SMMA

Permitting Application: Appendices

Andover West Elementary and Shawsheen Preschool

58 Beacon Street | Andover, MA

December 7th, 2021

Prepared for Applicant

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Appendices

- Appendix A: Soils Report and Logs
- Appendix B: Traffic Assessment Report (prepared by Brennan Consulting)
- Appendix C: Stormwater Calculations
- Appendix D: Construction Management Plan (prepared by Gilbane Building Company)
- Appendix E: Operation and Maintenance Plan
- Appendix F: Phase II Environmental Site Assessment
- Appendix G: Illicit Discharge Compliance Statement
- Appendix H: Stormwater Pollution Prevention Plan (Draft—in progress)
- Appendix I: Order of Resource Area Delineation

Appendix A: Soils Report and Logs

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Essex County, Massachusetts, Northern Part



September 21, 2021

Preface

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

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

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

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

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

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

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How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

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

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

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

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

Soil Map

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

Custom Soil Resource Report
Soil Map



Map Scale: 1:2,090 if printed on B landscape (17" x 11") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

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

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

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

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

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

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

Soil Survey Area: Essex County, Massachusetts, Northern Part
Survey Area Data: Version 16, Jun 9, 2020

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

Date(s) aerial images were photographed: Aug 13, 2020—Sep 15, 2020

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
32A	Wareham loamy sand, 0 to 3 percent slopes	1.0	3.4%
253B	Hinckley loamy sand, 3 to 8 percent slopes	3.4	11.1%
256A	Deerfield loamy fine sand, 0 to 3 percent slopes	0.0	0.1%
260B	Sudbury fine sandy loam, 3 to 8 percent slopes	2.2	7.0%
411B	Sutton fine sandy loam, 0 to 8 percent slopes, very stony	2.1	6.9%
420C	Canton fine sandy loam, 8 to 15 percent slopes	1.8	5.9%
421B	Canton fine sandy loam, 0 to 8 percent slopes, very stony	3.2	10.4%
421D	Canton fine sandy loam, 15 to 25 percent slopes, very stony	0.0	0.1%
651	Udorthents, smoothed	16.9	54.9%
Totals for Area of Interest		**30.8**	**100.0%**

Map Unit Descriptions

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

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

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the

scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

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

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

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

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

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

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

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

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

Essex County, Massachusetts, Northern Part

32A—Wareham loamy sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: vjxp
Elevation: 100 to 1,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Wareham

Setting

Landform: Terraces
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Loose sandy glaciofluvial deposits

Typical profile

H1 - 0 to 10 inches: loamy sand
H2 - 10 to 17 inches: loamy sand
H3 - 17 to 32 inches: sand
H4 - 32 to 60 inches: stratified sand to fine sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: About 4 to 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A/D
Ecological site: F144AY028MA - Wet Outwash
Hydric soil rating: Yes

Minor Components

Scarboro

Percent of map unit: 15 percent
Landform: Terraces

Hydric soil rating: Yes

253B—Hinckley loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2svm8
Elevation: 0 to 1,430 feet
Mean annual precipitation: 36 to 53 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 140 to 250 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Hinckley

Setting

Landform: Moraines, kame terraces, kames, outwash terraces, outwash deltas, outwash plains, eskers
Landform position (two-dimensional): Summit, backslope, footslope, shoulder
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, tread, riser
Down-slope shape: Linear, convex, concave
Across-slope shape: Convex, linear, concave
Parent material: Sandy and gravelly glaciofluvial deposits derived from gneiss and/or granite and/or schist

Typical profile

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

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 3.0 inches)

Interpretive groups

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

Minor Components

Windsor

Percent of map unit: 8 percent
Landform: Outwash plains, kames, eskers, moraines, outwash terraces, outwash deltas, kame terraces
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, tread, riser
Down-slope shape: Linear, convex, concave
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

Sudbury

Percent of map unit: 5 percent
Landform: Moraines, outwash terraces, outwash deltas, kame terraces, outwash plains
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope, base slope, head slope, tread
Down-slope shape: Concave, linear
Across-slope shape: Linear, concave
Hydric soil rating: No

Agawam

Percent of map unit: 2 percent
Landform: Eskers, moraines, outwash terraces, outwash deltas, kame terraces, outwash plains, kames
Landform position (two-dimensional): Summit, shoulder, backslope, footslope
Landform position (three-dimensional): Nose slope, side slope, base slope, crest, riser, tread
Down-slope shape: Linear, convex, concave
Across-slope shape: Convex, linear, concave
Hydric soil rating: No

256A—Deerfield loamy fine sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2xfg8
Elevation: 0 to 1,100 feet
Mean annual precipitation: 36 to 71 inches
Mean annual air temperature: 39 to 55 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

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

Description of Deerfield

Setting

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

Typical profile

Ap - 0 to 9 inches: loamy fine sand
Bw - 9 to 25 inches: loamy fine sand
BC - 25 to 33 inches: fine sand
Cg - 33 to 60 inches: sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (1.42 to 99.90 in/hr)
Depth to water table: About 15 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Sodium adsorption ratio, maximum: 11.0
Available water supply, 0 to 60 inches: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: A
Ecological site: F144AY027MA - Moist Sandy Outwash
Hydric soil rating: No

Minor Components

Windsor

Percent of map unit: 7 percent
Landform: Outwash terraces, outwash plains, outwash deltas, kame terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear, convex, concave
Across-slope shape: Concave, linear, convex
Hydric soil rating: No

Wareham

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Down-slope shape: Concave
Across-slope shape: Concave

Hydric soil rating: Yes

Sudbury

Percent of map unit: 2 percent
Landform: Outwash terraces, outwash deltas, kame terraces, outwash plains
Landform position (three-dimensional): Tread
Down-slope shape: Convex, linear, concave
Across-slope shape: Concave, linear, convex
Hydric soil rating: No

Ninigret

Percent of map unit: 1 percent
Landform: Outwash terraces, outwash plains, kame terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear, convex
Across-slope shape: Concave, convex
Hydric soil rating: No

260B—Sudbury fine sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: vjsn
Elevation: 0 to 2,100 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Sudbury and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sudbury

Setting

Landform: Terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Friable loamy eolian deposits over loose sandy glaciofluvial deposits derived from granite and gneiss

Typical profile

O - 0 to 1 inches: muck
H2 - 1 to 5 inches: fine sandy loam
H3 - 5 to 21 inches: sandy loam
H4 - 21 to 27 inches: loamy sand
H5 - 27 to 60 inches: Error

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Ecological site: F144AY027MA - Moist Sandy Outwash
Hydric soil rating: No

Minor Components

Merrimac

Percent of map unit: 15 percent
Hydric soil rating: No

Walpole

Percent of map unit: 5 percent
Landform: Terraces
Hydric soil rating: Yes

411B—Sutton fine sandy loam, 0 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2xfff
Elevation: 0 to 1,410 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

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

Description of Sutton, Very Stony

Setting

Landform: Ground moraines, hills
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope

Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Coarse-loamy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 7 inches: fine sandy loam
Bw1 - 7 to 19 inches: fine sandy loam
Bw2 - 19 to 27 inches: sandy loam
C1 - 27 to 41 inches: gravelly sandy loam
C2 - 41 to 62 inches: gravelly sandy loam

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: About 12 to 27 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B/D
Ecological site: F144AY008CT - Moist Till Uplands
Hydric soil rating: No

Minor Components

Charlton, very stony

Percent of map unit: 7 percent
Landform: Ridges, hills, ground moraines
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Crest, side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Canton, very stony

Percent of map unit: 4 percent
Landform: Ridges, hills, moraines
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Leicester, very stony

Percent of map unit: 3 percent
Landform: Hills, drainageways, ground moraines, depressions

Landform position (two-dimensional): Footslope, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave, linear
Across-slope shape: Concave
Hydric soil rating: Yes

Whitman, very stony

Percent of map unit: 1 percent
Landform: Depressions, drainageways, hills, ground moraines, drumlins
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

420C—Canton fine sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2w817
Elevation: 0 to 1,330 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

Canton and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canton

Setting

Landform: Ridges, moraines, hills
Landform position (two-dimensional): Backslope, summit, shoulder
Landform position (three-dimensional): Side slope, crest, nose slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Ap - 0 to 7 inches: fine sandy loam
Bw1 - 7 to 15 inches: fine sandy loam
Bw2 - 15 to 26 inches: gravelly fine sandy loam
2C - 26 to 65 inches: gravelly loamy sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification

Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Scituate

Percent of map unit: 6 percent
Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Montauk

Percent of map unit: 6 percent
Landform: Drumlins, hills, ground moraines, moraines
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Newfields

Percent of map unit: 4 percent
Landform: Moraines, hills, ground moraines
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

Charlton

Percent of map unit: 4 percent
Landform: Hills, ground moraines, ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

421B—Canton fine sandy loam, 0 to 8 percent slopes, very stony

Map Unit Setting

National map unit symbol: 2w81l
Elevation: 0 to 1,180 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

Canton, very stony, and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Canton, Very Stony

Setting

Landform: Ridges, hills, moraines
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope, crest, nose slope
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Coarse-loamy over sandy melt-out till derived from gneiss, granite, and/or schist

Typical profile

Oi - 0 to 2 inches: slightly decomposed plant material
A - 2 to 5 inches: fine sandy loam
Bw1 - 5 to 16 inches: fine sandy loam
Bw2 - 16 to 22 inches: gravelly fine sandy loam
2C - 22 to 67 inches: gravelly loamy sand

Properties and qualities

Slope: 0 to 8 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 19 to 39 inches to strongly contrasting textural stratification
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.14 to 14.17 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.9 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Scituate, very stony
Percent of map unit: 9 percent
Landform: Ground moraines, drumlins, hills
Landform position (two-dimensional): Footslope, backslope, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Montauk, very stony
Percent of map unit: 5 percent
Landform: Hills, ground moraines, recessionial moraines, drumlins
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear, convex
Across-slope shape: Convex
Hydric soil rating: No

Gloucester, very stony
Percent of map unit: 4 percent
Landform: Ridges, hills, moraines
Landform position (two-dimensional): Summit, backslope, shoulder
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Swansea
Percent of map unit: 2 percent
Landform: Kettles, swamps, bogs, depressions, marshes
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

421D—Canton fine sandy loam, 15 to 25 percent slopes, very stony

Map Unit Setting
National map unit symbol: vj5c
Elevation: 0 to 1,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Canton

Setting

Landform: Hills
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Friable coarse-loamy eolian deposits over friable sandy and gravelly basal till derived from granite and gneiss

Typical profile

H1 - 0 to 6 inches: fine sandy loam
H2 - 6 to 33 inches: fine sandy loam
H3 - 33 to 60 inches: gravelly loamy sand

Properties and qualities

Slope: 15 to 25 percent
Surface area covered with cobbles, stones or boulders: 1.6 percent
Depth to restrictive feature: 18 to 36 inches to strongly contrasting textural stratification
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: F144AY034CT - Well Drained Till Uplands
Hydric soil rating: No

Minor Components

Scituate

Percent of map unit: 10 percent
Hydric soil rating: No

Charlton

Percent of map unit: 5 percent
Hydric soil rating: No

651—Udorthents, smoothed

Map Unit Setting

National map unit symbol: vjwk
Elevation: 0 to 3,000 feet
Mean annual precipitation: 45 to 54 inches
Mean annual air temperature: 43 to 54 degrees F
Frost-free period: 145 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Udorthents and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Setting

Parent material: Excavated and filled land loamy and/or excavated and filled land sandy and gravelly

Typical profile

H1 - 0 to 6 inches: variable
H2 - 6 to 60 inches: variable

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to very high (0.06 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Hydric soil rating: Unranked

Minor Components

Urban land

Percent of map unit: 10 percent
Hydric soil rating: Unranked

Beaches

Percent of map unit: 8 percent
Hydric soil rating: Unranked

Dumps

Percent of map unit: 2 percent
Hydric soil rating: Unranked

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October 19, 2021
File No. 96480.02

Mr. John C. Hart, PE, CDT, LEED AP
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Geotechnical Engineering Report
Design Development Phase Services
Andover West Elementary School
Andover, Massachusetts

Dear Mr. Hart:

Nobis Engineering, Inc. (Nobis) d/b/a Nobis Group® is pleased to submit this geotechnical engineering evaluation for the proposed Andover West Elementary School at 58 Beacon Street in Andover, Massachusetts (the site). Refer to the attached **Figure 1** for a site locus plan.

Our services were performed in accordance with our Proposal for Geotechnical Engineering Services dated May 4, 2021. This report summarizes the results of our subsurface exploration program performed at the site and presents geotechnical recommendations for the design and construction of the proposed school building. Existing and proposed conditions discussed in this report are based on plans and AutoCAD drawings provided by SMMA. Elevations referenced herein are relative to the North American Vertical Datum of 1988 (NAVD88). This report is subject to the limitations included in **Appendix A**.

BACKGROUND

Site Location & Existing Information

Location	The project site is located on the existing Andover West Elementary School campus located at 58 Beacon Street in Andover, Massachusetts (site).

Existing Improvements & Current Ground Cover	The site is currently developed with the existing elementary school within the eastern half of the site (with associated paved parking and hardscape playground areas surrounding the school). Baseball fields, natural turf fields, and playgrounds are located within the western half of the site. Wooded areas are present within the western and northwestern portions of the site, and wetland areas are located within the north-central, southeastern, and southwestern portions of the property.
Existing Topography [1]	Site topography generally slopes downward to the east. Within the eastern portion of the site around the existing school building, ground surface elevations generally slope downward from approximately El 160 feet at the western (rear) side of the existing building to approximately El 145 feet along Beacon Street. Within the western portion of the site, ground surface elevations are terraced to account for the existing athletic fields. Ground surface elevations generally range from approximately El 180 feet at the top of the existing grassed earth slope at the tree line to the west down to El 166 feet along the western edge of the athletic fields; El 166 feet to El 164 feet across the athletic fields; and from approximately El 164 feet down to El 160 feet at the west side of the existing school.

1. Topography based on a review of the "Grading and Utilities Plan I and II" dated January 4, 2021, and prepared by SMMA of Cambridge, Massachusetts.

Project Description/Information

Project Description	Based on our current understanding, the project consists of constructing a new, two- and three-story school west of the existing school with parking and athletic fields located in the eastern portion of the site. The planned athletic field area is currently occupied by the existing school building.
Building Construction	Building construction for the proposed school is not known at this time but is expected to consist of steel framing with concrete masonry units (CMUs) and architectural finishes. The new structure is expected to be supported on conventional shallow spread footing foundations and slab-on-grade construction. A basement level is not proposed.

Lowest Finish Floor Elevation	Lowest finish floor elevation for the new school is anticipated at elevation (El) 162 feet.
Maximum Loads	Structural loads are not available at this time; however, based on our experience with structures of similar size and use, anticipated structural loads are as follows: *Column Load:* 100 to 300 kips *Wall Load:* 2 to 4 kips per linear foot *Slab Load:* 150 to 250 pounds per square foot (psf)
Maximum Allowable Settlement	*Total:* 1 inch (assumed) *Differential:* ½ inch over 40 feet (assumed)
Grading/Cut and Fill Slopes	Based on the "Grading and Utilities Plan I and II", site cutting and filling on the order of 5 to 8 feet is anticipated to achieve design grades.
Retaining Wall	Three retaining walls are currently planned: one to the north of the proposed building, one to the south of the proposed building and one at the east side of the proposed athletic fields. Maximum exposed height of the proposed retaining walls is on the order of 5 to 8 feet.

For a visual representation of the site location refer to the Locus Plan attached as **Figure 1** and the Exploration Location Plans attached as **Figures 2 and 3**.

Several utilities are located within the vicinity of the site and include, but may not be limited to, electric, telephone, sanitary sewer, stormwater drainage, and water.

SUBSURFACE CONDITIONS

Geologic Maps

Based on a review of available surficial geologic maps, the surficial geologic conditions at the site most likely consist of Coarse Deposits comprised of gravel deposits, sand and gravel deposits and sand deposits. A site-focused plan view of a 2018 USGS map entitled "Surficial Geologic Map of the Lawrence Quadrangle" along with the corresponding descriptions of geologic units are provided in **Figure 4**.

A 2005 bedrock geologic map entitled "Preliminary Bedrock Geologic Maps of the Lawrence Quadrangle" prepared by Castle, R.O., Hepburn, J.C., and Kopera, J.P. indicates that the bedrock at the project site will likely consist of Andover Granite with either pegmatite facies or fine-

grained granite-gneiss facies. See **Figure 5** for a site-focus plan view of the map and description of bedrock geologic units in the area.

Subsurface Explorations by Others

SMMA oversaw the excavation of seven (7) test pits on February 28, 2020. Test pits ranged in depth from 7 to 10 feet. The approximate locations of the test pits are shown on **Figures 2 and 3** and the test pit logs prepared by SMMA are included as **Appendix B.1**.

Subsurface Explorations by Nobis

To collect subsurface information and assess generalized subsurface conditions at the site, Nobis coordinated an exploration program consisting of 48 test borings and 9 test pits. The approximate locations are depicted on **Figures 2 and 3**.

Test Borings in 2020

Thirteen (13) borings (B-1 through B-13) performed for the feasibility study were advanced by Geosearch, Inc. of Sterling, Massachusetts between February 24th and 27th, 2020. The borings were performed to depths ranging from 0.5 to 22 feet below ground surface (bgs) within the vicinity of the proposed school footprint. Borings were performed using off-road drilling equipment and 4¼-inch inside-diameter hollow-stem augers. Borings were completed in landscaped areas and backfilled to existing grade with drilling spoils. Test boring soil samples were generally obtained nearly continuously from the ground surface to a depth of 10 feet and at 5-foot intervals, thereafter, using a standard 2-inch outside-diameter split-barrel sampler. Standard Penetration Tests (SPTs) were performed in general accordance with industry standards. Soil samples obtained from the explorations were classified by a Nobis representative using the Modified Burmister classification system. The boring logs from the test borings observed by Nobis in 2020 are provided in **Appendix B.2**.

Test Borings in 2021

Thirty-five (35) borings (B-101 through B-135) were performed by New England Boring Contractors of Derry, Massachusetts between August 17th and August 27th, 2021. The borings were advanced to depths ranging from 4.5 to 23 feet bgs within the vicinity of the proposed school footprint, paved areas, and athletic field. Borings were performed using off-road drilling

equipment and either 2¼-inch inside-diameter hollow-stem augers or 4-inch inside-diameter drive and wash casing methods. Borings were completed in either landscaped or paved areas. Each boring was backfilled to existing grade with drilling spoils and borings completed in paved areas were restored with cold patch asphalt. Test boring soil samples were generally obtained nearly continuously from the ground surface to a depth of 8 to 12 feet and at 5-foot intervals, thereafter, using a standard 2-inch outside-diameter split-barrel sampler. Standard Penetration Tests (SPTs) were performed in general accordance with industry standards. An NX-sized bedrock core was collected in B-110, in general accordance with ASTM D2113 to confirm the presence of bedrock and to evaluate bedrock type and quality. Soil and rock samples obtained from the explorations were classified by a Nobis representative using the Modified Burmister classification system. Boring logs of test borings observed by Nobis in 2021 are provided in **Appendix B.3.**

Test Pits

Nine (9) test pits were performed by New England Boring Contractors of Derry, Massachusetts between August 18th and August 20th, 2021. Test pits were excavated using a Kubota KX080-4 mini excavator with a toothed bucket. The test pits were advanced to depths ranging from 5 to 11 feet bgs. Soil samples obtained from the explorations were classified by a Nobis representative using the Modified Burmister classification system. Test pit logs for the test pits observed by Nobis are provided in **Appendix B.4**.

Soil and Rock Conditions

The generalized subsurface stratigraphy encountered in the test borings and test pits consisted of surficial pavement or topsoil, overlying granular fill in some areas, above intermittent buried organics and some areas of sand and silt, glacial till, weathered/fractured bedrock, and competent bedrock. Not all strata were encountered at every location. Generalized descriptions of the conditions encountered in the subsurface explorations are discussed below. A generalized subsurface exploration summary table is attached as **Table 1**.

Topsoil/Asphalt: A topsoil layer generally consisting of a mixture of organic silt, roots, and granular materials or a layer of asphalt was encountered at each exploration location, except B-109, B-125 and B-131, where fill or sand and silt was encountered at the ground surface. The topsoil ranged in thickness from 0.4 to 2.7 feet. The asphalt ranged in thickness from 0.3 to 0.6 feet.

Fill: Beneath the asphalt or topsoil layer, fill was encountered in some of the explorations. Where encountered, the fill sampled in the explorations generally consisted of moist, loose to medium dense (occasionally dense to very dense) granular material with varying amounts of sand, gravel, and fines, with occasional cobbles. Fill extended to depths ranging from approximately 0.4 foot to 6 feet bgs.

Buried Organics: Buried organic soils were encountered in a few of the explorations. In B-101, B-108, B-113, B-117, and TP-104, the buried organics typically appeared to be a buried topsoil layer. The buried topsoil layer ranged in thickness from 0.8 to 3 feet and was encountered at depths ranging from 1 to 4 feet bgs. Elevations for the top of this layer ranged from 147 to 160.5 feet. In TP-101 and TP-102 the buried organics consisted of a black to dark brown, organic silt with some fine to coarse sand. This layer of buried organics was approximately 0.8 feet thick and was encountered at elevations ranging from 141.8 to 145.5 feet.

Sands and Silts: In most explorations granular deposits consisting primarily of sands and silts were encountered. The top of the deposit ranged in elevation from El. 139.5 to 169 feet. The deposit was gray, brown, or tan with orange staining and was typically a fine to coarse sand with varying amounts of silt and gravel. The deposit thickness ranged from 0.7 to 14 feet.

Glacial Till: Native soils interpreted to be glacial till were encountered below the topsoil, fill, and/or sand and silts in most of the explorations performed at the site. The glacial till primarily consisted of gray to brown, fine to coarse sand and silt with varying amounts of fine to coarse gravel. It ranged from dense to very dense and occasionally had signs of redoximorphic staining. Where encountered, glacial till was encountered at depths ranging from 0.5 to 15 feet bgs and was 1.7 to 19.4 feet thick. The elevation at the top of this stratum ranged from 131 to 165.5 feet.

Weathered/Fractured Bedrock: Weathered bedrock was occasionally encountered beneath the sands and silts and/or glacial till stratums. The weathered bedrock stratum was inferred based on split spoon samples as well as drilling behavior. Weathered rock ranged in thickness from 0.2 to 3 feet and was encountered at elevations ranging from 140 to 163 feet.

Competent Bedrock: Competent bedrock was inferred from spoon refusal, auger refusal, or excavator refusal. Competent bedrock was cored in boring B-110 via NX-size core barrel. The bedrock core obtained consisted of moderately hard, moderately weathered, moderately to

extremely fractured, light gray; fine to medium grained Granite. Inferred top of competent bedrock elevations ranged from El. 136 to 166 feet.

Groundwater

Groundwater observations were made at the time of each exploration and are summarized in the following tables. Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the explorations were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the exploration logs.

Exploration ID	Approximate Ground Surface Elevation (feet)	Approximate Depth to Groundwater (feet)	Approximate Groundwater Elevation (feet)	Date
B-101	155	3.8	151.2	8/24/2021
B-102	156.5	7	149.5	8/24/2021
B-103	159	4	155	8/24/2021
B-104	159	8	151	8/17/2021
B-105	162	7.5	154.5	8/17/2021
B-106	161	8	153	8/17/2021
B-107	160	2.5	157.5	8/17/2021
B-108	161.5	2	159.5	8/24/2021
B-109	164	0	164	8/20/2021
B-110	165	4	161	8/18/2021
B-111(ow)	166.5	4	162.5	8/18/2021
B-112	165.5	4	161.5	8/20/2021
B-113	164.5	1	163.5	8/20/2021
B-114	165	1	164	8/19/2021
B-115	163	6.5	156.5	8/25/2021
B-116	153	0	153	8/25/2021
B-117	154.5	2	152.5	8/25/2021
B-118	155	2	153	8/27/2021
B-119	156	2.2	153.8	8/27/2021
B-120	152.5	4	148.5	8/27/2021
B-121	148	2.8	145.2	8/27/2021
B-122	152	3.5	148.5	8/27/2021
B-123	166	3	163	8/19/2021

Exploration ID	Approximate Ground Surface Elevation (feet)	Approximate Depth to Groundwater (feet)	Approximate Groundwater Elevation (feet)	Date
B-124 (ow)	148.5	6	142.5	8/27/2021
B-125	146.5	3	143.5	8/27/2021
B-126	146	2	144	8/27/2021
B-127	143.5	1.5	142	8/27/2021
B-128	154	2	152	8/26/2021
B-129	159	4	155	8/26/2021
B-130	158.5	1.5	157	8/26/2021
B-131	160.5	2	158.5	8/26/2021
B-132	170	>4.5	<165.5	8/25/2021
B-133	163	4	159	8/25/2021
B-134	165	2	163	8/20/2021
B-135	166	2	164	8/19/2021
TP-101	147	6	141	8/18/2021
TP-102	148	3.3	144.7	8/19/2021
TP-103	159	5.5	153.5	8/19/2021
TP-104	150	6.8	143.2	8/18/2021
TP-105	158	>10	<148	8/18/2021
TP-106	157	>10	<147	8/20/2021
TP-107	154	>11	<143	8/20/2021
TP-108	155.5	6	149.5	8/19/2021
TP-109	166	>4	<162	8/18/2021

Permeability Testing

Field permeability testing was conducted at test pit locations TP-101 through TP-108 within the proposed project area. Permeability tests were completed at the approximate depths presented in the table below to evaluate the field saturated hydraulic conductivity of the soils. Infiltration testing was performed in general accordance with the Massachusetts Department of Environmental Protection (MassDEP) Stormwater Management Standards utilizing a compact constant head permeameter. Results of the permeability tests are summarized below.

Test Location	Strata	Approximate Depth of Test (inches)	Field Saturated Hydraulic Conductivity (K_{fs}) (in/hour)	Depth to ESHWT (inches)	Approximate Depth to Groundwater (inches)
TP-101	Fill	39	0.3	32	73
TP-102	Fill/Silty Sand	20	1.1	22	40
TP-103	Fill	25	0.2	24	66
TP-104	Subsoil	57	2.7	58	82
TP-105	Fill	43	1.2	40	n/e
TP-106	Fill	27	0.5	26	n/e
TP-107	Fill	27	0.7	26	n/e
TP-108	Topsoil/Fill	13	0.1	14	72

Notes:

1. ESHWT – Estimated Seasonal High Water Table
2. The permeability rates presented in the table are measured field hydraulic conductivity rates and do not include a factor of safety. The MassDEP Stormwater Management Standards require a minimum factor of safety of 2 be applied to field-derived values for use in design.
3. n/e – not encountered

It should be noted that individual permeability tests measure the hydraulic conductivity in the immediate vicinity of the test and may not be representative of the average hydraulic conductivity of the soil. Various factors may influence field hydraulic conductivity testing results, including lack of soil saturation, a non-homogenous soil profile surrounding the test interval, the presence of large gravel or cobbles, or variation in soil density. Field hydraulic conductivity values should be evaluated based on the measured data in conjunction with published values for the material.

Laboratory Testing

Laboratory testing was performed on twenty-three (23) select soil samples obtained from the Nobis test borings and test pits to assist in classification and evaluating physical engineering characteristics. Geotechnical laboratory testing consisted of twenty-three (23) grain size distributions (sieve analyses) performed by ConTest Consultants, Inc. of Goffstown, New Hampshire. Laboratory tests are included in **Appendix C**.

GEOTECHNICAL DESIGN RECOMMENDATIONS

The following sections present our geotechnical evaluation of the subsurface conditions for the proposed site development including our recommendations for the design of the foundation systems for the proposed Andover West Elementary School. Recommendations are subject to the limitations presented in **Appendix A**.

Primary Geotechnical Issues

The primary geotechnical issues associated with design and construction of the proposed Andover West Elementary School are:

- Presence of shallow bedrock as compared to the depth of the proposed footings, utilities, roadways, and the associated rock removal requirements;
- Presence of existing unsuitable fill and buried organics; and,
- High groundwater levels.

These issues are discussed below:

- Shallow Bedrock – Bedrock was encountered in explorations performed within the proposed school building and western roadway area at depths ranging from 2 to 17 feet, which correspond to elevations ranging from 140 to 163 feet. Based on a proposed finish floor elevation of 162 feet, rock removal of up to about 5 feet may be required for roadway and/or foundation construction. The bedrock at the site is typically weathered at the surface and appears to be more competent with depth. As a result, it is anticipated that some of the rock near the surface (generally up to about 2 feet) may be excavatable with large earthwork equipment. However, some amount of rock removal through mechanical means (i.e., hoe ram removal combined with pre-drilled holes) should be anticipated. It is understood that controlled blasting will not be performed for mass rock removal at the site.

  Existing Unsuitable Fill and Buried Organics – The majority of the site is underlain by existing fill located beneath the surficial topsoil and pavement with a thickness of up to 6 feet. Also, buried topsoil is located beneath the existing fill as noted in several of the borings and test pits. The fill and organics typically have a high silt content, contain organics and/or other deleterious materials and are generally not suitable for support of

the proposed building foundations and slab. The recommendations in this report assume that removal and replacement of existing fill will be performed throughout the building footprint.

Additionally, the majority of the existing fill soils may not be suitable for reuse in other structural areas at the site such as roadway and parking areas. Mixing of the existing fill with imported structural fill should be considered as a potential option to allow reuse of as much of the on-site soils as possible.

- High Groundwater Levels – High groundwater levels were encountered at the site at depths as high as the ground surface. Most groundwater depths were within the upper 5 to 10 feet of the ground surface at the site. As a result, both temporary and permanent dewatering are anticipated at the site including installation of perimeter foundation drains and an underslab drainage system as discussed herein.

Design Considerations

Foundation Type

Existing pavement, concrete, utilities, fill material and organics should be removed from the bearing zone of the proposed building areas prior to foundation construction and/or fill placement in these areas. The bearing zone is defined by a one horizontal to one vertical (1H:1V) line extending down and outward from 1 foot horizontally outside the bottom edge of exterior foundations to the bearing stratum. Foundation recommendations are as follows:

Bearing Material	Minimum 6-inch-thick layer of compacted Crushed Stone placed above compacted Structural Fill, glacial outwash sand, or glacial till, provided natural soil subgrades are properly prepared and proof rolled. [1] In areas of high bedrock, a minimum 12-inch-thick layer of Crushed Stone is recommended beneath foundations.
Anticipated Maximum Net Allowable Bearing Pressure [2]	4,000 pounds per square foot (psf) (DL+LL)
Minimum Footing Depth [3]	48 inches (frost protection)
Anticipated Minimum Footing Widths	Strip Footings: 18 inches Isolated Spread Footings: 36 inches

Estimated Settlement [4]	Total: < 1 inch Differential: < ½-inch over 40 ft.

1. Crushed stone, if used, should be separated from soil subgrades, excavation sidewalls, and backfill using a geotextile separation fabric such as Mirafi 140N, or equivalent.
2. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Assumes unsuitable fill or soft soil, where present, will be replaced with compacted structural fill or crushed stone.
3. Footing embedment for frost protection is applicable for perimeter footings and footings beneath unheated areas. Minimum recommended embedment for interior footings beneath heated areas is 18 inches below finished grade.
4. Foundation settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footing, the thickness of compacted fill, and the quality of the earthwork operations.

The allowable foundation bearing pressure applies to dead loads plus design live load conditions. The weight of the foundation concrete below grade may be neglected in dead load computations.

Slab-On-Grade

We recommend slab-on-grade construction after full removal of existing fill and organic soils and after removal of bedrock to the require subgrade elevation. Subgrade preparation recommendations for subgrade soil and rock are provided later in the report.

Slab-on-grade recommendations are as follows:

Lowest Floor Slab Support [1]	Base course layer (12-inches-thick) of ¾-inch Crushed Stone placed above Structural Fill, proof-rolled natural glacial outwash and/or till subgrades, or above bedrock.
Recommended Modulus of Subgrade Reaction (k)	150 pounds per square inch per inch (psi/in)

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.

The use of a vapor retarder/barrier should be considered beneath concrete slabs that will be covered with wood, tile, carpet, or other moisture-sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. Floor slab design and construction recommendations include:

- Positive separations and/or isolation joints should be provided between slabs and all foundations, columns, or utility lines to allow independent movement.
- Control joints should be provided in slabs to control the location and extent of cracking.
- Other design and construction considerations, as outlined in the ACI Design Manual, Section 302.1R are recommended.

Settlement

Settlement estimations are based on column loads of 100 to 300 kips, wall loads of 2 to 4 kips per linear foot and slab loads of 150 to 250 psf (dead plus sustained live loads), and assume foundations are designed and constructed as recommended herein. For a shallow foundation bearing on Structural Fill placed over natural soils or bedrock, we estimate maximum settlement of the building foundations is approximately 1-inch with differential settlements of approximately 1/2-inch in 40 horizontal feet.

Lateral Earth Pressures

Below-grade retaining walls and below-grade spaces should be designed to resist lateral earth pressures. We recommend an equivalent fluid pressure of 65 pcf, for design of below-grade walls (rigid walls, at-rest pressures) and an equivalent fluid pressure of 40 pcf for design of site retaining walls (walls free to rotate, active pressures).

These values assume horizontal backfill and that the walls are backfilled with free draining Structural Fill (provided that it has less than 8 percent passing sieve No. 200) so that no water pressure develops behind the wall. A 4-inch diameter slotted PVC drain should be provided at the base of the wall. The PVC pipe should be surrounded with an annulus of 6 inches of ¾-inch crushed stone and wrapped in filter fabric.

Where the calculated earth pressure behind walls is less than 250 pounds per square foot (psf), it should be increased to 250 psf to account for stresses created by compaction within 5 feet of the wall. Walls should also be designed for appropriate sloping backfill, surcharge (for example, floor loads), and seismic loads per the MSBC.

Use a coefficient of friction of 0.4 to resist lateral sliding between mass concrete and compacted Structural Fill or Crushed Stone. In addition to sliding resistance, foundation walls may be designed to resist lateral loads with the passive resistance of soil provided that the soil will not

be removed from the front of the wall. We recommend using an equivalent fluid pressure of 180 pcf to calculate the passive resistance of soils. The top one foot of soil should be neglected when calculating passive pressures. The minimum factors of safety for sliding and overturning under static loads should be 1.5 and 2, respectively.

Seismic

Code Used	Commonwealth of Massachusetts Building Code, 9th Edition which includes reference to the 2015 International Building Code (1)
Site Class	Site Class C (1)
Maximum Considered Earthquake (MCE) Spectral Acceleration (5 percent damping)	S_s= 0.247 g (0.2 second spectral response acceleration) S_1= 0.075 g (1.0 second spectral response acceleration)
Liquefaction Potential	Not considered susceptible to liquefaction.

1. In general accordance with the 2015 International Building Code (IBC); Site Class is based on the average characteristics of the upper 100 feet of the subsurface profile. The Code requires a site soil profile determination extending a depth of 100 feet for seismic site classification. The current scope does not include the required 100-foot soil profile determination. Test borings extended to a maximum depth of 23 feet below existing grade. The seismic site class definition considers that similar soil conditions continue below the maximum depth of the subsurface explorations.

Flexible Pavement Sections

The following typical minimum pavement cross-sections are recommended for the proposed parking areas and access roads.

	Minimum Thickness	
	Car Parking	Truck Loading/Access Roads
Surface Course (MassDOT – M3.11.03, Table A – Surface Course – Standard Top)	2 inches	2 inches
Binder Course (MassDOT – M3.11.03, Table A – Surface Course – Dense Binder)	2 inches	2.5 inches
Gravel Base Course (MassDOT – M2.01.7)	14 inches	18 inches

Periodic maintenance should be anticipated. Preventative maintenance should be planned and provided through an ongoing pavement management program. Preventative maintenance

activities are intended to slow the rate of pavement deteriorations, preserving pavement performance and prolonging service life.

Dampproofing and Drainage

Building

Elevator pits and other below-grade interior spaces (if planned) will need to be dampproofed or waterproofed in accordance with the Commonwealth of Massachusetts Building Code, 9th Edition. Foundation perimeter drains are recommended along the exterior foundations of the proposed building and should be constructed similar to the retaining wall drains described above. Underslab drains are also recommended for cut portions of the building (approximately 2/3 of the southwestern portion of the proposed building). The underslab drains should be constructed similar to the retaining wall drains and perimeter foundation drains. The underslab drains should be spaced at a maximum of 20 feet apart.

We recommend the design groundwater elevation be set at the elevation of the underslab drainage system.

Site

We recommend a pavement underdrain along cut portions of the following areas:

- roadway at the southwestern edge of the site; and,
- roadway and parking areas at the southern edge of the site.

The need for underdrains below other roadway elements is not anticipated.

Site Utility Trenches

Site utility installation will likely require excavation trenches in soil and bedrock. Utility trenches are a common source of water infiltration and migration. Utility trenches that extend near foundations, slabs or other settlement or moisture sensitive improvements should be effectively sealed to restrict water intrusion and flow through the trenches that could impact the improvement. Based on the groundwater conditions at the site and proposed utilities, the need for seepage collars or trench plugs is not anticipated.

Permanent Soil & Rock Slopes

Soil Slopes

Cut and fill slopes are proposed as part of the site development. Permanent soil cut and fill slopes should be inclined no steeper than 3H:1V. Based on the estimated strength of both on-site and potential borrow materials, soil fill slopes may be safely constructed to a steepness of 3H:1V, provided that materials are compacted to at least 92 percent of their maximum dry density as determined by ASTM D-1557. Fill slopes designed at inclinations steeper than 3H:1V should be designed by a licensed geotechnical engineer. It is recommended that permanent slope surfaces be vegetated to protect against erosion. Temporary sedimentation and erosion control methods should be implemented during construction and left in place until the slope surface has been permanently stabilized.

Rock Slopes

Depending on the exposed rock cuts, some smaller rock slopes could be constructed at the site. We recommend a maximum steepness of 1H:3V be used for initial design. Depending on the height of the exposed slope, a fallout zone width of 4 feet and depth of 2 feet is anticipated but could likely be reduced once the bedrock face is exposed. The fallout zone width should be measured from the rock slope toe to the edge of pavement or building (whichever is closer). The fallout zone depth is measured from proposed finished adjacent grade. Final rock slope inclines should be assessed during excavation to evaluate the presence of unstable rock blocks or wedges. Based upon the bedrock jointing encountered at the rock face, rock slopes may need to be flattened if unstable or unfavorable joint orientation is observed.

We recommend line drilling be utilized along the proposed rock face with a spacing of no greater than 6 inches. Additionally, pre-drilling the proposed areas of rock removal could help expedite the removal process. Pre-drilled holes advanced at a spacing of 18 inches or less are recommended.

Groundwater Seepage Control

Groundwater may seep from cut slopes during seasonally wet periods. Groundwater seepage at the face of the soil slopes may result in surface sloughs and erosion if not controlled. Seepage, if encountered at cut slopes during construction, should be evaluated and engineered controls

incorporated if applicable. Engineered controls should include the potential for riprap armoring and inclusion of drainage swales at the slope toe.

CONSTRUCTION RECOMMENDATIONS

Soil Subgrade Preparation

Prior to fill placement, existing structures and vegetation including concrete, pavement, topsoil, existing utilities, existing fill and organic soils should be removed within the influence zone of the proposed building areas. The influence zone is defined by one horizonal to one vertical (1H:1V) lines sloping down from the bottom exterior edge of footings. Where encountered, bedrock should be removed from the within the influence zone of foundations, slabs and pavements to at least 12 inches below the bottom of concrete/asphalt.

Soil subgrades should be excavated using a smooth edge bucket to reduce the potential for disturbance. Subgrade soils should be proof-compacted prior to fill placement with at least six passes in perpendicular directions using a minimum 10-ton vibratory roller in open areas, or a 1-ton vibratory roller or large plate compactor in pits and trenches. Depending on the moisture content of the soils proof compacting might need to be accomplished statically to reduce the potential for disturbing soil subgrade. Any weak or soft spots identified during proof-compaction should be over-excavated and replaced with compacted Structural Fill. Where subgrades are wet the use of Crushed Stone should be considered in lieu of Structural Fill. Crushed stone should be wrapped in a non-woven geotextile equivalent with properties equivalent to Mirafi 140N to separate the crushed stone from soil subgrades and backfill.

The geotechnical engineer of record or their representative should observe subgrades and the proof-compaction process. Subgrade stability will be affected by precipitation, construction traffic and other factors. To reduce disturbance construction traffic (including foot traffic) should be limited to the extent practical, run-off should be diverted, and subgrades should not be left exposed overnight unless the forecast calls for above freezing, clear conditions.

