSG A
*	11,190	98	ROOF
	106,012	68	Weighted Average
	47,942		45.22% Pervious Area
	58,070		54.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.0200	1.24		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.58"
0.2	33	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.5	133	Total			

Summary for Subcatchment 2S:

Runoff = 7.37 cfs @ 12.00 hrs, Volume= 0.406 af, Depth= 3.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 50-yr Rainfall=5.30"

Area (sf)	CN	Description
26,469	98	Roofs, HSG A
20,819	98	Paved parking, HSG A
14,328	32	Woods/grass comb., Good, HSG A
61,616	83	Weighted Average
14,328		23.25% Pervious Area
47,288		76.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	60	0.0200	1.12		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.58"
0.1	43	0.0100	4.91	3.86	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.1	76	0.0300	8.51	6.69	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
1.1	179	Total			

Summary for Subcatchment 3S:

Runoff = 2.26 cfs @ 12.02 hrs, Volume= 0.138 af, Depth= 1.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 50-yr Rainfall=5.30"

	Area (sf)	CN	Description
*	11,640	98	ROOF
*	8,476	98	paving
	26,422	32	Woods/grass comb., Good, HSG A
	46,538	61	Weighted Average
	26,422		56.78% Pervious Area
	20,116		43.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	76	0.0200	1.17		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.58"
1.6	137	0.0440	1.47		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	40	0.0150	6.02	4.73	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
2.8	253	Total			

Summary for Subcatchment 4S:

Runoff = 0.21 cfs @ 12.38 hrs, Volume= 0.043 af, Depth= 0.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 50-yr Rainfall=5.30"

	Area (sf)	CN	Description
*	8,210	98	paving
	37,122	32	Woods/grass comb., Good, HSG A
	45,332	44	Weighted Average
	37,122		81.89% Pervious Area
	8,210		18.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	100	0.0750	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.58"
0.1	24	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.6	150	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
17.8	274	Total			

Summary for Subcatchment 5S:

Runoff = 0.00 cfs @ 23.99 hrs, Volume= 0.000 af, Depth= 0.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 50-yr Rainfall=5.30"

Area (sf)	CN	Description
13,908	30	Woods, Good, HSG A
13,908		100.00% Pervious Area

Summary for Pond 7P: Enhanced Buffer Area

Inflow Area = 1.041 ac, 18.11% Impervious, Inflow Depth = 0.49" for 50-yr event
Inflow = 0.21 cfs @ 12.38 hrs, Volume= 0.043 af
Outflow = 0.21 cfs @ 12.38 hrs, Volume= 0.043 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.21 cfs @ 12.38 hrs, Volume= 0.043 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 277.00' @ 12.38 hrs Surf.Area= 1,653 sf Storage= 0 cf

Plug-Flow detention time= 0.0 min calculated for 0.042 af (100% of inflow)
Center-of-Mass det. time= 0.0 min (938.2 - 938.2)

Volume	Invert	Avail.Storage	Storage Description
#1	277.00'	7 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
277.00	1,653	0.0	0	0
277.01	1,653	40.0	7	7

Device	Routing	Invert	Outlet Devices
#1	Discarded	277.00'	**45.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.72 cfs @ 12.38 hrs HW=277.00' (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 1.72 cfs)

Summary for Pond CB2:

Inflow Area = 2.434 ac, 54.78% Impervious, Inflow Depth = 2.10" for 50-yr event
Inflow = 7.60 cfs @ 12.00 hrs, Volume= 0.425 af
Outflow = 7.60 cfs @ 12.00 hrs, Volume= 0.425 af, Atten= 0%, Lag= 0.0 min
Primary = 7.60 cfs @ 12.00 hrs, Volume= 0.425 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 281.91' @ 12.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	280.50'	**24.0" Round Culvert** L= 43.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 280.50' / 280.00' S= 0.0116 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Secondary	283.50'	**30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=7.58 cfs @ 12.00 hrs HW=281.91' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 7.58 cfs @ 3.20 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=280.50' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond DP1: DP1

Inflow Area = 2.753 ac, 48.42% Impervious, Inflow Depth = 0.00" for 50-yr event
Inflow = 0.00 cfs @ 23.99 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 23.99 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond DP2: DP2

Inflow Area = 2.483 ac, 62.32% Impervious, Inflow Depth = 0.00" for 50-yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond FB1: forebay

Inflow Area = 2.434 ac, 54.78% Impervious, Inflow Depth = 2.10" for 50-yr event
Inflow = 7.60 cfs @ 12.00 hrs, Volume= 0.425 af
Outflow = 6.74 cfs @ 12.02 hrs, Volume= 0.364 af, Atten= 11%, Lag= 1.0 min
Primary = 6.74 cfs @ 12.02 hrs, Volume= 0.364 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 282.36' @ 12.02 hrs Surf.Area= 2,666 sf Storage= 3,540 cf

Plug-Flow detention time= 90.6 min calculated for 0.364 af (86% of inflow)
Center-of-Mass det. time= 27.2 min (862.5 - 835.3)

Volume	Invert	Avail.Storage	Storage Description
#1	279.50'	7,240 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
279.50	30	41.0	0	0	30
280.00	358	306.0	82	82	7,348
281.00	1,304	325.0	782	864	8,353
282.00	2,307	344.0	1,782	2,646	9,418
283.00	3,367	363.0	2,820	5,466	10,544
283.50	3,733	369.0	1,774	7,240	10,939

Device	Routing	Invert	Outlet Devices
#1	Primary	282.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Primary	282.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=6.70 cfs @ 12.02 hrs HW=282.36' (Free Discharge)
└**1=Broad-Crested Rectangular Weir** (Weir Controls 3.35 cfs @ 1.56 fps)
└**2=Broad-Crested Rectangular Weir** (Weir Controls 3.35 cfs @ 1.56 fps)

Summary for Pond FB2: Forebay

Inflow Area = 1.415 ac, 76.75% Impervious, Inflow Depth = 3.45" for 50-yr event
Inflow = 7.37 cfs @ 12.00 hrs, Volume= 0.406 af
Outflow = 6.55 cfs @ 12.01 hrs, Volume= 0.325 af, Atten= 11%, Lag= 0.9 min
Primary = 6.55 cfs @ 12.01 hrs, Volume= 0.325 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 282.37' @ 12.01 hrs Surf.Area= 2,205 sf Storage= 4,814 cf

Plug-Flow detention time= 115.0 min calculated for 0.325 af (80% of inflow)
Center-of-Mass det. time= 41.5 min (841.7 - 800.2)

Volume	Invert	Avail.Storage	Storage Description
#1	278.00'	5,103 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
278.00	208	91.0	0	0	208
279.00	530	118.0	357	357	669
280.00	943	148.0	727	1,083	1,318
281.00	1,462	183.0	1,193	2,276	2,255
282.00	2,052	205.0	1,749	4,025	2,961
282.50	2,260	212.0	1,078	5,103	3,216

Device	Routing	Invert	Outlet Devices
#1	Primary	281.75'	**5.0' long x 3.0' breadth Broad-Crested Rectangular Weir**

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00
2.50 3.00 3.50 4.00 4.50
Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68
2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=6.55 cfs @ 12.01 hrs HW=282.37' (Free Discharge)
↑1=Broad-Crested Rectangular Weir (Weir Controls 6.55 cfs @ 2.11 fps)

Summary for Pond FB3: Forebay

Inflow Area =	1.068 ac, 43.22% Impervious,	Inflow Depth =	1.55"	for 50-yr event
Inflow =	2.26 cfs @ 12.02 hrs,	Volume=	0.138 af	
Outflow =	0.30 cfs @ 12.85 hrs,	Volume=	0.079 af,	Atten= 87%, Lag= 49.8 min
Primary =	0.30 cfs @ 12.85 hrs,	Volume=	0.079 af	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 277.83' @ 12.85 hrs Surf.Area= 2,795 sf Storage= 2,825 cf

Plug-Flow detention time= 235.3 min calculated for 0.079 af (57% of inflow)
Center-of-Mass det. time= 116.0 min (969.8 - 853.7)

Volume	Invert	Avail.Storage	Storage Description
#1	276.00'	4,977 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
276.00	513	345.0	0	0	513
277.00	1,608	372.0	1,010	1,010	2,095
278.00	3,069	535.0	2,299	3,309	13,868
278.50	3,608	542.0	1,667	4,977	14,526

Device	Routing	Invert	Outlet Devices
#1	Primary	277.75'	**5.0' long x 3.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00
			2.50 3.00 3.50 4.00 4.50
			Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68
			2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.30 cfs @ 12.85 hrs HW=277.83' (Free Discharge)
↑1=Broad-Crested Rectangular Weir (Weir Controls 0.30 cfs @ 0.71 fps)

Summary for Pond IF1: Infiltration Basin

Inflow Area =	2.434 ac, 54.78% Impervious,	Inflow Depth =	1.80"	for 50-yr event
Inflow =	6.74 cfs @ 12.02 hrs,	Volume=	0.364 af	
Outflow =	3.35 cfs @ 12.16 hrs,	Volume=	0.364 af,	Atten= 50%, Lag= 8.8 min
Discarded =	3.35 cfs @ 12.16 hrs,	Volume=	0.364 af	
Primary =	0.00 cfs @ 0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 280.60' @ 12.16 hrs Surf.Area= 3,003 sf Storage= 1,619 cf

Plug-Flow detention time= 2.6 min calculated for 0.364 af (100% of inflow)
Center-of-Mass det. time= 2.6 min (865.1 - 862.5)

Volume	Invert	Avail.Storage	Storage Description
#1	280.00'	15,076 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
280.00	2,382	343.0	0	0	2,382
281.00	3,452	367.0	2,901	2,901	3,784
282.00	4,589	388.0	4,007	6,908	5,101
283.00	5,783	407.0	5,175	12,082	6,367
283.50	6,194	414.0	2,994	15,076	6,868

Device	Routing	Invert	Outlet Devices
#1	Primary	282.50'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	280.00'	**45.000 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=3.35 cfs @ 12.16 hrs HW=280.60' (Free Discharge)
↑**2=Exfiltration** (Exfiltration Controls 3.35 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=280.00' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond IF2: Infiltration Basin

Inflow Area = 1.415 ac, 76.75% Impervious, Inflow Depth = 2.76" for 50-yr event
Inflow = 6.55 cfs @ 12.01 hrs, Volume= 0.325 af
Outflow = 3.10 cfs @ 12.17 hrs, Volume= 0.325 af, Atten= 53%, Lag= 9.3 min
Discarded = 3.10 cfs @ 12.17 hrs, Volume= 0.325 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 278.93' @ 12.17 hrs Surf.Area= 2,481 sf Storage= 1,997 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 3.9 min (845.6 - 841.7)

Volume	Invert	Avail.Storage	Storage Description
#1	278.00'	6,812 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
278.00	1,833	207.0	0	0	1,833
279.00	2,535	241.0	2,175	2,175	3,066
280.00	3,312	265.0	2,915	5,089	4,065
280.50	3,580	271.0	1,723	6,812	4,353

Device	Routing	Invert	Outlet Devices
#1	Primary	279.50'	**4.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	278.00'	**45.000 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=3.10 cfs @ 12.17 hrs HW=278.93' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 3.10 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=278.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond IF3: Infiltration Basin

Inflow Area =	1.068 ac,	43.22% Impervious,	Inflow Depth =	0.88"	for 50-yr event
Inflow =	0.30 cfs @	12.85 hrs, Volume=	0.079 af		
Outflow =	0.30 cfs @	12.85 hrs, Volume=	0.079 af,	Atten= 0%,	Lag= 0.3 min
Discarded =	0.30 cfs @	12.85 hrs, Volume=	0.079 af		
Primary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af		

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 277.00' @ 12.85 hrs Surf.Area= 1,556 sf Storage= 4 cf

Plug-Flow detention time= 0.2 min calculated for 0.079 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (970.0 - 969.8)

Volume	Invert	Avail.Storage	Storage Description
#1	277.00'	2,915 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
277.00	1,555	171.0	0	0	1,555
278.00	2,097	190.0	1,819	1,819	2,130
278.50	2,289	196.0	1,096	2,915	2,338

Device	Routing	Invert	Outlet Devices
#1	Primary	277.75'	**5.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	277.00'	**45.000 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=1.62 cfs @ 12.85 hrs HW=277.00' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 1.62 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=277.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Subcatchment 1S:

Runoff = 3.83 cfs @ 12.00 hrs, Volume= 0.213 af, Depth= 1.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 10-YR 10-YR -DS Rainfall=3.75"

	Area (sf)	CN	Description
*	46,880	98	PAVEMENT
	27,367	30	Woods, Good, HSG A
	20,575	32	Woods/grass comb., Good, HSG A
*	11,190	98	ROOF
	106,012	68	Weighted Average
	47,942		45.22% Pervious Area
	58,070		54.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.0200	1.24		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.58"
0.2	33	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.5	133	Total			

Summary for Subcatchment 2S:

Runoff = 4.77 cfs @ 12.00 hrs, Volume= 0.244 af, Depth= 2.07"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 10-YR 10-YR -DS Rainfall=3.75"

Area (sf)	CN	Description
26,469	98	Roofs, HSG A
20,819	98	Paved parking, HSG A
14,328	32	Woods/grass comb., Good, HSG A
61,616	83	Weighted Average
14,328		23.25% Pervious Area
47,288		76.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	60	0.0200	1.12		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.58"
0.1	43	0.0100	4.91	3.86	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.1	76	0.0300	8.51	6.69	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
1.1	179	Total			

Summary for Subcatchment 3S:

Runoff = 0.88 cfs @ 12.02 hrs, Volume= 0.061 af, Depth= 0.69"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 10-YR 10-YR -DS Rainfall=3.75"

	Area (sf)	CN	Description
*	11,640	98	ROOF
*	8,476	98	paving
	26,422	32	Woods/grass comb., Good, HSG A
	46,538	61	Weighted Average
	26,422		56.78% Pervious Area
	20,116		43.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	76	0.0200	1.17		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.58"
1.6	137	0.0440	1.47		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	40	0.0150	6.02	4.73	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
2.8	253	Total			

Summary for Subcatchment 4S:

Runoff = 0.02 cfs @ 13.59 hrs, Volume= 0.009 af, Depth= 0.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 10-YR 10-YR -DS Rainfall=3.75"

	Area (sf)	CN	Description
*	8,210	98	paving
	37,122	32	Woods/grass comb., Good, HSG A
	45,332	44	Weighted Average
	37,122		81.89% Pervious Area
	8,210		18.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	100	0.0750	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.58"
0.1	24	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.6	150	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
17.8	274	Total			

Summary for Subcatchment 5S:

Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 10-YR 10-YR -DS Rainfall=3.75"

Area (sf)	CN	Description
13,908	30	Woods, Good, HSG A
13,908		100.00% Pervious Area

Summary for Pond 7P: Enhanced Buffer Area

Inflow Area = 1.041 ac, 18.11% Impervious, Inflow Depth = 0.10" for 10-YR -DS event
Inflow = 0.02 cfs @ 13.59 hrs, Volume= 0.009 af
Outflow = 0.02 cfs @ 13.59 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.02 cfs @ 13.59 hrs, Volume= 0.009 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 277.00' @ 13.59 hrs Surf.Area= 1,653 sf Storage= 0 cf

Plug-Flow detention time= 0.0 min calculated for 0.009 af (100% of inflow)
Center-of-Mass det. time= 0.0 min (1,053.8 - 1,053.8)

Volume	Invert	Avail.Storage	Storage Description
#1	277.00'	7 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
277.00	1,653	0.0	0	0
277.01	1,653	40.0	7	7

Device	Routing	Invert	Outlet Devices
#1	Discarded	277.00'	**45.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.72 cfs @ 13.59 hrs HW=277.00' (Free Discharge)
1=Exfiltration (Exfiltration Controls 1.72 cfs)

Summary for Pond CB2:

Inflow Area = 2.434 ac, 54.78% Impervious, Inflow Depth = 1.05" for 10-YR -DS event
Inflow = 3.83 cfs @ 12.00 hrs, Volume= 0.213 af
Outflow = 3.83 cfs @ 12.00 hrs, Volume= 0.213 af, Atten= 0%, Lag= 0.0 min
Primary = 3.83 cfs @ 12.00 hrs, Volume= 0.213 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 281.45' @ 12.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	280.50'	**24.0" Round Culvert** L= 43.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 280.50' / 280.00' S= 0.0116 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Secondary	283.50'	**30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.81 cfs @ 12.00 hrs HW=281.44' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 3.81 cfs @ 2.61 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=280.50' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond DP1: DP1

Inflow Area = 2.753 ac, 48.42% Impervious, Inflow Depth = 0.00" for 10-YR -DS event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond DP2: DP2

Inflow Area = 2.483 ac, 62.32% Impervious, Inflow Depth = 0.00" for 10-YR -DS event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond FB1: forebay

Inflow Area = 2.434 ac, 54.78% Impervious, Inflow Depth = 1.05" for 10-YR -DS event
Inflow = 3.83 cfs @ 12.00 hrs, Volume= 0.213 af
Outflow = 1.14 cfs @ 12.22 hrs, Volume= 0.152 af, Atten= 70%, Lag= 13.0 min
Primary = 1.14 cfs @ 12.22 hrs, Volume= 0.152 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 282.11' @ 12.22 hrs Surf.Area= 2,415 sf Storage= 2,908 cf

Plug-Flow detention time= 171.5 min calculated for 0.152 af (71% of inflow)
Center-of-Mass det. time= 65.2 min (929.8 - 864.6)

Volume	Invert	Avail.Storage	Storage Description
#1	279.50'	7,240 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
279.50	30	41.0	0	0	30
280.00	358	306.0	82	82	7,348
281.00	1,304	325.0	782	864	8,353
282.00	2,307	344.0	1,782	2,646	9,418
283.00	3,367	363.0	2,820	5,466	10,544
283.50	3,733	369.0	1,774	7,240	10,939

Device	Routing	Invert	Outlet Devices
#1	Primary	282.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Primary	282.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=1.13 cfs @ 12.22 hrs HW=282.11' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.57 cfs @ 0.85 fps)
└—**2=Broad-Crested Rectangular Weir** (Weir Controls 0.57 cfs @ 0.85 fps)

Summary for Pond FB2: Forebay

Inflow Area = 1.415 ac, 76.75% Impervious, Inflow Depth = 2.07" for 10-YR -DS event
Inflow = 4.77 cfs @ 12.00 hrs, Volume= 0.244 af
Outflow = 2.24 cfs @ 12.11 hrs, Volume= 0.163 af, Atten= 53%, Lag= 7.1 min
Primary = 2.24 cfs @ 12.11 hrs, Volume= 0.163 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 282.07' @ 12.11 hrs Surf.Area= 2,079 sf Storage= 4,160 cf

Plug-Flow detention time= 172.8 min calculated for 0.163 af (67% of inflow)
Center-of-Mass det. time= 71.7 min (891.4 - 819.7)

Volume	Invert	Avail.Storage	Storage Description
#1	278.00'	5,103 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
278.00	208	91.0	0	0	208
279.00	530	118.0	357	357	669
280.00	943	148.0	727	1,083	1,318
281.00	1,462	183.0	1,193	2,276	2,255
282.00	2,052	205.0	1,749	4,025	2,961
282.50	2,260	212.0	1,078	5,103	3,216

Device	Routing	Invert	Outlet Devices
#1	Primary	281.75'	**5.0' long x 3.0' breadth Broad-Crested Rectangular Weir**

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50
Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=2.22 cfs @ 12.11 hrs HW=282.06' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 2.22 cfs @ 1.41 fps)

Summary for Pond FB3: Forebay

Inflow Area =	1.068 ac, 43.22% Impervious, Inflow Depth = 0.69"	for 10-YR -DS event		
Inflow =	0.88 cfs @ 12.02 hrs, Volume=	0.061 af		
Outflow =	0.02 cfs @ 24.01 hrs, Volume=	0.002 af, Atten= 98%, Lag= 719.7 min		
Primary =	0.02 cfs @ 24.01 hrs, Volume=	0.002 af		

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 277.76' @ 24.01 hrs Surf.Area= 2,675 sf Storage= 2,619 cf

Plug-Flow detention time= 716.7 min calculated for 0.002 af (3% of inflow)
Center-of-Mass det. time= 540.4 min (1,431.8 - 891.4)

Volume	Invert	Avail.Storage	Storage Description
#1	276.00'	4,977 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
276.00	513	345.0	0	0	513
277.00	1,608	372.0	1,010	1,010	2,095
278.00	3,069	535.0	2,299	3,309	13,868
278.50	3,608	542.0	1,667	4,977	14,526

Device	Routing	Invert	Outlet Devices
#1	Primary	277.75'	**5.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=0.01 cfs @ 24.01 hrs HW=277.76' (Free Discharge)
↑**1=Broad-Crested Rectangular Weir** (Weir Controls 0.01 cfs @ 0.24 fps)

Summary for Pond IF1: Infiltration Basin

Inflow Area =	2.434 ac, 54.78% Impervious, Inflow Depth = 0.75"	for 10-YR -DS event		
Inflow =	1.14 cfs @ 12.22 hrs, Volume=	0.152 af		
Outflow =	1.13 cfs @ 12.23 hrs, Volume=	0.152 af, Atten= 1%, Lag= 0.6 min		
Discarded =	1.13 cfs @ 12.23 hrs, Volume=	0.152 af		
Primary =	0.00 cfs @ 0.00 hrs, Volume=	0.000 af		

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 280.02' @ 12.23 hrs Surf.Area= 2,397 sf Storage= 37 cf

Plug-Flow detention time= 0.6 min calculated for 0.152 af (100% of inflow)
Center-of-Mass det. time= 0.6 min (930.3 - 929.8)

Volume	Invert	Avail.Storage	Storage Description
#1	280.00'	15,076 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
280.00	2,382	343.0	0	0	2,382
281.00	3,452	367.0	2,901	2,901	3,784
282.00	4,589	388.0	4,007	6,908	5,101
283.00	5,783	407.0	5,175	12,082	6,367
283.50	6,194	414.0	2,994	15,076	6,868

Device	Routing	Invert	Outlet Devices
#1	Primary	282.50'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	280.00'	**45.000 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=2.50 cfs @ 12.23 hrs HW=280.02' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 2.50 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=280.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond IF2: Infiltration Basin

Inflow Area =	1.415 ac,	76.75% Impervious,	Inflow Depth =	1.38" for 10-YR -DS event
Inflow =	2.24 cfs @	12.11 hrs, Volume=	0.163 af	
Outflow =	1.96 cfs @	12.14 hrs, Volume=	0.163 af,	Atten= 12%, Lag= 1.8 min
Discarded =	1.96 cfs @	12.14 hrs, Volume=	0.163 af	
Primary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 278.04' @ 12.14 hrs Surf.Area= 1,861 sf Storage= 79 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.4 min (891.8 - 891.4)

Volume	Invert	Avail.Storage	Storage Description
#1	278.00'	6,812 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
278.00	1,833	207.0	0	0	1,833
279.00	2,535	241.0	2,175	2,175	3,066
280.00	3,312	265.0	2,915	5,089	4,065
280.50	3,580	271.0	1,723	6,812	4,353

Device	Routing	Invert	Outlet Devices
#1	Primary	279.50'	**4.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	278.00'	**45.000 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=1.96 cfs @ 12.14 hrs HW=278.04' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 1.96 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=278.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond IF3: Infiltration Basin

Inflow Area = 1.068 ac, 43.22% Impervious, Inflow Depth = 0.02" for 10-YR -DS event
Inflow = 0.02 cfs @ 24.01 hrs, Volume= 0.002 af
Outflow = 0.02 cfs @ 24.02 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.2 min
Discarded = 0.02 cfs @ 24.02 hrs, Volume= 0.002 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 277.00' @ 24.02 hrs Surf.Area= 1,555 sf Storage= 0 cf

Plug-Flow detention time= 0.2 min calculated for 0.002 af (100% of inflow)
Center-of-Mass det. time= 0.2 min (1,432.1 - 1,431.8)

Volume	Invert	Avail.Storage	Storage Description
#1	277.00'	2,915 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
277.00	1,555	171.0	0	0	1,555
278.00	2,097	190.0	1,819	1,819	2,130
278.50	2,289	196.0	1,096	2,915	2,338

Device	Routing	Invert	Outlet Devices
#1	Primary	277.75'	**5.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	277.00'	**45.000 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=1.62 cfs @ 24.02 hrs HW=277.00' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 1.62 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=277.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Subcatchment 1S:

Runoff = 10.76 cfs @ 12.00 hrs, Volume= 0.611 af, Depth= 3.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 100-YR 100-YR-DS Rainfall=6.50"