Bedrock Removal and Subgrade Preparation

As previously indicated, shallow bedrock was encountered in the western area at the site. The bedrock at the site varies from weathered bedrock to an inferred competent bedrock. Note that the description of competent bedrock is based on very limited bedrock coring but also on boring

and test pit refusals. Small amounts of bedrock might be excavatable by large earthwork equipment; however, mechanical removal via hoe-ramming will still likely be required.

Where bedrock subgrades are encountered, the bedrock should be excavated to provide a minimum 12-inch thick layer of ¾-inch Crushed Stone below foundations and floor slabs. Bedrock subgrades should be observed for open joints, loose rock, and uneven surfaces. Loose rock pieces should be removed, and open bedrock joints should be filled with lean concrete or 3/4-inch Crushed Stone before placing fill. Bedrock subgrades steeper than 4H:1V should be benched or leveled to grade by placing lean concrete. Bedrock subgrades will not require proof-rolling; however, if loose or over blasted rock is exposed it should be replaced with ¾-inch crushed stone or lean concrete.

Fill Placement and Compaction

All fill placed below and within the 1H:1V zone of influence of the foundations, slabs and pavements should be compacted to at least 95 percent of the maximum dry density as determined by Modified Proctor Tests (ASTM D-1557, Method C). Protect subgrades from frost at all times during construction. Fill should not be placed over frozen soil.

Structural Fill

Recommended below foundations and slabs and for backfill of foundation walls. Imported Structural Fill should meet the following gradation:

Sieve Size	Percent Passing by Weight
6-inch	100*
3-inch	70-100**
¾-inch	45-95
No 4	30-90
No. 10	25-80
No. 50	10-50
No. 200	0-10***
* Maximum particle size limited to 2/3 the loose lift thickness. ** Maximum 3-inch particle size within 12 inches of the underside of footings and for the entire slab and pavement base course. *** Slab base course and free-draining wall materials should have less than 8 percent fines.	

Structural Fill may be imported to the site or existing on-site soils may be mixed with imported materials to produce Structural Fill. Additionally, broken rock from the how ramming process may be processed to produce Crushed Stone or Structural Fill provided the required gradations requirements are met.

Extra care should be used when compacting adjacent to walls. Hand-operated rollers or plate compactors weighing not more than 250 pounds should be used within a lateral distance of 5 feet of walls. Where walls are buried on both sides, backfill and compaction should proceed on both sides of the wall so that the difference in top of fill on either side of the wall does not exceed 2 feet.

Crushed Stone

Recommended below foundations to protect the subgrade from disturbance, for slab base course and for wall drainage. Crushed stone shall meet the requirements defined by the Massachusetts Department of Transportation (MassDOT) Standard Specifications for Highways and Bridges, Table M2.01.0-1, Material M2.01.4 (3/4-inch stone). Crushed stone, where used, should be separated from soil subgrades, excavation sidewalls, and soil backfill with a geotextile separation fabric such as Mirafi 140N, or equivalent. Crushed stone should meet the requirements of MassDOT M2.01.4 and be compacted to a non-yielding condition.

Common Fill

Common Fill may be used in non-structural areas at the site such as athletic and playing fields. Common fill should have a maximum particle size no greater than 2/3 of the loose lift thickness and should have no more than 30 percent by weight passing the No. 200 sieve. Common fill should be compacted to a minimum of 92 percent of the maximum dry density as determined by the Modified Proctor Tests (ASTM D-1557, Method C).

Reuse of Onsite Soil

Based on visual and laboratory soil classifications, the on-site fill material is quite variable and has significant silt content. Additionally, there are some areas where organics are located below the fill, which will not be suitable for reuse. The Contractor will need to be selective with regard to reusing on-site material due to its variability, especially when considering use for Structural Fill.

Imported material (Structural Fill and Crushed Stone) will likely be necessary for fill placement at the site including beneath foundations and slabs, backfill of foundation walls and utilities, and for the pavement base course. Imported material may be mixed with existing fill to form Structural Fill, provided it meets the required gradation criteria.

It should be noted that environmental chemical analytical testing was not performed by Nobis at the site and disposal of excess soil at an off-site location could potentially be required, incurring premium soil disposal costs. The Owner may want to consider environmental testing prior to export to evaluate project costs.

On-site material may be used as indicated below:

Common Fill

Based on the results of our subsurface explorations, it is anticipated that excavated granular fill, glacial outwash sand, and glacial till are suitable for reuse as common fill outside proposed building footprints (including slab/footing bearing zones) and outside pavement areas, provided these materials are free of deleterious material, the maximum particle size is limited to 8 inches, and they are stable and can be adequately compacted. However, portions of the on-site soil have an elevated silt content and will likely be sensitive to moisture and lose strength quickly when wet. As such, reusing the on-site soil may be limited to drier periods that are more favorable for reusing a silty soil.

Structural Fill

Structural fill consists of well-graded granular material with less than 10 percent fines (percent passing the No. 200 Sieve). However, the specification can be modified to help reduce import/export costs depending upon the suitability of the on-site material, moisture content, and quality of construction. Based on the explorations and laboratory testing, it is our opinion that portions of the excavated granular fill, glacial outwash, and glacial till may be suitable for reusing these materials as Structural Fill below floor slabs at depths greater than 12 inches below design slab elevation, provided they are free of deleterious materials, the maximum particle size is limited to 6 inches, and they are stable and can be adequately compacted. Reuse of on-site soil that does not meet the Structural Fill specification is contingent on meeting the above requirements in addition to performing fill placement during favorable weather conditions.

In addition, excavated bedrock (if generated) can be processed to provide a select material suitable for reuse as structural fill.

Existing Pavement

The existing asphalt pavement may be ground up for reuse as base course for new pavement areas provided the gradation requirements for MassDOT M2.01.7 – Dense Graded Crushed Stone for Sub-base are met.

Temporary Support of Excavation

The Owner and the Contractor should make themselves aware of and become familiar with applicable local, state, and federal safety regulations, including the current Occupational Safety and Health Administration (OSHA) Excavation and Trench Safety Standards. Construction site safety generally is the sole responsibility of the Contractor, who shall also be solely responsible for the means, methods, and sequencing of construction operations.

The Contractor should be aware that slope height, slope inclination, or excavation depths (including utility trench excavations) should in no case exceed those specified in local, state, or federal safety regulations, including OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations. Such regulations are strictly enforced and, if they are not followed, the Owner, Contractor, and/or earthwork and utility subcontractors could be liable for substantial penalties.

As a safety measure, it is recommended that all vehicles and soil piles be kept a minimum lateral distance from the crest of the slope equal to no less than the slope height. Exposed slope faces should also be protected against the elements.

Groundwater Control

Based on groundwater observations, anticipated seasonally perched/elevated water conditions, and anticipated excavation depths, dewatering will likely be required for construction of foundations and utilities and general cuts, especially in western areas of the site. Regardless of excavation depths, limited construction dewatering will also be required to maintain a stable subgrade during construction and prevent surface water runoff from collecting in excavations. The Contractor should select a dewatering method to lower groundwater at least 2 feet below the

excavation subgrade in order to minimize bearing surface disturbance during fill placement and compaction, and construction of footings and utilities.

Discharge of pumped water may be subject to local, state, and federal regulations. It is also recommended that temporary control measures be implemented to reduce the amount of surface water (from rainfall runoff) from potentially entering and ponding in the excavations. Temporary measures should include, but not be limited to, construction of drainage ditches to divert and/or reduce the amount of surface water flowing into excavations during construction.

Thank you for the opportunity to be of service. Please do not hesitate to call us if you have any questions.

Very truly yours,

NOBIS GROUP®

Alfred Jones, PE
Director, Geotechnical Services

Kurt Jelinek, PE
Project Reviewer

Attachments:
Table
1. Generalized Subsurface Exploration Summary Table

Figures
1. Site Locus Plan
2. Exploration Location Plan (Existing Conditions)
3. Exploration Location Plan (Proposed Grading & Utilities)
4. Surficial Geologic Map
5. Bedrock Geologic Map

Appendix A Limitations
Appendix B.1 Test Pit Logs by SMMA
Appendix B.2 Nobis Boring Logs B-1 series
Appendix B.3 Nobis Boring Logs B-101 series
Appendix B.4 Nobis Test Pit Logs
Appendix C Laboratory Test Results

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TABLES

TABLE 1
96480.02 - Andover West Elementary School
GENERALIZED SUMMARY OF SUBSURFACE CONDITONS

	B-1	B-2	B-2A	B-3 (OW)	B-4	B-5	B-6	B-7 (OW)	B-8	B-9 (OW)	B-10 (OW)	B-11	B-12	B-13	B-101	B-102	B-103	B-104	B-105	B-106	B-107	B-108	B-109	B-110	B-111 (OW)
Depth (ft) to Top of:	T	T	T	T	T	T	T	T	T	T	T	A	T	T	T	A	T	A	A	A	T	T	--	T	T
Asphalt/Topsoil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NE	0.0	0.0
Fill	0.9	0.5	NE	NE	NE	0.7	0.9	0.4	NE	0.6	0.7	0.3	1.7	NE	1.0	NE	NE	0.5	0.5	0.3	NE	1.0	0.0	NE	NE
Buried Organics	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	2.5	NE	NE	NE	NE	NE	NE	2.0	NE	NE	NE
Sands & Silts	5.0	NE	NE	0.7	2	5.5	2.8	6.0	0.8	2.0	2.0	5.0	5.0	0.4	3.5	0.3	2.5	2.5	4.0	NE	0.5	3.0	4.0	0.5	1.0
Glacial Till	15.0	NE	0.8	10.0	14	11.1	10.9	NE	2.0	12.5	5.0	10.0	15.0	5.0	NE	15.0	15.0	6.0	NE	4.0	NE	NE	NE	NE	2.5
Weathered/Fractured Bedrock	NE	NE	2.0	NE	NE	NE	NE	17.0	NE	NE	NE	NE	NE	11.8	NE	NE	NE	NE	11.5	15.0	NE	15.0	8.0	4.0	NE
Competent Bedrock	NE	NE	5.0	NE	NE	NE	NE	18.0	NE	NE	8.6	NE	NE	12.0	NE	NE	NE	23.0	12.5	19.0	6.7	16.0	9.0	7.0	NE
Bottom of Exploration	22.0	0.5	5.0	21.8	22.0	22.0	22.0	18.0	20.9	21.4	8.6	22.0	22.0	12.0	14.0	20.8	22.0	23.0	12.5	19.0	6.7	16.0	9.0	12.0	19.0
Thickness (ft) of:																									
Asphalt/Topsoil	0.9	0.5	0.8	0.7	2.0	0.7	0.9	0.4	0.8	0.6	0.7	0.3	1.7	0.4	1.0	0.3	2.5	0.5	0.5	0.3	0.5	1.0	NE	0.5	1.0
Fill	4.1	NE	NE	NE	NE	4.8	1.9	5.6	NE	1.4	1.3	4.7	3.3	NE	1.5	NE	NE	2.0	0.5	3.7	NE	1.0	4.0	NE	NE
Buried Organics	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	1.0	NE	NE	NE	NE	NE	NE	1.0	NE	NE	NE
Sands & Silts	10.0	NE	NE	9.3	12.0	5.6	8.1	11.0	1.2	10.5	3.0	5.0	10.0	4.6	10.5	14.7	12.5	3.5	3.5	NE	6.2	12.0	4.0	3.5	1.5
Glacial Till	7.0	NE	1.2	11.8	8.0	10.9	11.1	NE	18.9	8.9	3.6	12.0	7.0	6.8	NE	5.8	7.0	17.0	NE	11.0	NE	NE	NE	NE	16.5
Weathered/Fractured Bedrock	NE	NE	3.0	NE	NE	NE	NE	1.0	NE	NE	NE	NE	NE	0.2	NE	NE	NE	NE	1.0	4.0	NE	1.0	1.0	3.0	NE
Elev. (ft) top of:																									
Asphalt/Topsoil	164.0	165.0	165.0	166.0	156.0	158.0	157.0	157.0	157.0	148.0	161.0	156.0	154.0	166.0	155.0	156.5	159.0	159.0	162.0	161.0	160.0	161.5	NE	165.0	166.5
Fill	163.1	NE	NE	NE	NE	157.3	156.1	156.6	NE	147.4	160.3	155.7	152.3	NE	154.0	NE	NE	158.5	161.5	160.7	NE	160.5	164.0	NE	NE
Buried Organics	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	152.5	NE	NE	NE	NE	NE	NE	159.5	NE	NE	NE
Sands & Silts	159.0	NE	NE	165.3	154.0	152.5	154.2	151.0	156.2	146.0	159.0	151.0	149.0	165.6	151.5	156.2	156.5	156.5	158.0	NE	159.5	158.5	160.0	164.5	165.5
Glacial Till	149.0	NE	164.2	156.0	142.0	146.9	146.1	NE	155.0	135.5	156.0	146.0	139.0	161.0	NE	141.5	144.0	153.0	NE	157.0	NE	NE	NE	NE	164.0
Weathered/Fractured Bedrock	NE	NE	163.0	NE	NE	NE	NE	140.0	NE	NE	NE	NE	NE	154.2	NE	NE	NE	NE	150.5	146.0	NE	146.5	156.0	161.0	NE
Competent Bedrock	NE	NE	160.0	NE	NE	NE	NE	139.0	NE	NE	152.4	NE	NE	154.0	NE	NE	NE	136.0	149.5	142.0	153.3	145.5	155.0	158.0	NE
Bottom of Exploration	142.0	164.5	160.0	144.2	134.0	136.0	135.0	139.0	136.1	126.6	152.4	134.0	132.0	154.0	141.0	135.7	137.0	136.0	149.5	142.0	153.3	145.5	155.0	153.0	147.5

Notes:
1.) NE = Not Encountered; T = Topsoil; A = Asphalt
2.) Mixed topsoil and fill is reported as topsoil.
3.) Competent bedrock is reported as the depth at which the rock core recovery began, auger refusal was encountered, or excavator refusal was encountered.
4.) Fills with organic content noted on the exploration logs are reported as organic soils.
5.) All elevations referenced to the North American Vertical Datum (NAVD88).
6.) Soil descriptions, and lithology, are based on visual classifications and should be considered approximate.

TABLE 1
96480.02 - Andover West Elementary School
GENERALIZED SUMMARY OF SUBSURFACE CONDITONS

	B-112	B-113	B-114	B-115	B-116 (OW)	B-117	B-118	B-119	B-120	B-121	B-122	B-123	B-124 (OW)	B-125	B-126	B-127	B-128	B-129	B-130	B-131	B-132	B-133	B-134	B-135	TP-1
Depth (ft) to Top of:	T	T	T	T	T	T	A	A	T	A	T	T	T	--	T	T	T	T	T	--	T	T	T	T	T
Asphalt/Topsoil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NE	0.0	0.0	0.0	0.0	0.0	NE	0.0	0.0	0.0	0.0	0.0
Fill	NE	1.0	NE	NE	NE	0.5	0.3	0.4	1.0	0.6	0.8	NE	NE	NE	NE	NE	NE	NE	NE	0.0	NE	NE	NE	NE	0.7
Buried Organics	NE	4.0	NE	NE	NE	1.0	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Sands & Silts	0.5	6.0	1.0	1.0	0.5	4.0	2.0	2.0	4.0	3.0	4.0	0.5	2.0	0.0	2.0	4.0	2.0	1.0	0.5	1.0	1.0	1.0	NE	NE	NE
Glacial Till	NE	15.0	15.0	10.0	15.0	15.0	4.0	6.0	5.0	NE	NE	6.0	NE	NE	15.0	NE	NE	NE	8.0	NE	NE	NE	1.5	0.5	1.5
Weathered/Fractured Bedrock	9.3	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	15.0	NE	NE	NE	NE	NE	NE	NE	NE	NE	4.0	3.0	NE	NE
Competent Bedrock	11.0	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	15.5	NE	NE	NE	NE	NE	NE	NE	NE	4.0	7.0	3.7	NE	NE
Bottom of Exploration	11.0	20.5	21.3	18.5	16.5	22.0	8.0	8.0	8.0	8.0	8.0	15.5	17.0	10.0	17.0	10.0	16.5	10.0	9.8	10.0	4.5	7.0	3.7	19.9	7.0
Thickness (ft) of:																									
Asphalt/Topsoil	0.5	1.0	1.0	1.0	0.5	0.5	0.3	0.4	1.0	0.6	0.8	0.5	2.0	NE	2.0	4.0	2.0	1.0	0.5	NE	1.0	1.0	1.5	0.5	0.7
Fill	NE	3.0	NE	NE	NE	0.5	1.7	1.6	3.0	2.4	3.2	NE	NE	NE	NE	NE	NE	NE	NE	1.0	NE	NE	NE	NE	0.8
Buried Organics	NE	2.0	NE	NE	NE	3.0	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Sands & Silts	8.8	9.0	14.0	9.0	14.5	11.0	2.0	4.0	1.0	5.0	4.0	5.5	15.0	10.0	13.0	6.0	14.5	9.0	7.5	9.0	3.0	3.0	NE	NE	NE
Glacial Till	NE	5.5	6.3	8.5	1.5	7.0	4.0	2.0	3.0	NE	NE	9.0	NE	NE	2.0	NE	NE	NE	1.8	NE	NE	NE	1.5	19.4	5.5
Weathered/Fractured Bedrock	1.7	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0.5	NE	NE	NE	NE	NE	NE	NE	NE	NE	3.0	0.7	NE	NE
Elev. (ft) top of:																									
Asphalt/Topsoil	165.5	164.5	164.5	163.0	153.0	154.5	155.0	156.0	152.5	148.0	152.0	166.0	148.5	NE	146.0	143.5	154.0	159.0	158.5	NE	170.0	163.0	165.0	167.0	158.5
Fill	NE	163.5	NE	NE	NE	154.0	154.7	155.6	151.5	147.4	151.2	NE	NE	NE	NE	NE	NE	NE	NE	160.5	NE	NE	NE	NE	157.8
Buried Organics	NE	160.5	NE	NE	NE	153.5	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Sands & Silts	165.0	158.5	163.5	162.0	152.5	150.5	153.0	154.0	148.5	145.0	148.0	165.5	146.5	146.5	144.0	139.5	152.0	158.0	158.0	159.5	169.0	162.0	NE	NE	NE
Glacial Till	NE	149.5	149.5	153.0	138.0	139.5	151.0	150.0	147.5	NE	NE	160.0	NE	NE	131.0	NE	NE	NE	150.5	NE	NE	NE	163.5	166.5	157.0
Weathered/Fractured Bedrock	156.2	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	151.0	NE	NE	NE	NE	NE	NE	NE	NE	NE	159.0	162.0	NE	NE
Competent Bedrock	154.5	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	150.5	NE	NE	NE	NE	NE	NE	NE	NE	166.0	156.0	161.3	NE	NE
Bottom of Exploration	154.5	144.0	143.2	144.5	136.5	132.5	147.0	148.0	144.5	140.0	144.0	150.5	131.5	136.5	129.0	133.5	137.5	149.0	148.7	150.5	165.5	156.0	161.3	147.1	151.5

Notes:
1.) NE = Not Encountered; T = Topsoil; A = Asphalt
2.) Mixed topsoil and fill is reported as topsoil.
3.) Competent bedrock is reported as the depth at which the rock core recovery began, auger refusal was encountered, or excavator refusal was encountered.
4.) Fills with organic content noted on the exploration logs are reported as organic soils.
5.) All elevations referenced to the North American Vertical Datum (NAVD88).
6.) Soil descriptions, and lithology, are based on visual classifications and should be considered approximate.

TABLE 1
96480.02 - Andover West Elementary School
GENERALIZED SUMMARY OF SUBSURFACE CONDITONS

	TP-2	TP-3	TP-4	TP-5	TP-6	TP-7	TP-101	TP-102	TP-103	TP-104	TP-105	TP-106	TP-107	TP-108	TP-109
Depth (ft) to Top of:	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
Asphalt/Topsoil	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fill	1.0	1.0	2.7	0.7	NE	NE	0.8	0.7	1.0	1.0	0.7	0.8	0.8	1.0	NE
Buried Organics	NE	NE	NE	NE	NE	NE	5.2	2.5	NE	3.0	NE	NE	NE	NE	NE
Sands & Silts	2.0	1.5	4.0	5.5	1.3	0.7	6.0	3.3	2.5	3.3	4.0	3.0	2.9	NE	NE
Glacial Till	2.7	2.3	5.0	NE	NE	NE	NE	NE	6.0	NE	6.5	4.7	7.0	3.0	0.7
Weathered/Fractured Bedrock	NE	NE	NE	NE	NE	NE	NE	NE	7.7	NE	NE	NE	NE	NE	NE
Competent Bedrock	NE	NE	NE	NE	NE	NE	NE	NE	8.2	NE	10.0	10.0	NE	NE	NE
Bottom of Exploration	7.5	7.5	9.0	10.0	10.0	10.0	7.8	5.0	8.2	8.5	10.0	10.0	11.0	8.0	4.0
Thickness (ft) of:															
Asphalt/Topsoil	1.0	1.0	2.7	0.7	1.3	0.7	0.8	0.7	1.0	1.0	0.7	0.8	0.8	1.0	0.7
Fill	1.0	0.5	1.3	4.8	NE	NE	4.4	1.8	1.5	2.0	3.3	2.2	2.1	2.0	NE
Buried Organics	NE	NE	NE	NE	NE	NE	0.8	0.8	NE	0.3	NE	NE	NE	NE	NE
Sands & Silts	0.7	0.8	1.0	4.5	8.7	9.3	1.8	1.7	3.5	5.2	2.5	1.7	4.1	NE	NE
Glacial Till	4.8	5.2	4.0	NE	NE	NE	NE	NE	1.7	NE	3.5	5.3	4.0	5.0	3.3
Weathered/Fractured Bedrock	NE	NE	NE	NE	NE	NE	NE	NE	0.5	NE	NE	NE	NE	NE	NE
Elev. (ft) top of:															
Asphalt/Topsoil	165.5	166.5	159.5	160.0	154.0	165.0	147.0	148.0	159.0	150.0	158.0	157.0	154.0	155.5	166.0
Fill	164.5	165.5	156.8	159.3	NE	NE	146.2	147.3	158.0	149.0	157.3	156.2	153.2	154.5	NE
Buried Organics	NE	NE	NE	NE	NE	NE	141.8	145.5	NE	147.0	NE	NE	NE	NE	NE
Sands & Silts	163.5	165.0	155.5	154.5	152.7	164.3	141.0	144.7	156.5	146.7	154.0	154.0	151.1	NE	NE
Glacial Till	162.8	164.2	154.5	NE	NE	NE	NE	NE	153.0	NE	151.5	152.3	147.0	152.5	165.3
Weathered/Fractured Bedrock	NE	NE	NE	NE	NE	NE	NE	NE	151.3	NE	NE	NE	NE	NE	NE
Competent Bedrock	NE	NE	NE	NE	NE	NE	NE	NE	150.8	NE	148.0	147.0	NE	NE	NE
Bottom of Exploration	158.0	159.0	150.5	150.0	144.0	155.0	139.2	143.0	150.8	141.5	148.0	147.0	143.0	147.5	162.0

Notes:
1.) NE = Not Encountered; T = Topsoil; A = Asphalt
2.) Mixed topsoil and fill is reported as topsoil.
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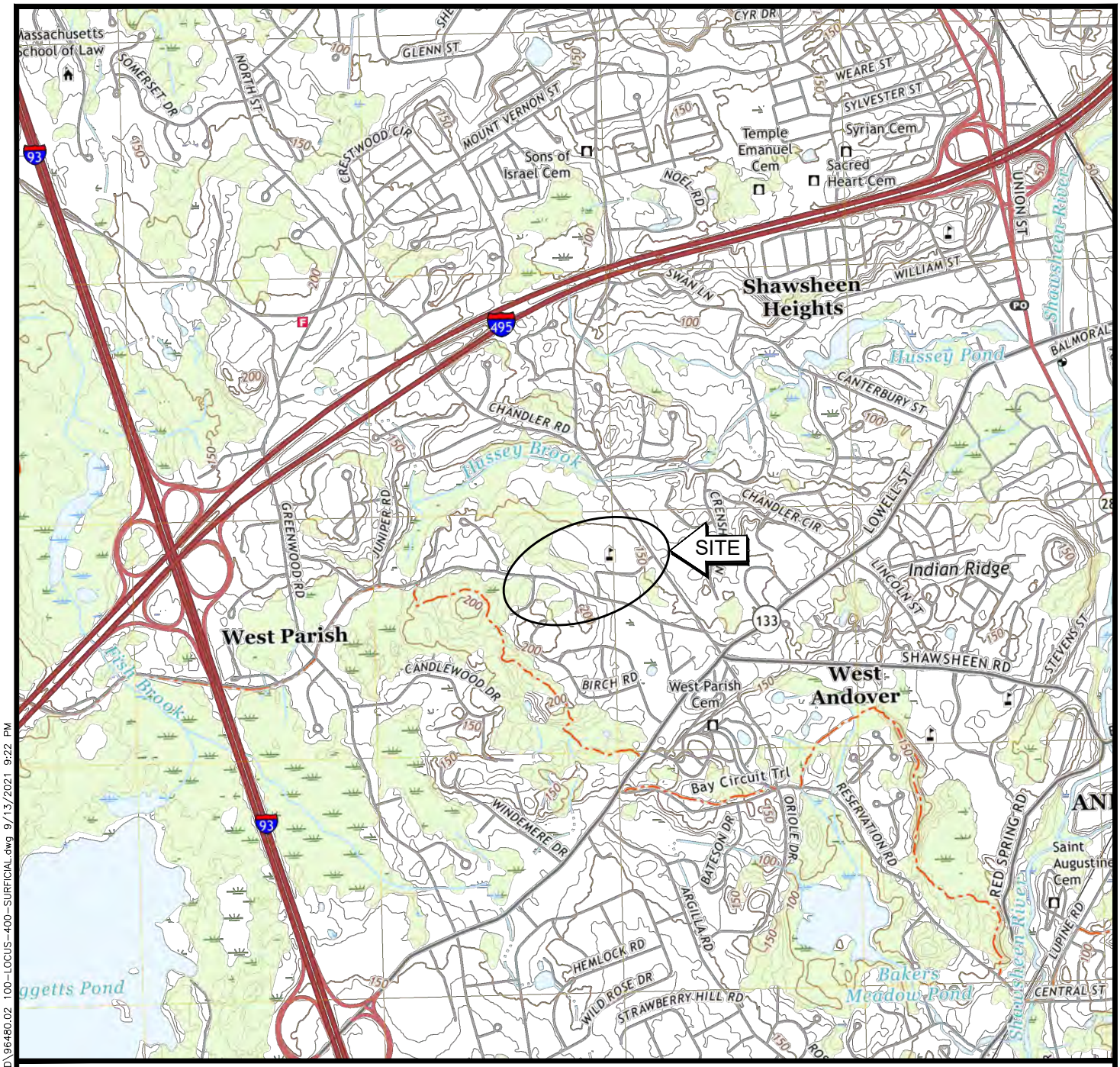
5.) All elevations referenced to the North American Vertical Datum (NAVD88).
6.) Soil descriptions, and lithology, are based on visual classifications and should be considered approximate.

FIGURES



NORTH

2021 USGS TOPOGRAPHIC MAP

LAWRENCE QUADRANGLE
NORTH AMERICAN VERTICAL DATUM OF 1988
CONTOUR INTERVAL 10 FEET

APPROXIMATE SCALE
1 INCH = 2,000 FEET

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QUADRANGLE LOCATION

FIGURE 1

SITE LOCUS PLAN

ANDOVER WEST ELEMENTARY SCHOOL AND
SHAWSHEEN PRESCHOOL
58 BEACON STREET
ANDOVER, MASSACHUSETTS

DRAWN BY:	SMC	CHECKED BY:	AJ
PROJECT NO.	96480.02	DATE:	SEPTEMBER 2021

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NOTES:

1. THIS FIGURE WAS DEVELOPED FROM THE "EXISTING CONDITIONS PLAN I AND II" LAST REVISED FEBRUARY 24, 2021, BY SYMMES, MAINI & MCKEE ASSOCIATES, INC.
2. LOCATIONS AND SITE FEATURES DEPICTED ARE APPROXIMATE AND GIVEN FOR ILLUSTRATIVE PURPOSES.
3. SOIL BORINGS B-1 THRU B-13 WERE DRILLED BY GEOSEARCH, INC. OF STERLING, MASSACHUSETTS AND OBSERVED BY NOBIS BETWEEN FEBRUARY 24 AND 27, 2020.
4. SOIL BORINGS B-101 THRU B-136 WERE DRILLED BY NEW ENGLAND BORING CONTRACTORS OF DERRY, NEW HAMPSHIRE AND OBSERVED BUY NOBIS BETWEEN AUGUST 17 AND 27, 2021.
5. TEST PITS TP-1 THRU TP-7 WERE COMPLETED BY SYMMES MAINI & MCKEE ASSOCIATES (SMMA) ON FEBRUARY 28, 2020.
6. TEST PITS TP-101 THRU TP-109 WERE EXCAVATED BY NEW ENGLAND BORING CONTRACTORS OF DERRY, NEW HAMPSHIRE AND OBSERVED BUY NOBIS BETWEEN AUGUST 18 AND 20, 2021.

LEGEND

B-1	APPROXIMATE BORING LOCATION OBSERVED BY NOBIS (2/2020)
B-101	APPROXIMATE BORING LOCATION OBSERVED BY NOBIS (8/2021)
B-3 (OW)	APPROXIMATE TEST BORING/OBSERVATION WELL LOCATION OBSERVED BY NOBIS
TP-1	APPROXIMATE TEST PIT LOCATION OBSERVED BY SMMA (2/2020)
TP-101	APPROXIMATE TEST PIT LOCATION OBSERVED BY NOBIS (8/2021)
	APPROXIMATE PROPOSED BUILDING LOCATION

0 100' 200'

GRAPHIC SCALE

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FIGURE 2

EXPLORATION LOCATION PLAN
EXISTING CONDITIONS
WEST ANDOVER ELEMENTARY SCHOOL
58 BEACON STREET
ANDOVER, MASSACHUSETTS

DRAWN BY:	SMC	CHECKED BY:	AJ
PROJECT NO.	96480.02	DATE:	SEPTEMBER 2021

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NOTES:

1. THIS FIGURE WAS DEVELOPED FROM THE "GRADING & UTILITIES PLAN I AND II" LAST REVISED JANUARY 4, 2021, BY SYMMES, MAINI & MCKEE ASSOCIATES, INC.
2. LOCATIONS AND SITE FEATURES DEPICTED ARE APPROXIMATE AND GIVEN FOR ILLUSTRATIVE PURPOSES.
3. SOIL BORINGS B-1 THRU B-13 WERE DRILLED BY GEOSEARCH, INC. OF STERLING, MASSACHUSETTS AND OBSERVED BY NOBIS BETWEEN FEBRUARY 24 AND 27, 2020.
4. SOIL BORINGS B-101 THRU B-136 WERE DRILLED BY NEW ENGLAND BORING CONTRACTORS OF DERRY, NEW HAMPSHIRE AND OBSERVED BUY NOBIS BETWEEN AUGUST 17 AND 27, 2021.
5. TEST PITS TP-1 THRU TP-7 WERE COMPLETED BY SYMMES MAINI & MCKEE ASSOCIATES (SMMA) ON FEBRUARY 28, 2020.
6. TEST PITS TP-101 THRU TP-109 WERE EXCAVATED BY NEW ENGLAND BORING CONTRACTORS OF DERRY, NEW HAMPSHIRE AND OBSERVED BUY NOBIS BETWEEN AUGUST 18 AND 20, 2021.

LEGEND

B-1	APPROXIMATE BORING LOCATION OBSERVED BY NOBIS (2/2020)
B-101	APPROXIMATE BORING LOCATION OBSERVED BY NOBIS (8/2021)
B-3 (OW)	APPROXIMATE TEST BORING/OBSERVATION WELL LOCATION OBSERVED BY NOBIS
TP-1	APPROXIMATE TEST PIT LOCATION OBSERVED BY SMMA (2/2020)
TP-101	APPROXIMATE TEST PIT LOCATION OBSERVED BY NOBIS (8/2021)
	APPROXIMATE EXISTING BUILDING LOCATION

0 100' 200'

GRAPHIC SCALE

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FIGURE 3

EXPLORATION LOCATION PLAN
PROPOSED GRADING & UTILITIES
WEST ANDOVER ELEMENTARY SCHOOL
58 BEACON STREET
ANDOVER, MASSACHUSETTS

DRAWN BY:	SMC	CHECKED BY:	AJ
PROJECT NO.	96480.02	DATE:	SEPTEMBER 2021

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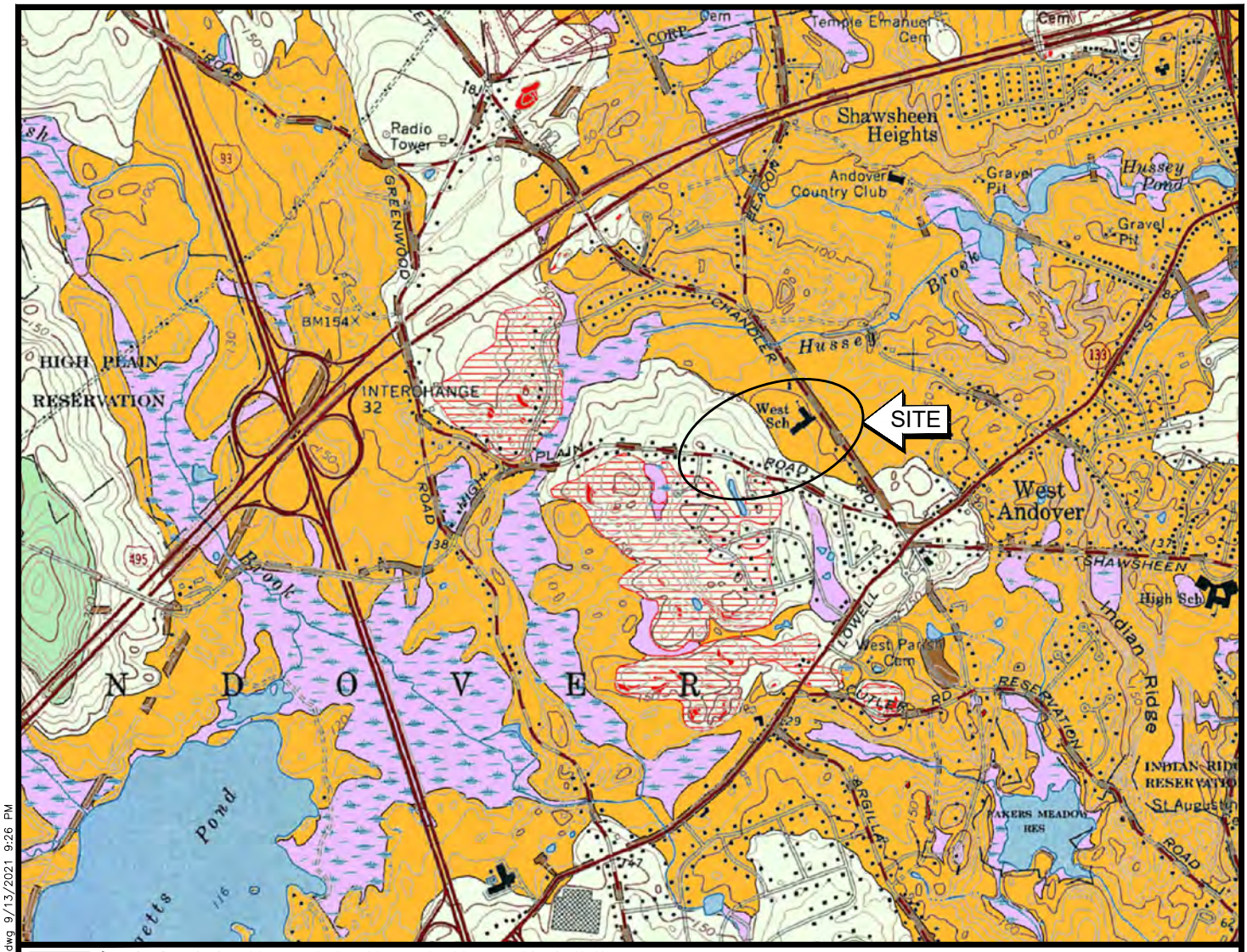

Coarse deposits consist of *gravel deposits*, *sand and gravel deposits*, and *sand deposits*, not differentiated in this report. *Gravel deposits* are composed of at least 50 percent gravel-size clasts; cobbles and boulders predominate; minor amounts of sand occur within gravel beds, and sand comprises a few separate layers. Gravel layers generally are poorly sorted, and bedding commonly is distorted and faulted due to postdepositional collapse related to melting of ice. *Sand and gravel deposits* occur as mixtures of gravel and sand within individual layers and as layers of sand alternating with layers of gravel. Sand and gravel layers generally range between 25 and 50 percent gravel particles and between 50 and 75 percent sand particles. Layers are well sorted to poorly sorted; bedding may be distorted and faulted due to postdepositional collapse. *Sand deposits* are composed mainly of very coarse to fine sand, commonly in well-sorted layers. Coarser layers may contain up to 25 percent gravel particles, generally granules and pebbles; finer layers may contain some very fine sand, silt, and clay

Thin till—Nonsorted, nonstratified matrix of sand, some silt, and little clay containing scattered pebble, cobble, and boulder clasts; large surface boulders are common; unit was mapped where till is generally less than 10 to 15 ft thick including areas of shallow bedrock. Predominantly consists of upper till of the last glaciation; loose to moderately compact, generally sandy, commonly stony. Two facies are present in some places: a looser, coarser grained ablation facies, melted out from supraglacial position; and an underlying more compact, finer grained lodgement facies deposited subglacially. In general, both ablation and lodgement facies of upper till derived from fine-grained bedrock are finer grained, more compact, less stony and have fewer surface boulders than upper till derived from coarse-grained crystalline rocks. Across Massachusetts, fine-grained bedrock sources include the red Mesozoic sedimentary rocks of the Connecticut Valley lowland, marble in the western river valleys, and fine-grained schists in upland areas

Bedrock Areas

Bedrock outcrops and areas of abundant outcrop or shallow bedrock—Solid color shows extent of individual bedrock outcrops; horizontal-line pattern indicates areas of shallow bedrock or areas where small outcrops are too numerous to map individually; in areas of shallow bedrock, surficial materials are less than 5 to 10 ft thick. These units were not mapped consistently among all quadrangles; see note at beginning of appendix 1 fo information on bedrock outcrop mapping by quadrangle

2018 USGS SURFICIAL GEOLOGIC MAP

NORTH

SURFICIAL GEOLOGIC MAP OF THE LAWRENCE QUADRANGLE
NORTH AMERICAN VERTICAL DATUM OF 1988
CONTOUR INTERVAL 10 FEET

APPROXIMATE SCALE
1 INCH = 2,000 FEET

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FIGURE 4

SURFICIAL GEOLOGY PLAN
ANDOVER WEST ELEMENTARY SCHOOL AND SHAWSHEEN PRESCHOOL
58 BEACON STREET
NORTON, MASSACHUSETTS

DRAWN BY:	SMC	CHECKED BY:	AJ
PROJECT NO.	96480.02	DATE:	SEPTEMBER 2021

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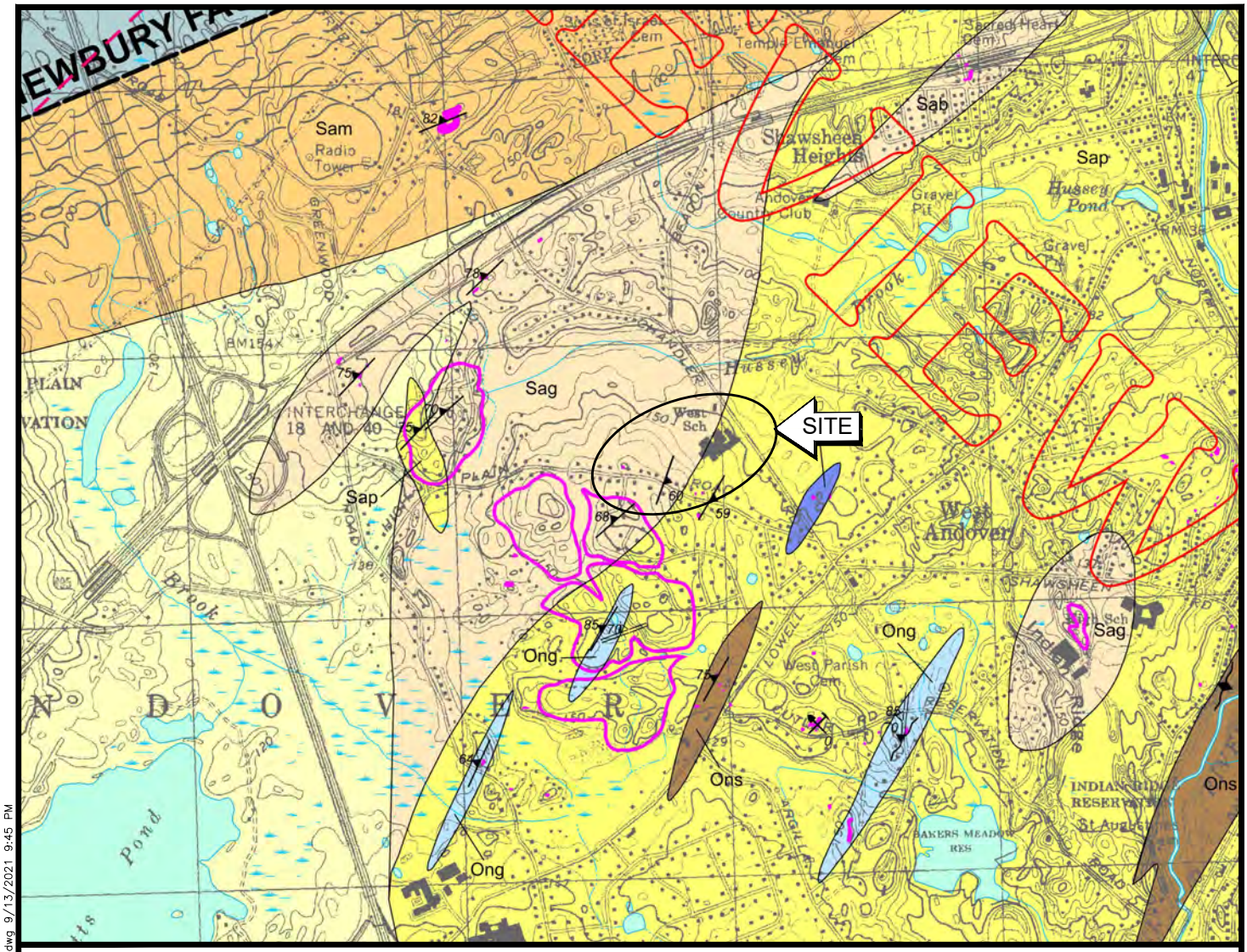

Sap **Andover Granite, pegmatite facies**

Medium to extreamly coarse-grained, massive, white to light-gray pegmatite and monzogranite. Composed mainly of microcline, plagioclase, quartz and muscovite. Biotite occurs locally and garnet is a common accessory. Broad areas underlain entirely by pegmatite.

Sag **Andover Granite, fine-grained granite-gneiss facies**

Fine- to medium-grained, generally prominently foliated, light-gray to white monzogranite-gneiss.

NORTH

BEDROCK GEOLOGIC MAP OF THE LAWRENCE QUADRANGLE, MASSACHUTTS - 2005 (IN REVIEW)

CASTLE, R.O., HEPBURN, J.C., AND KOPERA, J.P. BEDROCK MAP OF THE LAWRENCE QUADRANGLE, MASSACHUSEETS.V 1.0. MASSACHUSEETS GEOLOGIC SURVEY (4TH), (IN REVIEW APRIL 2005)
NORTH AMERICAN VERTICAL DATUM OF 1988
CONTOUR INTERVAL 10 FEET

APPROXIMATE SCALE
1 INCH = 2,000 FEET

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QUADRANGLE LOCATION

FIGURE 5

BEDROCK GEOLOGY PLAN

ANDOVER WEST ELEMENTARY SCHOOL AND SHAWSHEEN PRESCHOOL
58 BEACON STREET
ANDOVER, MASSACHUSETTS

DRAWN BY:	SMC	CHECKED BY:	AJ
PROJECT NO.	96480.02	DATE:	SEPTEMBER 2021

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APPENDIX A - LIMITATIONS

GEOTECHNICAL LIMITATIONS

Explorations and Subsurface Conditions

1. The analyses and design recommendations submitted in this report are based in part upon the data obtained from subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it will be necessary to reevaluate the recommendations of this report.

   In preparing this report, Nobis relied on certain information provided by the Client and other parties referenced therein which were made available to Nobis at the time of our evaluation. Nobis did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this evaluation.

2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretations of widely spaced explorations and samples; actual soil transitions are probably more erratic. For specific information, refer to the exploration logs.

3. Water level readings have been made in the explorations at times and under conditions stated on the logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors occurring since the time measurements were made. The water table encountered in the course of the work may differ from that indicated in the Report.

   Recommendations for foundation drainage, waterproofing, and moisture control address the conventional geotechnical engineering aspects of seepage control. These recommendations may not preclude an environment that allows the infestation of mold or other biological pollutants.

4. Nobis' geotechnical services did not include an assessment of the presence of oil or hazardous materials at the property. Consequently, we did not consider the potential impacts (if any) that contaminants in soil or groundwater may have on construction activities, or the use of structures on the property.

Additional Services

5. Nobis recommends that we be retained to provide services during future site observations, design, implementation activities, construction and/or property development/ redevelopment. This will allow us the opportunity to: i) observe conditions and compliance with our recommendations, design concepts and/or opinions; ii) allow for changes in the event that conditions are other than anticipated; iii) provide modifications to our design recommendations; and iv) assess the consequences of changes in technologies and/or regulations.

Use of Report

6. Nobis prepared this report on behalf of, and for the exclusive use of our Client for the stated purpose(s) and location(s) identified in our proposal and/or report. Use of this report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Reliance by any party not expressly identified in the agreement, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to Nobis.

   This report is for design purposes only and is not sufficient to prepare an accurate construction bid. Contractors wishing a copy of the report may secure it with the understanding that its scope is limited to design considerations only.

7. Nobis' findings and conclusions are based on the work conducted as part of the scope of work set forth in our proposal and/or report, and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions considering the limited data gathered during the course of our work. If conditions other than those described in this report are found at the subject location(s), or the project design has been altered in any way, Nobis shall be so notified and afforded the opportunity to revise the report, as appropriate, to reflect the unanticipated changed conditions.

8. Nobis' services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services, at the same time, under similar conditions, at the same or a similar property. No warranty, expressed or implied, is made.

Compliance with Codes and Regulations

9. Nobis used reasonable care in identifying and interpreting applicable codes and regulations. These codes and regulations are subject to various, and possibly contradictory, interpretations. Compliance with codes and regulations by other parties is beyond our control.

Opinion of Cost

10. This report may contain or be based on comparative cost opinions for the purpose of evaluating alternative foundation schemes. These opinions may also involve approximate quantity evaluations. It should be noted that quantity estimates may not be accurate enough for construction bids. In addition, since we are not professional estimators of labor and materials cost, the evaluation of construction costs should be considered as approximate guidelines and could vary significantly from actual costs. Nobis does not guarantee the accuracy of our cost opinions as compared to contractor's bids for construction costs.

END OF LIMITATIONS

APPENDIX B.1 – TEST PITS LOGS BY SMMA

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Andover West Elementary School Date: 02-28-2020

C. On-Site Review (continued) (Near Playground Equipment)

Deep Observation Hole Number: TP-1

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-8"	Ap					top soil					
8"-18"	Fill					fill					
18"-84"	Cd					glacial till					

Additional Notes:

Redoximorphic features @ 20"

Standing water @ bottom of pit

TP. El. 158.5+/-

Refusal @ 84"

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Andover West Elementary School Date: 02-28-2020

C. On-Site Review (continued) (In Soccer Fields)

Deep Observation Hole Number: TP-2

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-12"	Ap					top soil					
12"-24"	Fill					fill					
24"-32"	C1					sand & silt					
32"-90"	Cd					glacial till					

Additional Notes:

Redoximorphic features @ 30"

Water Weeping @ 48"

TP. El. 165.5+/-

Refusal @ 90"

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Andover West Elementary School Date: 02-28-2020

C. On-Site Review (continued) (In Soccer Fields)

Deep Observation Hole Number: TP-3

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-12"	Ap					top soil					
12"-18"	Fill					fill					
18"-28"	Bw					sand & silt					
28"-90"	Cd					glacial till					some loam

Additional Notes:

Redoximorphic features @ 48"

Water Weeping @ 54"

TP. El. 166.5+/-

Refusal @ 90"

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Andover West Elementary School Date: 02-28-2020

C. On-Site Review (continued) (Near Playground Equipment)

Deep Observation Hole Number: TP-4

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-32"	Ap					top soil					
32"-48"	Fill					fill					
48"-60"	X					loamy sand					
60"-108"	Cd					glacial till					

Additional Notes:

Redoximorphic features @ 48"

Water Weeping @ 60"

TP. El. 159.5+/-

No Refusal; Test Pit began collapsing

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Andover West Elementary School Date: 02-28-2020

C. On-Site Review (continued) (Slope Near Wetland)

Deep Observation Hole Number: TP-5

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-8"	Ap					top soil					
8"-66"	Fill					fill					
66"-120"	Cd					loamy sand					

Additional Notes:

Redoximorphic features @
Water Weeping @
TP. El. 160.0+/-
Refusal @ 120"

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Andover West Elementary School Date: 02-28-2020

C. On-Site Review (continued) (Slope Near Wetland)

Deep Observation Hole Number: TP-6

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color- Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-16"	Ap					top soil					
16"-36"	C1					fine sand					
36"-42"	Bw					X					
42"-120"	X					sand & gravel					

Additional Notes:

Redoximorphic features @ 60"

Water Weeping @ 66"

TP. El. 154.0+/-

No Refusal; Test Pit began collapsing

Commonwealth of Massachusetts
City/Town of

Form 11 - Soil Suitability Assessment for On-Site Sewage Disposal

Andover West Elementary School Date: 02-28-2020

C. On-Site Review (continued) (In Ball Field)

Deep Observation Hole Number: TP-7

Depth (in.)	Soil Horizon/ Layer	Soil Matrix: Color-Moist (Munsell)	Redoximorphic Features (mottles)			Soil Texture (USDA)	Coarse Fragments % by Volume		Soil Structure	Soil Consistence (Moist)	Other
			Depth	Color	Percent		Gravel	Cobbles & Stones			
0"-8"	Ap					top soil					
8"-66"	C1					fine sand					
66"-120"	Cd					loamy sand					

Additional Notes:

Redoximorphic features @ 24"

Water Weeping @ 48"

TP. El. 165.0+/-

Refusal @ 72"

APPENDIX B.2 – NOBIS BORING LOGS (B-1 SERIES)

BORING LOG

Project: West Andover Elementary School

Location: Andover, Massachusetts

Nobis Project No.: 96480.00

Boring No.: **B-1**

Boring Location: See Exploration Location Plan

Checked by: M. Ciance

Date Start: February 24, 2020

Date Finish: February 24, 2020

Contractor: Geosearch, Inc.

Driller: K. Byland

Nobis Rep.: J. Vanotti

Rig Type / Model: ATV Track Rig / CME 55

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 164

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	3-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▼ 02/24/20	10:30	11.3	OUT	22	10 minutes

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	22	0-2	4 6 7 5			TOPSOIL 163.1 / 0.9	S-1A (11"): Medium dense, dark brown, fine to medium SAND, some Silt, trace fine Gravel, few grass root fibers. Dry. (TOPSOIL).	
2								S-1B (11"): Medium dense, light brown, fine to medium SAND, little Silt, trace fine Gravel. Dry. (FILL).	1
3	S-2	17	2-4	5 3 4 7			FILL	S-2: Loose, light brown, fine to medium SAND, little Silt, trace fine Gravel. Dry. (FILL).	
4									
5							159.0 / 5.0		
6	S-3	18	5-7	6 12 13 14				S-3A (6"): Medium dense, orangish brown, fine to coarse SAND, little Silt, little fine Gravel, faint redoximorphic staining. Moist.	
7								S-3B (12"): Medium dense, light brown, fine to medium SAND, little Silt, trace fine Gravel. Dry.	
8	S-4	20	7-9	15 17 17 14				S-4: Dense, light brown, fine to medium SAND, little Silt. Dry.	
9									
10							SILTY SAND		
11	S-5	20	10-12	8 9 10 12	▼			S-5: Medium dense, light brown, fine to medium SAND and Silt. Wet.	
12									
13									
14									
15							149.0 / 15.0		
16	S-6	20	15-17	3 11 26 30				S-6: Dense, gray-brown, fine to coarse SAND, some Silt, little fine to coarse Gravel. Dry. (GLACIAL TILL).	
17									
18									
19							GLACIAL TILL		
20									
21	S-7	24	20-22	16 30 35 41				S-7: Very dense, gray, fine to coarse SAND, some Silt, little fine to coarse Gravel. Dry. (GLACIAL TILL).	
22							142.0 / 22.0		
23								Boring terminated at 22 feet.	
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spools to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:34 - J:\96480.00 - ANDOVER WEST ELEMENTARY SCHOOL - ANDOVER\SUBSURFACE INFORMATION\BORING LOGS\96480.00 BORING LOGS.GPJ

BORING LOG

Project: West Andover Elementary School

Location: Andover, Massachusetts

Nobis Project No.: 96480.00

Boring No.: **B-2**

Boring Location: See Exploration Location Plan

Checked by: M. Ciance

Date Start: February 24, 2020

Date Finish: February 24, 2020

Contractor: Geosearch, Inc.

Driller: K. Byland

Nobis Rep.: J. Vanotti

Rig Type / Model: ATV Track Rig / CME 55

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 165

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	3-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
02/24/20	00:00	Not Encountered	N/A	0.5	0 minutes

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	LITHOLOGY Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	5	0-0.4	60/5"			TOPSOIL 164.5 / 0.5	S-1: Very dense, brown, fine to medium SAND and Silt. very few grass root fibers, possible bedrock fragments in sample tip. Moist. (TOPSOIL).	1 2
2								Boring terminated at 0.5 feet on auger refusal.	
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.
2) Boring encountered shallow refusal, offset approximately 5-feet north and advanced Boring B-2A.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:34 - J:\96480.00 - ANDOVER WEST ELEMENTARY SCHOOL - ANDOVER\SUBSURFACE INFORMATION\BORING LOGS\96480.00 BORING LOGS.GPJ

BORING LOG

Project: West Andover Elementary School

Location: Andover, Massachusetts

Nobis Project No.: 96480.00

Boring No.: **B-2A**

Boring Location: See Exploration Location Plan

Checked by: M. Ciance

Date Start: February 24, 2020

Date Finish: February 24, 2020

Contractor: Geosearch, Inc.

Driller: K. Byland

Nobis Rep.: J. Vanotti

Rig Type / Model: ATV Track Rig / CME 55

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 165

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	3-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
02/24/20	00:00	Not Encountered	5	5	10 minutes

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	20	0-1.8	2 8 27 60/3"			TOPSOIL 164.2 / 0.8	S-1A (10"): Dense, dark brown, fine to medium SAND and Silt. few grass root fibers. Moist. (TOPSOIL).	1
2							GLACIAL TILL 163.0 / 2.0	S-1B (10"): Dense, gray-brown, fine to coarse SAND, some Silt, some fine to coarse Gravel. Dry. (GLACIAL TILL).	
3								Significant increase in drilling resistance from 2- to 3-feet; possible bedrock.	
4	S-2	4	3-3.3	60/4"			POSSIBLE WEATHERED BEDROCK	S-2: Very dense, gray-white-orange, fine to coarse SAND, some Silt, some fine to coarse Gravel, pulverized rock in sample tip, possible bedrock. Dry.	
5							160.0 / 5.0	Significant increase in drilling resistance from 3- to 5-feet; possible bedrock.	
6								Boring terminated at 5 feet on auger refusal.	
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:34 - J:\96480.00 - ANDOVER WEST ELEMENTARY SCHOOL - ANDOVER\SUBSURFACE INFORMATION\BORING LOGS\96480.00 BORING LOGS.GPJ

BORING LOG

Project: West Andover Elementary School

Location: Andover, Massachusetts

Nobis Project No.: 96480.00

Boring No.: **B-3 (OW)**

Boring Location: See Exploration Location Plan

Checked by: M. Ciance

Date Start: February 24, 2020

Date Finish: February 24, 2020

Contractor: Geosearch, Inc.

Driller: K. Byland

Nobis Rep.: J. Vanotti

Rig Type / Model: ATV Track Rig / CME 55

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 166

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	3-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 02/24/20	12:00	7	7	9	0 minutes
▽ 02/25/20	12:34	3.1	WELL	15.4	24 hours
▼ 02/27/20	13:35	2.5	WELL	15.4	48 hours

Depth (ft.)	Sample Info: Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Lithology: Graphic	Lithology: Stratum Elev. / Depth (ft.)	Sample Description and Remarks (Classification System: Modified Burmister)	Well Detail	Notes
1	S-1	24	0-2	2 4			TOPSOIL 165.3 / 0.7	S-1A (8"): Medium dense, dark brown, fine to medium SAND and Silt. very few grass root fibers. Moist. (TOPSOIL).	CUTTINGS AND ROADBOX	
2				8 13				S-1B (16"): Medium dense, light brown, fine to medium SAND, little Silt. Moist.		
3	S-2	19	2-4	17 38	▼			S-2: Very dense, light brown, fine to medium SAND, little Silt, trace fine Gravel, very few pulverized cobbles in sample. Dry.	2-INCH RISER PVC	
4				28 22	▽					
5									BENTONITE SEAL	
6	S-3	16	5-7	16 12			SILTY SAND	S-3: Medium dense, brown, fine to medium SAND, little fine to coarse Gravel, little Silt. Moist.	2-INCH RISER PVC	
7				14 12	▽					
8	S-4	16	7-9	7 10				S-4: Medium dense, brown, fine to medium SAND, little Silt, little fine to coarse Gravel. Wet.		
9				12 12						
10							156.0 / 10.0			
11	S-5	20	10-12	17 21				S-5: Dense, gray-brown, fine to coarse SAND, some Silt, little fine to coarse Gravel. Wet. (GLACIAL TILL).	2-INCH SLOTTED PVC	
12				25 26						
13										
14										
15										
16	S-6	23	15-17	16 28			GLACIAL TILL	S-6: Very dense, gray-brown, fine to coarse SAND, some Silt, little fine to coarse Gravel. Wet. (GLACIAL TILL).		1
17				32 34						
18										
19										
20										
21	S-7	19	20-21.8	22 33				S-7: Very dense, gray-brown, fine to coarse SAND, some Silt, little fine to coarse Gravel. Wet. (GLACIAL TILL).		
22				60 60/4"			144.2 / 21.8			
23								Boring terminated at 21.8 feet.		
24										
25										

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring completed as observation well.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:34 - J:\96480.00 - ANDOVER WEST ELEMENTARY SCHOOL - ANDOVER\SUBSURFACE INFORMATION\BORING LOGS\96480.00 BORING LOGS.GPJ

BORING LOG

Project: West Andover Elementary School

Location: Andover, Massachusetts

Nobis Project No.: 96480.00

Boring No.: **B-4**

Boring Location: See Exploration Location Plan

Checked by: M. Ciance

Date Start: February 24, 2020

Date Finish: February 24, 2020

Contractor: Geosearch, Inc.

Driller: K. Byland

Nobis Rep.: J. Vanotti

Rig Type / Model: ATV Track Rig / CME 55

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 156

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	3-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 02/24/20	14:30	7	7	9	Wet Sample
▼ 02/24/20	15:35	8.1	20	22	5 minutes

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	23	0-2	4 5			TOPSOIL	S-1: Medium dense, dark brown-black, fine to medium SAND and Silt, little fine to coarse Gravel, very few grass root fibers. Moist. (TOPSOIL).	1
2				6 5			154.0 / 2.0		
3	S-2	24	2-4	4 25				S-2: Medium dense, orangish brown, fine to coarse SAND, trace fine to coarse Gravel, trace Silt, faint redoximorphic staining. Moist.	
4				22 18					
5							SAND		
6	S-3	15	5-7	12 16				S-3: Medium dense, brown, fine to coarse SAND, little Silt, trace fine Gravel. Moist.	
7				12 15	▽		149.0 / 7.0		
8	S-4	20	7-9	10 10	▼			S-4: Medium dense, brown, fine to medium SAND, some Silt, trace fine Gravel. Wet.	
9				9 8					
10									
11	S-5	8	10-12	6 6			SILTY SAND	S-5: Medium dense, gray-brown, fine to medium SAND and Silt. Wet.	
12				12 14					
13									
14							142.0 / 14.0		
15								Significant increase in drilling resistance at approximately 14-feet.	
16	S-6	15	15-16.8	10 28				S-6: Very dense, gray-brown, fine to medium SAND, some Silt, trace fine to coarse Gravel. Wet. (GLACIAL TILL).	
17				35 60/4"					
18							GLACIAL TILL		
19									
20									
21	S-7	24	20-22	11 40				S-7: Very dense, gray, fine to medium SAND, some Silt, trace fine Gravel. Wet. (GLACIAL TILL).	
22				43 70			134.0 / 22.0		
23								Boring terminated at 22 feet.	
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:34 - J:\96480.00 - ANDOVER WEST ELEMENTARY SCHOOL - ANDOVER\SUBSURFACE INFORMATION\BORING LOGS\96480.00 BORING LOGS.GPJ

BORING LOG

Project: West Andover Elementary School

Location: Andover, Massachusetts

Nobis Project No.: 96480.00

Boring No.: **B-5**

Boring Location: See Exploration Location Plan

Checked by: M. Ciance

Date Start: February 25, 2020

Date Finish: February 25, 2020

Contractor: Geosearch, Inc.

Driller: K. Byland

Nobis Rep.: J. Vanotti

Rig Type / Model: ATV Track Rig / CME 55

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 158

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	3-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 02/25/20	06:46	7	7	9	wet sample
▼ 02/25/20	07:38	7.9	20	22	5 minutes

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	18	0-2	6 8			TOPSOIL 157.3 / 0.7	S-1A (8"): Medium dense, dark brown, fine to medium SAND and Silt. very few grass root fibers. Moist. (TOPSOIL).	1
2				12 6				S-1B (10"): Medium dense, brown, fine to medium SAND, some Silt, trace fine to coarse Gravel. Dry. (FILL).	
3	S-2	13	2-4	6 4			FILL	S-2: Medium dense, brown, fine to medium SAND, some Silt, trace fine to coarse Gravel. Dry. (FILL).	
4				6 5					
5									
6	S-3	18	5-6.8	9 18			152.5 / 5.5	S-3A (6"): Dense, brown, fine to medium SAND, little Silt, trace fine to coarse Gravel. Dry. (FILL).	
7				21 60/3"	▽			S-3B (12"): Dense, light brown-gray, fine to medium SAND, little Silt, trace fine Gravel. Dry.	
8	S-4	18	7-9	10 8	▼		SILTY SAND	Significant increase in drilling resistance 6.8- to 7-feet. S-4: Medium dense, brown, fine to coarse SAND, some Silt, trace fine Gravel, faint redoximorphic staining. Wet.	
9				9 9					
10									
11	S-5	22	10-12	15 19			146.9 / 11.1	S-5A (13"): Dense, brown, fine to coarse SAND, some Silt, trace fine to coarse Gravel. Wet.	
12				21 32				S-5B (9"): Dense, gray, fine to medium SAND, some Silt, trace fine Gravel, trace Clay. Dry. (GLACIAL TILL).	
13									
14									
15									
16	S-6	23	15-17	15 19			GLACIAL TILL	S-6: Dense, gray, fine to coarse SAND, some Silt, trace fine to coarse Gravel, trace Clay. Dry. (GLACIAL TILL).	
17				24 36					
18									
19									
20									
21	S-7	22	20-22	6 32				S-7: Very dense, gray, fine to coarse SAND, some Silt, trace fine Gravel. Wet. (GLACIAL TILL).	
22				38 32			136.0 / 22.0		
23								Boring terminated at 22 feet.	
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

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BORING LOG

nobis

Project: West Andover Elementary School

Location: Andover, Massachusetts

Nobis Project No.: 96480.00

Boring No.: **B-6**

Boring Location: See Exploration Location Plan

Checked by: M. Ciance

Date Start: February 25, 2020

Date Finish: February 25, 2020

Contractor: Geosearch, Inc.

Driller: K. Byland

Nobis Rep.: J. Vanotti

Rig Type / Model: ATV Track Rig / CME 55

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 157

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	3-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 02/25/20	09:15	8	8	10	wet sample
▼ 02/25/20	10:15	7.7	20	22	10 minutes

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	23	0-2	4 10			TOPSOIL 156.1 / 0.9	S-1A (11"): Medium dense, dark brown, fine to medium SAND, some Silt, trace fine Gravel, very few grass root fibers. Dry. (TOPSOIL).	1
2				10 6			FILL	S-1B (12"): Medium dense, brown, fine to coarse SAND, some fine to coarse Gravel, trace Silt. Dry. (FILL).	
3	S-2	16	2-4	9 11			154.2 / 2.8	S-2A (10"): Medium dense, brown, fine to coarse SAND, some fine to coarse Gravel, trace Silt. Dry. (FILL).	
4				11 16				S-2B (6"): Medium dense, orangish brown-gray, fine to medium SAND and Silt, little fine to coarse Gravel, faint redoximorphic staining. Dry.	
5							SILTY SAND		
6	S-3	14	5-6.8	22 33				S-3: Dense, brown, fine to medium SAND, some Clayey Silt, trace fine Gravel. Dry.	
7				10 60/4"			150.2 / 6.8		
8					▽		BOULDERS/ COBBLES IN SILTY SAND 149.0 / 8.0	Significant drilling resistance from 6.8- to 8-feet. Possible cobbles/ boulders.	
9	S-4	18	8-10	8 12				S-4: Medium dense, light brown - dark brown, fine to coarse SAND, some Silt, little fine Gravel, with decomposed cobble/ rock in sample. Wet.	
10				11 14			SILTY SAND		
11	S-5	23	10-12	9 17			146.1 / 10.9	S-5A (11"): Dense, brown, fine to coarse SAND, some Silt, trace fine Gravel. Wet.	
12				22 26				S-5B (12"): Dense, gray-brown, fine to medium SAND, some Silt, trace fine to coarse Gravel. Dry. (GLACIAL TILL).	
13									
14									
15									
16	S-6	24	15-17	19 19				S-6: Dense, gray, fine to coarse SAND, some Silt, little fine to coarse Gravel. Wet. (GLACIAL TILL).	
17				31 35			GLACIAL TILL		
18									
19									
20									
21	S-7	21	20-22	27 48				S-7: Very dense, gray, fine to coarse SAND, some Silt, some fine to coarse Gravel. Wet. (GLACIAL TILL).	
22				51 61			135.0 / 22.0		
23								Boring terminated at 22 feet.	
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

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BORING LOG

Project: West Andover Elementary School

Location: Andover, Massachusetts

Nobis Project No.: 96480.00

Boring No.: **B-7 (OW)**

Boring Location: See Exploration Location Plan

Checked by: M. Ciance

Date Start: February 25, 2020

Date Finish: February 25, 2020

Contractor: Geosearch, Inc.

Driller: K. Byland

Nobis Rep.: J. Vanotti

Rig Type / Model: ATV Track Rig / CME 55

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 157

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	3-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 02/25/20	11:00	6	5	7	wet sample
▼ 02/27/20	12:15	3.3	WELL	16.2	47 hours

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	WELL DETAIL	NOTES
1	S-1	21	0-2	6 10			156.6 / 0.4 TOPSOIL	S-1A (5"): Medium dense, dark brown, fine to medium SAND and Silt. very few grass root fibers. Moist. (TOPSOIL).	CUTTINGS AND ROADBOX	
2				8 8				S-1B (16"): Medium dense, light brown, fine to medium SAND, some Silt, trace fine Gravel. Dry. (FILL).		
3	S-2	8	2-4	6 2				S-2: Loose, light brown, fine to medium SAND, some Silt, trace fine Gravel. Dry. (FILL).	2-INCH RISER PVC	
4				2 3	▼		FILL			
5									BENTONITE SEAL	
6	S-3	17	5-7	1 2	▽		151.0 / 6.0	S-3A (12"): Loose, brown, fine to medium SAND and Silt. Moist. (FILL).	2-INCH RISER PVC	
7				4 10				S-3B (5"): Loose, light brown, fine to coarse SAND, little Silt, trace fine Gravel. Wet.		
8	S-4	23	7-9	7 12				S-4: Medium dense, orangish brown, fine to coarse SAND, trace fine Gravel, trace Silt. Wet.		
9				13 11						
10										
11	S-5	14	10-12	7 12				S-5: Dense, orangish brown, fine to medium SAND, some Silt, little fine to coarse Gravel, faint redoximorphic staining. Wet.	2-INCH SLOTTED PVC	
12				18 24			SILTY SAND			
13										
14										
15										
16	S-6	18	15-17	10 16				S-6: Dense, light brown, fine to coarse SAND, some Silt, trace fine Gravel. Wet.		1
17				15 13			140.0 / 17.0			
18							WEATHERED BEDROCK 139.0 / 18.0	Increase in drilling resistance at approximately 17- to 18-feet. Possible bedrock.		
19								Boring terminated at 18 feet on auger refusal.		
20										
21										
22										
23										
24										
25										

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring completed as observation well.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

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BORING LOG

Project: West Andover Elementary School

Location: Andover, Massachusetts

Nobis Project No.: 96480.00

Boring No.: **B-8**

Boring Location: See Exploration Location Plan

Checked by: M. Ciance

Date Start: February 26, 2020

Date Finish: February 26, 2020

Contractor: Geosearch, Inc.

Driller: K. Byland

Nobis Rep.: J. Vanotti

Rig Type / Model: ATV Track Rig / CME 55

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 157

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	3-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 02/26/20	06:35	1	N/A	2	wet sample
▼ 02/26/20	07:40	6.7	20	20.9	5 minutes

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	20	0-2	2 24	▽		TOPSOIL 156.2 / 0.8	S-1A (9"): Dense, dark brown-black, fine to medium SAND and Silt. very few grass root fibers. Wet. (TOPSOIL).	1
2				19 12			SILTY SAND 155.0 / 2.0	S-1B (11"): Dense, orangish brown-gray, fine to coarse SAND, some fine to coarse Gravel, little Silt. Moist.	
3	S-2	12	2-4	17 25				S-2: Very dense, orangish brown-gray, fine to medium SAND, some Silt, little fine to coarse Gravel. Moist. (GLACIAL TILL).	
4				26 28					
5									
6	S-3	23	5-7	14 18				S-3: Dense, gray-brown, fine to medium SAND, some Silt, trace fine to coarse Gravel. Dry. (GLACIAL TILL).	
7				28 48	▼				
8	S-4	22	7-8.8	32 68				S-4: Very dense, gray, fine to medium SAND and Silt, trace fine to coarse Gravel. Dry. (GLACIAL TILL).	
9				81 60/4"					
10									
11	S-5	13	10-11.1	58 60				S-5: Very dense, gray, fine to medium SAND and Silt, trace fine to coarse Gravel. Dry. (GLACIAL TILL).	
12				60/1"			GLACIAL TILL	Significant drilling resistance from 11- to 14-feet.	
13									
14									
15									
16	S-6	17	15-16.4	19 44				S-6: Very dense, gray, fine to medium SAND, some Silt, little fine to coarse Gravel. Moist. (GLACIAL TILL).	
17				60/5"					
18									
19									
20									
21	S-7	11	20-20.9	36 60/5"			136.1 / 20.9	S-7: Very dense, gray, fine to coarse SAND, some Silt, little fine to coarse Gravel. Wet. (GLACIAL TILL).	
22								Boring terminated at 20.9 feet.	
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

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BORING LOG

nobis

Project: West Andover Elementary School

Location: Andover, Massachusetts

Nobis Project No.: 96480.00

Boring No.: **B-9 (OW)**

Boring Location: See Exploration Location Plan

Checked by: M. Ciance

Date Start: February 26, 2020

Date Finish: February 26, 2020

Contractor: Geosearch, Inc.

Driller: K. Byland

Nobis Rep.: J. Vanotti

Rig Type / Model: ATV Track Rig / CME 55

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 148

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	3-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 02/26/20	09:20	2	N/A	4	wet sample
▽ 02/26/20	09:50	8	10	10	0 hour
▼ 02/27/20	13:00	4.1	WELL	16.7	27 hours

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	WELL DETAIL	NOTES
1	S-1	11	0-2	2 2 3 5			TOPSOIL 147.4 / 0.6	S-1A (7"): Loose, dark brown, fine to medium SAND and Silt. very few grass root fibers. Moist. (TOPSOIL).	CUTTINGS AND ROADBOX	
2					▽		FILL 146.0 / 2.0	S-1B (4"): Loose, brown, fine to medium SAND and Silt. Moist. (FILL).		
3	S-2	22	2-4	7 8 9 11				S-2: Medium dense, light brown, fine to medium SAND, some Silt, very faint redoximorphic staining. Wet.	2-INCH RISER PVC	
4					▼				BENTONITE SEAL	
5										
6	S-3	17	5-7	8 10 9 9				S-3: Medium dense, gray-brown, fine to medium SAND, some Silt. Wet.	2-INCH RISER PVC	
7										
8	S-4	24	7-9	13 19 36 19	▽		SILTY SAND	S-4A (19"): Very dense, light brown, fine to medium SAND and Silt, trace fine to coarse Gravel. Wet.		
9								S-4B (5"): Very dense, gray-white, fine to coarse SAND, little fine to coarse Gravel, with decomposed rock or cobble. Wet.		
10										
11	S-5	18	10-12	12 18 13 14				S-5: Dense, orangish brown, fine to coarse SAND, some Silt, some fine to coarse Gravel. Wet.	2-INCH SLOTTED PVC	
12										
13							135.5 / 12.5	Significant increase in drilling resistance at approximately 12.5-feet.		
14										
15										
16	S-6	18	15-17	8 35 48 51				S-6: Very dense, gray-brown, fine to coarse SAND, some Silt, some fine to coarse Gravel. Wet. (GLACIAL TILL).		1
17							GLACIAL TILL			
18										
19										
20										
21	S-7	17	20-21.4	27 44 60/5"				S-7: Very dense, gray, fine to coarse SAND, some Silt, little fine to coarse Gravel. Wet. (GLACIAL TILL).		
22							126.6 / 21.4	Boring terminated at 21.4 feet.		
23										
24										
25										

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring completed as observation well.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

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BORING LOG

Project: West Andover Elementary School		Boring No.: **B-10 (OW)**
		Boring Location: See Exploration Location Plan
Location: Andover, Massachusetts		Checked by: M. Ciance
Nobis Project No.: 96480.00		Date Start: February 26, 2020
		Date Finish: February 26, 2020
Contractor: Geosearch, Inc.	Rig Type / Model: ATV Track Rig / CME 55	Ground Surface Elev.: (+/-) 161
Driller: K. Byland	Hammer Type: Automatic Hammer	
Nobis Rep.: J. Vanotti	Hammer Hoist: Automatic	Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	3-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 02/26/20	11:55	7.5	7	7.9	wet sample
▼ 02/27/20	11:50	0	WELL	8.7	24 hours

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	LITHOLOGY Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	WELL DETAIL	NOTES
1	S-1	23	0-2	5 3			TOPSOIL 160.3 / 0.7	S-1A (8"): Loose, dark brown, fine to medium SAND and Silt. very few grass root fibers. Moist. (TOPSOIL).	CUTTINGS AND ROADBOX	
2				5 9			FILL 159.0 / 2.0	S-1B (15"): Loose, brown, fine to coarse SAND, some Silt, some fine to coarse Gravel. Moist. (FILL).	2-INCH RISER PVC	
3	S-2	18	2-4	20 19				S-2: Dense, orangish brown-gray, fine to coarse SAND, little fine to coarse Gravel, little Silt, very faint redoximorphic staining. Wet.	BENTONITE SEAL	
4				20 19			SILTY SAND 156.0 / 5.0			
5										
6	S-3	14	5-7	15 22				S-3: Dense, gray-brown, fine to coarse SAND and Gravel, some Silt, very faint redoximorphic staining. Moist. (GLACIAL TILL).	2-INCH SLOTTED PVC	
7				17 17			GLACIAL TILL			
8	S-4	8	7-7.9	11 60/5"	▽		152.4 / 8.6	S-4: Very dense, gray-brown, fine to coarse SAND, some Silt, little fine to coarse Gravel. Wet. (GLACIAL TILL). Significant increase in drilling resistance 7.9- to 8.5-feet.		
9	S-5	1	8.5-8.6	60/1"				S-5: Very dense, gray-brown-white, fine to coarse GRAVEL, possible bedrock fragments. Wet.		1
10								Boring terminated at 8.6 feet on auger refusal.		
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring completed as observation well.
2) Stabilized GW observation reading on 2/27/20 - likely perched condition due to heavy rains and ponding water at ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

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BORING LOG

Project: West Andover Elementary School

Location: Andover, Massachusetts

Nobis Project No.: 96480.00

Boring No.: **B-11**

Boring Location: See Exploration Location Plan

Checked by: M. Ciance

Date Start: February 27, 2020

Date Finish: February 27, 2020

Contractor: Geosearch, Inc.

Driller: K. Byland

Nobis Rep.: J. Vanotti

Rig Type / Model: ATV Track Rig / CME 55

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 156

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	3-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 02/27/20	07:15	8	7	9	west sample
▼ 02/27/20	07:55	7.3	20	22	5 minutes

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
							155.77 / 0.3	4 inches Asphalt.	1
1	S-1	14	0.5-2.5	11			ASPHALT	S-1: Medium dense, tan-brown, fine to coarse SAND, little fine to coarse Gravel, trace Silt. Moist. (FILL).	
2				15					
				15					
3	S-2	13	2.5-4.5	10			FILL	S-2: Dense, tan, fine to coarse SAND, little Gravel, trace Silt. Dry. (FILL).	
4				11					
				16					
5				19					
				60			151.0 / 5.0		
6	S-3	22	5-7	11				S-3: Medium dense, gray, fine to medium SAND, some Silt. Dry.	
				9					
7				10					
				6					
8	S-4	12	7-9	8	▼ ▽		SILTY SAND	S-4: Medium dense, gray-brown, fine to medium SAND, some Silt, little fine to coarse Gravel, very faint redoximorphic staining. Moist.	
				8					
9				14					
				12					
10							146.0 / 10.0		
11	S-5	24	10-12	32				S-5: Very dense, gray, fine to medium SAND, some Silt, trace fine to coarse Gravel. Dry. (GLACIAL TILL).	
				39					
12				44					
				36					
13									
14									
15									
16	S-6	23	15-16.9	21			GLACIAL TILL	S-6: Very dense, gray, fine to medium SAND, some Silt, little fine to coarse Gravel. Dry. (GLACIAL TILL).	
				32					
17				32					
				60/5"					
18									
19									
20									
21	S-7	24	20-22	27				S-7: Very dense, gray, fine to medium SAND, some Silt, trace fine Gravel. Dry. (GLACIAL TILL).	
				36					
22				37					
				48			134.0 / 22.0		
23								Boring terminated at 22 feet.	
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils and finished at ground surface with asphalt cold patch.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:34 - J:\96480.00 - ANDOVER WEST ELEMENTARY SCHOOL - ANDOVER\SUBSURFACE INFORMATION\BORING LOGS\96480.00 BORING LOGS.GPJ

BORING LOG

Project:	West Andover Elementary School	Boring No.:	**B-12**
Location:	Andover, Massachusetts	Boring Location:	See Exploration Location Plan
Nobis Project No.:	96480.00	Checked by:	M. Ciance
Contractor:	Geosearch, Inc.	Date Start:	February 27, 2020
Driller:	K. Byland	Date Finish:	February 27, 2020
Nobis Rep.:	J. Vanotti	Rig Type / Model:	ATV Track Rig / CME 55
Hammer Type:	Automatic Hammer	Ground Surface Elev.:	(+/-) 154
Hammer Hoist:	Automatic	Datum:	NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	3-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations					
Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 02/27/20	09:06	5	5	7	wet sample

Depth (ft.)	Sample Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	21	0-2	6 3 3 3			TOPSOIL 152.3 / 1.7	S-1: Loose, dark brown, fine to coarse SAND, some Silt, trace fine Gravel. Dry. (TOPSOIL).	1
3	S-2	11	2-4	5 6 18 16			FILL 149.0 / 5.0	S-2: Medium dense, brown, fine to coarse SAND, little fine to coarse Gravel, trace Silt. Dry. (FILL).	
6	S-3	19	5-7	17 22 24 23	▽		SILTY SAND 139.0 / 15.0	S-3: Dense, gray, fine to medium SAND, some Silt, trace fine Gravel. Wet.	
11	S-4	22	10-12	6 15 13 16				S-4: Medium dense, orangish brown-gray, fine to coarse SAND, some Silt, trace fine Gravel, strong redoximorphic staining. Wet.	
16	S-5	12	15-17	10 26 23 35			GLACIAL TILL 132.0 / 22.0	S-5: Dense, gray, fine to medium SAND, some Silt, trace fine Gravel. Dry. (GLACIAL TILL).	
21	S-6	9	20-22	15 25 30 44				S-6: Very dense, gray, fine to medium SAND, some Silt, trace fine Gravel. Wet. (GLACIAL TILL).	
23								Boring terminated at 22 feet.	