	Area (sf)	CN	Description
*	46,880	98	PAVEMENT
	27,367	30	Woods, Good, HSG A
	20,575	32	Woods/grass comb., Good, HSG A
*	11,190	98	ROOF
	106,012	68	Weighted Average
	47,942		45.22% Pervious Area
	58,070		54.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.3	100	0.0200	1.24		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.58"
0.2	33	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
1.5	133	Total			

Summary for Subcatchment 2S:

Runoff = 9.32 cfs @ 12.00 hrs, Volume= 0.537 af, Depth= 4.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 100-YR 100-YR-DS Rainfall=6.50"

Area (sf)	CN	Description
26,469	98	Roofs, HSG A
20,819	98	Paved parking, HSG A
14,328	32	Woods/grass comb., Good, HSG A
61,616	83	Weighted Average
14,328		23.25% Pervious Area
47,288		76.75% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
0.9	60	0.0200	1.12		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.58"
0.1	43	0.0100	4.91	3.86	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
0.1	76	0.0300	8.51	6.69	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
1.1	179	Total			

Summary for Subcatchment 3S:

Runoff = 3.47 cfs @ 12.01 hrs, Volume= 0.209 af, Depth= 2.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 100-YR 100-YR-DS Rainfall=6.50"

	Area (sf)	CN	Description
*	11,640	98	ROOF
*	8,476	98	paving
	26,422	32	Woods/grass comb., Good, HSG A
	46,538	61	Weighted Average
	26,422		56.78% Pervious Area
	20,116		43.22% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	76	0.0200	1.17		**Sheet Flow,** Smooth surfaces n= 0.011 P2= 2.58"
1.6	137	0.0440	1.47		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
0.1	40	0.0150	6.02	4.73	**Pipe Channel,** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.012
2.8	253	Total			

Summary for Subcatchment 4S:

Runoff = 0.59 cfs @ 12.30 hrs, Volume= 0.081 af, Depth= 0.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 100-YR 100-YR-DS Rainfall=6.50"

	Area (sf)	CN	Description
*	8,210	98	paving
	37,122	32	Woods/grass comb., Good, HSG A
	45,332	44	Weighted Average
	37,122		81.89% Pervious Area
	8,210		18.11% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.1	100	0.0750	0.12		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 2.58"
0.1	24	0.0200	2.87		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
3.6	150	0.0100	0.70		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
17.8	274	Total			

Summary for Subcatchment 5S:

Runoff = 0.01 cfs @ 13.49 hrs, Volume= 0.004 af, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
RAIN DATA 24-hr S0P 100-YR 100-YR-DS Rainfall=6.50"

Area (sf)	CN	Description
13,908	30	Woods, Good, HSG A
13,908		100.00% Pervious Area

Summary for Pond 7P: Enhanced Buffer Area

Inflow Area = 1.041 ac, 18.11% Impervious, Inflow Depth = 0.94" for 100-YR-DS event
Inflow = 0.59 cfs @ 12.30 hrs, Volume= 0.081 af
Outflow = 0.59 cfs @ 12.30 hrs, Volume= 0.081 af, Atten= 0%, Lag= 0.0 min
Discarded = 0.59 cfs @ 12.30 hrs, Volume= 0.081 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 277.00' @ 12.30 hrs Surf.Area= 1,653 sf Storage= 0 cf

Plug-Flow detention time= 0.0 min calculated for 0.081 af (100% of inflow)
Center-of-Mass det. time= 0.0 min (905.1 - 905.1)

Volume	Invert	Avail.Storage	Storage Description
#1	277.00'	7 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
277.00	1,653	0.0	0	0
277.01	1,653	40.0	7	7

Device	Routing	Invert	Outlet Devices
#1	Discarded	277.00'	**45.000 in/hr Exfiltration over Surface area**

Discarded OutFlow Max=1.72 cfs @ 12.30 hrs HW=277.00' (Free Discharge)
1=Exfiltration (Exfiltration Controls 1.72 cfs)

Summary for Pond CB2:

Inflow Area = 2.434 ac, 54.78% Impervious, Inflow Depth = 3.01" for 100-YR-DS event
Inflow = 10.76 cfs @ 12.00 hrs, Volume= 0.611 af
Outflow = 10.76 cfs @ 12.00 hrs, Volume= 0.611 af, Atten= 0%, Lag= 0.0 min
Primary = 10.76 cfs @ 12.00 hrs, Volume= 0.611 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs / 2
Peak Elev= 282.30' @ 12.00 hrs

Device	Routing	Invert	Outlet Devices
#1	Primary	280.50'	**24.0" Round Culvert** L= 43.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 280.50' / 280.00' S= 0.0116 '/' Cc= 0.900 n= 0.012, Flow Area= 3.14 sf
#2	Secondary	283.50'	**30.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=10.75 cfs @ 12.00 hrs HW=282.30' (Free Discharge)
↑—**1=Culvert** (Inlet Controls 10.75 cfs @ 3.61 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=280.50' (Free Discharge)
↑—**2=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond DP1: DP1

Inflow Area =	2.753 ac,	48.42% Impervious,	Inflow Depth =	0.02" for 100-YR-DS event
Inflow =	0.01 cfs @	13.49 hrs, Volume=	0.004 af	
Primary =	0.01 cfs @	13.49 hrs, Volume=	0.004 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond DP2: DP2

Inflow Area =	2.483 ac,	62.32% Impervious,	Inflow Depth =	0.00" for 100-YR-DS event
Inflow =	0.00 cfs @	0.00 hrs, Volume=	0.000 af	
Primary =	0.00 cfs @	0.00 hrs, Volume=	0.000 af,	Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Summary for Pond FB1: forebay

Inflow Area =	2.434 ac,	54.78% Impervious,	Inflow Depth =	3.01" for 100-YR-DS event
Inflow =	10.76 cfs @	12.00 hrs, Volume=	0.611 af	
Outflow =	10.23 cfs @	12.01 hrs, Volume=	0.550 af,	Atten= 5%, Lag= 0.7 min
Primary =	10.23 cfs @	12.01 hrs, Volume=	0.550 af	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 282.47' @ 12.01 hrs Surf.Area= 2,785 sf Storage= 3,850 cf

Plug-Flow detention time= 67.6 min calculated for 0.550 af (90% of inflow)
Center-of-Mass det. time= 19.6 min (842.9 - 823.2)

Volume	Invert	Avail.Storage	Storage Description
#1	279.50'	7,240 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
279.50	30	41.0	0	0	30
280.00	358	306.0	82	82	7,348
281.00	1,304	325.0	782	864	8,353
282.00	2,307	344.0	1,782	2,646	9,418
283.00	3,367	363.0	2,820	5,466	10,544
283.50	3,733	369.0	1,774	7,240	10,939

Device	Routing	Invert	Outlet Devices
#1	Primary	282.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Primary	282.00'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32

Primary OutFlow Max=10.20 cfs @ 12.01 hrs HW=282.47' (Free Discharge)
↑ **1=Broad-Crested Rectangular Weir** (Weir Controls 5.10 cfs @ 1.80 fps)
└ **2=Broad-Crested Rectangular Weir** (Weir Controls 5.10 cfs @ 1.80 fps)

Summary for Pond FB2: Forebay

Inflow Area = 1.415 ac, 76.75% Impervious, Inflow Depth = 4.56" for 100-YR-DS event
Inflow = 9.32 cfs @ 12.00 hrs, Volume= 0.537 af
Outflow = 8.60 cfs @ 12.01 hrs, Volume= 0.456 af, Atten= 8%, Lag= 0.5 min
Primary = 8.60 cfs @ 12.01 hrs, Volume= 0.456 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 282.50' @ 12.01 hrs Surf.Area= 2,258 sf Storage= 5,092 cf

Plug-Flow detention time= 95.6 min calculated for 0.456 af (85% of inflow)
Center-of-Mass det. time= 34.3 min (825.8 - 791.5)

Volume	Invert	Avail.Storage	Storage Description
#1	278.00'	5,103 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
278.00	208	91.0	0	0	208
279.00	530	118.0	357	357	669
280.00	943	148.0	727	1,083	1,318
281.00	1,462	183.0	1,193	2,276	2,255
282.00	2,052	205.0	1,749	4,025	2,961
282.50	2,260	212.0	1,078	5,103	3,216

Device	Routing	Invert	Outlet Devices
#1	Primary	281.75'	**5.0' long x 3.0' breadth Broad-Crested Rectangular Weir**

Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50
Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=8.57 cfs @ 12.01 hrs HW=282.49' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 8.57 cfs @ 2.31 fps)

Summary for Pond FB3: Forebay

Inflow Area =	1.068 ac,	43.22% Impervious,	Inflow Depth =	2.35"	for 100-YR-DS event
Inflow =	3.47 cfs @	12.01 hrs,	Volume=	0.209 af	
Outflow =	1.11 cfs @	12.25 hrs,	Volume=	0.149 af,	Atten= 68%, Lag= 14.3 min
Primary =	1.11 cfs @	12.25 hrs,	Volume=	0.149 af	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 277.95' @ 12.25 hrs Surf.Area= 2,989 sf Storage= 3,165 cf

Plug-Flow detention time= 159.3 min calculated for 0.149 af (72% of inflow)
Center-of-Mass det. time= 64.4 min (903.5 - 839.1)

Volume	Invert	Avail.Storage	Storage Description
#1	276.00'	4,977 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
276.00	513	345.0	0	0	513
277.00	1,608	372.0	1,010	1,010	2,095
278.00	3,069	535.0	2,299	3,309	13,868
278.50	3,608	542.0	1,667	4,977	14,526

Device	Routing	Invert	Outlet Devices
#1	Primary	277.75'	**5.0' long x 3.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4.00 4.50 Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.97 3.07 3.32

Primary OutFlow Max=1.11 cfs @ 12.25 hrs HW=277.95' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 1.11 cfs @ 1.10 fps)

Summary for Pond IF1: Infiltration Basin

Inflow Area =	2.434 ac,	54.78% Impervious,	Inflow Depth =	2.71"	for 100-YR-DS event
Inflow =	10.23 cfs @	12.01 hrs,	Volume=	0.550 af	
Outflow =	4.25 cfs @	12.18 hrs,	Volume=	0.550 af,	Atten= 58%, Lag= 10.4 min
Discarded =	4.25 cfs @	12.18 hrs,	Volume=	0.550 af	
Primary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs

Peak Elev= 281.23' @ 12.18 hrs Surf.Area= 3,702 sf Storage= 3,731 cf

Plug-Flow detention time= 5.7 min calculated for 0.550 af (100% of inflow)
Center-of-Mass det. time= 5.5 min (848.4 - 842.9)

Volume	Invert	Avail.Storage	Storage Description
#1	280.00'	15,076 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
280.00	2,382	343.0	0	0	2,382
281.00	3,452	367.0	2,901	2,901	3,784
282.00	4,589	388.0	4,007	6,908	5,101
283.00	5,783	407.0	5,175	12,082	6,367
283.50	6,194	414.0	2,994	15,076	6,868

Device	Routing	Invert	Outlet Devices
#1	Primary	282.50'	**6.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	280.00'	**45.000 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=4.25 cfs @ 12.18 hrs HW=281.23' (Free Discharge)
2=Exfiltration (Exfiltration Controls 4.25 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=280.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond IF2: Infiltration Basin

Inflow Area = 1.415 ac, 76.75% Impervious, Inflow Depth = 3.87" for 100-YR-DS event
Inflow = 8.60 cfs @ 12.01 hrs, Volume= 0.456 af
Outflow = 3.65 cfs @ 12.18 hrs, Volume= 0.456 af, Atten= 58%, Lag= 10.5 min
Discarded = 3.65 cfs @ 12.18 hrs, Volume= 0.456 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 279.45' @ 12.18 hrs Surf.Area= 2,874 sf Storage= 3,397 cf

Plug-Flow detention time= 6.0 min calculated for 0.456 af (100% of inflow)
Center-of-Mass det. time= 6.0 min (831.8 - 825.8)

Volume	Invert	Avail.Storage	Storage Description
#1	278.00'	6,812 cf	**Custom Stage Data (Irregular)**Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
278.00	1,833	207.0	0	0	1,833
279.00	2,535	241.0	2,175	2,175	3,066
280.00	3,312	265.0	2,915	5,089	4,065
280.50	3,580	271.0	1,723	6,812	4,353