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:34 - J:\96480.00 - ANDOVER WEST ELEMENTARY SCHOOL - ANDOVER\SUBSURFACE INFORMATION\BORING LOGS\96480.00 BORING LOGS.GPJ

BORING LOG

Project: West Andover Elementary School

Location: Andover, Massachusetts

Nobis Project No.: 96480.00

Boring No.: **B-13**

Boring Location: See Exploration Location Plan

Checked by: M. Ciance

Date Start: February 27, 2020

Date Finish: February 27, 2020

Contractor: Geosearch, Inc.

Driller: K. Byland

Nobis Rep.: J. Vanotti

Rig Type / Model: ATV Track Rig / CME 55

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 166

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	3-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 02/27/20	11:00	7	7	9	wet sample
▼ 02/27/20	11:20	6.4	12	12	5 minutes

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	21	0-2	2 2			165.6 / 0.4 TOPSOIL	S-1A (5"): Loose, dark brown, fine to medium SAND and Silt. very few grass root fibers. Moist. (TOPSOIL).	1
2				7 12				S-1B (16"): Loose, tan, fine to medium SAND, some Silt. Moist.	
3	S-2	18	2-4	10 17			SILTY SAND	S-2: Dense, orangish brown, fine to coarse SAND, some Silt, little fine to coarse Gravel. Moist.	
4				20 22					
5							161.0 / 5.0		
6	S-3	22	5-7	13 22				S-3: Very dense, gray-brown, SILT and fine to medium Sand. Dry. (GLACIAL TILL).	
7				30 28	▼ ▽				
8	S-4	16	7-9	6 16			GLACIAL TILL	S-4: Very dense, gray-brown, fine to medium SAND, some Silt, trace fine Gravel. Wet. (GLACIAL TILL).	
9				34 32					
10									
11	S-5	20	10-11.8	11 24				S-5: Very dense, gray-brown, fine to medium SAND, some Silt, trace fine Gravel. Wet. (GLACIAL TILL).	
12				40 60/4"			154.2 / 11.8 154.0 / 12.0		
13							POSSIBLE BEDROCK	Significant increase in drilling resistance from 11.8- to 12-feet. Possible bedrock. Boring terminated at 12 feet on auger refusal.	
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:34 - J:\96480.00 - ANDOVER WEST ELEMENTARY SCHOOL - ANDOVER\SUBSURFACE INFORMATION\BORING LOGS\96480.00 BORING LOGS.GPJ

APPENDIX B.3 – NOBIS BORING LOGS (B-101 SERIES)

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-101**

Boring Location: See exploration location plan.

Checked by: S. Carter

Date Start: August 24, 2021

Date Finish: August 24, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 155

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/24/21	14:25	3.8	0	15	10 min

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	20	0-2	1 3			TOPSOIL 154.0 / 1.0	S-1A (7"): Loose, brown, Organic SILT and fine to coarse Sand. Moist. (TOPSOIL).	
2				5 5			FILL 152.5 / 2.5	S-1B (13"): Loose, light brown, fine to coarse SAND, little fine Gravel, little Silt. Moist. (FILL).	
3	S-2	18	2-4	3 3			TOPSOIL 151.5 / 3.5	S-2A (5"): Loose, light brown, fine to coarse SAND, little fine Gravel, little Silt. Moist. (FILL). S-2B (10"): Loose, dark brown, Organic SILT, some fine to coarse Sand. Moist. (TOPSOIL).	
4				2 7	▽			S-2C (3"): Loose, tan, fine to coarse SAND, little Silt, trace fine to coarse Gravel. Wet.	
5	S-3	18	4-6	10 15				S-3A (12"): Dense, tan, fine to coarse SAND, trace fine to coarse Gravel, trace Silt. Redoximorphic staining present Wet.	
6				20 17				S-3B (6"): Dense, tan, fine to coarse GRAVEL and fine to coarse Sand, trace Silt. Wet.	
7	S-4	24	6-8	7 12				S-4A (18"): Medium dense, tan, fine to medium SAND, little Silt. Wet.	
8				14 18				S-4B (6"): Medium dense, tan, SILT and fine Sand. Wet.	
9	S-5	24	8-10	8 13			SAND	S-5A (12"): Medium dense, tan, fine to medium SAND, little Silt. Wet.	
10				14 15				S-5B (12"): Medium dense, tan, fine to coarse SAND, little fine Gravel, little Silt. Wet.	
11	S-6	24	10-12	3 17				S-6: Dense, tan, fine to coarse SAND, some Silt. Redoximorphic staining. Gray Silty CLAY in tip sampler. Wet.	
12				16 10					
13									
14							141.0 / 14.0	Boring terminated due to "blow-in" in auger.	
15								Boring terminated at 14 feet.	1
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:21 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-102**

Boring Location: See exploration location plan.

Checked by: S. Carter

Date Start: August 24, 2021

Date Finish: August 24, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 156.5

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/24/21	12:45	7	10	20.8	40 min

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	17	0-2	41 10			156.27 / 0.3 ASPHALT	S-1A (4"): Approximately 4 inches of asphalt pavement. (ASPHALT). S-1B (13"): Medium dense, brown, fine to coarse SAND, some Silt, little fine to coarse Gravel. Moist.	
2				8 9					
3	S-2	17	2-4	11 14				S-2A (11"): Medium dense, tan, fine to coarse SAND and fine to coarse Gravel, little Silt. Moist. S-2B (6"): Medium dense, brown, fine to coarse SAND, some fine to coarse Gravel, little Silt. Moist to wet.	
4				11 13					
5	S-3	18	4-6	11 10				S-3: Medium dense, brown, fine to coarse SAND, little Silt, trace fine to coarse Gravel. Wet.	
6				11 14					
7	S-4	20	6-8	10 10	▽			S-4: Medium dense, tan, fine to coarse SAND and Silt, trace fine Gravel. Wet.	
8				11 10			SAND		
9	S-5	16	8-10	25 38				S-5: Very dense, tan, fine to coarse SAND, little fine to coarse Gravel, little Silt, frequent cobbles. Wet.	
10				22 22					
11	S-6	24	10-12	8 13				S-6: Dense, tan, fine to coarse SAND, some Silt, little fine to coarse Gravel. Wet.	
12				16 16					
13									
14									
15							141.5 / 15.0		
16	S-7	18	15-17	23 27				S-7: Very dense, gray, fine to coarse SAND and fine to coarse Gravel, some Silt. Wet. (GLACIAL TILL).	
17				35 47					
18							GLACIAL TILL		
19									
20									
21	S-8	10	20-20.8	52 70/4"			135.7 / 20.8	S-8: Very dense, gray, fine to coarse SAND and Silt, little fine to coarse Gravel. Wet. (GLACIAL TILL).	
22								Boring terminated at 20.8 feet.	1
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface. Pavement repaired with asphalt coldpatch.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:21 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-103**

Boring Location: See exploration location plan.

Checked by: S. Carter

Date Start: August 24, 2021

Date Finish: August 24, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 159

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/24/21	08:50	4	20	22	0 min

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	15	0-2	2 1				S-1: Very soft, dark brown, Organic SILT, some fine to coarse Sand, numerous bark mulch fragments. Wet. (FILL).	
2				1 2			TOPSOIL		
3	S-2	19	2-4	3 10			156.5 / 2.5	S-2A (3"): Very soft, dark brown, Organic SILT, some fine to coarse Sand, numerous bark mulch fragments. Wet. (FILL).	
4				12 14	▽			S-2B (4"): Medium dense, tan, fine to coarse SAND, little fine to coarse Gravel, trace Silt. Moist.	
5	S-3	13	4-6	10 8				S-3: Medium dense, tan, fine to coarse SAND, little fine to coarse Gravel, trace Silt. Moist to wet.	
6				7 9					
7	S-4	16	6-8	15 16				S-4A (6"): Dense, tan, fine to coarse SAND, little fine to coarse Gravel, trace Silt. Wet. S-4B (10"): Dense, tan, fine to coarse SAND, some fine Gravel, little Silt. Wet.	
8				16 25					
9	S-5	8	8-10	5 11			SAND	S-5: Medium dense, tan, fine to coarse SAND, some fine to coarse Gravel, some Silt. Wet.	
10				13 12					
11	S-6	24	10-12	5 7				S-6A (22"): Medium dense, tan, fine to coarse SAND, some Silt, little fine to coarse Gravel. Redoximorphic staining present. Wet.	
12				8 9				S-6B (2"): Medium dense, tan, fine to coarse SAND and Silt. Wet.	
13									
14									
15							144.0 / 15.0		
16	S-7	24	15-17	24 34				S-7A (8"): Very dense, tan-gray, fine to coarse GRAVEL and fine to coarse Sand, some Silt. Wet. (GLACIAL TILL). S-7B (7"): Very dense, tan-gray, SILT and fine to coarse Sand. Wet. (GLACIAL TILL).	
17				47 45				S-7C (7"): Very dense, gray, fine to coarse SAND and fine to coarse Gravel, some Silt. Wet. (GLACIAL TILL).	
18									
19							GLACIAL TILL		
20									
21	S-8		20-22	40 24				S-8: Very dense, tan-gray, fine to coarse SAND and fine to coarse Gravel, some Silt. Wet. (GLACIAL TILL).	
22				46 45			137.0 / 22.0		
23								Boring terminated at 22 feet.	1
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:21 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-104**

Boring Location: See exploration location plan.

Checked by: S. Carter

Date Start: August 17, 2021

Date Finish: August 17, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 159

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/17/21	10:05	13	20	23	10 min

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	14	0-2	39 9			ASPHALT 158.5 / 0.5	S-1A (6"): Approximately 6 inches of asphalt pavement. (ASPHALT).	
2				8 10			FILL	S-1B (8"): Medium dense, brown, fine to coarse SAND, some fine to coarse Gravel, little Silt. Moist. (FILL).	
3	S-2	18	2-4	9 10			156.5 / 2.5	S-2A (4"): Medium dense, brown, fine to coarse SAND, some fine to coarse Gravel, little Silt. Moist. (FILL).	
4				8 10				S-2B (14"): Medium dense, light gray, fine to coarse SAND, some fine to coarse Gravel, little Silt. Moist.	
5	S-3	19	4-6	11 17			SAND	S-3: Dense, gray-tan, fine to coarse SAND, some fine to coarse Gravel, trace Silt. Moist.	1
6				14 13			153.0 / 6.0		
7	S-4	21	6-8	12 16				S-4: Dense, gray-tan, fine to coarse SAND, some fine to coarse Gravel, some Silt. Moist to wet. (GLACIAL TILL).	
8				15 15					
9	S-5	17	8-10	18 18				S-5: Very dense, gray-tan, fine to coarse SAND, some fine to coarse Gravel, little Silt, few weathered cobbles. Wet. (GLACIAL TILL).	
10				40 35					
11	S-6	21	10-12	9 15				S-6: Dense, tan, fine to coarse SAND, some fine to coarse Gravel, some Silt, few cobbles. Wet. (GLACIAL TILL).	
12				16 25					
13					▽				
14									
15							GLACIAL TILL		
16	S-7	23	15-17	24 29				S-7: Very dense, gray-tan, fine to coarse SAND, some fine to coarse Gravel, some Silt, few cobbles. Wet. (GLACIAL TILL).	
17				27 21					
18									
19									
20									
21	S-8	1	20-20.2	100/2"				S-8: Very dense, tan, fine to coarse GRAVEL and fine to coarse Sand, trace Silt. Wet. (GLACIAL TILL).	
22									
23							136.0 / 23.0		
24								Boring terminated at 23 feet on auger refusal.	2
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) S-3, S-4 and S-5 may have artificially high blow counts due to lack of augering prior to 10 feet bgs.
2) Boring backfilled with drilling spoils to approximate ground surface. Pavement repaired with asphalt coldpatch.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:21 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-105**

Boring Location: See exploration location plan.

Checked by: S. Carter

Date Start: August 17, 2021

Date Finish: August 17, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 162

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/17/21	11:26	7.5	12.5	12.5	10 min

Depth (ft.)	Sample Info: Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Lithology: Graphic	Stratum Elev. / Depth (ft.)	Sample Description and Remarks (Classification System: Modified Burmister)	Notes
1	S-1	18	0-2	39			ASPHALT 161.5 / 0.5	S-1A (6"): Approximately 6 inches of asphalt pavement. (ASPHALT).	
				8				S-1B (5"): Medium dense, brown, fine to coarse SAND and fine to coarse Gravel, little Silt. Moist. (FILL).	
2				4				S-1C (7"): Medium dense, tan-brown, fine to coarse SAND, trace fine to coarse Gravel, trace Silt. Moist. (FILL).	
				3					
3	S-2	15	2-4	4			FILL	S-2: Medium dense, brown, fine to coarse SAND, some fine to coarse Gravel, little Silt. Moist. (FILL). [Laboratory Analysis - Particle Size Analysis (Sieve Only): Gravel = 29.4%, Sand = 58.3%, Silt & Clay = 12.3%].	
				9					
4				8					
				10			158.0 / 4.0		
5	S-3	18	4-6	5				S-3: Medium dense, tan-gray, fine to coarse SAND, some fine to coarse Gravel, some Silt. Redoximorphic staining present Moist.	
				9					
6				11					
				12					
7	S-4	22	6-8	28				S-4: Dense, tan-gray, fine to coarse SAND and fine to coarse Gravel, some Silt, few cobbles. Moist to wet.	
				22					
8				22	▽				
				24			SAND		
9	S-5	19	8-10	8				S-5: Medium dense, gray-tan, fine to coarse SAND, some Silt, little fine to coarse Gravel, few cobbles. Wet.	
				11					
10				18					
				18					
11	S-6	15	10-12	7				S-6A (13"): Dense, tan, fine to coarse SAND, some Silt, little fine to coarse Gravel, few cobbles. Wet.	
				19					
12				23			150.5 / 11.5		
				60			WEATHERED BEDROCK 149.5 / 12.5	S-6B (2"): Very dense, WEATHERED BEDROCK.	
13								Boring terminated at 12.5 feet on auger refusal.	1
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface. Pavement repaired with asphalt coldpatch.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:21 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-106**

Boring Location: See exploration location plan.

Checked by: S. Carter

Date Start: August 17, 2021

Date Finish: August 17, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 161

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/17/21	14:00	8	19	19	10 min

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	18	0-2	36 12			160.7 / 0.3 ASPHALT	S-1A (3"): Approximately 3 inches of asphalt pavement. (ASPHALT). S-1B (15"): Medium dense, brown, fine to coarse SAND, some fine to coarse Gravel, little Silt. Moist. (FILL).	
2				12 13			FILL		
3	S-2	16	2-4	12 20				S-2A (15"): Dense, brown, fine to coarse SAND, little fine to coarse Gravel, trace Silt. Moist. (FILL). [Laboratory Analysis - Particle Size Analysis (Sieve Only): Gravel = 16.9%, Sand = 75.3%, Silt & Clay = 7.8%].	
4				18 19			157.0 / 4.0	S-2B (1"): Dense, tan, fine to coarse SAND, some fine to coarse Gravel, some Silt. Moist. (FILL).	
5	S-3	15	4-6	6 20				S-3: Dense, tan, fine to coarse SAND, some fine to coarse Gravel, some Silt, few cobbles. Moist.	
6				40 18					
7	S-4	24	6-8	12 16				S-4: Dense, tan, fine to coarse SAND, some fine to coarse Gravel, some Silt, very few cobbles. Moist to wet.	
8				25 33	▽				
9	S-5	18	8-10	13 24				S-5: Dense, tan, fine to coarse SAND, some fine to coarse Gravel, some Silt, few cobbles. Wet.	
10				20 22			GLACIAL TILL		
11	S-6	16	10-12	27 23				S-6: Dense, gray-tan, fine to coarse SAND, some Silt, little fine to coarse Gravel, few weathered cobbles. Wet.	
12				18 13					
13									
14									
15							146.0 / 15.0		
16	S-7	19	15-17	22 72				S-7: Very dense, light tan and orange, WEATHERED BEDROCK. Wet.	
17				48 27			WEATHERED BEDROCK		
18									
19							142.0 / 19.0		
20								Boring terminated at 19 feet on auger refusal.	1
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface. Pavement repaired with asphalt coldpatch.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-107**

Boring Location: See exploration location plan.

Checked by: S. Carter

Date Start: August 17, 2021

Date Finish: August 17, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 160

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/17/21	15:00	2.5	0	6.7	15 min

Depth (ft.)	Sample Type & No.	Rec (in.)	Sample Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	15	0-2	1 3			TOPSOIL 159.5 / 0.5	S-1A (6"): Loose, brown, fine to coarse SAND, and Organic Silt, numerous fine roots. Moist. (TOPSOIL).	
2				5 5				S-1B (8"): Loose, brown, fine to coarse SAND, some fine to coarse Gravel, little Silt. Moist.	
3	S-2	22	2-4	10 18	▽			S-2: Dense, tan, fine to coarse SAND, some fine to coarse Gravel, some Silt. Moist.	
4				22 18			SAND		
5	S-3	13	4-6	11 12				S-3: Dense, tan, fine to coarse GRAVEL, some fine to coarse Sand, little Silt. Wet.	
6				19 34					
7	S-4	6	6-6.7	30 50/2"			153.3 / 6.7	Boring terminated at 6.7 feet on auger refusal.	1
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-108**

Boring Location: See exploration location plan.

Checked by: S. Carter

Date Start: August 24, 2021

Date Finish: August 24, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 161.5

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/24/21	10:00	2	15	16	0 min

Depth (ft.)	Sample Type & No.	Rec (in.)	Sample Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	14	0-2	1 1			TOPSOIL 160.5 / 1.0	S-1A (7"): Loose, brown, Organic SILT and fine to coarse Sand. Moist. (TOPSOIL).	
2				3 5	▽		FILL 159.5 / 2.0	S-1B (7"): Loose, tan, fine to coarse SAND, little Silt, trace fine Gravel. Moist to wet. (FILL).	
3	S-2	16	2-4	4 5			TOPSOIL 158.5 / 3.0	S-2A (7"): Medium dense, gray-brown, fine to coarse SAND, and Organic Silt. Wet. (TOPSOIL).	
4				9 11				S-2B (9"): Medium dense, tan, fine to coarse SAND and Silt, trace fine Gravel. Wet.	
5	S-3	19	4-6	10 6				S-3: Medium dense, tan, fine to coarse SAND, some Silt, trace fine Gravel. Wet.	
6				6 11					
7	S-4	19	6-8	4 10				S-4: Medium dense, tan, fine to coarse SAND, some Silt, little fine to coarse Gravel. Wet.	
8				11 12					
9	S-5	17	8-10	7 8			SAND	S-5: Medium dense, tan, fine to coarse SAND, some Silt, little fine to coarse Gravel. Wet.	
10				17 20					
11	S-6	10	10-11	27 100				S-6: Very dense, tan, fine to coarse SAND and Silt, some fine to coarse Gravel. Wet.	
12									
13									
14									
15							146.5 / 15.0		
16	S-7	6	15-15.5	100			WEATHERED BEDROCK 145.5 / 16.0	S-7: Very dense, gray-brown, WEATHERED BEDROCK. Wet.	
17								Boring terminated at 16 feet on auger refusal.	1
18									
19									
20									
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-109**

Boring Location: See exploration location plan.

Checked by: S. Carter

Date Start: August 20, 2021

Date Finish: August 21, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 164

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/20/21	14:40	7.5	8	9	0 min

Depth (ft.)	Sample Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	Sample Description and Remarks (Classification System: Modified Burmister)	Notes
1	S-1	14	0-2	2 3				S-1A (7"): Loose, brown, Organic SILT and fine to coarse Sand. Wet. (FILL).	
2				6 7				S-1B (7"): Loose, brown, fine to coarse SAND and Silt, some fine to coarse Gravel. Wet. (FILL).	
3	S-2	15	2-4	14 14			FILL	S-2: Medium dense, brown, fine to coarse SAND, some Silt. Wet. (FILL). [Laboratory Analysis - Particle Size Analysis (Sieve Only): Gravel = 1.5%, Sand = 64.7%, Silt & Clay = 33.8%].	
4				15 17			160.0 / 4.0		
5	S-3	24	4-6	12 16				S-3: Dense, tan, fine to coarse SAND, some Silt, trace fine Gravel. Wet. [Laboratory Analysis - Particle Size Analysis (Sieve Only): Gravel = 7.4%, Sand = 63.1%, Silt & Clay = 29.5%].	
6				17 19			SAND		
7	S-4	15	6-8	13 16				S-4: Medium dense, tan, fine to coarse SAND, some Silt, little fine to coarse Gravel. Wet.	
8				12 13	▽		156.0 / 8.0		
9	S-5	5	8-8.4	100/5"			WEATHERED BEDROCK 155.0 / 9.0	S-5: Very dense, WEATHERED BEDROCK.	
10								Boring terminated at 9 feet on auger refusal.	1
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-110**

Boring Location: See exploration location plan.

Checked by: S. Carter

Date Start: August 18, 2021

Date Finish: August 18, 2021

Contractor: New England Boring Contractors

Driller: J. Jalutkewicz

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 165

Datum: NAVD 88

	Drilling Method	Sampler
Type	Casing	Split-Spoon
Size ID (in.)	4	1-3/8
Advancement	Drive and Wash	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/18/21	09:45	5	6	12	5 min

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	REC % / RQD %	Ground Water	LITHOLOGY Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	17	0-2	2 3				TOPSOIL 164.5 / 0.5	S-1A (3"): Medium dense, brown, fine to coarse SAND, and Organic Silt, numerous fine roots. Moist. (TOPSOIL).	
2				7 8					S-1B (14"): Medium dense, brown to tan, fine to coarse SAND, some Silt, trace fine to coarse Gravel. Moist.	
3	S-2	17	2-4	12 15				SAND	S-2: Very dense, tan, fine to coarse SAND, some Silt, few cobbles. Moist to wet. [Laboratory Analysis - Particle Size Analysis (Sieve Only): Gravel = 3.9%, Sand = 67.1%, Silt & Clay = 29.0%].	
4				35 55				161.0 / 4.0		
5	S-3	16	4-5.4	83 62		▽		WEATHERED BEDROCK	S-3: Very dense, WEATHERED BEDROCK.	
6				50/5"						
7	S-4	4	6-6.4	100/5"				158.0 / 7.0	S-4: Very dense, WEATHERED BEDROCK.	
8	C-1	48	7-12		80/23			BEDROCK	C-1: Moderately Hard, moderately weathered, moderately to extremely fractured, light gray, fine to medium grained, GRANITE, horizontal to steep joint angles.	
9										
10										
11										
12								153.0 / 12.0		
13									Boring terminated at 12 feet.	1
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/30/21 14:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-111 (OW)**

Boring Location: See exploration location plan.

Checked by: S. Carter

Date Start: August 18, 2021

Date Finish: August 18, 2021

Contractor: New England Boring Contractors

Driller: J. Voight

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 166.5

Datum: NAVD 88

	Drilling Method	Sampler
Type	Casing	Split-Spoon
Size ID (in.)	4	1-3/8
Advancement	Drive and Wash	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/18/21	13:45	4	6	18	10 min

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	LITHOLOGY Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	WELL DETAIL	NOTES
1	S-1	18	0-2	1 3			TOPSOIL 165.5 / 1.0	S-1A (7"): Loose, brown, fine to coarse SAND, and Organic Silt, numerous fine roots. Moist. (TOPSOIL).		
2				6 9			SAND 164.0 / 2.5	S-1B (7"): Loose, tan, fine to coarse SAND, some fine to coarse Gravel, trace Silt. Moist.	CUTTINGS AND ROADBOX	
3	S-2	22	2-4	16 17				S-2A (7"): Dense, tan, fine to coarse SAND, some fine to coarse Gravel, trace Silt. Moist.		
4				17 22	▽			S-2B (15"): Dense, tan-gray, fine to coarse SAND and Silt. Moist to wet. (GLACIAL TILL). [Laboratory Analysis - Particle Size Analysis (Sieve Only): Gravel = 3.4%, Sand = 53.2%, Silt & Clay = 43.4%].	BENTONITE SEAL	
5	S-3	24	4-6	14 18				S-3: Dense, tan-gray, SILT and fine to coarse Sand. Redoximorphic staining on aggregate Wet. (GLACIAL TILL). [Laboratory Analysis - Particle Size Analysis (Sieve Only): Gravel = 4.8%, Sand = 46.3%, Silt & Clay = 48.9%].		
6				23 32				S-4: Very dense, tan-gray, fine to coarse SAND, some fine to coarse Gravel, some Silt. Redoximorphic staining on aggregate Wet. (GLACIAL TILL).		
7	S-4	22	6-8	23 37				S-5: Very dense, tan-gray, fine to coarse SAND, some fine to coarse Gravel, little Silt, few cobbles. Wet. (GLACIAL TILL).	2-INCH RISER PVC	
8				34 49					SILICA SAND	
9	S-5	21	8-10	20 30						
10				30 60						
11	S-6	16	10-12	90 36			GLACIAL TILL	S-6: Very dense, gray, fine to coarse SAND and Silt, some fine to coarse Gravel, few cobbles. Wet. (GLACIAL TILL).		
12				32 35						
13	S-7	22	12-14	19 37				S-7: Very dense, gray, fine to coarse SAND and Silt, some fine to coarse Gravel, few cobbles. Wet. (GLACIAL TILL).		
14				43 35						
15	S-8	23	14-16	23 43				S-8: Very dense, gray, fine to coarse SAND, some Silt, some fine to coarse Gravel. Wet. (GLACIAL TILL).		
16				64 96						
17									2-INCH SLOTTED PVC	
18								Increase in drilling resistance, possible weathered rock.		
19							147.5 / 19.0			
20								Boring terminated at 19 feet.		1
21										
22										
23										
24										
25										

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring completed as observation well.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-112**

Boring Location: See exploration location plan.

Checked by: S. Carter

Date Start: August 20, 2021

Date Finish: August 21, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 165.5

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/20/21	12:00	4	8	10.4	0 min

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	LITHOLOGY Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	8	0-2	2 3			TOPSOIL 165.0 / 0.5	S-1A (4"): Medium dense, brown, Organic SILT and fine to coarse Sand. Moist. (TOPSOIL).	
2				9 9				S-1B (4"): Medium dense, light brown, fine to coarse SAND, little Silt, little fine to coarse Gravel. Wet.	
3	S-2	18	2-4	9 11				S-2A (6"): Medium dense, light brown, fine to coarse SAND, little Silt, little fine to coarse Gravel. Wet. S-2B (12"): Medium dense, tan, fine to coarse SAND and Silt, little fine to coarse Gravel. Wet.	
4				17 20	▽			S-3: Dense, tan, fine to coarse SAND and Silt. Wet. [Laboratory Analysis - Particle Size Analysis (Sieve Only): Gravel = 1.5%, Sand = 57.5%, Silt & Clay = 41.0%].	
5	S-3	19	4-6	15 15			SAND		
6				19 23				S-4: Dense, tan, fine to coarse SAND and Silt. Wet.	
7	S-4	17	6-8	22 22					
8				21 16				S-5: Very dense, tan, fine to coarse SAND and Silt, little fine to coarse Gravel. Wet.	
9	S-5	8	8-9.3	8 17					
10				50/3"			156.2 / 9.3		
11	S-6	4	10-10.3	100/4"			WEATHERED BEDROCK 154.5 / 11.0	S-6: Very dense, WEATHERED BEDROCK.	
12								Boring terminated at 11 feet on auger refusal.	1
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-113**

Boring Location: See exploration location plan.

Checked by: S. Carter

Date Start: August 20, 2021

Date Finish: August 21, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 164.5

Datum: NAVD 88

	Drilling Method	Sampler
Type	Casing	Split-Spoon
Size ID (in.)	4	1-3/8
Advancement	Drive and Wash	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/20/21	10:00	1	20	20.5	5 min

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	15	0-2	1 2	▽		TOPSOIL 163.5 / 1.0	S-1A (6"): Loose, brown, Organic SILT and fine to coarse Sand. Wet. (TOPSOIL).	
2				4 3			FILL	S-1B (9"): Loose, brown, fine to coarse SAND, some Silt, little fine to coarse Gravel. Wet. (FILL).	
3	S-2	4	2-4	4 3				S-2: Loose, brown, fine to coarse SAND, some Silt, little fine to coarse Gravel. Wet. (FILL).	
4				3 4			160.5 / 4.0		
5	S-3	8	4-6	1 2			TOPSOIL	S-3: Loose, brown, fine to coarse SAND, some Silt, trace Gravel, with organics. Wet. (TOPSOIL). [Laboratory Analysis - Particle Size Analysis (Sieve Only): Gravel = 8.1%, Sand = 59.0%, Silt & Clay = 32.9%].	
6				5 7			158.5 / 6.0		
7	S-4	18	6-8	10 17			SAND	S-4: Dense, tan, fine to coarse SAND, some fine to coarse Gravel, little Silt. Wet.	
8				23 21					
9	S-5	10	8-10	9 15				S-5A (6"): Dense, tan, fine to coarse SAND, some fine to coarse Gravel, little Silt. Wet.	
10				15 16				S-5B (4"): Dense, tan, fine to coarse SAND, little Silt, trace fine Gravel. Wet.	
11	S-6	10	10-12	1 3				S-6: Medium dense, tan, fine to coarse SAND, little Silt, trace fine Gravel. Wet.	
12				10 15					
13									
14									
15							149.5 / 15.0		
16	S-7	18	15-17	11 20			GLACIAL TILL	S-7: Dense, tan-gray, fine to coarse SAND, some Silt, some fine to coarse Gravel. Wet. (GLACIAL TILL).	
17				19 21					
18								Increase in drilling resistance, possible weathered rock.	
19	S-8	24	18.5-20.5	25					
20				30 45					
21				72			144.0 / 20.5	Boring terminated at 20.5 feet.	1
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-114**

Boring Location: See exploration location plan.

Checked by: S. Carter

Date Start: August 19, 2021

Date Finish: August 19, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 164.5

Datum: NAVD 88

	Drilling Method	Sampler
Type	Casing	Split-Spoon
Size ID (in.)	4	1-3/8
Advancement	Drive and Wash	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/19/21	14:50	1	20	21.3	0 min

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	LITHOLOGY Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	21	0-2	1 3	▽		TOPSOIL 163.5 / 1.0	S-1A (9"): Loose, brown, Organic SILT and fine to coarse Sand. Wet. (TOPSOIL).	
2				4 3				S-1B (12"): Loose, tan, fine to coarse SAND, some Silt, trace fine to coarse Gravel. Moist to wet.	
3	S-2	17	2-4	3 4				S-2: Medium dense, tan, fine to coarse SAND and Silt, trace fine to coarse Gravel. Wet.	
4				6 6					
5	S-3	17	4-6	4 6			SAND & SILT	S-3: Medium dense, tan, fine to coarse SAND and Silt, trace fine to coarse Gravel. Wet.	
6				6 12					
7	S-4	22	6-8	12 14				S-4: Dense, tan, fine to coarse SAND and Silt, little fine to coarse Gravel. Wet.	
8				19 19			156.5 / 8.0		
9	S-5	20	8-10	9 10				S-5: Medium dense, tan, fine to medium SAND, little Silt, little fine Gravel. Wet.	
10				14 12					
11	S-6	18	10-12	2 6				S-6: Medium dense, tan, fine to coarse SAND, little fine Gravel, trace Silt. Wet.	
12				10 12			SAND		
13									
14									
15							149.5 / 15.0		
16	S-7	18	15-17	15 29				S-7: Very dense, gray, fine to coarse SAND, some fine to coarse Gravel, little Silt. Wet. (GLACIAL TILL).	
17				49 63					
18									
19							GLACIAL TILL		
20									
21	S-8	14	20-21.3	18 27				S-8: Very dense, gray, fine to coarse GRAVEL and fine to coarse Sand, some Silt. Wet. (GLACIAL TILL).	1
22				100/4"			143.2 / 21.3		
23								Boring terminated at 21.3 feet.	
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-115**

Boring Location: See exploration location plan.

Checked by: A. Jones

Date Start: August 25, 2021

Date Finish: August 25, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 163

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/25/21	10:08	6.5	15	18.5	0 min

Depth (ft.)	Sample Info: Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Lithology: Graphic	Stratum Elev. / Depth (ft.)	Sample Description and Remarks (Classification System: Modified Burmister)	Notes
1	S-1	20	0-2	1 2 3 6			TOPSOIL 162.0 / 1.0	S-1A (7"): Loose, dark brown, Organic SILT and fine to coarse Sand. Moist. (TOPSOIL).	
2								S-1B (13"): Loose, tan, fine to coarse SAND, some Silt, little fine to coarse Gravel. Moist.	
3	S-2	18	2-4	5 7 6 5				S-2: Medium dense, tan, fine to medium SAND, some Silt, trace fine to coarse Gravel. Moist.	
4									
5	S-3	12	4-6	3 2 1 2				S-3: Very loose, tan, fine to coarse SAND and Silt, trace fine to coarse Gravel. Wet.	
6							SAND		
7	S-4	11	6-8	6 6 5 6	▽			S-4: Medium dense, tan, fine to medium SAND, little Silt, trace fine to coarse Gravel. Wet.	
8									
9	S-5	16	8-10	15 42 25 25				S-5: Very dense, tan, fine to coarse SAND, little Silt, little fine Gravel, few cobbles. Wet.	
10							153.0 / 10.0		
11	S-6	24	10-12	37 25 29 31				S-6: Very dense, light gray, fine to coarse SAND, some fine to coarse Gravel, little Silt. Wet. (GLACIAL TILL).	
12									
13									
14									
15							GLACIAL TILL		
16	S-7	16	15-17	11 12 14 16				S-7: Medium dense, tan, fine to coarse SAND, some Silt, some fine to coarse Gravel. Wet. (GLACIAL TILL).	
17									
18	S-8	18	17-18.5	25 35 41				S-8: Very dense, gray-tan, fine to coarse SAND, some Silt, some fine to coarse Gravel. Wet. (GLACIAL TILL).	
19							144.5 / 18.5	Boring terminated at 18.5 feet.	1
20									
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-116 (OW)**

Boring Location: See exploration location plan.

Checked by: A. Jones

Date Start: August 25, 2021

Date Finish: August 25, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 153

Datum: NAVD 88

	Drilling Method	Sampler
Type	Casing	Split-Spoon
Size ID (in.)	4	1-3/8
Advancement	Drive and Wash	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/25/21	11:45	0	0	16.5	5 min

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	WELL DETAIL	NOTES
1	S-1	18	0-2	1 22	▽		TOPSOIL 152.5 / 0.5	S-1A (6"): Dense, brown, Organic SILT and fine to coarse Sand. Wet. (TOPSOIL).		
2				12 4				S-1B (4"): Dense, brown, fine to coarse SAND, some Silt, little fine to coarse Gravel. Wet. S-1C (4"): Possible pulverized cobble.. S-1D (4"): Loose, tan, fine to coarse SAND, little Silt, trace fine Gravel. Wet.	CUTTINGS AND ROADBOX	
3	S-2	15	2-4	6 7						
4				8 11				S-2: Medium dense, tan, fine to coarse SAND, little Silt, trace fine Gravel. Redoximorphic staining present. Wet.	BENTONITE SEAL	
5	S-3	16	4-6	10 10			SAND	S-3: Medium dense, tan, fine to coarse SAND, little Silt, trace fine Gravel. Wet.		
6				11 11						
7	S-4	18	6-8	9 9				S-4: Medium dense, tan, fine to coarse SAND, little fine to coarse Gravel, little Silt. Wet.	2-INCH RISER PVC	
8				10 14			145.0 / 8.0			
9	S-5	12	8-10	6 6				S-5: Medium dense, tan, fine to coarse SAND and fine to coarse Gravel, little Silt. Wet.		
10				6 7						
11	S-6	17	10-12	9 20				S-6: Dense, tan, fine to coarse SAND and fine to coarse Gravel, some Silt. Wet.	SILICA SAND	
12				25 28			SAND AND GRAVEL		2-INCH SLOTTED PVC	
13										
14										
15							138.0 / 15.0			
16	S-7	12	15-16.5	20 24			GLACIAL TILL	S-7: Very dense, gray, fine to coarse SAND and Silt, some fine to coarse Gravel, few cobbles. Wet. (GLACIAL TILL).		
17				50			136.5 / 16.5	Boring terminated at 16.5 feet.		1
18										
19										
20										
21										
22										
23										
24										
25										

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring completed as observation well.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-117**

Boring Location: See exploration location plan.

Checked by: A. Jones

Date Start: August 25, 2021

Date Finish: August 25, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 154.5

Datum: NAVD 88

	Drilling Method	Sampler
Type	Casing	Split-Spoon
Size ID (in.)	4	1-3/8
Advancement	Drive and Wash	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/25/21	07:20	2	0	4	0 min

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	14	0-2	WOH 6			TOPSOIL 154.0 / 0.5	S-1A (4"): Very loose, brown, Organic SILT, numerous woodchip fragments. Moist. (TOPSOIL).	
				4			FILL 153.5 / 1.0	S-1B (5"): Medium dense, tan, fine to coarse SAND, some fine to coarse Gravel, trace Silt. Moist. (FILL).	
2				2	▽			S-1C (5"): Loose, dark brown, Organic SILT. Wet. (TOPSOIL).	
3	S-2	12	2-4	1/12 2			TOPSOIL	S-2: Very loose, dark brown, Organic SILT, some fine to coarse Sand. Wet. (TOPSOIL).	
				3					
4							150.5 / 4.0		
5	S-3	15	4-6	14 19				S-3: Dense, orangish brown to tan, fine to coarse SAND and fine to coarse Gravel, little Silt. Wet.	
				24					
6				15					
7	S-4	19	6-8	20 16				S-4A (10"): Dense, tan, fine to coarse GRAVEL and fine to coarse Sand, trace Silt. Wet.	
				16				S-4B (9"): Dense, tan, SILT and fine Sand. Wet.	
8				23					
9	S-5	14	8-10	12 12				S-5: Medium dense, tan, fine to coarse SAND, some fine to coarse Gravel, some Silt. Wet.	
				14			SAND		
10				14					
11	S-6	14	10-12	8 9				S-6: Medium dense, light gray, fine to coarse SAND, some fine to coarse Gravel, some Silt. Wet.	
				19					
12				25					
13									
14									
15							139.5 / 15.0		
16	S-7	6	15-17	33 34				S-7: Very dense, light gray, fine to coarse SAND and fine to coarse Gravel, trace Silt. Wet. (GLACIAL TILL).	
				37					
17				47					
18									
19							GLACIAL TILL		
20									
21	S-8	20	20-22	19 22				S-8: Dense, light gray, fine to coarse SAND, some Silt, little fine to coarse Gravel. Wet. (GLACIAL TILL).	
				27					
22				30			132.5 / 22.0		
23								Boring terminated at 22 feet.	1
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

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BOREHOLE LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-118**

Boring Location: See exploration location plan.

Checked by: A. Jones

Date Start: August 27, 2021

Date Finish: August 27, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: K. Kocia

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 155

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/27/21	14:50	2	N/ A	8	5 min

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	15	0-2	16 7			154.7 / 0.3 ASPHALT	S-1A (3"): Medium dense, black to gray, asphalt present (approximately 7-inches in thickness). Dry to moist. (ASPHALT).	
2				6 5	▽		FILL 153.0 / 2.0	S-1B (13"): Medium dense, brown, fine to coarse SAND, some Silt, trace fine Gravel, very few asphalt fragments, 1-inch of organics present between interface of soil strata. Dry to moist. (FILL).	
3	S-2	24	2-4	10 10			SILTY SAND	S-2: Medium dense, brown, tan, and orangish-brown, fine to coarse SAND, some Silt, trace fine Gravel. Redoximorphic staining present. Dry to moist.	
4				12 16			151.0 / 4.0		
5	S-3	14	4-6	11 13			GLACIAL TILL	S-3: Dense, dark gray to gray, fine to coarse GRAVEL and fine to coarse Sand, little Silt. Dry to moist. (GLACIAL TILL).	
6				30 47					
7	S-4	17	6-8	22 18				S-4: Dense, orangish-brown and gray, fine to coarse SAND, some Silt, little fine to coarse Gravel. Redoximorphic staining present. Moist. (GLACIAL TILL).	
8				16 24			147.0 / 8.0		
9								Boring terminated at 8 feet.	1
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface. Pavement repaired with asphalt coldpatch.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-119**

Boring Location: See exploration location plan.