Device	Routing	Invert	Outlet Devices
#1	Primary	279.50'	**4.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	278.00'	**45.000 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=3.65 cfs @ 12.18 hrs HW=279.45' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 3.65 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=278.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond IF3: Infiltration Basin

Inflow Area = 1.068 ac, 43.22% Impervious, Inflow Depth = 1.68" for 100-YR-DS event
Inflow = 1.11 cfs @ 12.25 hrs, Volume= 0.149 af
Outflow = 1.11 cfs @ 12.26 hrs, Volume= 0.149 af, Atten= 0%, Lag= 0.2 min
Discarded = 1.11 cfs @ 12.26 hrs, Volume= 0.149 af
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 277.01' @ 12.26 hrs Surf.Area= 1,560 sf Storage= 16 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 0.2 min (903.7 - 903.5)

Volume	Invert	Avail.Storage	Storage Description
#1	277.00'	2,915 cf	**Custom Stage Data (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
277.00	1,555	171.0	0	0	1,555
278.00	2,097	190.0	1,819	1,819	2,130
278.50	2,289	196.0	1,096	2,915	2,338

Device	Routing	Invert	Outlet Devices
#1	Primary	277.75'	**5.0' long x 2.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 Coef. (English) 2.54 2.61 2.61 2.60 2.66 2.70 2.77 2.89 2.88 2.85 3.07 3.20 3.32
#2	Discarded	277.00'	**45.000 in/hr Exfiltration over Wetted area**

Discarded OutFlow Max=1.63 cfs @ 12.26 hrs HW=277.01' (Free Discharge)
↑—**2=Exfiltration** (Exfiltration Controls 1.63 cfs)

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=277.00' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

APPENDIX F
GREEN INFRASTRUCTURE WORKSHEETS

Version 1.8
Last Updated: 11/09/2015

Total Water Quality Volume Calculation
WQv(acre-feet) = [(P)(Rv)(A)] /12

Is this project subject to Chapter 10 of the NYS Design Manual (i.e. WQv is equal to post-development 1 year runoff volume)?.....		
Design Point:		
P=	1.20	*inch*

Breakdown of Subcatchments

Catchment Number	Total Area *(Acres)*	Impervious Area *(Acres)*	Percent Impervious *%*	Rv	WQv *(ft^3)*	Description
1	2.43	1.33	55%	0.54	5,743	
2	1.40	1.09	78%	0.75	4,578	
3	1.06	0.46	43%	0.44	2,034	
4	1.04	0.19	18%	0.21	971	
5	0.32	0.00	0%	0.05	70	
6						
7						
8						
9						
10						
Subtotal (1-30)	6.25	3.07	49%	0.49	**13,397**	**Subtotal 1**
Total	6.25	3.07	49%	0.49	**13,397**	**Initial WQv**

Identify Runoff Reduction Techniques By Area

Technique	Total Contributing Area *(Acre)*	Contributing Impervious Area *(Acre)*	Notes
Conservation of Natural Areas	0.00	0.00	*minimum 10,000 sf*
Riparian Buffers	0.00	0.00	*maximum contributing length 75 feet to 150 feet*
Filter Strips	0.00	0.00	
Tree Planting	0.00	0.00	*Up to 100 sf directly connected impervious area may be subtracted per tree*
Total	**0.00**	**0.00**	

Recalculate WQv after application of Area Reduction Techniques

	Total Area *(Acres)*	Impervious Area *(Acres)*	Percent Impervious *%*	Runoff Coefficient Rv	WQv *(ft^3)*
"<<Initial WQv"	6.25	3.07	49%	0.49	13,397
Subtract Area	0.00	0.00			
WQv adjusted after Area Reductions	**6.25**	**3.07**	49%	0.49	13,397
Disconnection of Rooftops		0.00			
Adjusted WQv after Area Reduction and Rooftop Disconnect	6.25	3.07	49%	0.49	**13,397**
WQv reduced by Area Reduction techniques					0

Minimum RRv

Enter the Soils Data for the site		
Soil Group	Acres	S
A	6.25	55%
B		40%
C		30%
D		20%
Total Area	6.25	

Calculate the Minimum RRv		
S =	**0.55**	
Impervious =	3.07	*acre*
Precipitation	1.2	*in*
Rv	0.95	
Minimum RRv	**6,987**	***ft3***
	0.16	af

Runoff Reduction Volume and Treated Volumes						
	Runoff Reduction Techiques/Standard SMPs		Total Contributing Area	Total Contributing Impervious Area	WQv Reduced (RRv)	WQv Treated
			(acres)	(acres)	cf	cf
Area/Volume Reduction	Conservation of Natural Areas	RR-1	0.00	0.00		
	Sheetflow to Riparian Buffers/Filter Strips	RR-2	0.00	0.00		
	Tree Planting/Tree Pit	RR-3	0.00	0.00		
	Disconnection of Rooftop Runoff	RR-4		0.00		
	Vegetated Swale	RR-5	0.00	0.00	0	
	Rain Garden	RR-6	0.00	0.00	0	
	Stormwater Planter	RR-7	0.00	0.00	0	
	Rain Barrel/Cistern	RR-8	0.00	0.00	0	
	Porous Pavement	RR-9	0.00	0.00	0	
	Green Roof (Intensive & Extensive)	RR-10	0.00	0.00	0	
Standard SMPs w/RRv Capacity	Infiltration Trench	I-1	0.00	0.00	0	0
	Infiltration Basin	I-2	4.89	2.88	11902	4904
	Dry Well	I-3	0.00	0.00	0	0
	Underground Infiltration System	I-4				
	Bioretention & Infiltration Bioretention	F-5	0.00	0.00	0	0
	Dry swale	O-1	0.00	0.00	0	0
Standard SMPs	Micropool Extended Detention (P-1)	P-1				
	Wet Pond (P-2)	P-2				
	Wet Extended Detention (P-3)	P-3				
	Multiple Pond system (P-4)	P-4				
	Pocket Pond (p-5)	P-5				
	Surface Sand filter (F-1)	F-1				
	Underground Sand filter (F-2)	F-2				
	Perimeter Sand Filter (F-3)	F-3				
	Organic Filter (F-4	F-4				
	Shallow Wetland (W-1)	W-1				
	Extended Detention Wetland (W-2	W-2				
	Pond/Wetland System (W-3)	W-3				
	Pocket Wetland (W-4)	W-4				
	Wet Swale (O-2)	O-2				
Totals by Area Reduction →			0.00	0.00	0	
Totals by Volume Reduction →			0.00	0.00	0	
Totals by Standard SMP w/RRV →			4.89	2.88	11902	4904
Totals by Standard SMP →			0.00	0.00		0
Totals (Area + Volume + all SMPs) →			4.89	2.88	11,902	4,904
	Impervious Cover √	error				

Infiltration Basin Worksheet

Design Point:							
Enter Site Data For Drainage Area to be Treated by Practice							
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Precipitation** *(in)*	**Description**
1	2.43	1.33	0.55	0.54	5743.39	1.20	
Enter Impervious Area Reduced by Disconnection of Rooftops			55%	0.54	5,743	<<WQv after adjusting for Disconnected Rooftops	
Enter the portion of the WQv that is not reduced for all practices routed to this practice.						ft^3	

Pretreatment Techniques to Prevent Clogging			
Infiltration Rate	45.00	*in/hour*	*Okay*
Pretreatment Sizing	100	*% WQv*	*25% minimum;* *50% if >2 in/hr* *100% if >5in/hour*
Pretreatment Required Volume	5,743	ft^3	
Pretreatment Provided	7,240	ft^3	
Pretreatment Techniques utilized	*Sedimentation Basin*		

Size An Infiltration Basin			
Design Volume	5,743	ft^3	WQv
Basal Area Required	1,641	ft^2	*Infiltration practices shall be designed to exfiltrate the entire WQv through the floor of each practice.*
Basal Area Provided	2,381	ft^2	
Design Depth	3.50	*ft*	
Volume Provided	8,334	ft^3	*Storage Volume provided in infiltration basin area (not including pretreatment.*

Determine Runoff Reduction			
RRv	**5,743**	ft^3	***90% of the storage provided in the basin or WQv whichever is smaller***
Volume Treated	0	ft^3	*This is the portion of the WQv that is not reduced/infiltrated*
Sizing √	OK		*The infiltration basin must provide storage equal to or greater than the WQv of the contributing area.*

Infiltration Basin Worksheet

Design Point:	

Enter Site Data For Drainage Area to be Treated by Practice							
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Precipitation** *(in)*	**Description**
2	1.40	1.09	0.78	0.75	4578.16	1.20	
Enter Impervious Area Reduced by Disconnection of Rooftops			78%	0.75	4,578	<<WQv after adjusting for Disconnected Rooftops	
Enter the portion of the WQv that is not reduced for all practices routed to this practice.						*ft^3*	

Pretreatment Techniques to Prevent Clogging			
Infiltration Rate	45.00	*in/hour*	*Okay*
Pretreatment Sizing	100	*% WQv*	*25% minimum;* *50% if >2 in/hr* *100% if >5in/hour*
Pretreatment Required Volume	4,578	*ft^3*	
Pretreatment Provided	5,103	*ft^3*	
Pretreatment Techniques utilized	*Sedimentation Basin*		

Size An Infiltration Basin			
Design Volume	4,578	*ft^3*	WQv
Basal Area Required	1,831	*ft^2*	*Infiltration practices shall be designed to exfiltrate the entire WQv through the floor of each practice.*
Basal Area Provided	1,833	*ft^2*	
Design Depth	2.50	*ft*	
Volume Provided	4,583	*ft^3*	*Storage Volume provided in infiltration basin area (not including pretreatment.*

Determine Runoff Reduction			
RRv	**4,124**	***ft^3***	***90% of the storage provided in the basin or WQv whichever is smaller***
Volume Treated	454	*ft^3*	*This is the portion of the WQv that is not reduced/infiltrated*
Sizing √	OK		*The infiltration basin must provide storage equal to or greater than the WQv of the contributing area.*

Infiltration Basin Worksheet

Design Point:							
Enter Site Data For Drainage Area to be Treated by Practice							
Catchment Number	**Total Area** *(Acres)*	**Impervious Area** *(Acres)*	**Percent Impervious** *%*	**Rv**	**WQv** *(ft^3)*	**Precipitation** *(in)*	**Description**
3	1.06	0.46	0.43	0.44	2034.25	1.20	
Enter Impervious Area Reduced by Disconnection of Roofs			43%	0.44	2,034	<<WQv after adjusting for Disconnected Rooftops	
Enter the portion of the WQv that is not reduced for all practices routed to this practice.						ft^3	

Pretreatment Techniques to Prevent Clogging			
Infiltration Rate	45.00	*in/hour*	*Okay*
Pretreatment Sizing	100	*% WQv*	*25% minimum; 50% if >2 in/hr 100% if >5in/hour*
Pretreatment Required Volume	2,034	ft^3	
Pretreatment Provided	4,977	ft^3	
Pretreatment Techniques utilized	*Sedimentation Basin*		

Size An Infiltration Basin			
Design Volume	2,034	ft^3	WQv
Basal Area Required	814	ft^2	*Infiltration practices shall be designed to exfiltrate the entire WQv through the floor of each practice.*
Basal Area Provided	1,555	ft^2	
Design Depth	2.50	*ft*	
Volume Provided	3,888	ft^3	*Storage Volume provided in infiltration basin area (not including pretreatment.*

Determine Runoff Reduction			
RRv	**2,034**	ft^3	***90% of the storage provided in the basin or WQv whichever is smaller***
Volume Treated	0	ft^3	*This is the portion of the WQv that is not reduced/infiltrated*
Sizing √	OK		*The infiltration basin must provide storage equal to or greater than the WQv of the contributing area.*

APPENDIX G
DRAFT NOI

NOI for coverage under Stormwater General Permit for Construction Activity

version 1.32

(Submission #: HPC-QV22-AM7WJ, version 1)

Details

Originally Started By Matthew Huntington

Submission ID HPC-QV22-AM7WJ

Submission Reason New

Status Draft

Form Input

Owner/Operator Information

Owner/Operator Name (Company/Private Owner/Municipality/Agency/Institution, etc.)
Saratoga Biochar Solutions, LLC

Owner/Operator Contact Person Last Name (NOT CONSULTANT)
Apy

Owner/Operator Contact Person First Name
Raymond

Owner/Operator Mailing Address
26 F Congress St. #346

City
Saratoga Springs

State
NY

Zip
12866

Phone
518-391-0566

Email
rapy@northeasternbiochar.com

Federal Tax ID
NONE PROVIDED

Project Location

Project/Site Name
Saratoga Biochar Solutions, LLC

Street Address (Not P.O. Box)
Farnan Road

Side of Street
West

City/Town/Village (THAT ISSUES BUILDING PERMIT)
Moreau

State
NY

Zip
12803

DEC Region
NONE PROVIDED

County
SARATOGA

Name of Nearest Cross Street
Bluebird Road

Distance to Nearest Cross Street (Feet)
3696

Project In Relation to Cross Street
South

Tax Map Numbers Section-Block-Parcel
50.-4-22 and 50.-4-16

Tax Map Numbers
50.-4-22; 50.-4-16

1. Coordinates

Provide the Geographic Coordinates for the project site. The two methods are:
- Navigate to the project location on the map (below) and click to place a marker and obtain the XY coordinates.
- The "Find Me" button will provide the lat/long for the person filling out this form. Then pan the map to the correct location and click the map to place a marker and obtain the XY coordinates.

Navigate to your location and click on the map to get the X,Y coordinates
43.28299536171419,-73.60429419726917

Project Details

2. What is the nature of this project?
New Construction

3. Select the predominant land use for both pre and post development conditions.

Pre-Development Existing Landuse
Forest

Post-Development Future Land Use
Industrial

3a. If Single Family Subdivision was selected in question 3, enter the number of subdivision lots.
NONE PROVIDED

4. In accordance with the larger common plan of development or sale, enter the total project site acreage, the acreage to be disturbed and the future impervious area (acreage)within the disturbed area.

*** ROUND TO THE NEAREST TENTH OF AN ACRE. ***

Total Site Area (acres)
5.28

Total Area to be Disturbed (acres)
4.8

Existing Impervious Area to be Disturbed (acres)
0

Future Impervious Area Within Disturbed Area (acres)
3.25

5. Do you plan to disturb more than 5 acres of soil at any one time?
No

---

6. Indicate the percentage (%) of each Hydrologic Soil Group(HSG) at the site.

A (%)
100

B (%)
0

C (%)
0

D (%)
0

7. Is this a phased project?
Yes

8. Enter the planned start and end dates of the disturbance activities.

Start Date
3/1/2022

End Date
10/1/2027

9. Identify the nearest surface waterbody(ies) to which construction site runoff will discharge.
Hudson River

9a. Type of waterbody identified in question 9?
River Off Site

Other Waterbody Type Off Site Description
NONE PROVIDED

9b. If "wetland" was selected in 9A, how was the wetland identified?
NONE PROVIDED

10. Has the surface waterbody(ies in question 9 been identified as a 303(d) segment in Appendix E of GP-0-20-001?
No

11. Is this project located in one of the Watersheds identified in Appendix C of GP-0-20-001?
No

12. Is the project located in one of the watershed areas associated with AA and AA-S classified waters?
No

If No, skip question 13.

13. Does this construction activity disturb land with no existing impervious cover and where the Soil Slope Phase is identified as an E or F on the USDA Soil Survey?
NONE PROVIDED

If Yes, what is the acreage to be disturbed?
NONE PROVIDED

14. Will the project disturb soils within a State regulated wetland or the protected 100 foot adjacent area?
No

15. Does the site runoff enter a separate storm sewer system (including roadside drains, swales, ditches, culverts, etc)?
Yes

16. What is the name of the municipality/entity that owns the separate storm sewer system?
Town of Moreau

17. Does any runoff from the site enter a sewer classified as a Combined Sewer?
No

18. Will future use of this site be an agricultural property as defined by the NYS Agriculture and Markets Law?
No

19. Is this property owned by a state authority, state agency, federal government or local government?
No

20. Is this a remediation project being done under a Department approved work plan? (i.e. CERCLA, RCRA, Voluntary Cleanup Agreement, etc.)
No

Required SWPPP Components

21. Has the required Erosion and Sediment Control component of the SWPPP been developed in conformance with the current NYS Standards and Specifications for Erosion and Sediment Control (aka Blue Book)?
Yes

22. Does this construction activity require the development of a SWPPP that includes the post-construction stormwater management practice component (i.e. Runoff Reduction, Water Quality and Quantity Control practices/techniques)?
Yes

If you answered No in question 22, skip question 23 and the Post-construction Criteria and Post-construction SMP Identification sections.

23. Has the post-construction stormwater management practice component of the SWPPP been developed in conformance with the current NYS Stormwater Management Design Manual?
Yes

24. The Stormwater Pollution Prevention Plan (SWPPP) was prepared by:
Professional Engineer (P.E.)

SWPPP Preparer
Studio A Landscape Architecture & Engineering, DPC

Contact Name (Last, Space, First)
Huntington Mathew

Mailing Address
38 High Rock Ave, Suite 3

City
Saratoga Springs

State
NY

Zip
12866

Phone
5184504030

Email
mhuntington@studioadpc.com

Download SWPPP Preparer Certification Form
Please take the following steps to prepare and upload your preparer certification form:

1) Click on the link below to download a blank certification form
2) The certified SWPPP preparer should sign this form

3) Scan the signed form
4) Upload the scanned document
Download SWPPP Preparer Certification Form

Please upload the SWPPP Preparer Certification
NONE PROVIDED
Comment
NONE PROVIDED

Erosion & Sediment Control Criteria

25. Has a construction sequence schedule for the planned management practices been prepared?
Yes

26. Select all of the erosion and sediment control practices that will be employed on the project site:

Temporary Structural
Silt Fence
Stabilized Construction Entrance

Biotechnical
None

Vegetative Measures
Topsoiling
Protecting Vegetation
Seeding

Permanent Structural
Land Grading
Rock Outlet Protection

Other
NONE PROVIDED

Post-Construction Criteria

*** IMPORTANT: Completion of Questions 27-39 is not required if response to Question 22 is No.**

27. Identify all site planning practices that were used to prepare the final site plan/layout for the project.
Preservation of Undisturbed Area
Preservation of Buffers

27a. Indicate which of the following soil restoration criteria was used to address the requirements in Section 5.1.6("Soil Restoration") of the Design Manual (2010 version).
All disturbed areas will be restored in accordance with the Soil Restoration requirements in Table 5.3 of the Design Manual (see page 5-22).

28. Provide the total Water Quality Volume (WQv) required for this project (based on final site plan/layout). (Acre-feet)
0.31

29. Post-construction SMP Identification
Use the Post-construction SMP Identification section to identify the RR techniques (Area Reduction), RR techniques(Volume Reduction) and Standard SMPs with RRv Capacity that were used to reduce the Total WQv Required (#28).

Identify the SMPs to be used by providing the total impervious area that contributes runoff to each technique/practice selected. For the Area Reduction Techniques, provide the total contributing area (includes pervious area) and, if applicable, the total impervious area that contributes runoff to the technique/practice.

Note: Redevelopment projects shall use the Post-Construction SMP Identification section to identify the SMPs used to treat and/or reduce the WQv required. If runoff reduction techniques will not be used to reduce the required WQv, skip to question 33a after identifying the SMPs.

30. Indicate the Total RRv provided by the RR techniques (Area/Volume Reduction) and Standard SMPs with RRv capacity identified in question 29. (acre-feet)
.27

31. Is the Total RRv provided (#30) greater than or equal to the total WQv required (#28)?
No

If Yes, go to question 36. If No, go to question 32.

32. Provide the Minimum RRv required based on HSG. [Minimum RRv Required = (P) (0.95) (Ai) / 12, Ai=(s) (Aic)] (acre-feet)
.16

32a. Is the Total RRv provided (#30) greater than or equal to the Minimum RRv Required (#32)?
Yes

If Yes, go to question 33.
Note: Use the space provided in question #39 to summarize the specific site limitations and justification for not reducing 100% of WQv required (#28). A detailed evaluation of the specific site limitations and justification for not reducing 100% of the WQv required (#28) must also be included in the SWPPP.

If No, sizing criteria has not been met; therefore, NOI can not be processed. SWPPP preparer must modify design to meet sizing criteria.

33. SMPs
Use the Post-construction SMP Identification section to identify the Standard SMPs and, if applicable, the Alternative SMPs to be used to treat the remaining total WQv (=Total WQv Required in #28 - Total RRv Provided in #30).

Also, provide the total impervious area that contributes runoff to each practice selected.

NOTE: Use the Post-construction SMP Identification section to identify the SMPs used on Redevelopment projects.

33a. Indicate the Total WQv provided (i.e. WQv treated) by the SMPs identified in question #33 and Standard SMPs with RRv Capacity identified in question #29. (acre-feet)
.11

Note: For the standard SMPs with RRv capacity, the WQv provided by each practice = the WQv calculated using the contributing drainage area to the practice - provided by the practice. (See Table 3.5 in Design Manual)

34. Provide the sum of the Total RRv provided (#30) and the WQv provided (#33a).
.39

35. Is the sum of the RRv provided (#30) and the WQv provided (#33a) greater than or equal to the total WQv required (#28)?
Yes

If Yes, go to question 36.

If No, sizing criteria has not been met; therefore, NOI can not be processed. SWPPP preparer must modify design to meet sizing criteria.

36. Provide the total Channel Protection Storage Volume (CPv required and provided or select waiver (#36a), if applicable.

CPv Required (acre-feet)
NONE PROVIDED

CPv Provided (acre-feet)
NONE PROVIDED

36a. The need to provide channel protection has been waived because:
Reduction of the total CPv is achieved on site through runoff reduction techniques or infiltration systems.

37. Provide the Overbank Flood (Qp) and Extreme Flood (Qf) control criteria or select waiver (#37a), if applicable.

Overbank Flood Control Criteria (Qp)

Pre-Development (CFS)
0

Post-Development (CFS)
0

Total Extreme Flood Control Criteria (Qf)

Pre-Development (CFS)
0.7

Post-Development (CFS)
0.4

37a. The need to meet the Qp and Qf criteria has been waived because:
NONE PROVIDED

38. Has a long term Operation and Maintenance Plan for the post-construction stormwater management practice(s) been developed?
Yes

If Yes, Identify the entity responsible for the long term Operation and Maintenance
Property Owner

39. Use this space to summarize the specific site limitations and justification for not reducing 100% of WQv required (#28). (See question #32a) This space can also be used for other pertinent project information.
WQv was not 100% reduced due to high groundwater encountered in the eastern extremities of the site. Though, adequate treatment capacity has been provided to reduce and treat a volume greater than total WQv.

Post-Construction SMP Identification

Runoff Reduction (RR) Techniques, Standard Stormwater Management Practices (SMPs) and Alternative SMPs
Identify the Post-construction SMPs to be used by providing the total impervious area that contributes runoff to each technique/practice selected. For the Area Reduction Techniques, provide the total contributing area (includes pervious area) and, if applicable, the total impervious area that contributes runoff to the technique/practice.