Checked by: A. Jones

Date Start: August 27, 2021

Date Finish: August 27, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: K. Kocia

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 156

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/27/21	14:20	2.2	N/ A	8	5 min

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	21	0-2	30 9			155.6 / 0.4 ASPHALT	S-1A (5"): Dense, black to gray, asphalt present (approximately 7-inches in thickness). (ASPHALT).	
2				6 4			FILL 154.0 / 2.0	S-1B (16"): Medium dense, brown to gray, fine to coarse SAND, trace fine Gravel, trace Silt, very few asphalt fragments, 1-inch of organics present between interface of soil strata 1-inch of organics present between interface of soil strata, in bottom of split-spoon sample. Dry to moist. (FILL).	
3	S-2	18	2-4	7 14	▽			S-2A (9"): Medium dense, orangish-brown, fine to coarse SAND, little Silt, trace fine Gravel. Redoximorphic staining present. Moist.	
4				10 11			SAND WITH SILT AND GRAVEL	S-2B (9"): Medium dense, tan, fine to coarse SAND, little fine to coarse Gravel, trace Silt. Moist.	
5	S-3	21	4-6	12 12				S-3: Medium dense, tan and gray, fine to coarse SAND, little fine to coarse Gravel, trace Silt. Moist.	
6				13 14			150.0 / 6.0		
7	S-4	22	6-8	15 16			GLACIAL TILL	S-4: Very dense, gray, fine to coarse SAND, some Silt, little fine to coarse Gravel. Moist. (GLACIAL TILL).	
8				35 20			148.0 / 8.0		
9								Boring terminated at 8 feet.	1
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface. Pavement repaired with asphalt coldpatch.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-120**

Boring Location: See exploration location plan.

Checked by: A. Jones

Date Start: August 27, 2021

Date Finish: August 27, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: K. Kocia

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 152.5

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/27/21	13:50	4	N/ A	8	5 min

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	LITHOLOGY Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	17	0-2	1 3			TOPSOIL 151.5 / 1.0	S-1A (9"): Very loose, dark brown to brown, fine to medium SAND and Silt, trace Organics, very few roots / grass fibers. Dry to moist. (TOPSOIL).	
2				3 3				S-1B (8"): Loose, brown, fine to coarse SAND, little Silt, trace Organics, few roots. Moist. (FILL).	
3	S-2	13	2-4	8 16			FILL	S-2: Dense, gray and tan, fine to coarse SAND, some fine to coarse Gravel, trace Silt. Faint redoximorphic staining present. Moist. (FILL).	
4				16 14	▽		148.5 / 4.0		
5	S-3	14	4-6	10 13			SAND 147.5 / 5.0	S-3A (7"): Medium dense, tan, fine to medium SAND, trace Silt. Very faint redoximorphic staining present. Moist.	
6				20 35				S-3B (7"): Dense, tan and white, fine to coarse SAND, little fine Gravel, little Silt. Moist. (GLACIAL TILL).	
7	S-4	20	6-8	23 22			GLACIAL TILL	S-4: Medium dense, light gray and white, fine to coarse SAND, some fine to coarse Gravel, some Silt. Moist. (GLACIAL TILL).	
8				18 22			144.5 / 8.0		
9								Boring terminated at 8 feet.	1
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-121**

Boring Location: See exploration location plan.

Checked by: A. Jones

Date Start: August 27, 2021

Date Finish: August 27, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: K. Kocia

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 148

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/27/21	13:25	2.8	N/ A	8	5 min

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	17	0-2	34 11			ASPHALT 147.4 / 0.6	S-1A (7"): Dense, black to gray, asphalt present (approximately 7-inches in thickness). Dry to moist. (ASPHALT).	
2				9 8			FILL	S-1B (10"): Medium dense, brown, fine to coarse SAND, trace fine Gravel, trace Silt, very few asphalt fragments. Dry to moist. (FILL).	
3	S-2	17	2-4	8 10	▽		145.0 / 3.0	S-2A (8"): Medium dense, brown, fine to coarse SAND, little Silt. Redoximorphic staining present. Moist. (FILL).	
4				6 5			SILTY SAND 144.0 / 4.0	S-2B (9"): Medium dense, dark brown and orangish-brown, fine SAND and Silt. 1-inch of organics present between interface of soil strata. Strong redoximorphic staining present. Moist.	
5	S-3	18	4-6	7 9				S-3: Medium dense, tan, fine to coarse SAND, some Silt, one (1) piece of coarse gravel. Moist.	
6				10 10			SAND		
7	S-4	19	6-8	12 17				S-4: Dense, tan, fine to coarse SAND, little fine to coarse Gravel, trace Silt. Moist.	
8				14 17			140.0 / 8.0		
9								Boring terminated at 8 feet.	1
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface. Pavement repaired with asphalt coldpatch.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-122**

Boring Location: See exploration location plan.

Checked by: A. Jones

Date Start: August 27, 2021

Date Finish: August 27, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: K. Kocia

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 152

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/27/21	13:00	3.5	N/ A	8	5 min

Depth (ft.)	Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	21	0-2	1 3 6 9			TOPSOIL 151.3 / 0.8	S-1A (6"): Very loose, dark brown, fine to medium SAND and Silt, trace Organics, very few roots / grass fibers. Dry to moist. (TOPSOIL).	
2								S-1B (15"): Loose, brown and tan, fine to coarse SAND, little Silt, trace fine Gravel. Dry to moist. (FILL).	
3	S-2	19	2-4	8 9			FILL	S-2: Medium dense, brown, tan, and orangish-brown, fine to coarse SAND, little fine to coarse Gravel, little Silt. Redoximorphic staining present. Dry to moist. (FILL).	
4				10 9	▽		148.0 / 4.0		
5	S-3	13	4-6	9 8			SILTY SAND	S-3: Medium dense, tan and orangish-brown, fine to coarse SAND, little Silt, one (1) piece of coarse gravel. Redoximorphic staining present. Moist.	
6				9 10			146.0 / 6.0		
7	S-4	18	6-8	9 10			SAND	S-4: Medium dense, tan, fine to coarse SAND, trace Silt. Moist.	
8				9 11			144.0 / 8.0		
9								Boring terminated at 8 feet.	1
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BOREHOLE LOG

Boring No.: **B-123**

Boring Location: See exploration location plan.

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Checked by: A. Jones

Date Start: August 19, 2021

Date Finish: August 19, 2021

Contractor: New England Boring Contractors

Driller: J. Voight

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 166

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/19/21	13:35	3	0	15.5	0 min

Depth (ft.)	Sample Info: Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Lithology: Graphic	Stratum Elev. / Depth (ft.)	Sample Description and Remarks (Classification System: Modified Burmister)	Notes
1	S-1	24	0-2	2 6			TOPSOIL 165.5 / 0.5	S-1A (8"): Very loose, brown, Organic SILT and fine Sand. Wet. (TOPSOIL).	
								S-1B (16"): Medium dense, tan-gray, fine to coarse SAND, some Silt, some fine to coarse Gravel. Moist.	
2				14 20					
3	S-2	12	2-3	19 100	▽			S-2: Very dense, tan, fine to coarse SAND, some Silt, little fine to coarse Gravel. Moist.	
4							SAND	Boring offset due to spoon refusal.	
5	S-3	24	4-6	11 20				S-3: Dense, tan, SILT and fine to coarse Sand. Wet. [Laboratory Analysis - Particle Size Analysis (Sieve Only): Gravel = 4.2%, Sand = 47.2%, Silt & Clay = 48.6%].	
6				30 32			160.0 / 6.0		
7	S-4	24	6-8	27 38				S-4: Very dense, gray-brown, fine to coarse SAND and Silt. Wet. (GLACIAL TILL). [Laboratory Analysis - Particle Size Analysis (Sieve Only): Gravel = 2.4%, Sand = 50.3%, Silt & Clay = 47.3%].	
8				45 50					
9	S-5	24	8-10	18 24				S-5: Very dense, gray-brown, fine to coarse SAND and Silt. Wet. (GLACIAL TILL).	
10				35 50					
11	S-6	24	10-12	5 18			GLACIAL TILL	S-6: Dense, gray-brown, fine to coarse SAND and Silt. Wet. (GLACIAL TILL).	
12				23 46					
13									
14									
15							151.0 / 15.0		
16	S-7	6	15-15.5	100			WEATHERED BEDROCK 150.5 / 15.5	S-7: Very dense, gray, WEATHERED BEDROCK. Boring terminated at 15.5 feet on auger refusal.	1
17									
18									
19									
20									
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-124 (OW)**

Boring Location: See exploration location plan.

Checked by: A. Jones

Date Start: August 27, 2021

Date Finish: August 27, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 148.5

Datum: NAVD 88

	Drilling Method	Sampler
Type	Casing	Split-Spoon
Size ID (in.)	4	1-3/8
Advancement	Drive and Wash	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/27/21	11:00	6	0	17	5 min

Depth (ft.)	Sample Info: Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Lithology: Graphic	Stratum Elev. / Depth (ft.)	Sample Description and Remarks (Classification System: Modified Burmister)	Well Detail	Notes
1	S-1	18	0-2	1 1 2 4			TOPSOIL 146.5 / 2.0	S-1: Very loose, brown, fine to coarse SAND, and Organic Silt, trace fine to coarse Gravel. Moist. (TOPSOIL).	CUTTINGS AND ROADBOX	
3	S-2	14	2-4	10 10 12 13				S-2: Medium dense, tan, fine to coarse SAND, some fine to coarse Gravel, little Silt. Moist.	BENTONITE SEAL	
5	S-3	9	4-6	15 15 12 11	▽			S-3: Medium dense, tan, fine to coarse SAND, some Silt, little fine to coarse Gravel. Moist to wet.		
7	S-4	20	6-8	11 11 21 16				S-4: Dense, tan, fine to coarse SAND and Silt, some fine to coarse Gravel. Wet.	2-INCH RISER PVC	
9	S-5	20	8-10	10 10 12 12			SAND	S-5: Medium dense, tan to dark orange-brown, fine to coarse SAND and Silt, little fine to coarse Gravel. Wet.	SILICA SAND	
11	S-6	9	10-12	11 15 16 16				S-6: Dense, tan, fine to coarse SAND and Silt, little fine to coarse Gravel. Wet.	2-INCH SLOTTED PVC	
16	S-7	11	15-17	19 19 30 80			131.5 / 17.0	S-7: Dense, tan, fine to coarse SAND and fine to coarse Gravel, some Silt. Wet.		
17								Boring terminated at 17 feet.		1

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring completed as observation well.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-125**

Boring Location: See exploration location plan.

Checked by: A. Jones

Date Start: August 27, 2021

Date Finish: August 27, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 146.5

Datum: NAVD 88

	Drilling Method	Sampler
Type	N/A	Split-Spoon
Size ID (in.)	N/A	1-3/8
Advancement	N/A	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/27/21	09:30	3	0	10	10 min

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	LITHOLOGY Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	19	0-2	2 1 2 3				S-1: Very loose, light brown to gray, fine to coarse SAND, some Silt, some fine to coarse Gravel. Moist.	
3	S-2	15	2-4	3 3 5 11	▽			S-2: Loose, tan, SILT and fine to coarse Sand, little fine Gravel. Redoximorphic staining present Moist to wet.	
5	S-3	14	4-6	33 43 22 16			SAND	S-3: Very dense, gray-tan, fine to coarse SAND, some Silt, some fine to coarse Gravel. Wet.	
7	S-4	12	6-8	9 15 16 16				S-4: Dense, tan, fine to coarse SAND, some Silt, some fine to coarse Gravel. Wet.	
9	S-5	17	8-10	13 13 15 19				S-5: Medium dense, tan, fine to coarse SAND, some fine to coarse Gravel, some Silt. Wet.	
10							136.5 / 10.0		
11								Boring terminated at 10 feet.	1
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-126**

Boring Location: See exploration location plan.

Checked by: A. Jones

Date Start: August 27, 2021

Date Finish: August 27, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: K. Kocia

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 146

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/27/21	00:00	2	0	17	5 min

Depth (ft.)	Sample Type & No.	Rec (in.)	Sample Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	Sample Description and Remarks (Classification System: Modified Burmister)	Notes
1	S-1	12	0-2	1/12 2 3			TOPSOIL 144.0 / 2.0	S-1: Very loose, brown, Organic SILT, some fine to coarse Sand, numerous organic fibers. Wet. (TOPSOIL).	
2					▽				
3	S-2	18	2-4	4 6				S-2: Medium dense, tan, fine to coarse SAND and Silt, trace fine Gravel. Wet.	
4				8 8					
5	S-3	20	4-6	6 8				S-3: Medium dense, tan, fine to coarse SAND and Silt, trace fine Gravel. Redoximorphic staining present. Wet.	
6				10 11					
7	S-4	14	6-8	6 11				S-4: Medium dense, tan, fine to coarse SAND and Silt, trace fine Gravel. Wet.	
8				13 15					
9	S-5	16	8-10	8 9			SAND	S-5: Medium dense, tan, fine to coarse SAND and Silt, little fine to coarse Gravel. Wet.	
10				11 15					
11	S-6	14	10-12	17 22				S-6: Very dense, tan, fine to coarse SAND and Silt, little fine to coarse Gravel. Wet.	
12				28 32					
13									
14									
15							131.0 / 15.0		
16	S-7	21	15-17	25 30			GLACIAL TILL	S-7: Very dense, light gray, fine to coarse SAND and Silt, some fine to coarse Gravel. Wet. (GLACIAL TILL).	
17				37 65			129.0 / 17.0		
18								Boring terminated at 17 feet.	1
19									
20									
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-127**

Boring Location: See exploration location plan.

Checked by: A. Jones

Date Start: August 27, 2021

Date Finish: August 27, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 143.5

Datum: NAVD 88

	Drilling Method	Sampler
Type	N/A	Split-Spoon
Size ID (in.)	N/A	1-3/8
Advancement	N/A	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/27/21	08:50	1.5	0	10	5 min

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	LITHOLOGY Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	14	0-2	1 1	▽			S-1: Very loose, brown, Organic SILT and fine Sand. Moist to wet. (TOPSOIL).	
2				2 2			TOPSOIL		
3	S-2	19	2-4	WOH WOH				S-2: Very loose, dark brown, Organic SILT and fine Sand. Wet. (TOPSOIL).	
4				1 2			139.5 / 4.0		
5	S-3	12	4-6	1 5				S-3: Medium dense, tan, fine to coarse SAND, little Silt, trace fine Gravel. Wet.	
6				6 7					
7	S-4	15	6-8	10 10			SAND	S-4: Dense, tan, fine to medium SAND, some Silt. Wet.	
8				20 30					
9	S-5	14	8-10	13 15				S-5: Dense, tan to gray, fine to coarse SAND, little fine to coarse Gravel, trace Silt. Wet.	
10				20 21			133.5 / 10.0		
11								Boring terminated at 10 feet.	1
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-128**

Boring Location: See exploration location plan.

Checked by: A. Jones

Date Start: August 26, 2021

Date Finish: August 26, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: K. Kocia

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 154

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/26/21	14:30	2	0	16.5	5 min

Depth (ft.)	Sample Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	13	0-2	1 1 5 9			TOPSOIL 152.0 / 2.0	S-1: Loose, brown, Organic SILT and fine to coarse Sand. few fine roots. Moist. (TOPSOIL).	
3	S-2	10	2-4	5 6 7 8	▽			S-2: Medium dense, tan, fine to coarse SAND, some Silt, little fine to coarse Gravel. Moist to wet.	
5	S-3	0	4-6	11 12 19 22				S-3: No recovery.	
7	S-4	15	6-8	21 22 30 32				S-4: Very dense, tan, fine to coarse SAND, some fine to coarse Gravel, little Silt. Wet.	
9	S-5	20	8-10	16 19 24 40			SAND	S-5: Dense, tan, fine to coarse SAND, some Silt, little fine Gravel. Wet.	
11	S-6	9	10-10.9	60 100/5"				S-6: Very dense, tan, fine to coarse SAND and Silt, some fine to coarse Gravel. Wet.	
16	S-7	17	15-16.5	44 73 80			137.5 / 16.5		
17								Boring terminated at 16.5 feet.	1

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-129**

Boring Location: See exploration location plan.

Checked by: A. Jones

Date Start: August 26, 2021

Date Finish: August 26, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: K. Kocia

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 159

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/26/21	11:40	4	0	10	0 min

Depth (ft.)	Sample Type & No.	Rec (in.)	Sample Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	20	0-2	1 4			TOPSOIL 158.0 / 1.0	S-1A (7"): Loose, brown, fine to coarse SAND, and Organic Silt. Moist. (TOPSOIL).	
2				5 10				S-1B (13"): Loose, tan, fine to coarse SAND, some fine to coarse Gravel, some Silt. Moist.	
3	S-2	10	2-4	18 23				S-2: Dense, tan, fine to coarse SAND, some Silt, little fine to coarse Gravel. Moist to wet.	
4				20 16	▽				
5	S-3	14	4-6	18 25				S-3: Dense, tan, fine to coarse SAND and Silt, little fine Gravel. Wet.	
6				23 22			SAND		
7	S-4	17	6-8	10 11				S-4: Medium dense, tan, fine to coarse SAND, little fine to coarse Gravel, little Silt. Wet.	
8				11 12					
9	S-5	18	8-10	18 16				S-5: Dense, tan to gray, fine to coarse SAND, some Silt, little fine to coarse Gravel. Wet.	
10				29 40			149.0 / 10.0		
11								Boring terminated at 10 feet.	1
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-130**

Boring Location: See exploration location plan.

Checked by: A. Jones

Date Start: August 26, 2021

Date Finish: August 26, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: K. Kocia

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 158.5

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/26/21	10:20	1.5	8	9.8	0 min

Depth (ft.)	Sample Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	Sample Description and Remarks (Classification System: Modified Burmister)	Notes
1	S-1	17	0-2	1 4 5 7	▽		TOPSOIL 158.0 / 0.5	S-1A (6"): Loose, brown, Organic SILT and fine to coarse Sand. Moist. (TOPSOIL). S-1B (11"): Loose, tan, fine to coarse SAND and Silt, trace fine Gravel. Moist to wet.	
3	S-2	18	2-4	9 13 32 20				S-2: Dense, tan, fine to coarse SAND and Silt, trace fine Gravel. Wet.	
5	S-3	16	4-6	10 13 16 16			SAND	S-3: Medium dense, tan, fine to coarse SAND and Silt, trace fine Gravel. Wet. [Laboratory Analysis - Particle Size Analysis (Sieve Only): Gravel = 5.6%, Sand = 50.6%, Silt & Clay = 43.8%].	
7	S-4	24	6-8	9 17 27 35			150.5 / 8.0	S-4: Dense, tan, fine to coarse SAND and Silt, trace fine Gravel. Wet.	
9	S-5	19	8-9.8	22 31 58 50/3"			GLACIAL TILL 148.7 / 9.8	S-5: Very dense, gray, fine to coarse SAND, some fine to coarse Gravel, some Silt. Wet. (GLACIAL TILL).	
10								Boring terminated at 9.8 feet.	1

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-131**

Boring Location: See exploration location plan.

Checked by: A. Jones

Date Start: August 26, 2021

Date Finish: August 26, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: K. Kocia

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 160.5

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/26/21	09:10	2	8	10	0 min

Depth (ft.)	Sample Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	Graphic	Stratum Elev. / Depth (ft.)	Sample Description and Remarks (Classification System: Modified Burmister)	Notes
1	S-1	16	0-2	3 5 5 4			FILL 159.5 / 1.0	S-1: Medium dense, brown to tan, fine to coarse SAND, some fine to coarse Gravel, little Silt. Moist. (FILL).	
2					▽				
3	S-2	21	2-4	6 6 7 8				S-2: Medium dense, tan, fine to coarse SAND, some Silt, trace fine to coarse Gravel. Moist to wet.	
4									
5	S-3	16	4-6	9 12 11 14			SAND	S-3: Medium dense, gray and orange, fine to coarse SAND, little Silt, little fine Gravel. Redoximorphic staining present. Wet.	
6									
7	S-4	14	6-8	10 12 10 9				S-4: Medium dense, tan, fine to coarse SAND, some Silt, little fine to coarse Gravel. Wet.	
8									
9	S-5	19	8-10	11 9 9 14				S-5: Medium dense, tan, fine to coarse SAND, some fine to coarse Gravel, some Silt. Wet.	
10							150.5 / 10.0		
11								Boring terminated at 10 feet.	1
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-132**

Boring Location: See exploration location plan.

Checked by: A. Jones

Date Start: August 25, 2021

Date Finish: August 25, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 170

Datum: NAVD 88

	Drilling Method	Sampler
Type	Casing	Split-Spoon
Size ID (in.)	4	1-3/8
Advancement	Drive and Wash	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
08/25/21	07:40	dry	0	4	ws

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	LITHOLOGY Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	16	0-2	2 3			TOPSOIL 169.0 / 1.0	S-1A (8"): Loose, brown, Organic SILT and fine to coarse Sand, little fine to coarse Gravel. Moist. (TOPSOIL).	
2				9 24				S-1B (8"): Pulverized cobble.	
3	S-2	18	2-4	17 16			SAND	S-2: Dense, tan, fine to coarse SAND, some fine to coarse Gravel, some Silt. Moist to wet.	
4				23 60			166.0 / 4.0		
5							BEDROCK 165.5 / 4.5	Increase in drilling resistance. Boring terminated at 4.5 feet.	1
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-133**

Boring Location: See exploration location plan.

Checked by: A. Jones

Date Start: August 25, 2021

Date Finish: August 25, 2021

Contractor: New England Boring Contractors

Driller: M. Soucey

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 163

Datum: NAVD 88

	Drilling Method	Sampler
Type	Hollow Stem Auger	Split-Spoon
Size ID (in.)	2-1/4	1-3/8
Advancement	Augered	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/25/21	14:40	4	4	4	ws

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	LITHOLOGY Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	15	0-2	WOH			TOPSOIL 162.0 / 1.0	S-1A (7"): Very loose, brown, Organic SILT and fine to coarse Sand, trace fine to coarse Gravel. Moist. (TOPSOIL).	
2				1				S-1B (8"): Medium dense, tan, fine to coarse SAND, some Silt, little fine to coarse Gravel. Moist.	
3	S-2	16	2-4	19			SAND	S-2: Dense, tan, fine to coarse SAND, some Silt, little fine to coarse Gravel. Moist to wet.	
4				14				[Laboratory Analysis - Particle Size Analysis (Sieve Only): Gravel = 18.9%, Sand = 52.3%, Silt & Clay = 28.8%].	
5	S-3	3	4-4.3	10	▽		159.0 / 4.0	S-3: Very dense, WEATHERED BEDROCK.	
6				17					
7				19			WEATHERED BEDROCK		
8				16			156.0 / 7.0	Boring terminated at 7 feet on auger refusal.	1
9				100/3"					
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-134**

Boring Location: See exploration location plan.

Checked by: A. Jones

Date Start: August 20, 2021

Date Finish: August 20, 2021

Contractor: New England Boring Contractors

Driller: J. Voight

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 165

Datum: NAVD 88

	Drilling Method	Sampler
Type	N/A	Split-Spoon
Size ID (in.)	N/A	1-3/8
Advancement	N/A	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/20/21	13:25	2	0	3.7	5 min

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	LITHOLOGY Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	12	0-1.5	1 3			TOPSOIL 163.5 / 1.5	S-1: Very loose, brown, Organic SILT and fine to coarse Sand. Moist. (TOPSOIL).	
2				55 50/0"	▽				
3	S-2	15	2-3.7	14 14			GLACIAL TILL 162.0 / 3.0	S-2A (11"): Medium dense, tan, fine to coarse SAND, some Silt, some fine to coarse Gravel. Wet. (GLACIAL TILL).	
4				50 50/2"			WEATHERED BEDROCK 161.3 / 3.7	S-2B (4"): Very dense, WEATHERED BEDROCK. Boring terminated at 3.7 feet.	1
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

BORING LOG

Project: West Elementary & Shawsheen Preschool

Location: Andover, Massachusetts

Nobis Project No.: 96480.02

Boring No.: **B-135**

Boring Location: See exploration location plan.

Checked by: A. Jones

Date Start: August 18, 2021

Date Finish: August 19, 2021

Contractor: New England Boring Contractors

Driller: J. Voight

Nobis Rep.: S. Pape

Rig Type / Model: ATV / Mobile B53

Hammer Type: Automatic Hammer

Hammer Hoist: Automatic

Ground Surface Elev.: (+/-) 167

Datum: NAVD 88

	Drilling Method	Sampler
Type	Casing	Split-Spoon
Size ID (in.)	4	1-3/8
Advancement	Drive and Wash	140-lb Hammer

Groundwater Observations

Date	Time	Depth Below Ground (ft.)	Depth of Casing (ft.)	Depth to Bottom of Hole (ft.)	Stabilization Time
▽ 08/19/21	11:35	2	19.9	19.9	5 min

Depth (ft.)	SAMPLE INFORMATION Type & No.	Rec (in.)	Depth (ft.)	Blows/ 6 in.	Ground Water	LITHOLOGY Graphic	Stratum Elev. / Depth (ft.)	SAMPLE DESCRIPTION AND REMARKS (Classification System: Modified Burmister)	NOTES
1	S-1	23	0-1.9	1 7			TOPSOIL 166.5 / 0.5	S-1A (9"): Loose, brown, Organic SILT and fine to coarse Sand. Wet. (TOPSOIL).	
2				13 50/5"	▽			S-1B (14"): Medium dense, gray-tan, fine to coarse SAND, some Silt, little fine to coarse Gravel. Redoximorphic staining present. Wet. (GLACIAL TILL).	
3	S-2	24	2-4	24 23				S-2: Dense, tan-gray, SILT and fine to coarse Sand. Wet. (GLACIAL TILL). [Laboratory Analysis - Particle Size Analysis (Sieve Only): Gravel = 2.5%, Sand = 48.0%, Silt & Clay = 49.5%].	
4				28 44					
5	S-3	24	4-6	20 25				S-3: Very dense, tan, fine to coarse SAND, some fine to coarse Gravel, little Silt. Wet. (GLACIAL TILL).	
6				30 40					
7	S-4	24	6-8	17 22				S-4: Very dense, tan-gray, fine to coarse SAND and Silt, trace fine Gravel. Wet. (GLACIAL TILL).	
8				30 39					
9	S-5	24	8-10	21 24				S-5: Very dense, tan-gray, fine to coarse SAND and Silt, trace fine Gravel. Wet. (GLACIAL TILL). [Laboratory Analysis - Particle Size Analysis (Sieve Only): Gravel = 5.2%, Sand = 49.5%, Silt & Clay = 45.3%].	
10				29 35					
11	S-6	23	10-11.9	30 32			GLACIAL TILL	S-6: Very dense, tan-gray, fine to coarse SAND and Silt, trace fine Gravel. Wet. (GLACIAL TILL).	
12				40 75/5"					
13									
14									
15									
16	S-7	19	15-17	24 37				S-7: Very dense, gray, fine to coarse SAND and fine to coarse Gravel, some Silt. Wet. (GLACIAL TILL).	
17				49 44					
18									
19									
20	S-8	10	19-19.9	48 100/5"			147.1 / 19.9	S-8: Very dense, gray, fine to coarse SAND and fine to coarse Gravel, some Silt. Wet. (GLACIAL TILL).	
21								Boring terminated at 19.9 feet.	1
22									
23									
24									
25									

Soil	Percentage	Non-Soil
trace	5 - 10	very few
little	10 - 20	few
some	20 - 35	several
and	35 - 50	numerous

NOTES:

1) Boring backfilled with drilling spoils to approximate ground surface.

Soil descriptions, and lithology, are based on visual classifications and should be considered approximate. Stratification lines are approximate boundaries between stratums; transitions may be gradual.

BOREHOLE LOG - NOBIS GINT DATA TEMPLATE OCT 7 2011.GDT - 9/29/21 16:22 - J:\96480.02 - ANDOVER WEST (GEOTECH DDCA)\FIELD AND LAB DATA\EXPLORATIONS\96480.02 WEST ELEMENTARY AND SHAWSHEEN PRIMARY BORING LOGS.GPJ

APPENDIX B.4 – NOBIS TEST PITS LOGS

TEST PIT LOG

nobis

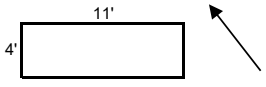
PROJECT		TEST PIT NO.	TP-101
Andover West Elementary School		SHEET	1 of 1
58 Beacon Street		FILE NO.	96480.02
Andover, Massachusetts		CHKD BY	Scott Carter

Engineer	KAK & SMC	Make	Kubota	Ground El.	(±) 147 feet
Contractor	New England Boring	Model	KX080-4	Datum	NAVD 88
Operator	Matt Soucy	Capacity	~1/2 CY	Time Start	7:45 AM
Weather	Sunny, 70's	Reach	~12 feet	Date	8/18/2020

Depth Below Grade (ft)	Strata Change & Water Level	Subsurface Description	Excavation Effort	Boulder Qty/Class	USDA
1	TOPSOIL 10"	Dark brown, fine to medium SAND, some Silt with organics, trace fine Gravel, few roots. Dry to moist. (TOPSOIL).	E	--	Sandy Loam
2	FILL	Brown to Tan, fine to coarse SAND and Silt, little fine to coarse Gravel, very few cobbles. Moist. Faint redoximorphic staining present. (FILL).	M - D		
3		▽ 32"			
4	48"	Increase in redoximorphic staining seams with depth.			
5	SILTY SAND 62"	Red to Brown, SILT, and fine to medium Sand. Moist. Faint redoximorphic staining present. (SUBSOIL).	E - M		
6	BURIED ORGANICS	Black to Dark brown, Organic SILT, some fine to coarse Sand. Moist. ▼ 73"			Silt Loam
7	72" SAND	Gray to Orangish-brown, fine to medium SAND, trace fine to coarse Gravel, trace Silt. Wet. Walls of test pit caving in once water began to seep in.			Sand - Loamy Sand
8					
9		Test pit terminated at 7.8 feet.			
10					
11					
12					
13					
14					
15					

Notes:
1.) Test pit backfilled with excavated soils and compacted with excavator bucket to ground surface.
2.) Three (3) Infiltration tests were performed with Amoozemeter at a depth of approximately 39 inches below ground surface.

WATER SYMBOLS
▼ Groundwater
▽ Estimated Seasonal High Groundwater



BOULDER	CLASS
12" - 24"	A
24" - 36"	B
>36"	C

PROPORTIONS USED	
0-10%	Trace
10-20%	Little
20-35%	Some
35-50%	And

EXCAVATION EFFORT
E = Easy
M = Moderate
D = Difficult

TEST PIT LOG

nobis

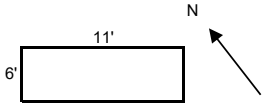
PROJECT		TEST PIT NO.	TP-102
Andover West Elementary School		SHEET	1 of 1
58 Beacon Street		FILE NO.	96480.02
Andover, Massachusetts		CHKD BY	Scott Carter

Engineer	Kamil Kocia	Make	Kubota	Ground El.	(±) 148 feet
Contractor	New England Boring	Model	KX080-4	Datum	NAVD 88
Operator	Matt Soucy	Capacity	~1/2 CY	Time Start	7:25 AM
Weather	Cloudy - Rain, 70's	Reach	~12 feet	Date	8/19/2020

Depth Below Grade (ft)	Strata Change & Water Level	Subsurface Description	Excavation Effort	Boulder Qty/Class	USDA
1	TOPSOIL 8"	Dark brown, fine to medium SAND, some Silt with organics, trace fine Gravel, few roots. Dry to moist. (TOPSOIL).	E	--	Sandy Loam
2	FILL 22"	Brown to Tan, fine to coarse SAND, some Silt, little fine to coarse Gravel. Moist. (FILL). ▽ 22"			
3	SILTY SAND 30"	Gray and Orangish-brown, fine to coarse SAND and SILT, trace fine Gravel. Moist. Faint redoxomorphic staining present.			Silt Loam
4	BURIED ORGANICS 40"	Black to Dark brown, Organic SILT, some fine to coarse Sand. Moist. ▼ 40"			
5	SAND 60"	Red to Brown, SILT, and fine to medium Sand. Moist. Faint redoxomorphic staining present. (SUBSOIL).			Sand - Loamy Sand
6		Test pit terminated at 5 feet.			
7					
8					
9					
10					
11					
12					
13					
14					
15					

Notes:
1.) Test pit backfilled with excavated soils and compacted with excavator bucket to ground surface.
2.) Three (3) Infiltration tests were performed with Amoozemeter at a depth of approximately 20 inches below ground surface.

WATER SYMBOLS
▼ Groundwater
▽ Estimated Seasonal High Groundwater



BOULDER	CLASS
12" - 24"	A
24" - 36"	B
>36"	C

PROPORTIONS USED	
0-10%	Trace
10-20%	Little
20-35%	Some
35-50%	And

EXCAVATION EFFORT
E = Easy
M = Moderate
D = Difficult

TEST PIT LOG

nobis

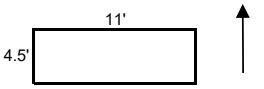
PROJECT		TEST PIT NO.	TP-103
Andover West Elementary School		SHEET	1 of 1
58 Beacon Street		FILE NO.	96480.02
Andover, Massachusetts		CHKD BY	Scott Carter

Engineer	Kamil Kocia	Make	Kubota	Ground El.	(±) 159 feet
Contractor	New England Boring	Model	KX080-4	Datum	NAVD 88
Operator	Matt Soucy	Capacity	~1/2 CY	Time Start	12:00 PM
Weather	Heavy Rain, 70's	Reach	~12 feet	Date	8/19/2020

Depth Below Grade (ft)	Strata Change & Water Level	Subsurface Description	Excavation Effort	Boulder Qty/Class	USDA
1	TOPSOIL 12"	Dark brown, fine to medium SAND, some Silt with organics, trace fine Gravel, few roots. Dry to moist. (TOPSOIL).	E	--	Sandy Loam
2	FILL 30"	Brown to Tan, fine to coarse SAND, some Silt, some fine to coarse Gravel. Moist. Faint redoximorphic staining present. (FILL). [Laboratory Analysis - Particle Size Analysis (Sieve Only): Gravel = 20.7%, Sand = 48.1%, Silt & Clay = 22.1%] ▽ 24"			
3					
4	SILTY SAND 72"	Tan to Gray, fine to coarse SAND, little Silt, trace to little fine to coarse Gravel, very few cobbles. Moist. Faint redoximorphic staining present.	E - M		Loamy Sand - Sandy Loam
5					
6		Water confined and seeping in at approximately 66 inches bgs. ▼ 66"			
7	GLACIAL TILL 92"	Gray and Orangish-brown, fine to coarse SAND, little fine to coarse Gravel, little Silt, few cobbles. Moist to Wet. Strong redoximorphic staining present.			Loamy Sand
8	BEDROCK 98"		D		-
9		Test pit terminated at 8.2 feet due to refusal on inferred bedrock.			
10					
11					
12					
13					
14					
15					

Notes:
1.) Test pit backfilled with excavated soils and compacted with excavator bucket to ground surface.
2.) Three (3) Infiltration tests were performed with Amoozemeter at a depth of approximately 25 inches below ground surface.

WATER SYMBOLS
▼ Groundwater
▽ Estimated Seasonal High Groundwater



BOULDER	CLASS
12" - 24"	A
24" - 36"	B
>36"	C

PROPORTIONS USED
0-10% Trace
10-20% Little
20-35% Some
35-50% And

EXCAVATION EFFORT
E = Easy
M = Moderate
D = Difficult

TEST PIT LOG

nobis

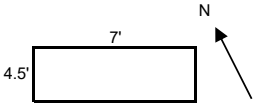
PROJECT		TEST PIT NO.	TP-104
Andover West Elementary School		SHEET	1 of 1
58 Beacon Street		FILE NO.	96480.02
Andover, Massachusetts		CHKD BY	Scott Carter

Engineer	KAK & SMC	Make	Kubota	Ground El.	(±) 150 feet
Contractor	New England Boring	Model	KX080-4	Datum	NAVD 88
Operator	Matt Soucy	Capacity	~1/2 CY	Time Start	9:30 AM
Weather	Sunny, 80's	Reach	~12 feet	Date	8/18/2020

Depth Below Grade (ft)	Strata Change & Water Level	Subsurface Description	Excavation Effort	Boulder Qty/Class	USDA
1	TOPSOIL 12"	Dark brown, fine to medium SAND, some Silt with organics, trace fine Gravel, few roots. Dry to moist. (TOPSOIL).	E	--	Sandy Loam
2	FILL	Brown to Tan, fine to coarse SAND, some Silt, little fine to coarse Gravel. Moist. Faint redoximorphic staining present. (FILL).			
3	36"				
4	BURIED TOPSOIL 40"	Black to Dark brown, Organic SILT, some fine to medium Sand. Moist.			
5	SUBSOIL	Red to Brown, SILT, and fine to medium Sand. Moist. Faint redoximorphic staining present. (SUBSOIL). [Laboratory Analysis - Particle Size Analysis (Sieve Only): Gravel = 0.3%, Sand = 41.7%, Silt & Clay = 57.5%] ▽ 58"			Silt Loam
6	72"		E - M		
7	SILTY SAND	Tan, fine to medium SAND, some Silt. Moist. ▼ 82"			Loamy Sand
	SAND 80" 90"	Brown, fine to coarse SAND, trace fine Gravel, trace Silt. Wet.			Sand
8	SAND & SILT 102"	Gray, fine SAND and SILT. Wet.			Sandy Loam
9		Test Pit terminated at 8.5 feet			
10					
11					
12					
13					
14					
15					

Notes:
1.) Test pit backfilled with excavated soils and compacted with excavator bucket to ground surface.
2.) Three (3) Infiltration tests were performed with Amoozemeter at a depth of approximately 57 inches below ground surface.

WATER SYMBOLS
▼ Groundwater
▽ Estimated Seasonal High Groundwater



BOULDER	CLASS
12" - 24"	A
24" - 36"	B
>36"	C

PROPORTIONS USED	
0-10%	Trace
10-20%	Little
20-35%	Some
35-50%	And

EXCAVATION EFFORT
E = Easy
M = Moderate
D = Difficult

TEST PIT LOG

nobis

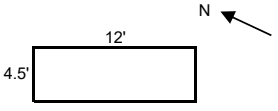
PROJECT		TEST PIT NO.	TP-105
Andover West Elementary School		SHEET	1 of 1
58 Beacon Street		FILE NO.	96480.02
Andover, Massachusetts		CHKD BY	Scott Carter

Engineer	KAK & SMC	Make	Kubota	Ground El.	(±) 158 feet
Contractor	New England Boring	Model	KX080-4	Datum	NAVD 88
Operator	Matt Soucy	Capacity	~1/2 CY	Time Start	12:30 PM
Weather	Sunny, 80's	Reach	~12 feet	Date	8/18/2020

Depth Below Grade (ft)	Strata Change & Water Level	Subsurface Description	Excavation Effort	Boulder Qty/Class	USDA
1	TOPSOIL 8"	Dark brown, fine to medium SAND, some Silt with organics, trace fine Gravel, few roots. Dry to moist. (TOPSOIL).	E	--	Loamy Sand - Sandy Loam
2	FILL	Brown to Tan, fine to coarse SAND, some Silt, little fine to coarse Gravel. Moist. Faint redoximorphic staining present. (FILL). [Laboratory Analysis - Particle Size Analysis (Sieve Only): Gravel = 17.7%, Sand = 60.7%, Silt & Clay = 21.6%] ▽ 40"	M - D		
3					
4	48"				
5	SILTY SAND 60"	Red to Brown, SILT, and fine to medium Sand. Moist. Faint redoximorphic staining present. (SUBSOIL).	E - M		
6	SAND 78"	Tan, fine to medium SAND, trace Silt. Moist.			Sand
7	GLACIAL TILL	Gray to tan, fine to coarse SAND, some fine to coarse Gravel, trace to little Silt, few cobbles. Moist.	M - D	1A	Sand - Loamy Sand
8					
9					
10	120"				
11		Test pit terminated at 10 feet on possible bedrock. No Groundwater encountered.			
12					
13					
14					
15					

Notes:
1.) Test pit backfilled with excavated soils and compacted with excavator bucket to ground surface.
2.) Three (3) Infiltration tests were performed with Amoozemeter at a depth of approximately 43 inches below ground surface.