RR Techniques (Area Reduction)

Round to the nearest tenth

Total Contributing Acres for Conservation of Natural Area (RR-1)
NONE PROVIDED

Total Contributing Impervious Acres for Conservation of Natural Area (RR-1)
NONE PROVIDED

Total Contributing Acres for Sheetflow to Riparian Buffers/Filter Strips (RR-2)
NONE PROVIDED

Total Contributing Impervious Acres for Sheetflow to Riparian Buffers/Filter Strips (RR-2)
NONE PROVIDED

Total Contributing Acres for Tree Planting/Tree Pit (RR-3)
NONE PROVIDED

Total Contributing Impervious Acres for Tree Planting/Tree Pit (RR-3)
NONE PROVIDED

Total Contributing Acres for Disconnection of Rooftop Runoff (RR-4)
NONE PROVIDED

RR Techniques (Volume Reduction)

Total Contributing Impervious Acres for Disconnection of Rooftop Runoff (RR-4)
NONE PROVIDED

Total Contributing Impervious Acres for Vegetated Swale (RR-5)
NONE PROVIDED

Total Contributing Impervious Acres for Rain Garden (RR-6)
NONE PROVIDED

Total Contributing Impervious Acres for Stormwater Planter (RR-7)
NONE PROVIDED

Total Contributing Impervious Acres for Rain Barrel/Cistern (RR-8)
NONE PROVIDED

Total Contributing Impervious Acres for Porous Pavement (RR-9)
NONE PROVIDED

Total Contributing Impervious Acres for Green Roof (RR-10)
NONE PROVIDED

Standard SMPs with RRv Capacity

Total Contributing Impervious Acres for Infiltration Trench (I-1)
NONE PROVIDED

Total Contributing Impervious Acres for Infiltration Basin (I-2)
2.99

Total Contributing Impervious Acres for Dry Well (I-3)
NONE PROVIDED

Total Contributing Impervious Acres for Underground Infiltration System (I-4)
NONE PROVIDED

Total Contributing Impervious Acres for Bioretention (F-5)
NONE PROVIDED

Total Contributing Impervious Acres for Dry Swale (O-1)
NONE PROVIDED

Standard SMPs

Total Contributing Impervious Acres for Micropool Extended Detention (P-1)
NONE PROVIDED

Total Contributing Impervious Acres for Wet Pond (P-2)
NONE PROVIDED

Total Contributing Impervious Acres for Wet Extended Detention (P-3)
NONE PROVIDED

Total Contributing Impervious Acres for Multiple Pond System (P-4)
NONE PROVIDED

Total Contributing Impervious Acres for Pocket Pond (P-5)
NONE PROVIDED

Total Contributing Impervious Acres for Surface Sand Filter (F-1)
NONE PROVIDED

Total Contributing Impervious Acres for Underground Sand Filter (F-2)
NONE PROVIDED

Total Contributing Impervious Acres for Perimeter Sand Filter (F-3)
NONE PROVIDED

Total Contributing Impervious Acres for Organic Filter (F-4)
NONE PROVIDED

Total Contributing Impervious Acres for Shallow Wetland (W-1)
NONE PROVIDED

Total Contributing Impervious Acres for Extended Detention Wetland (W-2)
NONE PROVIDED

Total Contributing Impervious Acres for Pond/Wetland System (W-3)
NONE PROVIDED

Total Contributing Impervious Acres for Pocket Wetland (W-4)
NONE PROVIDED

Total Contributing Impervious Acres for Wet Swale (O-2)
NONE PROVIDED

Alternative SMPs (DO NOT INCLUDE PRACTICES BEING USED FOR PRETREATMENT ONLY)

Total Contributing Impervious Area for Hydrodynamic
NONE PROVIDED

Total Contributing Impervious Area for Wet Vault
NONE PROVIDED

Total Contributing Impervious Area for Media Filter
NONE PROVIDED

"Other" Alternative SMP?
NONE PROVIDED

Total Contributing Impervious Area for "Other"
NONE PROVIDED

Provide the name and manufaturer of the alternative SMPs (i.e. proprietary practice(s)) being used for WQv treatment.

Note: Redevelopment projects which do not use RR techniques, shall use questions 28, 29, 33 and 33a to provide SMPs used, total WQv required and total WQv provided for the project.

Manufacturer of Alternative SMP
NONE PROVIDED

Name of Alternative SMP
NONE PROVIDED

Other Permits

40. Identify other DEC permits, existing and new, that are required for this project/facility.
Air Pollution Control
Solid Waste

If SPDES Multi-Sector GP, then give permit ID
NONE PROVIDED

If Other, then identify
NONE PROVIDED

41. Does this project require a US Army Corps of Engineers Wetland Permit?
No

If "Yes," then indicate Size of Impact, in acres, to the nearest tenth
NONE PROVIDED

42. If this NOI is being submitted for the purpose of continuing or transferring coverage under a general permit for stormwater runoff from construction activities, please indicate the former SPDES number assigned.
NONE PROVIDED

MS4 SWPPP Acceptance

43. Is this project subject to the requirements of a regulated, traditional land use control MS4?
Yes - Please attach the MS4 Acceptance form below

If No, skip question 44

44. Has the "MS4 SWPPP Acceptance" form been signed by the principal executive officer or ranking elected official and submitted along with this NOI?
NONE PROVIDED

MS4 SWPPP Acceptance Form Download
Download form from the link below. Complete, sign, and upload.
MS4 SWPPP Acceptance Form

MS4 Acceptance Form Upload
NONE PROVIDED
Comment
NONE PROVIDED

Owner/Operator Certification

Owner/Operator Certification Form Download
Download the certification form by clicking the link below. Complete, sign, scan, and upload the form.
Owner/Operator Certification Form (PDF, 45KB)

Upload Owner/Operator Certification Form

NONE PROVIDED

Comment

NONE PROVIDED

APPENDIX H
SOIL RESTORATION REQUIREMENTS

Soil Restoration Requirements			
Type of Soil Disturbance	**Soil Restoration Requirement**		**Comments/Examples**
No soil disturbance	Restoration not permitted		Preservation of Natural Features
Minimal soil disturbance	Restoration not required		Clearing and grubbing
Areas where topsoil is stripped only - no change in grade	HSG A &B	HSG C&D	Protect area from any ongoing construction activities.
	apply 6 inches of topsoil	Aerate* and apply 6 inches of topsoil	
Areas of cut or fill	HSG A &B	HSG C & D	
	Aerate and apply 6 inches of topsoil	Apply full Soil Restoration **	
Heavy traffic areas on site (especially in a zone 5-25 feet around buildings but not within a 5 foot perimeter around foundation walls)	Apply full Soil Restoration (de-compaction and compost enhancement)		
Areas where Runoff Reduction and/or Infiltration practices are applied	Restoration not required, but may be applied to enhance the reduction specified for appropriate practices.		Keep construction equipment from crossing these areas. To protect newly installed practice from any ongoing construction activities construct a single phase operation fence area
Redevelopment projects	Soil Restoration is required on redevelopment projects in areas where existing impervious area will be converted to pervious area.		

*Aeration includes the use of machines such as tractor-drawn implements with coulters making a narrow slit in the soil, a roller with many spikes making indentations in the soil, or prongs which function like a mini-subsoiler.

** Per "Deep Ripping and De-compaction, DEC 2008".

New York State
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Water

Deep-Ripping and Decompaction

April 2008

New York State
Department of Environmental Conservation

Document Prepared by:

John E. Lacey,
Land Resource Consultant and Environmental Compliance Monitor
(Formerly with the Division of Agricultural Protection and Development Services,
NYS Dept. of Agriculture & Markets)

Alternative Stormwater Management
Deep-Ripping and Decompaction

Description

The two-phase practice of 1) "Deep Ripping;" and 2) "Decompaction" (deep subsoiling), of the soil material as a step in the cleanup and restoration/landscaping of a construction site, helps mitigate the physically induced impacts of soil compression; i.e.: soil compaction or the substantial increase in the bulk density of the soil material.

Deep Ripping and Decompaction are key factors which help in restoring soil pore space and permeability for water infiltration. Conversely, the physical actions of cut-and-fill work, land grading, the ongoing movement of construction equipment and the transport of building materials throughout a site alter the architecture and structure of the soil, resulting in: the mixing of layers (horizons) of soil materials, compression of those materials and diminished soil porosity which, if left unchecked, severely impairs the soil's water holding capacity and vertical drainage (rainfall infiltration), from the surface downward.

In a humid climate region, compaction damage on a site is virtually guaranteed over the duration of a project. Soil in very moist to wet condition when compacted, will have severely reduced permeability. Figure 1 displays the early stage of the deep-ripping phase (Note that all topsoil was stripped prior to construction access, and it remains stockpiled until the next phase – decompaction – is complete). A heavy-duty tractor is pulling a three-shank ripper on the first of several series of incrementally deepening passes through the construction access corridor's densely compressed subsoil material. Figure 2 illustrates the approximate volumetric composition of a loam surface soil when conditions are good for plant growth, with adequate natural pore space for fluctuating moisture conditions.

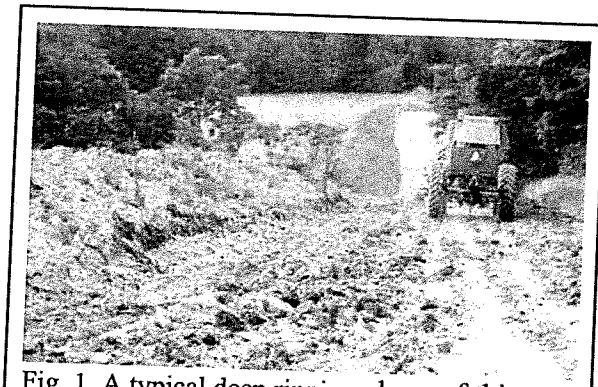

Fig. 1. A typical deep ripping phase of this practice, during the first in a series of progressively deeper "rips" through severely compressed subsoil.

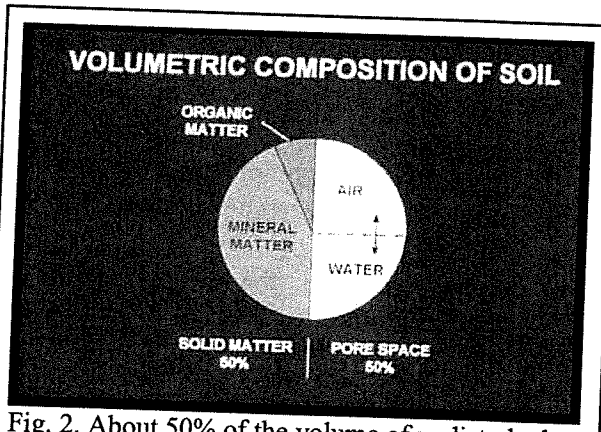

Fig. 2. About 50% of the volume of undisturbed loam surface soil is pore space, when soil is in good condition for plant growth. Brady, 2002.

Recommended Application of Practice

The objective of Deep Ripping and Decompaction is to effectively fracture (vertically and laterallly) through the thickness of the physically compressed subsoil material (see Figure 3), restoring soil porosity and permeability and aiding infiltration to help reduce runoff. Together with topsoil stripping, the "two-phase" practice of Deep Ripping and Decompaction first became established as a "best management practice" through ongoing success on commercial farmlands affected by heavy utility construction right-of-way projects (transmission pipelines and large power lines).

Fig. 3. Construction site with significant compaction of the deep basal till subsoil extends 24 inches below this exposed cut-and-fill work surface.

Soil permeability, soil drainage and cropland productivity were restored. For broader construction application, the two-phase practice of Deep Ripping and Decompaction is best adapted to areas impacted with significant soil compaction, on contiguous open portions of large construction sites and inside long, open construction corridors used as temporary access over the duration of construction. Each mitigation area should have minimal above-and-below-ground obstructions for the easy avoidance and maneuvering of a large tractor and ripping/decompacting implements. Conversely, the complete two-phase practice is not recommended in congested or obstructed areas due to the limitations on tractor and implement movement.

Benefits

Aggressive "deep ripping" through the compressed thickness of exposed subsoil before the replacement/respreading of the topsoil layer, followed by "decompaction," i.e.: "sub-soiling," through the restored topsoil layer down into the subsoil, offers the following benefits:

- Increases the project (larger size) area's direct surface infiltration of rainfall by providing the open site's mitigated soil condition and lowers the demand on concentrated runoff control structures
- Enhances direct groundwater recharge through greater dispersion across and through a broader surface than afforded by some runoff-control structural measures
- Decreases runoff volume generated and provides hydrologic source control
- May be planned for application in feasible open locations either alone or in

conjunction with plans for structural practices (e.g., subsurface drain line or infiltration basin) serving the same or contiguous areas

- Promotes successful long-term revegetation by restoring soil permeability, drainage and water holding capacity for healthy (rather than restricted) root-system development of trees, shrubs and deep rooted ground cover, minimizing plant drowning during wet periods and burnout during dry periods.

Feasibility/Limitations

The effectiveness of Deep Ripping and Decompaction is governed mostly by site factors such as: the original (undisturbed) soil's hydrologic characteristics; the general slope; local weather/timing (soil moisture) for implementation; the space-related freedom of equipment/implement maneuverability (noted above in **Recommended Application of Practice**), and by the proper selection and operation of tractor and implements (explained below in **Design Guidance**). The more notable site-related factors include:

Soil

In the undisturbed condition, each identified soil type comprising a site is grouped into one of four categories of soil hydrology, Hydrologic Soil Group A, B, C or D, determined primarily by a range of characteristics including soil texture, drainage capability when thoroughly wet, and depth to water table. The natural rates of infiltration and transmission of soil-water through the undisturbed soil layers for Group A is "high" with a low runoff potential while soils in Group B are moderate in infiltration and the transmission of soil-water with a moderate runoff potential, depending somewhat on slope. Soils in Group C have slow rates of infiltration and transmission of soil-water and a moderately high runoff potential influenced by soil texture and slope; while soils in Group D have exceptionally slow rates of infiltration and transmission of soil-water, and high runoff potential.