WATER SYMBOLS
▼ Groundwater
▽ Estimated Seasonal High Groundwater



BOULDER	CLASS
12" - 24"	A
24" - 36"	B
>36"	C

PROPORTIONS USED	
0-10%	Trace
10-20%	Little
20-35%	Some
35-50%	And

EXCAVATION EFFORT
E = Easy
M = Moderate
D = Difficult

TEST PIT LOG

nobis

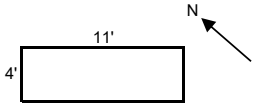
PROJECT		TEST PIT NO.	TP-106
Andover West Elementary School		SHEET	1 of 1
58 Beacon Street		FILE NO.	96480.02
Andover, Massachusetts		CHKD BY	Scott Carter

Engineer	Kamil Kocia	Make	Kubota	Ground El.	(±) 157 feet
Contractor	New England Boring	Model	KX080-4	Datum	NAVD 88
Operator	Matt Soucy	Capacity	~1/2 CY	Time Start	7:25 AM
Weather	Rain - Cloudy, 70's	Reach	~12 feet	Date	8/20/2020

Depth Below Grade (ft)	Strata Change & Water Level	Subsurface Description	Excavation Effort	Boulder Qty/Class	Remarks
1	TOPSOIL 9"	Dark brown, fine to medium SAND, little Silt with organics, trace fine Gravel, few roots. Dry to moist. (TOPSOIL).	E	--	Sandy Loam
2	FILL 36"	Brown to Tan, fine to coarse SAND, some Silt, little fine to coarse Gravel. Moist. Faint redoximorphic staining present. (FILL). [Laboratory Analysis - Particle Size Analysis (Sieve Only): Gravel = 18.0%, Sand = 50.0%, Silt & Clay = 32.0%]	▽ 26" E - M		Loamy Sand - Sandy Loam
3					
4	SUBSOIL 56"	Brown to Tan, fine to coarse SAND, some Silt. Moist. Very few asphalt pieces. Faint redoximorphic staining present.			
5					
6	GLACIAL TILL 120"	Gray to Tan to Orangish-brown, fine to coarse SAND, some fine to coarse Gravel, little to some Silt, few to several cobbles. Moist. Pockets of redoximorphic staining present. Cobbles increasing with depth.	M - D		Sandy Loam
7					
8					
9					
10					
11		Test pit terminated at 10 feet on possible bedrock. No Groundwater encountered.			
12					
13					
14					
15					

Notes:
1.) Test pit backfilled with excavated soils and compacted with excavator bucket to ground surface.
2.) Three (3) Infiltration tests were performed with Amoozemeter at a depth of approximately 27 inches below ground surface.

WATER SYMBOLS
▼ Groundwater
▽ Estimated Seasonal High Groundwater



BOULDER	CLASS
12" - 24"	A
24" - 36"	B
>36"	C

PROPORTIONS USED	
0-10%	Trace
10-20%	Little
20-35%	Some
35-50%	And

EXCAVATION EFFORT
E = Easy
M = Moderate
D = Difficult

TEST PIT LOG

nobis

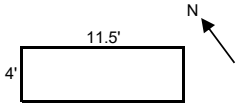
PROJECT		TEST PIT NO.	TP-107
Andover West Elementary School		SHEET	1 of 1
58 Beacon Street		FILE NO.	96480.02
Andover, Massachusetts		CHKD BY	Scott Carter

Engineer	Kamil Kocia	Make	Kubota	Ground El.	(±) 154 feet
Contractor	New England Boring	Model	KX080-4	Datum	NAVD 88
Operator	Matt Soucy	Capacity	~1/2 CY	Time Start	10:00 AM
Weather	Cloudy, 70's	Reach	~12 feet	Date	8/20/2020

Depth Below Grade (ft)	Strata Change & Water Level	Subsurface Description	Excavation Effort	Boulder Qty/Class	USDA
1	TOPSOIL 9"	Dark brown, fine to medium SAND, little Silt with organics, trace fine Gravel, few roots. Dry to moist. (TOPSOIL).	E	--	Sandy Loam
2	FILL	Brown to Tan, fine to coarse SAND, some Silt, little fine to coarse Gravel. Moist. Faint redoximorphic staining present. (FILL). [Laboratory Analysis - Particle Size Analysis (Sieve Only): Gravel = 23.3%, Sand = 59.5%, Silt & Clay = 17.2%] ▽ 26"	E - M		Loamy Sand - Sandy Loam
3	35"				
4	SAND & SILT	Brown to Tan to Gray, fine to coarse SAND, and to some Silt. Moist. Faint redoximorphic staining present.			Sandy Loam
5					
6					
7	84"				
8	GLACIAL TILL	Gray to Tan to Orangish-brown, fine to coarse SAND, some fine to coarse Gravel, little to some Silt, few to several cobbles, very few boulders. Moist. Pockets of redoximorphic staining present. Cobbles increasing with depth.	M - D	2A	
9					
10					
11	132"				
12		Test Pit terminated at 11 feet. No Groundwater encountered.			
13					
14					
15					

Notes:
1.) Test pit backfilled with excavated soils and compacted with excavator bucket to ground surface.
2.) Three (3) Infiltration tests were performed with Amoozemeter at a depth of approximately 27 inches below ground surface.

WATER SYMBOLS
▼ Groundwater
▽ Estimated Seasonal High Groundwater



BOULDER	CLASS
12" - 24"	A
24" - 36"	B
>36"	C

PROPORTIONS USED	
0-10%	Trace
10-20%	Little
20-35%	Some
35-50%	And

EXCAVATION EFFORT
E = Easy
M = Moderate
D = Difficult

TEST PIT LOG

nobis

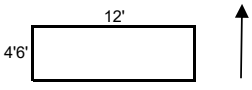
PROJECT		TEST PIT NO.	TP-108
Andover West Elementary School		SHEET	1 of 1
58 Beacon Street		FILE NO.	96480.02
Andover, Massachusetts		CHKD BY	Scott Carter

Engineer	Kamil Kocia	Make	Kubota	Ground El.	(±) 155.5 feet
Contractor	New England Boring	Model	KX080-4	Datum	NAVD 88
Operator	Matt Soucy	Capacity	~1/2 CY	Time Start	9:45 AM
Weather	Heavy Rain, 70's	Reach	~12 feet	Date	8/19/2020

Depth Below Grade (ft)	Strata Change & Water Level	Subsurface Description	Excavation Effort	Boulder Qty/Class	USDA
1	TOPSOIL / MULCH 12"	Dark brown, fine to medium SAND, and Silt with organics, trace fine Gravel, few roots and mulch fragments. Moist. (TOPSOIL).	E	--	Sandy Loam
2	FILL	Brown to Tan, fine to coarse SAND, some Silt, little fine to coarse Gravel. Moist. Faint redoximorphic staining present. (FILL).	▽ 14" M		
3	36"				
4	GLACIAL TILL	Gray to Orangish-brown, SILT and fine to coarse Sand, trace fine to coarse Gravel, very few cobbles. Moist. Redoximorphic staining present.	M - D		Silt Loam - Sandy Loam
5					
6	72"		▼ 72"		
7		Gray to Tan, fine to coarse SAND, some Silt, trace fine to coarse Gravel, very few cobbles. Wet. Water seeping in at 6 feet bgs from side walls, multiple areas collapsing.			
8	96"				
9		Test pit terminated at 8 feet.			
10					
11					
12					
13					
14					
15					

Notes:
1.) Test pit backfilled with excavated soils and compacted with excavator bucket to ground surface.
2.) Only one (1) Infiltration test was performed with Amoozemeter, due to heavy rainfall and standing water present, at a depth of approximately 13 inches below ground surface.

WATER SYMBOLS
▼ Groundwater
▽ Estimated Seasonal High Groundwater



BOULDER	CLASS
12" - 24"	A
24" - 36"	B
>36"	C

PROPORTIONS USED	
0-10%	Trace
10-20%	Little
20-35%	Some
35-50%	And

EXCAVATION EFFORT
E = Easy
M = Moderate
D = Difficult

TEST PIT LOG

nobis

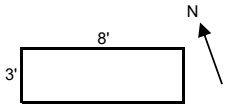
PROJECT		TEST PIT NO.	TP-109
Andover West Elementary School		SHEET	1 of 1
58 Beacon Street		FILE NO.	96480.02
Andover, Massachusetts		CHKD BY	Scott Carter

Engineer	Scott Carter	Make	Kubota	Ground El.	(±) 166 feet
Contractor	New England Boring	Model	KX080-4	Datum	NAVD 88
Operator	Matt Soucy	Capacity	~1/2 CY	Time Start	10:30 AM
Weather	Sunny, 70's	Reach	~12 feet	Date	8/18/2020

Depth Below Grade (ft)	Strata Change & Water Level	Subsurface Description	Excavation Effort	Boulder Qty/Class	USDA
1	TOPSOIL 8"	Dark brown, fine to medium SAND, some Silt with organics, trace fine Gravel, few roots. Dry to moist. (TOPSOIL).	E	--	Sandy Loam
2	GLACIAL TILL	Brown to Tan, fine to coarse SAND, some Silt, little fine to coarse Gravel. Moist. Faint redoximorphic staining present. (FILL). [Laboratory Analysis - Particle Size Analysis (Sieve Only): Gravel = 18.0%, Sand = 50.0%, Silt & Clay = 32.0%]	M - D		Sandy Loam - Silt Loam
3					
4	48"	Test pit terminated at 4 feet due to refusal on inferred bedrock.			
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

Notes: 1.) Test pit backfilled with excavated soils and compacted with excavator bucket to ground surface.

WATER SYMBOLS
▼ Groundwater
▽ Estimated Seasonal High Groundwater



BOULDER	CLASS
12" - 24"	A
24" - 36"	B
>36"	C

PROPORTIONS USED	
0-10%	Trace
10-20%	Little
20-35%	Some
35-50%	And

EXCAVATION EFFORT
E = Easy
M = Moderate
D = Difficult

APPENDIX C – LABORATORY TEST RESULTS

ConTest Consultants, Inc.

Providing Inspection/Testing & Consulting Services

LETTER OF TRANSMITTAL

TO: Nobis Group – Scott Carter

DATE: 3/10/2020

PROJECT: Andover West Elementary School (96480.00) – Andover, MA

CTC PROJECT NO.: 220116

Attached are the following for your use:

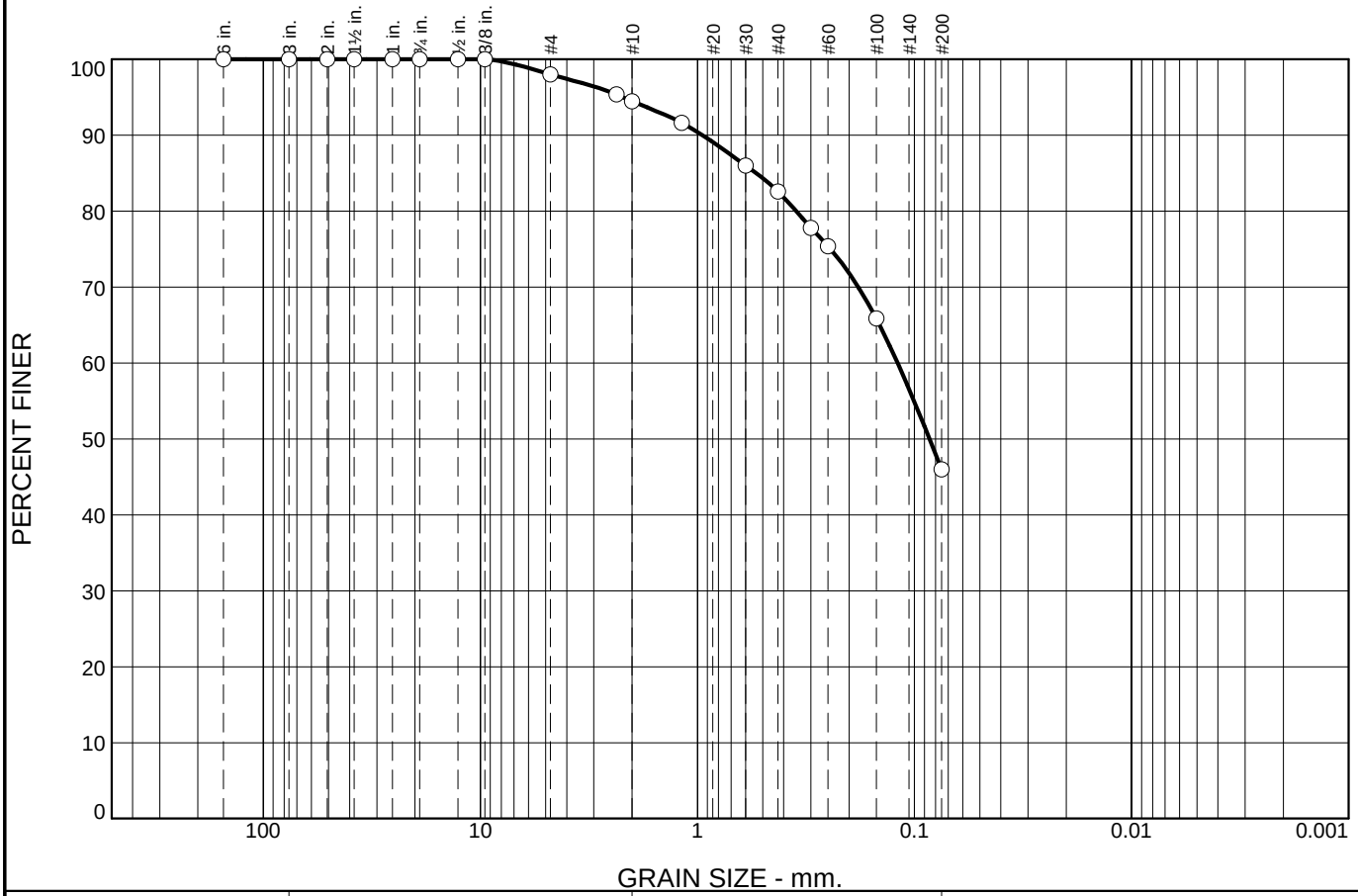
COPIES	DATE	LAB NUMBER	DESCRIPTION
			Concrete Report - Cylinders
			Concrete Inspection Report
			Reinforcing Steel Inspection Report
			Field Density Report
3		L-134-20 L-135-20 L-136-20	Particle Size Distribution Report
			Laboratory Soil Compaction Test Report
			Other

CC: Nobis Group – Mike Ciance

Reviewed By: Donald Walden

18 Cote Ave. Unit 11 Goffstown, NH 03045
p (603) 626-4422 • *f* (603) 782-0064
www.contestconsultantsinc.com

Particle Size Distribution Report



% +3"	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.0	0.0	5.5	8.5	10.6	29.4	46.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	100.0		
#4	98.0		
#8	95.4		
#10	94.5		
#16	91.6		
#30	86.0		
#40	82.6		
#50	77.8		
#60	75.4		
#100	65.9		
#200	46.0		

* (no specification provided)

Soil Description

coarse to fine Sand and Silt, trace fine Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.9474 D_{85}= 0.5375 D_{60}= 0.1196
D_{50}= 0.0854 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

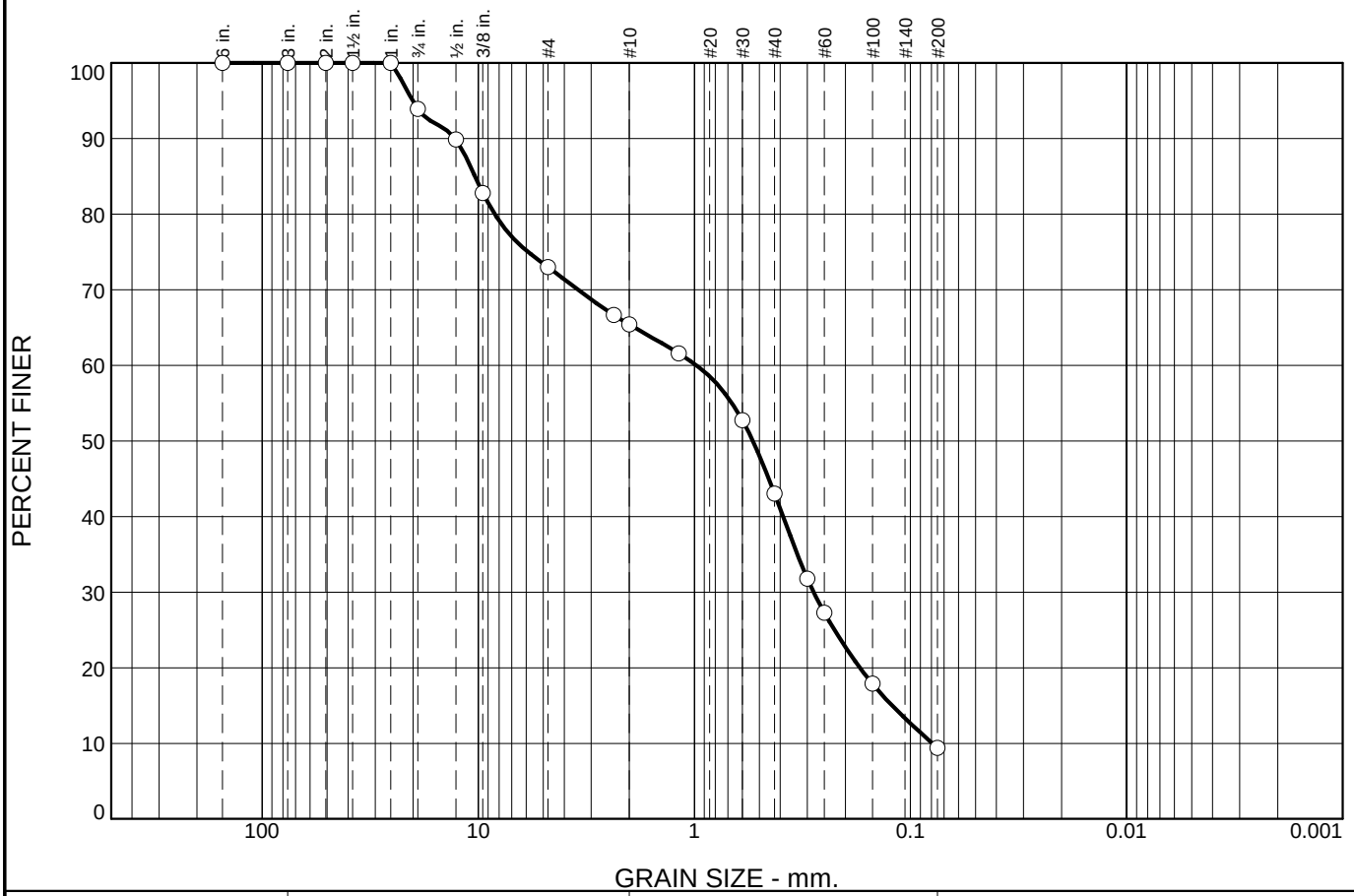
Location: B-1 / S5
Sample Number: L-134-20 **Depth:** 10'-12' **Date:** 3/10/2020

ConTest Consultants, Inc.

Goffstown, New Hampshire

Client: Nobis Group
Project: Andover West Elementary School (96480.00)
Andover, MA
Project No: 220116 **Figure**

Particle Size Distribution Report



% +3"	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.0	17.2	17.4	12.7	25.4	17.9	9.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	93.9		
1/2"	89.9		
3/8"	82.8		
#4	73.0		
#8	66.6		
#10	65.4		
#16	61.6		
#30	52.7		
#40	43.0		
#50	31.8		
#60	27.3		
#100	17.9		
#200	9.4		

* (no specification provided)

Soil Description

coarse to fine SAND, some med to fine Gravel, trace Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 12.7947 D_{85}= 10.3565 D_{60}= 0.9777
D_{50}= 0.5369 D_{30}= 0.2807 D_{15}= 0.1215
D_{10}= 0.0793 C_u= 12.33 C_c= 1.02

Classification

USCS= AASHTO=

Remarks

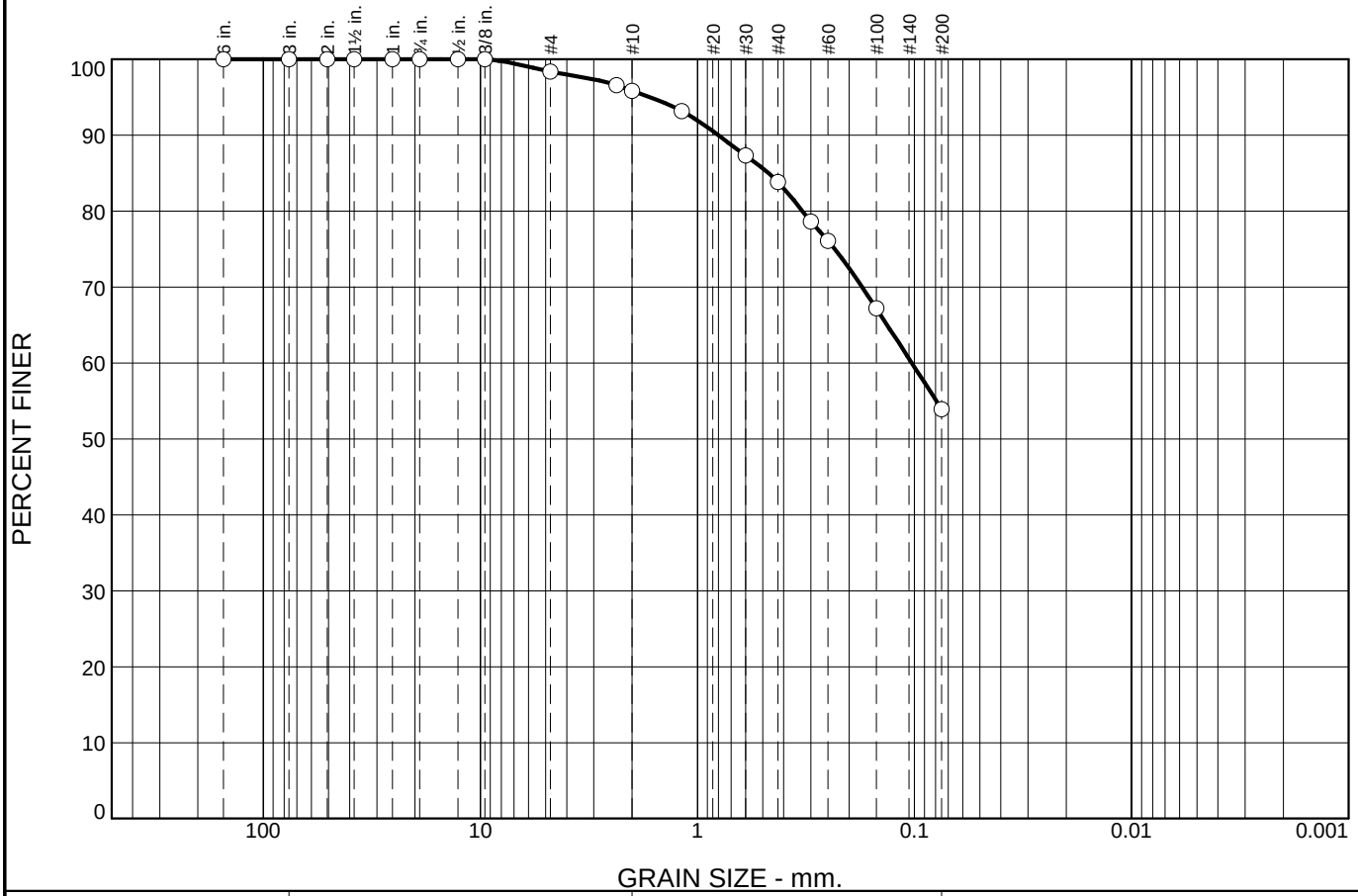
Location: B-11 / S2
Sample Number: L-135-20 **Depth:** 2.5'-4.5' **Date:** 3/10/2020

ConTest Consultants, Inc.

Goffstown, New Hampshire

Client: Nobis Group
Project: Andover West Elementary School (96480.00)
Andover, MA
Project No: 220116 **Figure**

Particle Size Distribution Report



% +3"	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.0	0.0	4.2	8.5	11.2	22.2	53.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	100.0		
#4	98.4		
#8	96.6		
#10	95.8		
#16	93.2		
#30	87.3		
#40	83.8		
#50	78.6		
#60	76.1		
#100	67.2		
#200	53.9		

* (no specification provided)

Soil Description

SILT and coarse to fine Sand, trace fine Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.8013 D_{85}= 0.4705 D_{60}= 0.1029
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Location: B-13 / S3
Sample Number: L-136-20 **Depth:** 5'-7' **Date:** 3/10/2020

ConTest Consultants, Inc.

Goffstown, New Hampshire

Client: Nobis Group
Project: Andover West Elementary School (96480.00)
Andover, MA
Project No: 220116 **Figure**

ConTest Consultants, Inc.

Providing Inspection/Testing & Consulting Services

LETTER OF TRANSMITTAL

TO: Nobis Group – Al Jones

DATE: 9/21/2021

PROJECT: Andover West Elem. School (096480.020) - Andover, MA

CTC PROJECT NO.: 221199

Attached are the following for your use:

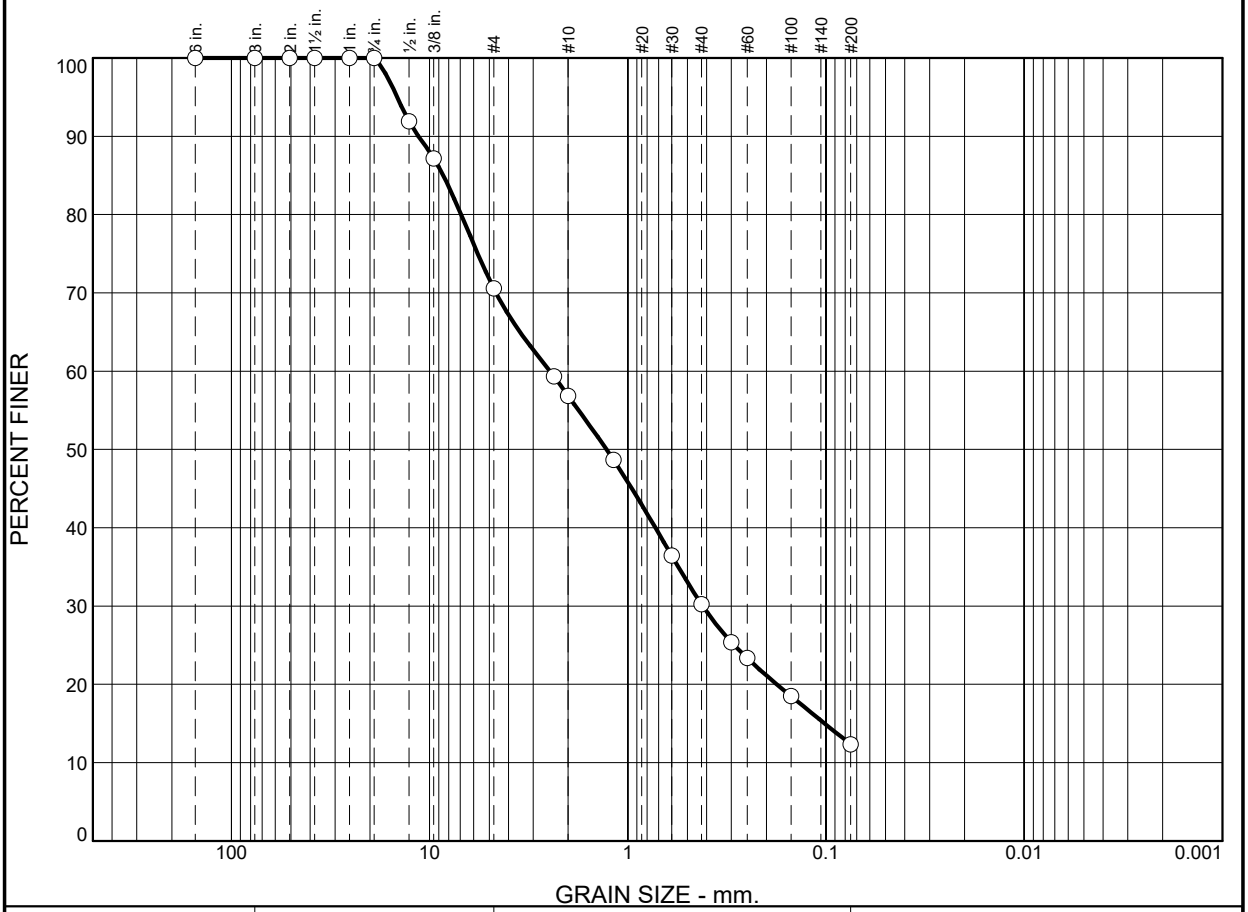
COPIES	DATE	LAB NUMBER	DESCRIPTION
			Concrete Report - Cylinders
			Concrete Inspection Report
			Reinforcing Steel Inspection Report
			Field Density Report
20		L-382-21 Thru L-401-21	Particle Size Distribution Report
			Laboratory Soil Compaction Test Report
			Atterberg Limits with Moisture Content

CC:

Reviewed By: Donald Walden

18 Cote Ave. Unit 11 Goffstown, NH 03045
p (603) 626-4422 • *f* (603) 782-0064
www.contestconsultantsinc.com

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	29.4	13.8	26.6	17.9	12.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	91.9		
3/8"	87.2		
#4	70.6		
#8	59.3		
#10	56.8		
#16	48.7		
#30	36.4		
#40	30.2		
#50	25.4		
#60	23.4		
#100	18.5		
#200	12.3		

* (no specification provided)

Soil Description

silty sand with gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 11.3817 D_{85}= 8.5420 D_{60}= 2.4714
D_{50}= 1.2813 D_{30}= 0.4185 D_{15}= 0.1015
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-1-b

Remarks

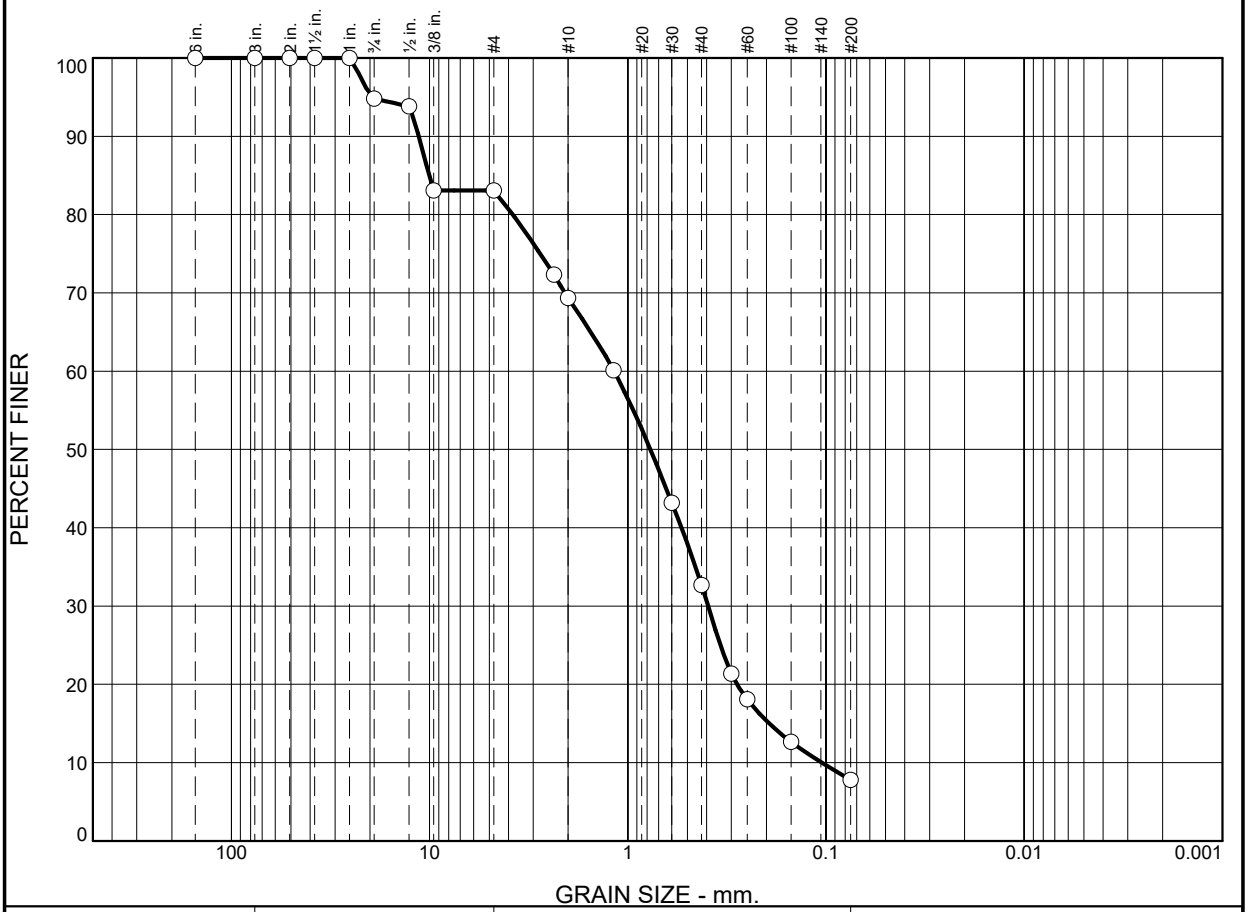
Location: B-105 / S2
Sample Number: L-382-21 **Depth:** 2'-4' **Date:** 9/20/2021

ConTest Consultants, Inc.

Goffstown, New Hampshire

Client: Nobis Group
Project: Andover West Elem. School (096480.020)
Andover, MA
Project No: 221199 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	5.2	11.7	13.7	36.7	24.9	7.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	94.8		
1/2"	93.8		
3/8"	83.1		
#4	83.1		
#8	72.3		
#10	69.4		
#16	60.1		
#30	43.2		
#40	32.7		
#50	21.3		
#60	18.1		
#100	12.7		
#200	7.8		

* (no specification provided)

Soil Description

well-graded sand with silt and gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 11.3401 D_{85}= 10.0584 D_{60}= 1.1740
D_{50}= 0.7693 D_{30}= 0.3936 D_{15}= 0.1935
D_{10}= 0.1051 C_u= 11.17 C_c= 1.26

Classification

USCS= SW-SM AASHTO= A-1-b

Remarks

Location: B-106 / S2
Sample Number: L-383-21 **Depth:** 2'-4' **Date:** 9/20/2021

ConTest Consultants, Inc.

Goffstown, New Hampshire

Client: Nobis Group
Project: Andover West Elem. School (096480.020)
Andover, MA
Project No: 221199 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.5	3.0	13.5	48.2	33.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	99.6		
#4	98.5		
#8	96.2		
#10	95.5		
#16	93.0		
#30	86.7		
#40	82.0		
#50	74.1		
#60	69.7		
#100	54.4		
#200	33.8		

* (no specification provided)

Soil Description

silty sand

Atterberg Limits

PL= NP LL= NV PI=

Coefficients

D_{90}= 0.8198 D_{85}= 0.5170 D_{60}= 0.1790
D_{50}= 0.1301 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

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

Remarks

Location: B-109 / S2
Sample Number: L-384-21 **Depth:** 2'-4' **Date:** 9/20/2021

ConTest Consultants, Inc.

Goffstown, New Hampshire

Client: Nobis Group
Project: Andover West Elem. School (096480.020)
Andover, MA
Project No: 221199 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	7.4	4.8	15.3	43.0	29.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	98.0		
3/8"	96.6		
#4	92.6		
#8	88.8		
#10	87.8		
#16	82.6		
#30	76.2		
#40	72.5		
#50	65.8		
#60	61.6		
#100	48.5		
#200	29.5		

* (no specification provided)

Soil Description

silty sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 2.9053 D_{85}= 1.4783 D_{60}= 0.2342
D_{50}= 0.1584 D_{30}= 0.0764 D_{15}=
D_{10}= C_u= C_c=

Classification

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

Remarks

Location: B-109 / S3
Sample Number: L-385-21 **Depth:** 4'-6' **Date:** 9/20/2021

ConTest Consultants, Inc.

Goffstown, New Hampshire

Client: Nobis Group
Project: Andover West Elem. School (096480.020)
Andover, MA
Project No: 221199 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.9	6.8	19.1	41.2	29.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	99.3		
#4	96.1		
#8	90.6		
#10	89.3		
#16	84.4		
#30	76.5		
#40	70.2		
#50	62.5		
#60	58.1		
#100	45.1		
#200	29.0		

* (no specification provided)

Soil Description

silty sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 2.1843 D_{85}= 1.2538 D_{60}= 0.2702
D_{50}= 0.1821 D_{30}= 0.0785 D_{15}=
D_{10}= C_u= C_c=

Classification

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

Remarks

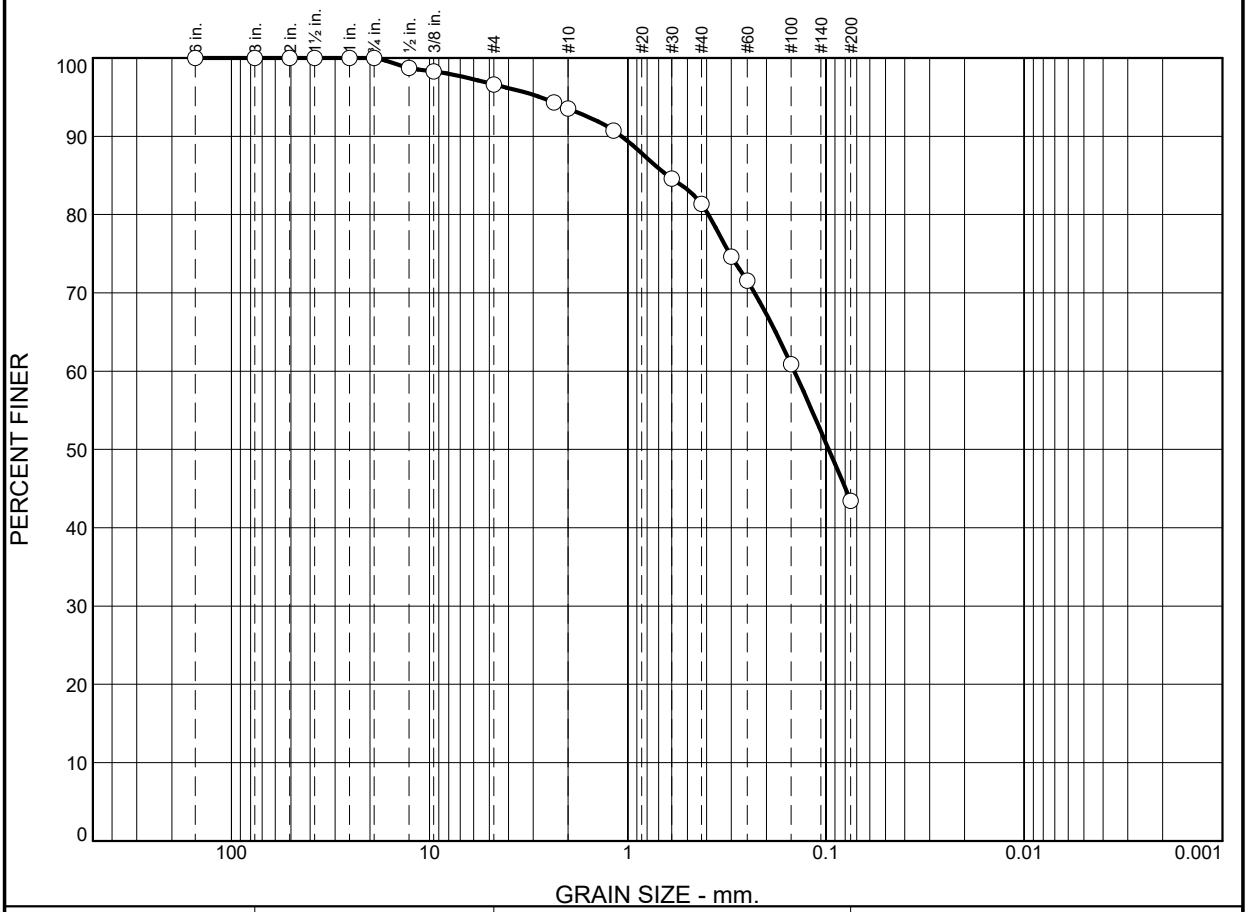
Location: B-110 / S2
Sample Number: L-386-21 **Depth:** 2'-4' **Date:** 9/20/2021

ConTest Consultants, Inc.