In Figure 4, the profile displays the undisturbed horizons of a soil in Hydrologic Soil Group C and the naturally slow rate of infiltration through the subsoil. The slow rate of infiltration begins immediately below the topsoil horizon (30 cm), due to the limited amount of macro pores, e.g.: natural subsoil fractures, worm holes and root channels. Infiltration after the construction-induced mixing and compression of such subsoil material is virtually absent; but can be restored back to this natural level with the two-phase practice of deep ripping and decompaction, followed by the permanent establishment of an appropriate, deep taproot

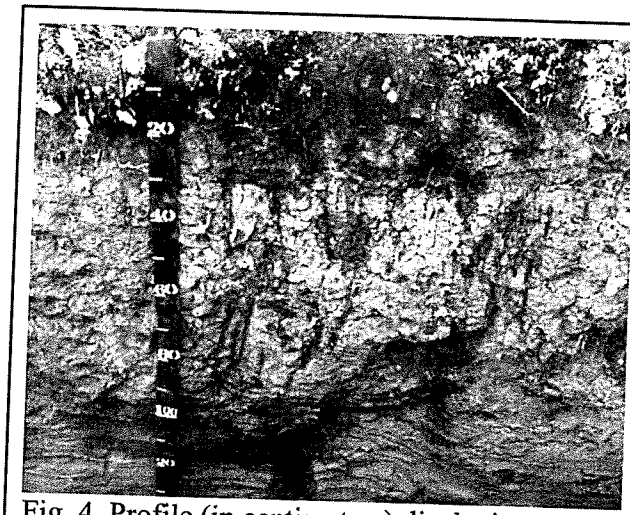

Fig. 4. Profile (in centimeters) displaying the infiltration test result of the natural undisturbed horizons of a soil in Hydrologic Soil Group C.

lawn/ground cover to help maintain the restored subsoil structure. Infiltration after construction-induced mixing and compression of such subsoil material can be notably rehabilitated with the Deep Ripping and Decompaction practice, which prepares the site for the appropriate long-term lawn/ground cover mix including deep taproot plants such as clover, fescue or trefoil, etc. needed for all rehabilitated soils.

Generally, soils in Hydrologic Soil Groups A and B, which respectively may include deep, well-drained, sandy-gravelly materials or deep, moderately well-drained basal till materials, are among the easier ones to restore permeability and infiltration, by deep ripping and decompaction. Among the many different soils in Hydrologic Soil Group C are those unique glacial tills having a natural fragipan zone, beginning about 12 to 18 inches (30 – 45cm), below surface. Although soils in Hydrologic Soil Group C do require a somewhat more carefully applied level of the Deep Ripping and Decompaction practice, it can greatly benefit such affected areas by reducing the runoff and fostering infiltration to a level equal to that of pre-disturbance.

Soils in Hydrologic Soil Group D typically have a permanent high water table close to the surface, influenced by a clay or other highly impervious layer of material. In many locations with clay subsoil material, the bulk density is so naturally high that heavy trafficking has little or no added impact on infiltration; and structural runoff control practices rather than Deep Ripping and Decompaction should be considered.

The information about Hydrologic Soil Groups is merely a general guideline. Site-specific data such as limited depths of cut-and-fill grading with minimal removal or translocation of the inherent subsoil materials (as analyzed in the county soil survey) or, conversely, the excavation and translocation of deeper, unconsolidated substratum or consolidated bedrock materials (unlike the analyzed subsoil horizons' materials referred to in the county soil survey) should always be taken into account.

Sites made up with significant quantities of large rocks, or having a very shallow depth to bedrock, are not conducive to deep ripping and decompation (subsoiling); and other measures may be more practical.

Slope

The two-phase application of 1) deep ripping and 2) decompaction (deep subsoiling), is most practical on flat, gentle and moderate slopes. In some situations, such as but not limited to temporary construction access corridors, inclusion areas that are moderately steep along a project's otherwise gentle or moderate slope may also be deep ripped and decompacted. For limited instances of moderate steepness on other projects, however, the post-construction land use and the relative alignment of the potential ripping and decompaction work in relation to the lay of the slope should be reviewed for safety and practicality. In broad construction areas predominated by moderately steep or steep slopes, the practice is generally not used.

Local Weather/Timing/Soil Moisture

Effective fracturing of compressed subsoil material from the exposed work surface, laterally and vertically down through the affected zone is achieved only when the soil material is moderately dry to moderately moist. Neither one of the two-phases, deep ripping nor decompaction (deep

subsoiling), can be effectively conducted when the soil material (subsoil or replaced topsoil) is in either a "plastic" or "liquid" state of soil consistency. Pulling the respective implements legs through the soil when it is overly moist only results in the "slicing and smearing" of the material or added "squeezing and compression" instead of the necessary fracturing. Ample drying time is needed for a "rippable" soil condition not merely in the material close to the surface, but throughout the material located down to the bottom of the physically compressed zone of the subsoil.

The "poor man's Atterberg field test" for soil plasticity is a simple "hand-roll" method used for quick, on-site determination of whether or not the moisture level of the affected soil material is low enough for: effective deep ripping of subsoil; respreading of topsoil in a friable state; and final decompaction (deep subsoiling). Using a sample of soil material obtained from the planned bottom depth of ripping, e.g.: 20 - 24 inches below exposed subsoil surface, the sample is hand rolled between the palms down to a 1/8-inch diameter thread. (Use the same test for stored topsoil material before respreading on the site.) If the respective soil sample crumbles apart in segments no greater than 3/8 of an inch long, by the time it is rolled down to 1/8 inch diameter, it is low enough in moisture for deep ripping (or topsoil replacement), and decompaction. Conversely, as shown in Figure 5, if the rolled sample stretches out in increments greater than 3/8 of an inch long before crumbling, it is in a "plastic" state of soil consistency and is too wet for subsoil ripping (as well as topsoil replacement) and final decompaction.

Fig. 5. Augered from a depth of 19 inches below the surface of the replaced topsoil, this subsoil sample was hand rolled to a 1/8-inch diameter. The test shows the soil at this site stretches out too far without crumbling; it indicates the material is in a plastic state of consistence, too wet for final decompaction (deep subsoiling) at this time.

Design Guidance

Beyond the above-noted site factors, a vital requirement for the effective Deep Ripping and Decompaction (deep subsoiling), is implementing the practice in its distinct, two-phase process:

1) Deep rip the affected thickness of exposed subsoil material (see Figure 10 and 11), aggressively fracturing it before the protected topsoil is reapplied on the site (see Figure 12); and

2) Decompact (deep subsoil), simultaneously through the restored topsoil layer and the upper half of the affected subsoil (Figure 13). The second phase, "decompaction," mitigates the partial recompaction which occurs during the heavy process of topsoil spreading/grading. Prior to deep ripping and decompacting the site, all construction activity, including construction equipment and material storage, site cleanup and trafficking (Figure 14), should be finished; and the site closed off to further disturbance. Likewise, once the practice is underway and the area's soil permeability and

rainfall infiltration are being restored, a policy limiting all further traffic to permanent travel lanes is maintained.

The other critical elements, outlined below, are: using the proper implements (deep, heavy-duty rippers and subsoilers), and ample pulling-power equipment (tractors); and conducting the practice at the appropriate speed, depth and pattern(s) of movement.

Note that an appropriate plan for the separate practice of establishing a healthy perennial ground cover, with deep rooting to help maintain the restored soil structure, should be developed in advance. This may require the assistance of an agronomist or landscape horticulturist.

Implements

Avoid the use of all undersize implements. The small-to-medium, light-duty tool will, at best, only "scarify" the uppermost surface portion of the mass of compacted subsoil material. The term "chisel plow" is commonly but incorrectly applied to a broad range of implements. While a few may be adapted for the moderate subsoiling of non-impacted soils, the majority are less durable and used for only lighter land-fitting (see Figure 6).

Fig. 6. A light duty chisel implement, not adequate for either the deep ripping or decompaction (deep subsoiling) phase.

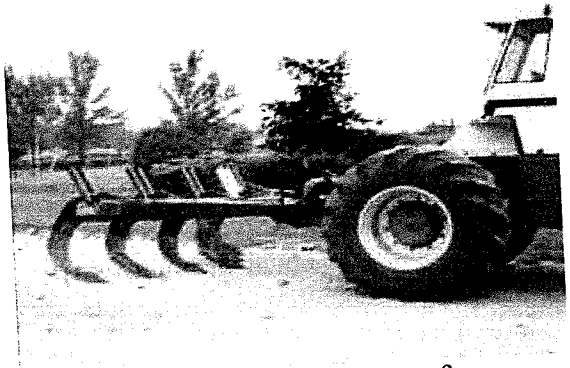

Fig. 7. One of several variations of an agricultural ripper. This unit has long, rugged shanks mounted on a steel V-frame for deep, aggressive fracturing through Phase 1.

Use a "heavy duty" agricultural-grade, deep ripper (see Figures 7,9,10 and 11) for the first phase: the lateral and vertical fracturing of the mass of exposed and compressed subsoil, down and through, to the bottom of impact, prior to the replacement of the topsoil layer. (Any oversize rocks which are uplifted to the subsoil surface during the deep ripping phase are picked and removed.) Like the heavy-duty class of implement for the first phase, the decompaction (deep subsoiling) of Phase 2 is conducted with the heavy-duty version of the deep subsoiler. More preferable is the angled-leg variety of deep subsoiler (shown in Figures 8 and 13). It minimizes the inversion of the subsoil and topsoil layers while laterally and vertically fracturing the upper half of the previously ripped subsoil layer and all of the topsoil layer by delivering a momentary, wave-like "lifting and shattering" action up through the soil layers as it is pulled.

Pulling-Power of Equipment

Use the following rule of thumb for tractor horsepower (hp) whenever deep ripping and decompacting a significantly impacted site: For both types of implement, have at least 40 hp of tractor pull available for each mounted shank/ leg.

Using the examples of a 3-shank and a 5-shank implement, the respective tractors should have 120 and 200 hp available for fracturing down to the final depth of 20-to-24 inches per phase. Final depth for the deep ripping in Phase 1 is achieved incrementally by a progressive series of passes (see Depth and Patterns of Movement, below); while for Phase 2, the full operating depth of the deep subsoiler is applied from the beginning.

The operating speed for pulling both types of implement should not exceed 2 to 3 mph. At this slow and managed rate of operating speed, maximum functional performance is sustained by the tractor and the implement performing the soil fracturing. Referring to Figure 8, the implement is the 6-leg version of the deep angled-leg subsoiler. Its two outside legs are "chained up" so that only four legs will be engaged (at the maximum depth), requiring no less than 160 hp, (rather than 240 hp) of pull. The 4-wheel drive, articulated-frame tractor in Figure 8 is 174 hp. It will be decompacting this unobstructed, former construction access area simultaneously through 11 inches of replaced topsoil and the upper 12 inches of the previously deep-ripped subsoil. In constricted areas of Phase 1) Deep Ripping, a medium-size tractor with adequate hp, such as the one in Figure 9 pulling a 3-shank deep ripper, may be more maneuverable.

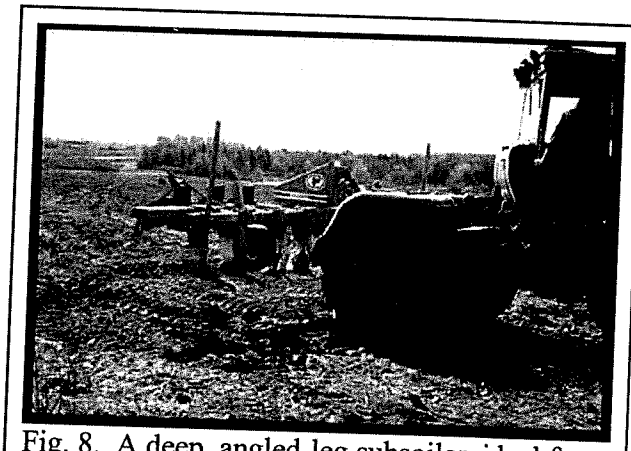

Fig. 8. A deep, angled-leg subsoiler, ideal for Phase 2 decompaction of after the topsoil layer is graded on top of the ripped subsoil.

Fig. 9. This medium tractor is pulling a 3-shank deep ripper. The severely compacted construction access corridor is narrow, and the 120 hp tractor is more maneuverable for Phase 1 deep ripping (subsoil fracturing), here.