Goffstown, New Hampshire

Client: Nobis Group
Project: Andover West Elem. School (096480.020)
Andover, MA
Project No: 221199 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.4	3.1	12.2	37.9	43.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	98.7		
3/8"	98.3		
#4	96.6		
#8	94.3		
#10	93.5		
#16	90.7		
#30	84.6		
#40	81.3		
#50	74.6		
#60	71.6		
#100	60.9		
#200	43.4		

* (no specification provided)

Soil Description

silty sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 1.0760 D_{85}= 0.6307 D_{60}= 0.1447
D_{50}= 0.0968 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

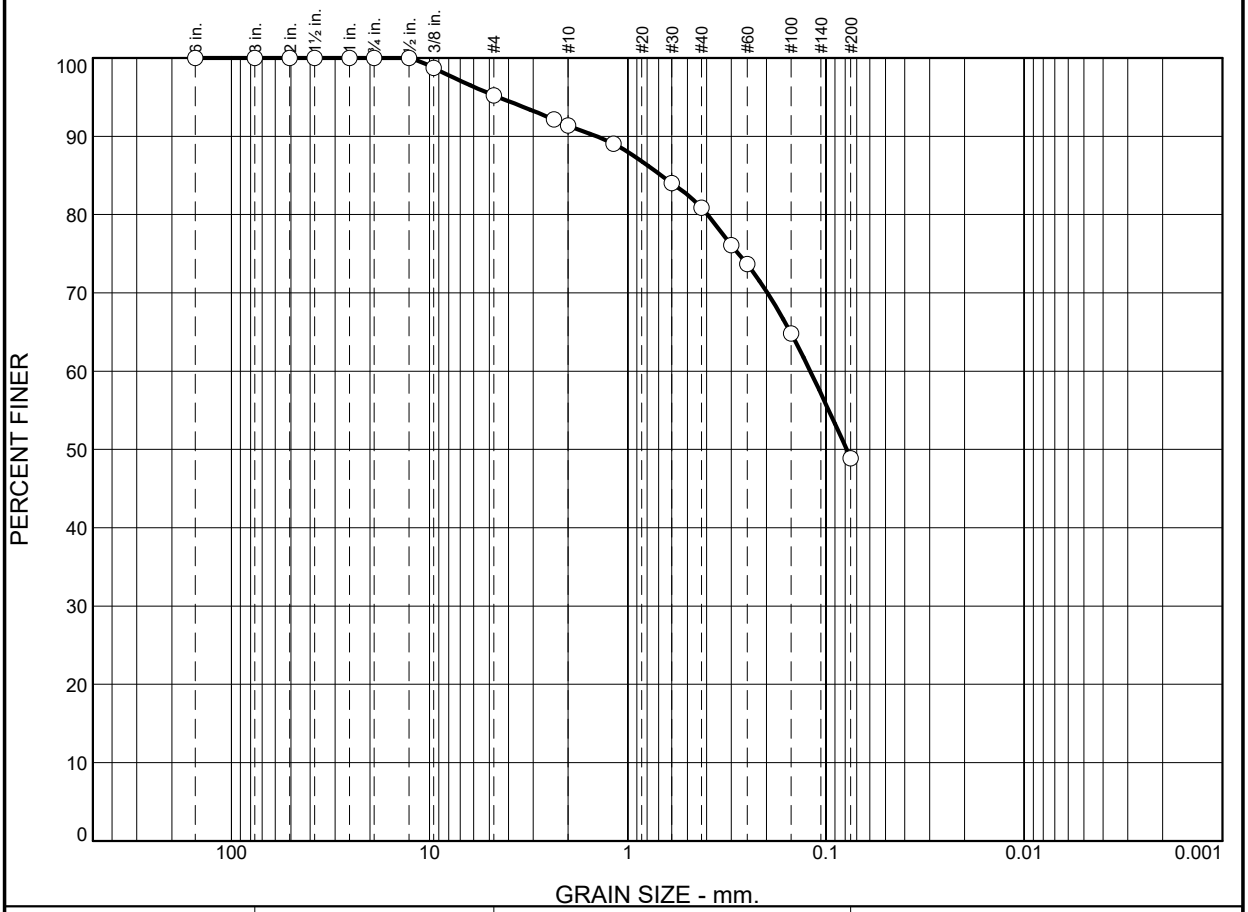
Location: B-111 / S2B
Sample Number: L-387-21 **Depth:** 2'-4' **Date:** 9/21/2021

ConTest Consultants, Inc.

Goffstown, New Hampshire

Client: Nobis Group
Project: Andover West Elem. School (096480.020)
Andover, MA
Project No: 221199 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.8	3.8	10.5	32.0	48.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	98.7		
#4	95.2		
#8	92.1		
#10	91.4		
#16	89.0		
#30	84.0		
#40	80.9		
#50	76.1		
#60	73.7		
#100	64.8		
#200	48.9		

* (no specification provided)

Soil Description

silty sand

Atterberg Limits

PL= NP LL= NV PI=

Coefficients

D_{90}= 1.4423 D_{85}= 0.6796 D_{60}= 0.1200
D_{50}= 0.0786 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Location: B-111 / S3
Sample Number: L-388-21 **Depth:** 4'-6' **Date:** 9/20/2021

ConTest Consultants, Inc.

Goffstown, New Hampshire

Client: Nobis Group
Project: Andover West Elem. School (096480.020)
Andover, MA
Project No: 221199 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.5	3.3	11.4	42.8	41.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	100.0		
#4	98.5		
#8	95.9		
#10	95.2		
#16	92.6		
#30	88.0		
#40	83.8		
#50	78.3		
#60	74.7		
#100	62.2		
#200	41.0		

* (no specification provided)

Soil Description

silty sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 0.7571 D_{85}= 0.4643 D_{60}= 0.1390
D_{50}= 0.0996 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

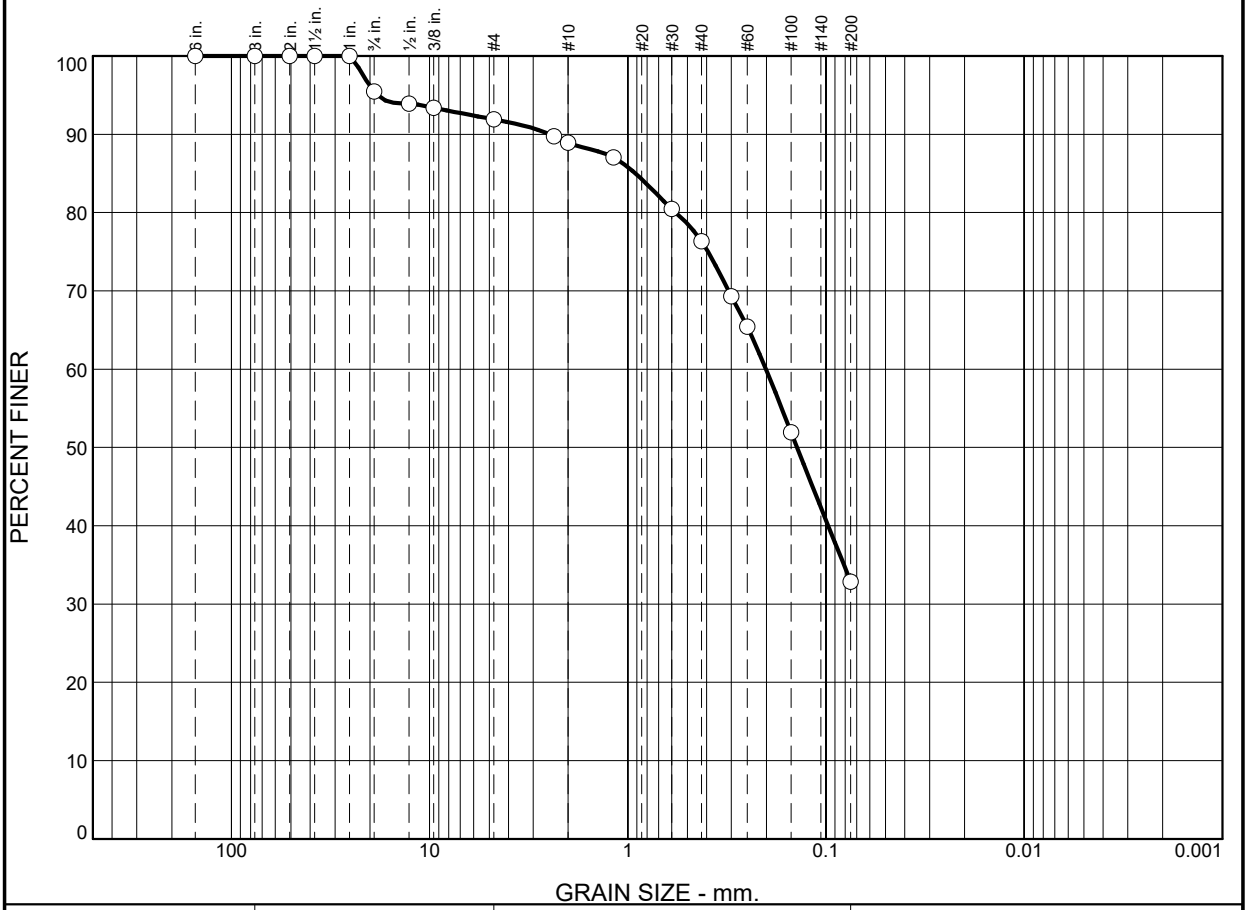
Location: B-112 / S3
Sample Number: L-389-21 **Depth:** 4'-6' **Date:** 9/20/2021

ConTest Consultants, Inc.

Goffstown, New Hampshire

Client: Nobis Group
Project: Andover West Elem. School (096480.020)
Andover, MA
Project No: 221199 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.5	3.6	3.0	12.6	43.4	32.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	95.5		
1/2"	93.9		
3/8"	93.4		
#4	91.9		
#8	89.8		
#10	88.9		
#16	87.0		
#30	80.5		
#40	76.3		
#50	69.3		
#60	65.4		
#100	51.9		
#200	32.9		

* (no specification provided)

Soil Description

silty sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 2.4821 D_{85}= 0.9165 D_{60}= 0.2008
D_{50}= 0.1401 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

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

Remarks

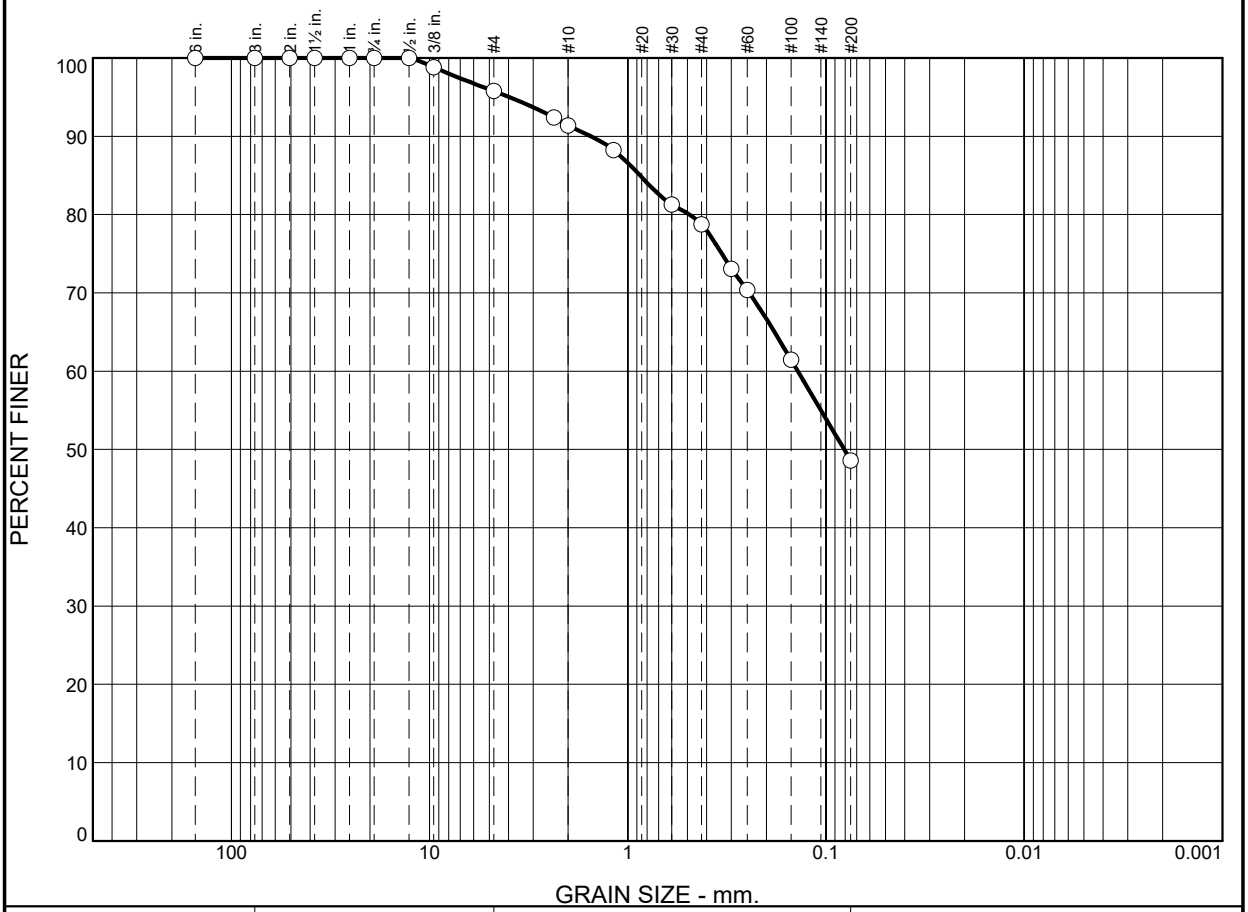
Location: B-114 / S3
Sample Number: L-390-21 **Depth:** 4'-6' **Date:** 9/21/2021

ConTest Consultants, Inc.

Goffstown, New Hampshire

Client: Nobis Group
Project: Andover West Elem. School (096480.020)
Andover, MA
Project No: 221199 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	4.2	4.4	12.7	30.1	48.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	98.8		
#4	95.8		
#8	92.4		
#10	91.4		
#16	88.2		
#30	81.3		
#40	78.7		
#50	73.1		
#60	70.4		
#100	61.4		
#200	48.6		

* (no specification provided)

Soil Description

silty sand

Atterberg Limits

PL= NP LL= NV PI=

Coefficients

D_{90}= 1.5376 D_{85}= 0.8690 D_{60}= 0.1389
D_{50}= 0.0809 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

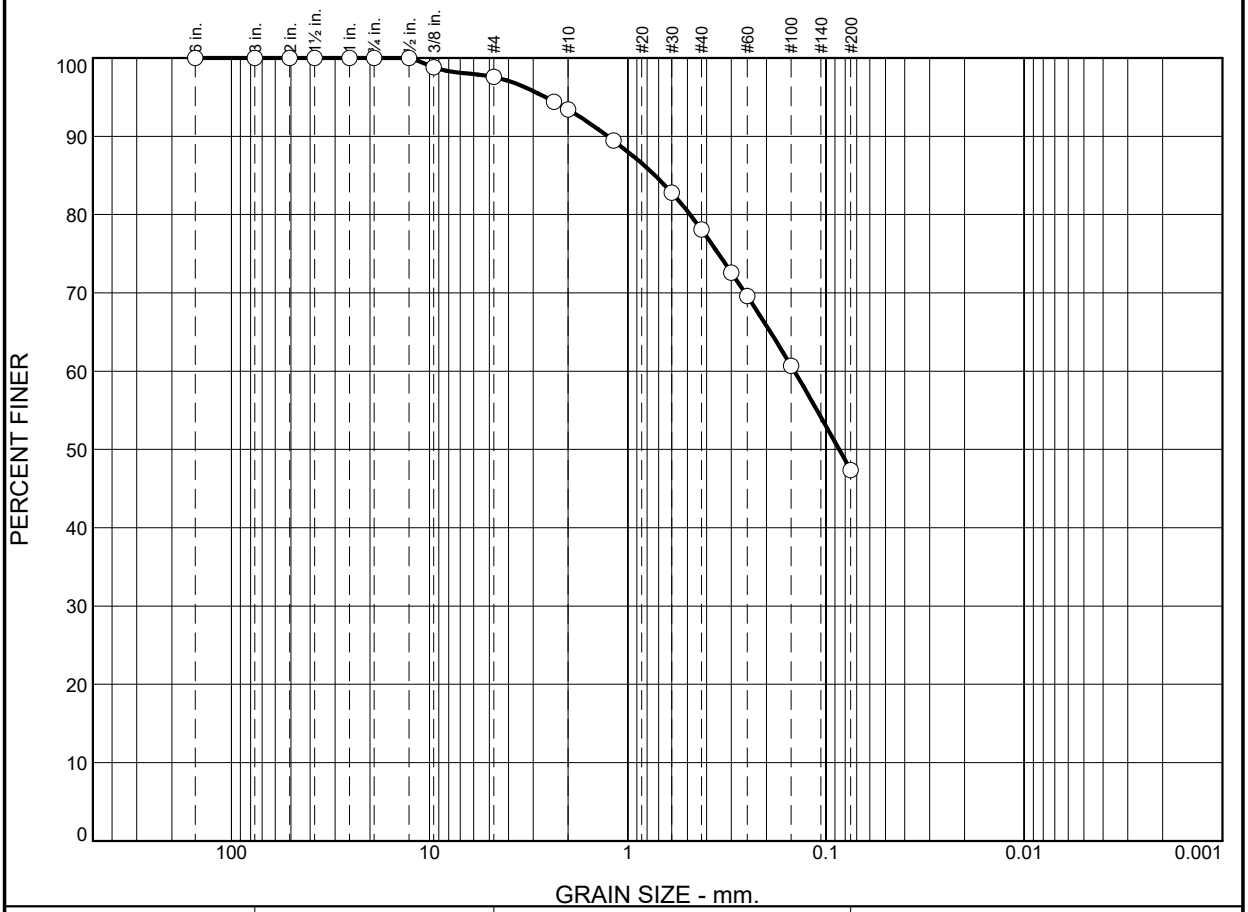
Location: B-123 / S3
Sample Number: L-391-21 **Depth:** 4'-6' **Date:** 9/21/2021

ConTest Consultants, Inc.

Goffstown, New Hampshire

Client: Nobis Group
Project: Andover West Elem. School (096480.020)
Andover, MA
Project No: 221199 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.4	4.2	15.3	30.8	47.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	98.8		
#4	97.6		
#8	94.4		
#10	93.4		
#16	89.4		
#30	82.8		
#40	78.1		
#50	72.6		
#60	69.6		
#100	60.7		
#200	47.3		

* (no specification provided)

Soil Description

silty sand

Atterberg Limits

PL= NP LL= NV PI=

Coefficients

D_{90}= 1.2637 D_{85}= 0.7303 D_{60}= 0.1444
D_{50}= 0.0858 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

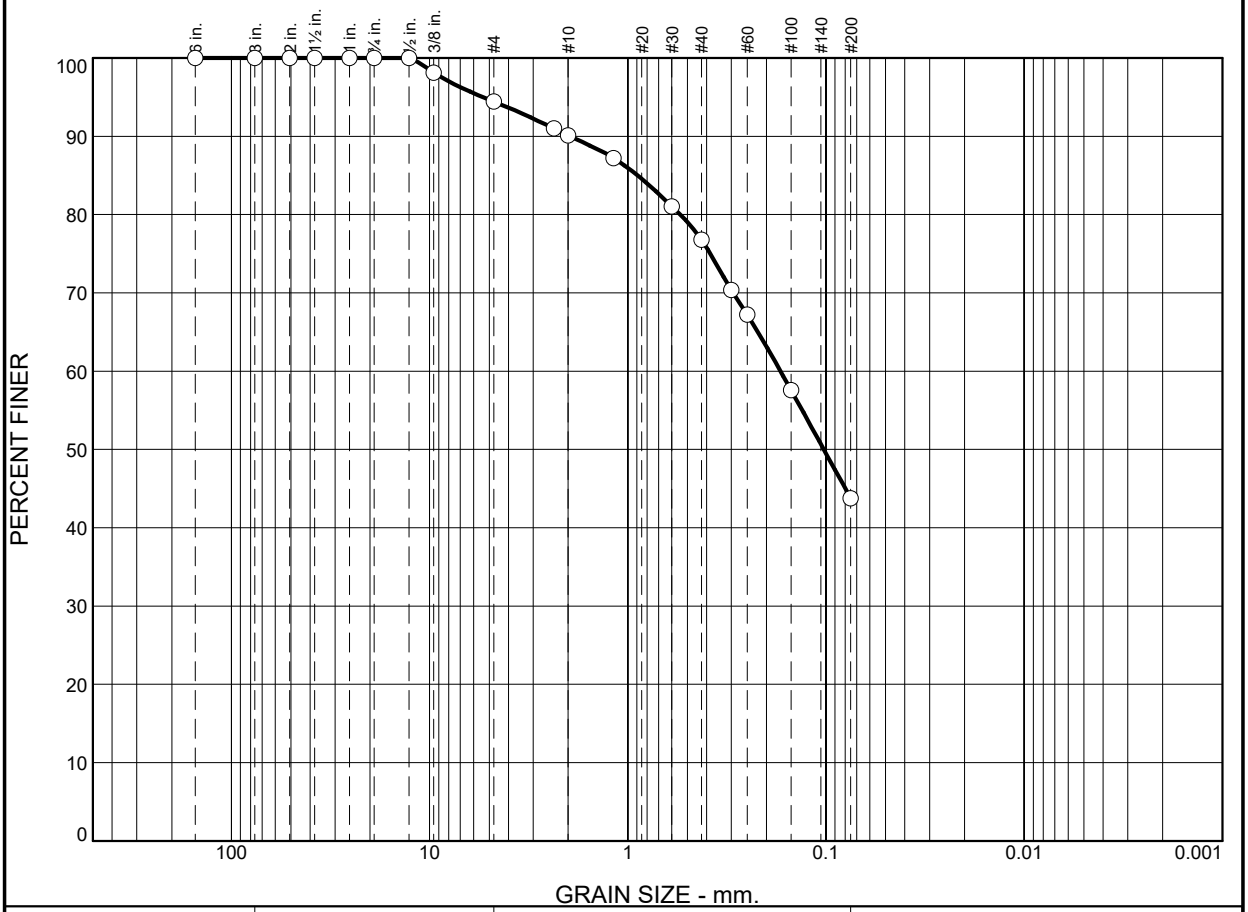
Location: B-123 / S4
Sample Number: L-392-21 **Depth:** 6'-8' **Date:** 9/21/2021

ConTest Consultants, Inc.

Goffstown, New Hampshire

Client: Nobis Group
Project: Andover West Elem. School (096480.020)
Andover, MA
Project No: 221199 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.6	4.3	13.3	33.0	43.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	98.1		
#4	94.4		
#8	91.0		
#10	90.1		
#16	87.2		
#30	81.0		
#40	76.8		
#50	70.3		
#60	67.2		
#100	57.6		
#200	43.8		

* (no specification provided)

Soil Description

silty sand

Atterberg Limits

PL= NP LL= NV PI=

Coefficients

D_{90}= 1.9660 D_{85}= 0.8942 D_{60}= 0.1698
D_{50}= 0.1026 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Location: B-130 / S3
Sample Number: L-393-21 **Depth:** 4'-6' **Date:** 9/21/2021

ConTest Consultants, Inc.

Goffstown, New Hampshire

Client: Nobis Group

Project: Andover West Elem. School (096480.020)
Andover, MA

Project No: 221199 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	5.6	13.3	6.6	14.0	31.7	28.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	94.4		
1/2"	94.4		
3/8"	91.7		
#4	81.1		
#8	76.1		
#10	74.5		
#16	70.5		
#30	64.2		
#40	60.5		
#50	55.0		
#60	52.2		
#100	42.5		
#200	28.8		

* (no specification provided)

Soil Description

silty sand with gravel

Atterberg Limits

PL= NP LL= NV PI=

Coefficients

D_{90}= 8.5348 D_{85}= 6.3010 D_{60}= 0.4099
D_{50}= 0.2201 D_{30}= 0.0798 D_{15}=
D_{10}= C_u= C_c=

Classification

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

Remarks

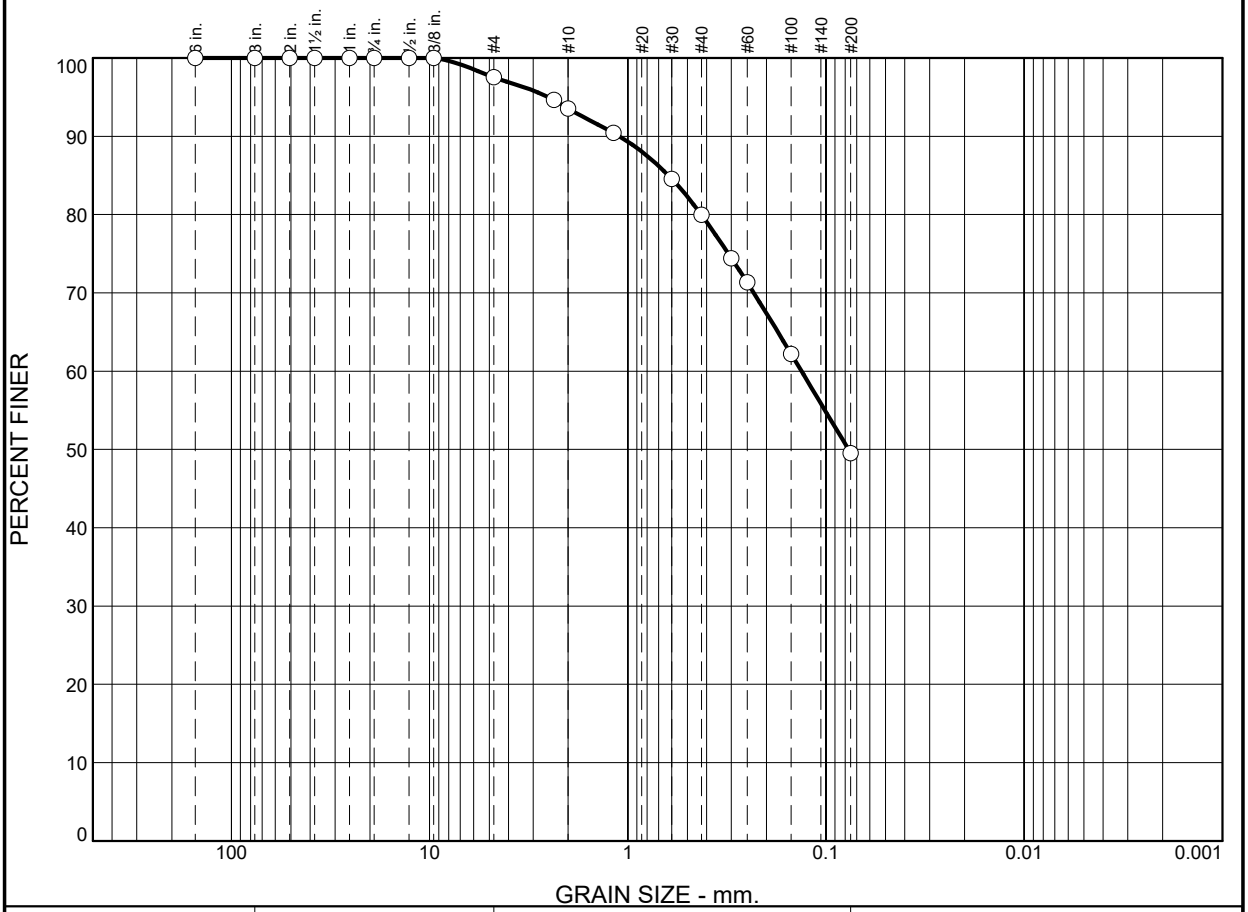
Location: B-133 / S2
Sample Number: L-394-21 **Depth:** 2'-4' **Date:** 9/21/2021

ConTest Consultants, Inc.

Goffstown, New Hampshire

Client: Nobis Group
Project: Andover West Elem. School (096480.020)
Andover, MA
Project No: 221199 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.5	4.0	13.5	30.5	49.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	100.0		
#4	97.5		
#8	94.6		
#10	93.5		
#16	90.4		
#30	84.6		
#40	80.0		
#50	74.4		
#60	71.3		
#100	62.2		
#200	49.5		

* (no specification provided)

Soil Description

silty sand

Atterberg Limits

PL= NP LL= NV PI=

Coefficients

D_{90}= 1.1062 D_{85}= 0.6239 D_{60}= 0.1330
D_{50}= 0.0771 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

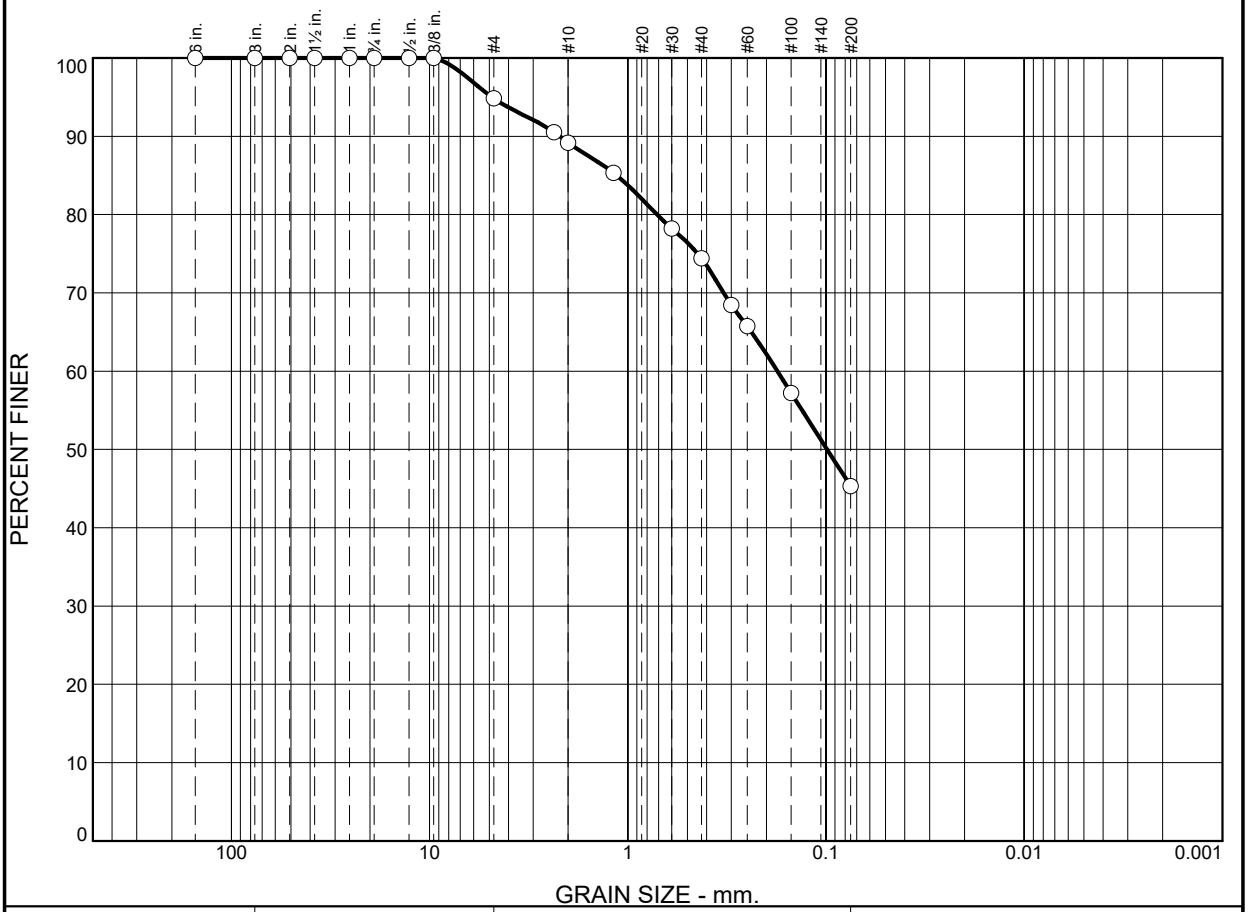
Location: B-135 / S2
Sample Number: L-395-21 **Depth:** 2'-4' **Date:** 9/200/2021

ConTest Consultants, Inc.

Goffstown, New Hampshire

Client: Nobis Group
Project: Andover West Elem. School (096480.020)
Andover, MA
Project No: 221199 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.2	5.6	14.8	29.1	45.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	100.0		
#4	94.8		
#8	90.5		
#10	89.2		
#16	85.3		
#30	78.2		
#40	74.4		
#50	68.4		
#60	65.7		
#100	57.2		
#200	45.3		

* (no specification provided)

Soil Description

silty sand

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 2.2119 D_{85}= 1.1381 D_{60}= 0.1759
D_{50}= 0.0987 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

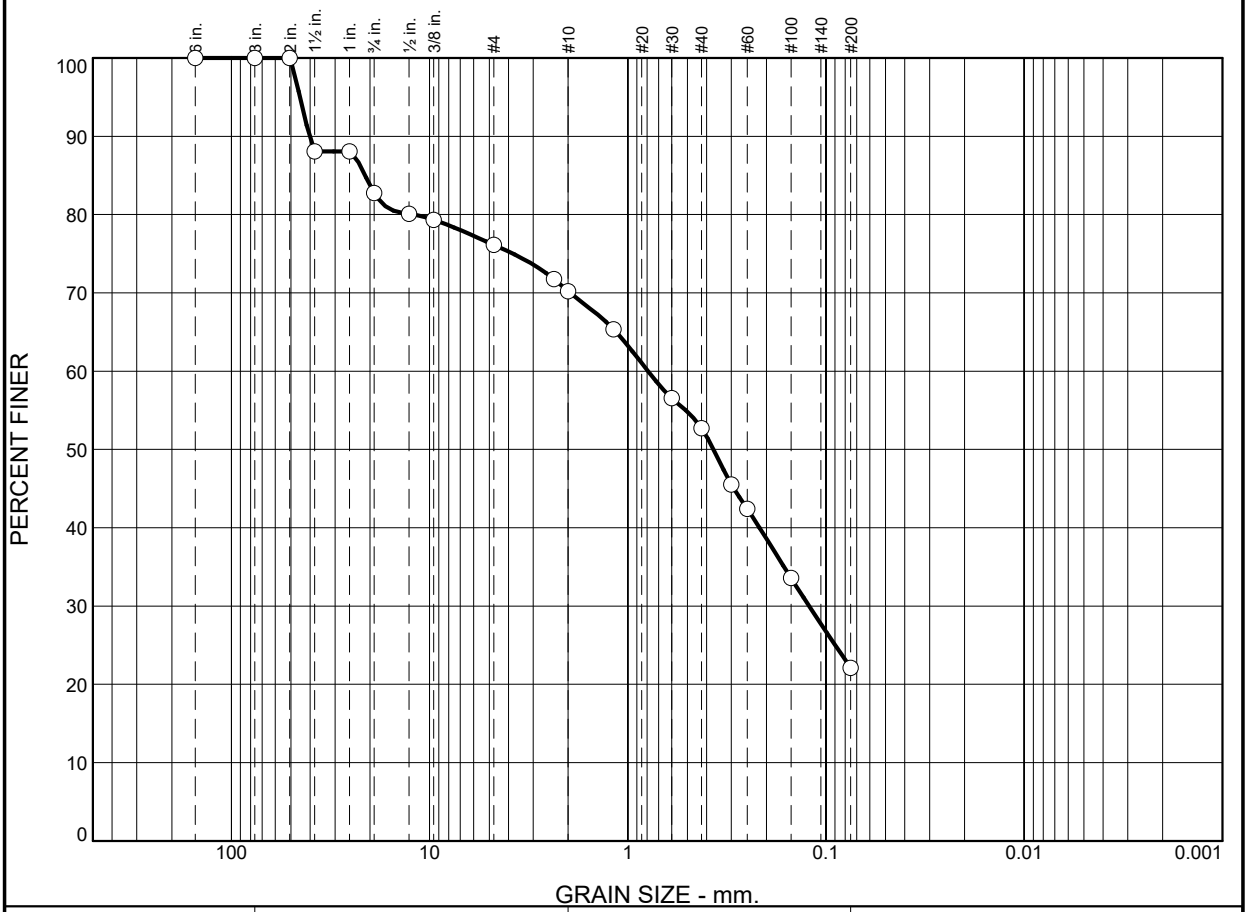
Location: B-135 / S5
Sample Number: L-396-21 **Depth:** 8'-10' **Date:** 9/21/2021

ConTest Consultants, Inc.

Goffstown, New Hampshire

Client: Nobis Group
Project: Andover West Elem. School (096480.020)
Andover, MA
Project No: 221199 **Figure**

Particle Size Distribution Report



% +3"	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	11.9	8.8	9.1	13.6	14.2	20.3	22.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
3"	100.0		
2"	100.0		
1.5"	88.1		
1"	88.1		
3/4"	82.8		
1/2"	80.1		
3/8"	79.3		
#4	76.1		
#8	71.7		
#10	70.2		
#16	65.3		
#30	56.6		
#40	52.7		
#50	45.5		
#60	42.4		
#100	33.6		
#200	22.1		

* (no specification provided)

Soil Description

silty sand with gravel

Atterberg Limits

PL= NP LL= NV PI=

Coefficients

D_{90}= 40.3707 D_{85}= 21.1508 D_{60}= 0.7913
D_{50}= 0.3700 D_{30}= 0.1217 D_{15}=
D_{10}= C_u= C_c=

Classification

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

Remarks

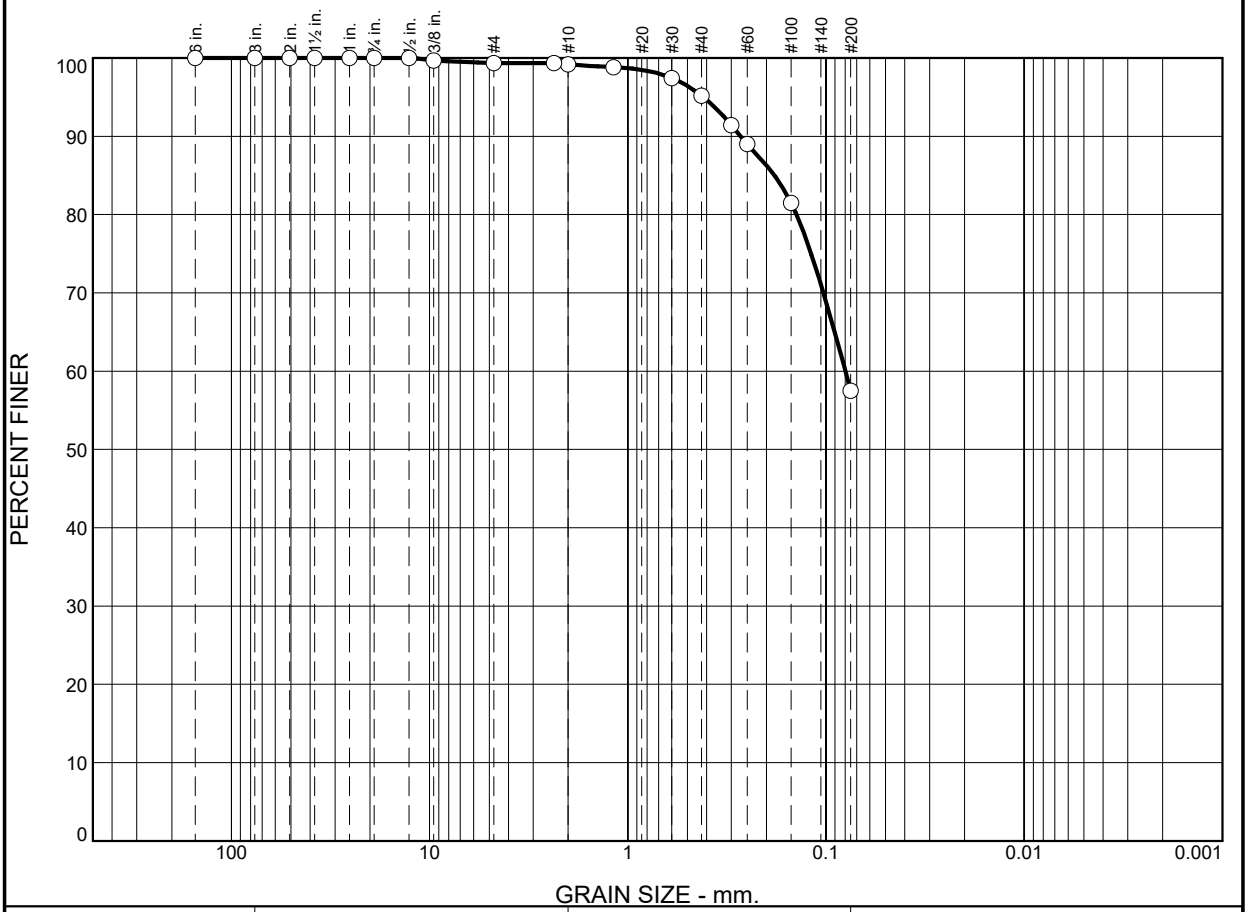
Location: TP-103
Sample Number: L-397-21 **Depth:** 1'-2' **Date:** 9/21/2021

ConTest Consultants, Inc.