Some industrial-grade variations of ripping implements are attached to power graders and bulldozers. Although highly durable, they are generally not recommended. Typically, the shanks or "teeth" of these rippers are too short and stout; and they are mounted too far apart to achieve the well-distributed type of lateral and vertical fracturing of the soil materials necessary to restore soil permeability and infiltration. In addition, the power graders and bulldozers, as pullers, are far less maneuverable for turns and patterns than the tractor.

Depth and Patterns of Movement

As previously noted both Phase 1 Deep Ripping through significantly compressed, exposed subsoil and Phase 2 Decompaction (deep subsoiling) through the replaced topsoil and upper subsoil need to be performed at maximum capable depth of each implement. With an implement's guide wheels attached, some have a "normal" maximum operating depth of 18 inches, while others may go deeper. In many situations, however, the tractor/implement operator must first remove the guide wheels and other non essential elements from the implement. This adapts the ripper or the deep subsoiler for skillful pulling with its frame only a few inches above surface, while the shanks or legs, fracture the soil material 20-to-24 inches deep.

There may be construction sites where the depth of the exposed subsoil's compression is moderate, e.g.: 12 inches, rather than deep. This can be verified by using a ¾ inch cone penetrometer and a shovel to test the subsoil for its level of compaction, incrementally, every three inches of increasing depth. Once the full thickness of the subsoil's compacted zone is finally "pieced" and there is a significant drop in the psi measurements of the soil penetrometer, the depth/thickness of compaction is determined. This is repeated at several representative locations of the construction site. If the thickness of the site's subsoil compaction is verified as, for example, ten inches, then the Phase 1 Deep Ripping can be correspondingly reduced to the implement's minimum operable depth of 12 inches. However, the Phase 2 simultaneous Decompation (subsoiling) of an 11 inch thick layer of replaced topsoil and the upper subsoil should run at the subsoiling implements full operating depth.

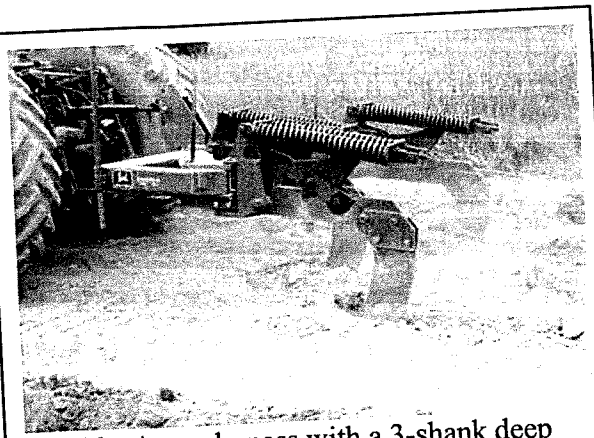

Fig. 10. An early pass with a 3-shank deep ripper penetrating only 8 inches into this worksite's severely compressed subsoil.

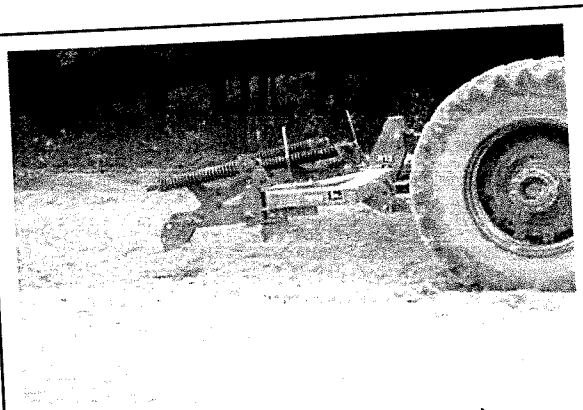

Fig. 11. A repeat run of the 3-shank ripper along the same patterned pass area as Fig. 9; here, incrementally reaching 18 of the needed 22 inches of subsoil fracture.

Typically, three separate series (patterns) are used for both the Phase 1 Deep Ripping and the Phase 2 Decompaction on significantly compacted sites. For Phase 1, each series begins with a moderate depth of rip and, by repeat-pass, continues until full depth is reached. Phase 2 applies the full depth of Decompation (subsoiling), from the beginning.

Every separate series (pattern) consists of parallel, forward-and-return runs, with each progressive

pass of the implement's legs or shanks evenly staggered between those from the previous pass. This compensates for the shank or leg-spacing on the implement, e.g., with 24-to-30 inches between each shank or leg. The staggered return pass ensures lateral and vertical fracturing actuated every 12 to 15 inches across the densely compressed soil mass.

Large, Unobstructed Areas

For larger easy areas, use the standard patterns of movement:

- The first series (pattern) of passes is applied lengthwise, parallel with the longest spread of the site; gradually progressing across the site's width, with each successive pass.

- The second series runs obliquely, crossing the first series at an angle of about 45 degrees.

- The third series runs at right angle (or 90 degrees), to the first series to complete the fracturing and shattering on severely compacted sites, and avoid leaving large unbroken blocks of compressed soil material. (In certain instances, the third series may be optional, depending on how thoroughly the first two series loosen the material and eliminate large chunks/blocks of material as verified by tests with a ¾-inch cone penetrometer.)

Fig. 12. Moderately dry topsoil is being replaced on the affected site now that Phase 1 deep ripping of the compressed subsoil is complete.

Fig. 13. The same deep, angled-leg subsoiler shown in Fig. 7 is engaged at maximum depth for Phase 2, decompaction (deep soiling), of the replaced topsoil and the upper subsoil materials.

Corridors

In long corridors of limited width and less maneuverability than larger sites, e.g.: along compacted areas used as temporary construction access, a modified series of pattern passes are used.

- First, apply the same initial lengthwise, parallel series of passes described above.

- A second series of passes makes a broad "S" shaped pattern of rips, continually and gradually alternating the "S" curves between opposite edges inside the compacted corridor.

- The third and final series again uses the broad, alternating S pattern, but it is "flip-flopped" to continually cross the previous S pattern along the corridor's centerline. This final series of the S pattern curves back along the edge areas skipped by the second series.

Maintenance and Cost

Once the two-phase practice of Deep Ripping and Decompation is completed, two items are essential for maintaining a site's soil porosity and permeability for infiltration. They are: planting and maintaining the appropriate ground cover with deep roots to maintain the soil structure (see Figure 15); and keeping the site free of traffic or other weight loads.

Note that site-specific choice of an appropriate vegetative ground-cover seed mix, including the proper seeding ratio of one or more perennial species with a deep taproot system and the proper amount of lime and soil nutrients (fertilizer mix) adapted to the soil-needs, are basic to the final practice of landscaping, i.e: surface tillage, seeding/planting/fertilizing and culti-packing or mulching is applied. The "maintenance" of an effectively deep-ripped and decompacted area is generally limited to the successful perennial (long-term) landscape ground cover; as long as no weight-bearing force of soil compaction is applied.

Fig. 14. The severely compacted soil of a temporary construction yard used daily by heavy equipment for four months; shown before deep ripping, topsoil replacement, and decompaction.

Fig. 15. The same site as Fig. 14 after deep ripping of the exposed subsoil, topsoil replacement, decompaction through the topsoil and upper subsoil and final surface tillage and revegetation to maintain soil permeability and infiltration.

The Deep Ripping and Decompaction practice is, by necessity, more extensive than periodic subsoiling of farmland.The cost of deep ripping and decompacting (deep subsoiling), will vary according to the depth and severity of soil-material compression and the relative amount of tractor and implement time that is required. In some instances, depending on open maneuverability, two-to-three acres of compacted project area may be deep-ripped in one day. In other situations of more severe compaction and - or less maneuverability, as little as one acre may be fully ripped in a day. Generally, if the Phase 1) Deep Ripping is fully effective, the Phase 2) Decompaction should be completed in 2/3 to 3/4 of the time required for Phase 1.

Using the example of two acres of Phase 1) Deep Ripping in one day, at $1800 per day, the net cost is $900 per acre. If the Phase 2) Decompacting or deep subsoiling takes 3/4 the time as Phase 1, it costs $675 per acre for a combined total of $1575 per acre to complete the practice (these figures do not include the cost of the separate practice of topsoil stripping and replacement). Due to the many variables, it must be recognized that cost will be determined by the specific conditions or constraints of the site and the availability of proper equipment.

Resources

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- US Department of Agriculture in cooperation with Cornell University Agricultural Experiment Station. Various years. *Soil Survey of (various names) County, New York.* USDA.

Internet Access:

- Examples of implements:
V-Rippers. Access by internet search of *John Deere Ag -New Equipment for 915* (larger-frame model) *V-Rippe*; and, *for 913* (smaller-frame model) *V-Ripper.* Deep, angled-leg subsoiler. Access by internet search of: *Bigham Brothers Shear Bolt Paratill-Subsoiler.* http://salesmanual.deere.com/sales/salesmanual/en_NA/primary_tillage/2008/feature/rippers/915v_pattern_frame.html?sbu=ag&link=prodcat Last visited March 08.
- Soils data of USDA Natural Resources Conservation Service. *NRCS Web Soil Survey.* http://websoilsurvey.nrcs.usda.gov/app/ and *USDA-NRCS Official Soil Series Descriptions; View by Name.* http://ortho.ftw.nrcs.usda.gov/cgi-bin/osd/osdname.cgi . *Last visited Jan. 08.*
- Soil penetrometer information. Access by internet searches of: *Diagnosing Soil Compaction using a Penetrometer (soil compaction tester), PSU Extension;* as well as *Dickey-john Soil Compaction Tester.* http://www.dickey-johnproducts.com/pdf/SoilCompactionTest.pdf and http://cropsoil.psu.edu/Extension/Facts/uc178pdf Last visited Sept. 07

APPENDIX I

SAMPLE STORMWATER CONTROL FACILITY MAINTENANCE AGREEMENT

SAMPLE STORMWATER CONTROL FACILITY MAINTENANCE AGREEMENT

Whereas, the Municipality of _____("Municipality") and the _____ ("facility owner") want to enter into an agreement to provide for the long term maintenance and continuation of stormwater control measures approved by the Municipality for the below named project, and

Whereas, the Municipality and the facility owner desire that the stormwater control measures be built in accordance with the approved project plans and thereafter be maintained, cleaned, repaired, replaced and continued in perpetuity in order to ensure optimum performance of the components. Therefore, the Municipality and the facility owner agree as follows:

1. This agreement binds the Municipality and the facility owner, its successors and assigns, to the maintenance provisions depicted in the approved project plans which are attached as Schedule A of this agreement.

2. The facility owner shall maintain, clean, repair, replace and continue the stormwater control measures depicted in Schedule A as necessary to ensure optimum performance of the measures to design specifications. The stormwater control measures shall include, but shall not be limited to, the following: drainage ditches, swales, dry wells, infiltrators, drop inlets, pipes, culverts, soil absorption devices and retention ponds.

3. The facility owner shall be responsible for all expenses related to the maintenance of the stormwater control measures and shall establish a means for the collection and distribution of expenses among parties for any commonly owned facilities.

4. The facility owner shall provide for the periodic inspection of the stormwater control measures, not less than once in every five year period, to determine the condition and integrity of the measures. Such inspection shall be performed by a Professional Engineer licensed by the State of New York. The inspecting engineer shall prepare and submit to the Municipality within 30 days of the inspection, a written report of the findings including recommendations for those actions necessary for the continuation of the stormwater control measures.

5. The facility owner shall not authorize, undertake or permit alteration, abandonment, modification or discontinuation of the stormwater control measures except in accordance with written approval of the Municipality.

6. The facility owner shall undertake necessary repairs and replacement of the stormwater control measures at the direction of the Municipality or in accordance with the recommendations of the inspecting engineer.

7. The facility owner shall provide to the Municipality within 30 days of the date of this agreement, a security for the maintenance and continuation of the stormwater control measures in the form of (a Bond, letter of credit or escrow account).

8. This agreement shall be recorded in the Office of the County Clerk, County of _____together with the deed for the common property and shall be included in the offering plan and/or prospectus approved pursuant to _____.

9. If ever the Municipality determines that the facility owner has failed to construct or maintain the stormwater control measures in accordance with the project plan or has failed to undertake corrective action specified by the Municipality or by the inspecting engineer, the Municipality is authorized to undertake such steps as reasonably necessary for the preservation, continuation or maintenance of the stormwater control measures and to affix the expenses thereof as a lien against the property.

10. This agreement is effective _____ .

_____ _____