Goffstown, New Hampshire

Client: Nobis Group
Project: Andover West Elem. School (096480.020)
Andover, MA
Project No: 221199 **Figure**

Particle Size Distribution Report



% +3"	% Gravel			% Sand			% Fines
	Coarse	Medium	Fine	Coarse	Medium	Fine	
0.0	0.0	0.3	0.5	1.8	8.4	31.5	57.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	99.7		
#4	99.4		
#8	99.3		
#10	99.2		
#16	98.8		
#30	97.4		
#40	95.2		
#50	91.4		
#60	89.0		
#100	81.5		
#200	57.5		

* (no specification provided)

Soil Description

sandy silt

Atterberg Limits

PL= NP LL= NV PI=

Coefficients

D_{90}= 0.2699 D_{85}= 0.1820 D_{60}= 0.0798
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

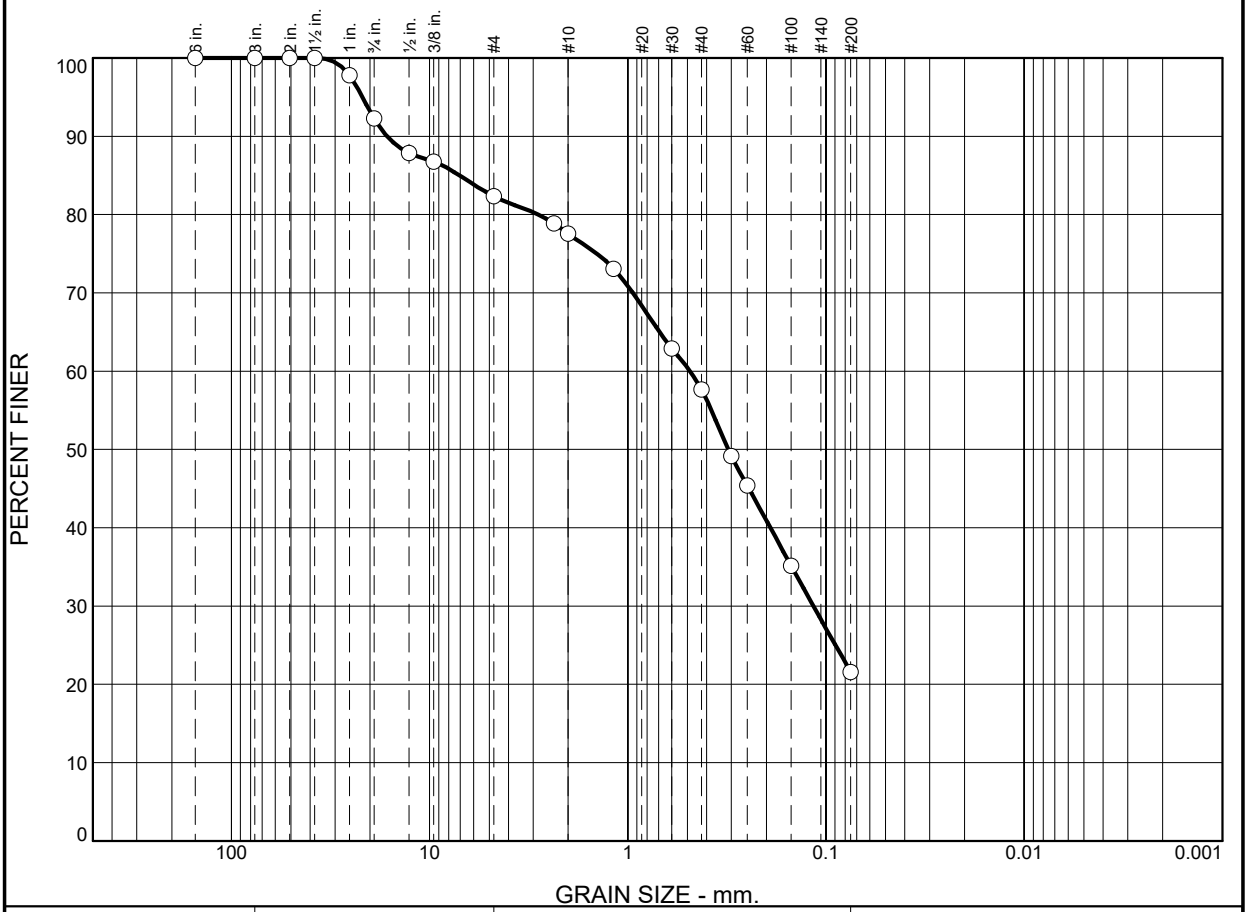
Location: TP-104
Sample Number: L-398-21 **Depth:** 4'-5' **Date:** 9/21/2021

ConTest Consultants, Inc.

Goffstown, New Hampshire

Client: Nobis Group
Project: Andover West Elem. School (096480.020)
Andover, MA
Project No: 221199 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	7.7	10.0	4.8	19.8	36.1	21.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	97.8		
3/4"	92.3		
1/2"	87.9		
3/8"	86.8		
#4	82.3		
#8	78.9		
#10	77.5		
#16	73.1		
#30	62.9		
#40	57.7		
#50	49.1		
#60	45.4		
#100	35.1		
#200	21.6		

* (no specification provided)

Soil Description

silty sand with gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 16.3924 D_{85}= 7.0563 D_{60}= 0.4857
D_{50}= 0.3112 D_{30}= 0.1157 D_{15}=
D_{10}= C_u= C_c=

Classification

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

Remarks

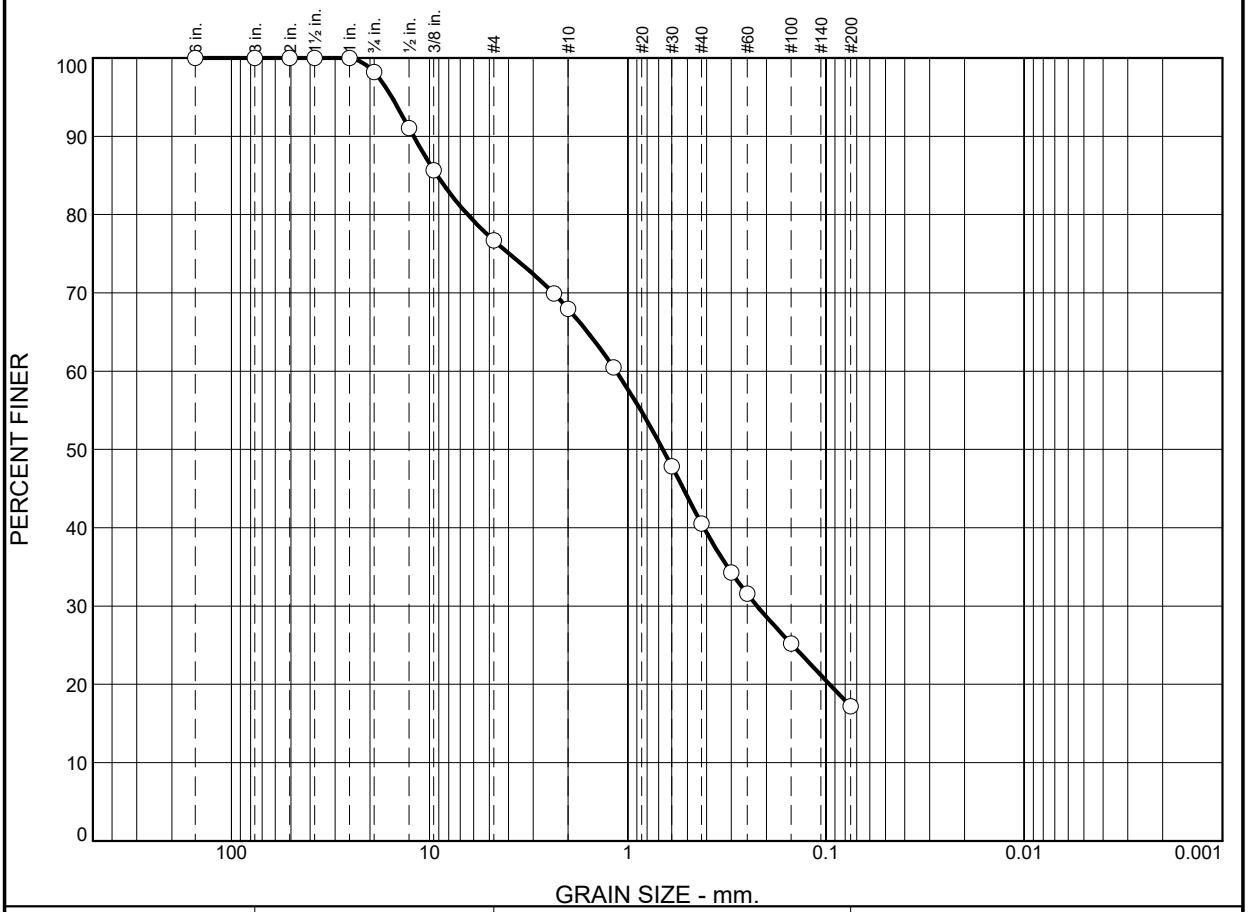
Location: TP-105
Sample Number: L-399-21 **Depth:** 3'-4' **Date:** 9/21/2021

ConTest Consultants, Inc.

Goffstown, New Hampshire

Client: Nobis Group
Project: Andover West Elem. School (096480.020)
Andover, MA
Project No: 221199 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	1.8	21.5	8.7	27.5	23.3	17.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
3"	100.0		
2"	100.0		
1.5"	100.0		
1"	100.0		
3/4"	98.2		
1/2"	91.0		
3/8"	85.7		
#4	76.7		
#8	69.9		
#10	68.0		
#16	60.5		
#30	47.9		
#40	40.5		
#50	34.3		
#60	31.6		
#100	25.2		
#200	17.2		

* (no specification provided)

Soil Description

silty sand with gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 12.0517 D_{85}= 9.1534 D_{60}= 1.1465
D_{50}= 0.6653 D_{30}= 0.2227 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-1-b

Remarks

Location: TP-107
Sample Number: L-400-21 **Depth:** 1.5'-2.5' **Date:** 9/21/2021

ConTest Consultants, Inc.

Goffstown, New Hampshire

Client: Nobis Group
Project: Andover West Elem. School (096480.020)
Andover, MA
Project No: 221199 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	7.1	10.9	4.2	15.7	30.1	32.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6"	100.0		
3"	100.0		
2"	100.0		
1.5"	98.7		
1"	95.7		
3/4"	92.9		
1/2"	90.4		
3/8"	88.7		
#4	82.0		
#8	78.8		
#10	77.8		
#16	73.8		
#30	66.9		
#40	62.1		
#50	56.8		
#60	53.9		
#100	44.9		
#200	32.0		

* (no specification provided)

Soil Description

silty sand with gravel

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 11.7590 D_{85}= 6.5087 D_{60}= 0.3708
D_{50}= 0.1989 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

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

Remarks

Location: TP-109
Sample Number: L-401-21 **Depth:** 1'-4' **Date:** 9/21/2021

ConTest Consultants, Inc.

Goffstown, New Hampshire

Client: Nobis Group
Project: Andover West Elem. School (096480.020)
Andover, MA
Project No: 221199 **Figure**

Appendix B: Traffic Assessment Report (prepared by Brennan Consulting)

TRAFFIC IMPACT STUDY
WEST ELEMENTARY SCHOOL
58 BEACON STREET, ANDOVER MA



Prepared for:

SMMA
1000 Massachusetts Avenue
Cambridge, MA 02138

Prepared by:
Brennan Consulting
24 Ray Avenue
Burlington, MA 01803

Brennan Consulting
ENGINEERING • TRANSPORTATION • SURVEYING

January 27, 2020

Brennan Consulting
ENGINEERING • TRANSPORTATION • SURVEYING

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   2.2 TRAFFIC COUNT VOLUMES AND SPEEDS 4

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APPENDIX A – EXISTING TRAFFIC COUNT DATA
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APPENDIX E – INTERSECTION CAPACITY AND QUEUE LENGTH ANALYSIS RESULTS

1. INTRODUCTION

The Andover School District is proposing to reconstruct the West Elementary School at 58 Beacon St in Andover, MA. The West Elementary School site is to be renovated to accommodate approximately 925 elementary students. The proposed staff is approximately 205 personnel. The project site has frontage on Beacon Street. Accessing and egressing the site is through main driveways north and south of the school building and through a one-way looped driveway at the middle of the site to the east of the building that serves a small parking area.

The purpose of this Traffic Impact Study is to assess the impacts of adding the students and staff to the local street network including Chandler Road, Beacon Street, Andover Country Club Lane, High Plain Road, Shawsheen Road, and Lowell Street.

An Existing Conditions Map, **Figure 1**, and a Proposed Site Plan, **Figure 2**, are provided illustrating the present and proposed future conditions.

Brennan Consulting Inc. has evaluated the traffic impacts of the additional vehicular trips to the street network and associated traffic intersections. The results are presented in this Traffic Impact Study (TIS) Report.

2. EXISTING CONDITIONS

Field investigations were conducted on Chandler Road, Beacon Street, Andover Country Club Lane, High Plain Road, Lowell Street, Shawsheen Road, and the three driveways from the site of the project. The investigations included an inventory of existing conditions, posted traffic controls, adjacent land uses, lane configurations, pavement widths, sidewalks, and existing vehicular traffic patterns.

2.1 ADJACENT ROADWAYS

❖ CHANDLER ROAD

Chandler Road is a two lane north-south Collector Road north of the project site, under the jurisdiction of the Town of Andover. The street serves as an access route from the Town to residential areas north and south of Route 495, and some commercial and industrial areas south of the Merrimack River. Chandler Road has a width of 28 feet with curb and sidewalk along the west side for a portion of the street length south of Route 495. There is no parking along Chandler Road in the area of the project. The speed limit is posted at 30 mph. The pavement and paint on Chandler Road are in good to fair condition.

❖ BEACON STREET/SHAWSHEEN ROAD

Beacon Street is a two-lane north-south Major Collector Road east of the project site which transitions to Shawsheen Road south of Route 133, which is also a two-lane north-south Major Collector Road, all under the jurisdiction of the Town of Andover. The Streets serve as an access route from the Town to Route 133. Beacon Street and Shawsheen Road have a roadway width of 30 feet with no parking allowed. There are sidewalks and curb on the west side of the street. The posted speed limit on Beacon Street is 40 MPH with a flashing 20 MPH posting along the school zone and a short 25 MPH zone posted at Andover Country Club Lane and at High Plain Road. The pavement and paint on Beacon Street and Shawsheen Road are generally in good to fair condition.

❖ ANDOVER COUNTRY CLUB LANE

Andover Country Club Lane is a two-lane east/west roadway classified as a Local Street under the jurisdiction of the Town of Andover. The street serves as an access route to the local residents in the area and to the Andover Country Club. Andover Country Club Lane has a roadway width of 28 feet with no designated parking. There is a sidewalk on the north side of the street and a curb on both sides. There is no posted speed limit on Andover Country Club Lane and the speed limit is assumed to be 20 mph for the purpose of this study. The pavement and paint on Andover Country Club Lane are generally in good to fair condition.

❖ NORTHERN DRIVEWAY

The Northern Driveway is a two lane east-west road that provides access to the pick up drop off area along the Beacon Street frontage and the parking lot and ball fields north of the school building. This driveway is the furthest north of the driveways to and from the project site. The Northern Driveway has a variable width and is flanked by parking areas and a fire lane. There is curb along both sides of the driveway at the entrance to the site but there are no sidewalks leading into the site. The speed limit is not posted for the driveway and there is no stop sign or painted stop line or painted crosswalk at the approach to Beacon Street. The pavement and paint at the Northern Driveway are in fair condition.

❖ MIDDLE DRIVEWAY

The Middle Driveway is a loop road along the street frontage side of the school building in between the North and South Driveways. The Middle Driveway has two curb cuts on Beacon Street with the southern cut serving as an entrance to a one-lane, one-way parking area and the northern cut serving as an exit only driveway to Beacon Street from the parking area to south and the bus pick up and drop off area to the north. The Middle Driveway has a variable width through the southerly loop with parallel parking on the Beacon Street side and angled parking along the school building. The northerly part of the loop is a 24 foot wide one-way exit driveway with a 16 foot travel lane flanked by 4 foot fire lanes on each side. There are curbs on both sides of the northerly loop and a sidewalk along the school building. There is no stop sign or stop line at the approach to Beacon Street. There is no speed limit posted for the Middle Driveway. The pavement and paint on the Middle Driveway are in good to fair condition.

❖ SOUTHERN DRIVEWAY

The Southern Driveway is a two lane east-west road that provides access to the rear of the school building and the ball fields and playground areas. This roadway is furthest south of the driveways at the project site. The Southern Driveway has a 24 foot pavement width with no curbs or sidewalks. There are parking areas along both sides of the driveway at the rear of the building only. There is a stop sign and a stop line and a painted crosswalk at the approach to Beacon Street. The speed limit is not posted on the Southern Driveway and is assumed to be 20 mph for the purposes of this study. The pavement and paint on the Southern Driveway are in good condition.

❖ HIGH PLAIN ROAD

High Plain Road is a two-lane east-west roadway classified as an urban collector and rural minor collector, all under the jurisdiction of the Town of Andover. The street serves as access to residential areas from West Andover to across Route 495. High Plain Road has a roadway width of 26 feet with curb and sidewalk along the south side near the intersection with Beacon Street. There is no designated parking on High Plain Road. There are no posted speed limits on High Plain Road and the speed limit is assumed to be 30 mph

for the purpose of this study. There is a stop sign and a stop line and a painted crosswalk at the approach to Beacon Street. The pavement and paint on High Plain Road are generally in good condition.

❖ **LOWELL STREET (STATE ROUTE 133)**

Lowell Street is a two-lane east-west arterial road that connects the City of Lowell to the west through several towns all of the way to the City of Gloucester under the jurisdiction of the Commonwealth of Massachusetts. Lowell Street has a roadway width of 28 feet with curbs on both sides in the vicinity of Beacon Street. There is a sidewalk on the north side of Lowell Street to the east of Beacon Street and a sidewalk on the south side to the west of Beacon Street. There is no parking on Lowell Street. The speed limit on Lowell Street is posted at 30 MPH in the vicinity of Beacon Street. The pavement and paint on Lowell Street are generally in good to fair condition.

2.2 TRAFFIC COUNT VOLUMES AND SPEEDS

The existing AM and PM peak hour traffic counts were obtained from the Transportation Data Corp. (TDC) for the existing study area intersections. AM and PM turning movement counts were collected on Thursday, November 21, 2019, from 7:00 to 9:00 am, and 2:00 pm to 4:00 pm. The existing traffic count data is shown in **Appendix A**.

The existing turning movement configuration for the AM and PM peak hours are shown in **Figure 3**.

The Chandler Road speed limit is 30 mph. High Plain Road does not have a posted speed limit in the area of the project so we assumed a speed limit of 30 mph for the purpose of this study. Beacon Street, and Shawsheen Road have posted speed limits of 40 mph, but at Beacon Street along the project site, there are flashing speed limit signs with a speed limit of 20 mph and there is a short 25 MPH zone posted at the intersection with Andover Country Club Lane and at the intersection with High Plain Road. Lowell Street has a posted speed limit of 30 mph both east and west of Beacon Street. Andover Country Club Lane does not have posted speed limit signs, however based on our numerous site visits the general speed is approximately 25 mph. The speed limits will be used to analyze the Sight Stopping Distance and Intersection Stopping Distance.

3. PROPOSED CONDITIONS

The proposed development uses the existing site access points, which will be reviewed and assessed for impact on the existing traffic conditions. The proposed site may reconfigure the site driveways and parking areas within the School Complex for access. All of the traffic coming to the School will use Beacon Street.

3.1 TRAFFIC ANALYSIS METHODOLOGY

The methodology used for the analysis and development of the TIS is a means to assess the impact of adding students and employees to the proposed West Elementary School. The analysis determines the operating capacity of the study area intersections. The operating capacity includes characteristics of the intersections such as delay times (for each lane approach and the intersection as a whole), Level of Service (LOS) which is a grading of the delay times, volume to capacity ratios, queues, etc. The operating capacity is calculated for each study area intersection in various conditions. The conditions are existing (how does the intersection operate today), Future No-Build and Future Build. Ultimately the Future No-Build and

Build conditions are compared and if necessary, mitigation is recommended if the Build condition operates significantly below the level of the No-Build.

The existing, no build and build condition operational analyses were performed using SYNCHRO 10; Traffic Control Coordination Software for the studied intersections. The software utilizes the methods for intersection analyses contained in the Highway Capacity Manual (HCM), Special Report 209; Transportation Research Board.

This project is classified as Elementary School (LUC 520 with peak hours in the AM (7 – 9am) and PM (2 – 4 pm) time periods. Consequently, all conditions were analyzed for these two peak hours. The AM peak period typically will have greater volume of traffic in a more condensed time period because of after school programs, students staying later for homework and extra help, etc.

The analysis then turns to the Future year condition. Standard engineering practice dictates that the Future Year is considered 7 years beyond the existing condition analysis. In our case the existing year is 2019, hence the future year is 2026. To get to the Future year the existing traffic counts are increased by using an annual background growth rate, and adding known future projects provided by the Town's Planning Department. By adding the background growth rate, and known projects, we created the Future Year No-Build condition. The Future Year Build condition is simply the Future Year No-Build with the additional trips generated by our project added in. The two Future Year conditions (No-Build and Build) are analyzed for their capacities, and then compared, and if the Build condition significantly degrades the intersections then the intersection must be mitigated to bring it to the No-Build operational capacity.

3.2 STUDY AREA INTERSECTIONS

The locations of the proposed study area intersections are shown in **Figure 4**.

❖ BEACON STREET AND CHANDLER STREET

The Beacon Street and Chandler Street intersection is an unsignalized fork intersection with one approach lane for each approach. The southbound Beacon Street approach has a stop sign and a painted stop line. There are two painted crosswalks for a golf cart path across the southerly portion of Beacon Street adjacent to the intersection with "Yield" and a pedestrian icon painted on the pavement on either side of the crosswalks. There are sidewalks on the west side of Chandler Road north of the intersection and on the west side of Beacon Street south of the intersection. The paint lines are in fair to good condition. The paving of the roadway and sidewalks is in good to fair condition.

❖ BEACON STREET AND ANDOVER COUNTRY CLUB LANE

The Beacon Street and Andover Country Club Lane intersection is an unsignalized T-intersection where Andover Country Club Lane ends at the east side of Beacon Street. There is a stop sign and a painted stop line on the Andover Country Club Lane approach to the intersection. There is a painted crosswalk across Beacon Street at the north side of Country Club Lane with "Yield" and a pedestrian icon painted on the pavement on either side of the crosswalk. The paint lines are in fair to good condition. The paving of the roadway and sidewalks is in good to fair condition.

❖ BEACON STREET AND NORTH DRIVEWAY

The Beacon Street and North Driveway intersection is an unsignalized T-intersection where the North Driveway ends at the west side of Beacon Street. There are no stop signs, stop lines, or crosswalks at the intersection. The paving is in fair condition.

❖ **BEACON STREET AND MIDDLE DRIVEWAY**

The Beacon Street and Middle Driveway intersection is an unsignalized T-intersection where the Middle Driveway ends at the west side of Beacon Street. The intersection is split into two curb cuts with the southern cut being an entrance and the northern cut being an exit. There are no stop signs or stop lines on any of the approaches to the intersection. There is a painted crosswalk across the southern Middle Driveway curb cut. The paint and paving are in good to fair condition.

❖ **BEACON STREET AND SOUTH DRIVEWAY**

The Beacon Street and South Driveway intersection is an unsignalized T-intersection where the South Driveway ends at the west side of Beacon Street. There is a stop sign and a painted stop line at the South Driveway approach to the intersection and there is a painted crosswalk across the South Driveway approach. The paint and paving are in good to fair condition.

❖ **BEACON STREET AND HIGH PLAIN ROAD**

The Beacon Street and High Plain Road intersection is an unsignalized T-intersection where High Plain Road ends at the west side of Beacon Street. There is a stop sign, stop line and crosswalk at the High Plain Road approach. There is a crosswalk across Beacon Street at the northerly approach with "Yield" painted on the pavement at the north side of the intersection for the southbound Beacon Street approach. The paint and paving are in good to fair condition.

❖ **BEACON STREET/ SHAWSHEEN ROAD/ LOWELL STREET**

The Beacon Street/Shawsheen Road and Lowell Street intersection is a signalized intersection with loop detection at each approach and a light-based receiver for emergency vehicle pre-emption. Additionally, Lowell Street westbound has a slip ramp connected to Beacon Street northbound. There is a crosswalk across Lowell Street at the east edge of the intersection and a crosswalk across Shawsheen Road at the east side of the intersection. The paint and paving are in good to fair condition.

3.3 TRIP DISTRIBUTION

The trips generated by the re-construction of West Elementary School were distributed to Beacon Street/Shawsheen Road, and through the project intersections to the surrounding streets. The trips to the school were distributed based on the existing conditions determined from the traffic counts done for this study which indicated an approximate 50/50 split to and from Beacon Street in both directions. The turning movements at each of the intersection approaches were derived from the distribution of the existing traffic utilizing the site. The distribution can be seen in **Figure 5** and **Figure 6**, which illustrates the percent of vehicles entering and exiting each intersection.

3.4 TRIP GENERATION

The volume of traffic generated by the re-construction of the West Elementary School building is calculated based on the additional students and administrative/faculty staff added to the School. The School currently has 600 elementary students and 120 administrative/faculty staff. The proposed (Build) condition will have 1,055 students (925 elementary and 130 pre-K) and over 205 administrative/faculty staff. During the course of our traffic counting task we were able to determine that the current School condition generates

approximately 418 and 207 trips in the AM and PM peak hours, respectively. Utilizing the Institute of Transportation Engineers (ITE) Trip General Manual 10th Edition, we calculated the AM and PM peak hour trips for the School in its current condition to be 402 and 204 trips, respectively. Consequently, we can see that the trip generations calculated using the Manual, are extremely close to the actual traffic counts.

Utilizing a ratio between the actual counts/students in the current condition, we extrapolated the trip generations created by the additional students (1,055 – 600 = 455) and staff. We then calculated the trip generations for the Build condition using the Manual, and again found the number of trips to be extremely close. We decided to use the extrapolated existing counts over the Manual because the extrapolated are slightly more conservative. Additionally, we used the existing count enter/exit numbers. The generated trips are illustrated below in Table 1.

The ITE trip generation graphs for the land uses described above are given in Appendix D.

The generated trips are then distributed throughout the study intersections utilizing the trip distribution described in section 3.3. The distributed generated trips are shown in Figures 7 and 8 for the AM and PM peak hours, respectively.

TABLE 1

TRIP GENERATION

LAND USE CODE	LAND USE		AM Peak Hour TOTAL		PM Peak Hour TOTAL	
			ENTER	EXIT	ENTER	EXIT
520	Elementary School	*Students	**315**		**156**	
		455	192	123	27	129

* - Trip generations based on the extrapolating the existing traffic counts and compared to Institute of Transportation Engineers, Trip Generation Tables, 10th Edition.

3.5 BACKGROUND GROWTH AND OTHER DEVELOPMENTS

The existing AM and PM traffic counts are projected (a standard 7-year time Future year) to year 2026 to analyze the future traffic build and no-build conditions. The future traffic conditions are acquired by applying a growth factor to all peak hour turning movement traffic volumes. The growth factor was obtained by contacting the Merrimack Valley Planning Commission who performed a background growth analysis based on increases in observed traffic counts over the past few years. Review of the traffic counts showed a background growth rate of 1.0% per year. This is a typical growth rate compared to most traffic studies performed and reviewed by Brennan Consulting and the use of this rate is considered to be conservative. The Andover Planning Department was contacted for other development projects within the vicinity of the project. The planning department responded that a Townhouse development currently under construction just north of the project site is the only known project proposed in the area of the school that will impact traffic in the neighborhood. Therefore, the background trip generation for the Future No-Build and Future Build conditions was calculated by applying the 1.0% per year growth rate to the existing traffic that was counted for this study, and then adding the traffic that will be generated by the Townhouse project currently under construction as determined by the ITE Trip Generation Manual reference above. The Future No-Build and Future Build condition traffic volumes can be seen in **Figure 9** and **Figure 10** which illustrates the volume of vehicles entering and exiting each intersection.

4.0 SAFETY AND OPERATIONAL ANALYSIS

4.1 CRASH RATE ANALYSIS

Brennan Consulting studied the seven intersections in the study area for this project by researching accident records on file with the Andover Police Dept. and the MassDOT. The Lowell Street/Beacon Street/Shawsheen Road intersection and the Beacon Street/High Plain Road intersection were the only intersections remaining in the study area to have more than one reported accident per year within the past three years. These intersections were analyzed to determine the crash rates and assess the level of safety utilizing the MassDOT methodology. In order to study the crash rate of the studied intersections, Brennan Consulting contacted the MassDOT and the Andover Police Department to obtain the accidents reported for the past three years. The crash rates were calculated using the turning movement counts and average number of crashes during the three year period, and is expressed as Crashes per Million Entering Vehicle (MEV). See **Appendix B** for crash reports from the Andover Police Department and Mass DOT.

This crash rate analysis method can be helpful in determining how a roadway location compares to the average of those obtained in the database. If the study area intersection is found to have a higher than average crash rate, it may indicate a problem area that will require mitigation. The average crash rate of a signalized intersection in MassDOT District 4 is 0.73 per MEV. The intersection of Lowell Street/Beacon Street and Shawsheen Road has a crash rate of 0.51 per MEV which is lower than both the District average and the Statewide Average. The Beacon Street/High Plain Road intersection had a crash rate of 0.41 per MEV in the three year period so the crashes per MEV is below the District and State Averages. See **Appendix C** for the MassDOT average crash rates data and the project intersection crash rate calculations.

Because the crash rates for the study intersections are less than the statewide averages and the averages for District 4 these intersections are not considered to be a problem area that will require mitigation.

4.2 SIGHT DISTANCE

The proposed study area intersections were measured and analyzed in accordance with criteria set forth by the American Association of State Highway and Transportation Officials (AASHTO) for the Intersection Sight Distance (ISD) and Stopping Sight Distance (SSD). ISD refers to the corner sight distance available in intersection quadrants that allows a driver approaching an intersection to observe the actions of vehicles on the crossing leg(s). SSD is the sum of the distance traveled during a driver's brake reaction time (i.e., perception/reaction time) and the braking distance (i.e., distance traveled while decelerating to a stop). The ISD requirement for 25 mph is 280 feet, and the SSD requirement for 25 mph is 155 feet.

The existing intersections with the project study area meet the ISD and SSD requirement.

It is important to note that the line of sight for the bus driver and the oncoming traffic will be different because the ISD and SSD requirements are calculated for passenger vehicles. The busses, and the bus driver, sit much higher off the roadway, and therefore have different lines of sight than the lines of sight utilized in the standard calculations utilized for ISD and SSD.

4.3 OPERATIONAL CAPACITY ANALYSIS

The Highway Capacity Manual (HCM) methodology uses Level of Service (LOS) as an index to the operational qualities of an intersection. LOS measures the operating conditions of signalized and unsignalized intersections for a specific period of time, typically the peak hour. The methodology evaluates operating conditions and assigns a LOS rating from "A" to "F" with LOS A being the most desirable. The

LOS is a function of the average vehicle delay at the intersection. **Table 2** illustrates the LOS thresholds for unsignalized and signalized intersections.

TABLE 2

LEVEL of SERVICE (LOS) DELAY THRESHOLD for INTERSECTIONS

UNSIGNALIZED INTERSECTION AVERAGE VEHICLE DELAY (SECONDS)	SIGNALIZED INTERSECTION AVERAGE VEHICLE DELAY (SECONDS)	LEVEL OF SERVICE	EXPECTED DELAY
Equal to or Less than 10.0	Equal to or Less than 10.0	A	Little or no delay
Between 10.1 and 15.0	Between 10.1 and 20.0	B	Short traffic delays
Between 15.1 and 25.0	Between 20.1 and 35.0	C	Average traffic delays
Between 25.1 and 35.0	Between 35.1 and 55.0	D	Long traffic delays
Between 35.1 and 50.0	Between 55.1 and 80.0	E	Very long traffic delays
Greater than 50.0	Greater than 80.0	F	Forced flow

The Future Year traffic volumes for the No-Build condition were calculated by projecting the existing traffic counts to the Future year using the annual background growth rate and other development projects. The Future Year traffic volumes for the Build condition were calculated by adding the trips generated by the redeveloped school to the No-Build condition. The generated trips were distributed as previously discussed.

The Operational Capacity for the No-Build and Build conditions was calculated, and then the two conditions were compared for LOS, Delay, Queue and Volume to Capacity Ratio (V/C). We have analyzed the intersections No-Build and Build conditions on all intersections, see **Tables 3 (AM peak hours) and 4 (PM peak hours).**

TABLE 3						
OPERATIONAL CAPACITY ANALYSIS - FUTURE NO BUILD vs BUILD						
DRIVEWAY/ INTERSECTION	**2026 NO BUILD AM PEAK HOUR**			**2026 BUILD AM PEAK HOUR**		
DESCRIPTION	**V/C[1]**	**Delay[2]**	**LOS[3]**	**V/C[1]**	**Delay[2]**	**LOS[3]**
Beacon St / Lowell St / Shawsheen Rd	**1.17**	**61.0**	**E**	**1.26**	**103.3**	**F**
Shawsheen Rd NBL	1.43	273.2	F	1.43	273.2	F
Shawsheen Rd NBT	0.35	19.2	B	0.44	20.1	C
Beacon St SBT	1.15	113.3	F	1.46	243.0	F
Beacon St SBR	0.19	17.9	B	0.22	18.2	B
Lowell St EB	0.83	26.9	C	0.96	47.4	D
Lowell St WB	0.74	20.5	C	0.75	20.6	C
Beacon St / High Plain Rd	**46.6%**	**1.9**	**A**	**54.0%**	**2.4**	**A**
Beacon St NB	0.00	0.0	A	0.00	0.0	A
High Plain Rd EB	0.36	19.0	C	0.48	26.6	D
Beacon St / South Driveway	**78.6%**	**4.6**	**D**	**94.9%**	**22.5**	**F**
South Driveway EB	0.46	23.2	C	1.07	116.6	F
Beacon St NB	0.15	3.7	A	0.27	5.9	A
Beacon St / Middle Driveway	**49.3%**	**0.6**	**A**	**62.5%**	**1.0**	**B**
Middle Driveway EB	0.07	19.0	C	0.13	22.4	C
Beacon St NB	0.02	0.6	A	0.04	1.0	A
Beacon St / North Driveway	**65.4%**	**0.6**	**C**	**72.7%**	**1.1**	**C**
North Driveway EB	0.01	14.3	B	0.03	15.9	C
Beacon St NB	0.04	1.3	A	0.08	2.1	A
Beacon St / Andover Country Club Ln	**56.9%**	**1.0**	**B**	**59.5%**	**1.1**	**B**
Andover Country Club Ln WB	0.14	20.0	C	0.17	22.3	C
Beacon St SB	0.02	0.6	A	0.02	0.6	A
Beacon St / Chandler Rd	**40.9%**	**5.8**	**A**	**43.6%**	**7.8**	**A**
Chandler Rd SEB	0.00	0.2	A	0.00	0.1	A
Beacon St SWB	0.61	30.8	D	0.72	41.4	E

1 - Volume to Capacity Ratio; for unsignalized intersections value is referred to as the Intersection Capacity Utilization

2 - Average Delay expressed in seconds per vehicle

3 - Level of Service

TABLE 4						
OPERATIONAL CAPACITY ANALYSIS - FUTURE NO BUILD vs BUILD						
DRIVEWAY/ INTERSECTION	**2026 NO BUILD PM PEAK HOUR**			**2026 BUILD PM PEAK HOUR**		
DESCRIPTION	**V/C[1]**	**Delay[2]**	**LOS[3]**	**V/C[1]**	**Delay[2]**	**LOS[3]**
Beacon St / Lowell St / Shawsheen Rd	**1.01**	**35.20**	**D**	**1.16**	**70.90**	**E**
Shawsheen Rd NBL	0.87	51.5	D	1.19	155.4	F
Shawsheen Rd NBT	0.56	21.7	C	0.58	22.1	C
Beacon St SBT	0.97	60.2	E	1.27	168.1	F
Beacon St SBR	0.08	17.1	B	0.12	17.3	B
Lowell St EB	0.91	35.3	D	0.93	38.4	D
Lowell St WB	0.38	13.5	B	0.38	13.5	B
Beacon St / High Plain Rd	**67.7%**	**2.90**	**C**	**74.1%**	**2.90**	**D**
Beacon St NB	0.11	2.70	A	0.12	2.90	A
High Plain Rd EB	0.22	13.4	B	0.26	15.4	C
Beacon St / South Driveway	**53.2%**	**1.60**	**A**	**65.2%**	**2.80**	**C**
South Driveway EB	0.18	13.0	B	0.33	15.9	C
Beacon St NB	0.02	0.6	A	0.04	1.0	A
Beacon St / Middle Driveway	**34.2%**	**0.50**	**A**	**35.7%**	**0.90**	**A**
Middle Driveway EB	0.07	12.1	B	0.13	12.9	B
Beacon St NB	0.00	0.0	N/A	0.00	0.0	N/A
Beacon St / North Driveway	**44.2%**	**1.10**	**A**	**55.1%**	**1.90**	**B**
North Driveway EB	0.11	12.3	B	0.21	13.4	B
Beacon St NB	0.01	0.3	A	0.02	0.6	A
Beacon St / Andover Country Club Ln	**37.8%**	**1.10**	**A**	**37.9%**	**1.10**	**A**
Andover Country Club Ln WB	0.11	14.3	B	0.12	15.0	C
Beacon St SB	0.02	0.1	A	0.02	0.8	A
Beacon St / Chandler Rd	**37.1%**	**1.60**	**A**	**38.8%**	**1.60**	**A**
Chandler Rd SEB	0.01	0.4	A	0.01	0.4	A
Beacon St SWB	0.18	14.7	B	0.19	15.1	C

1 - Volume to Capacity Ratio; for unsignalized intersections value is referred to as the Intersection Capacity Utilization

2 - Average Delay expressed in seconds per vehicle

3 - Level of Service

4.4 OPERATIONAL CAPACITY ANALYSIS - MITIGATION

The degraded intersections requiring mitigation are Beacon St/ Lowell St/ Shawsheen Rd, and Beacon St/ South Driveway. The need for the mitigation, and the mitigation itself is described below. The results of the mitigation are illustrated in **Tables 5 (AM peak hours) and 6 (PM peak hours)**.

Beacon St/ Lowell St/ Shawsheen Rd shows multiple approach LOS failures and extended queue lengths. The Shawsheen Rd northbound left LOS results in an F for No-Build and Build in the AM peak hours and changes from a LOS D to F in the PM peak hours. The delay time for this lane in the AM peak hours in the No-Build and Build is 273.2. The delay time for this lane stays the same because the additional traffic from the West Elementary School will not affect the traffic in this lane, although it should be noted that this lane is failing and is not acceptable.

The Beacon St southbound approach has an AM peak hour LOS F in the No-Build and Build and a LOS E to F in the PM peak hour. The delay time for this lane increases from 113.3 to 243.0 in the AM and 60.2 to 168.1 in the PM. The additional trip generations are significantly impacting the southern approach.

The Beacon St mitigation will be to change the southbound approach lane assignments from a left/thru and dedicated right hand turn lane, to a dedicated left hand turn lane and a thru/right turn lane. This will allow the thru traffic to operate more efficiently when combined with the right hand turns. The mitigation for the Shawsheen Rd approach will require a more comprehensive analysis, where additional lanes, and a full reconstruction of the intersection will most likely be necessary.

The South Driveway exit for the AM degenerated from LOS C to F. The delay time increases drastically from the No-Build to the Build from 23.2 to 116.6 seconds.

The South Driveway mitigation will be to increase the exit to two lanes. One lane to turn right, and the other to turn left. The driveway arrangement for the School should be reviewed and adjusted to minimize delays and queues. At the very least, the southern exit should operate as a two lane approach.

The Operational Capacity for the mitigations noted above was calculated to the compare the LOS, Delay, Volume to Capacity Ratio (V/C), and Queue to the Build condition. The results of the calculations can be seen in **Tables 5 (AM peak hours) and 6 (PM peak hours)**. The Beacon St southbound approach delay was cut in half, and the South Driveway is also improved with the additional exit lane.

TABLE 5

OPERATIONAL CAPACITY ANALYSIS - BUILD vs MITIGATED

DRIVEWAY/ INTERSECTION	2026 BUILD AM PEAK HOUR				2026 MITIGATED AM PEAK HOUR			
DESCRIPTION	**V/C[1]**	**Delay[2]**	**LOS[3]**	**Queue[4]**	**V/C[1]**	**Delay[2]**	**LOS[3]**	**Queue[4]**
Beacon St / Lowell St / Shawsheen Rd	**1.26**	**103.3**	**F**		**1.25**	**70.8**	**E**	
Shawsheen Rd NBL	1.43	273.2	F	#198	1.43	273.2	F	#198
Shawsheen Rd NBT	0.44	20.1	C	182.0	0.44	20.1	C	182.0
Beacon St SBT	1.46	243.0	F	#731	1.18	122.3	F	#706
Beacon St SBL					0.39	19.9	B	97.0
Beacon St SBR	0.22	18.2	B	80.0				
Lowell St EB	0.96	47.4	D	#507	0.96	47.4	D	#507
Lowell St WB	0.75	20.6	C	376.0	0.75	20.6	C	376.0
Beacon St / South Driveway	**94.9%**	**22.5**	**F**		**82.4%**	**8.4**	**E**	
South Driveway EB	1.07	116.6	F	289.0				
South Driveway EBL					0.63	105.1	F	73.0
South Driveway EBR					0.44	16.9	C	55.0
Beacon St NB	0.27	5.9	A	27.0	0.27	5.9	A	27.0

1 - Volume to Capacity Ratio; for unsignalized intersections value is referred to as the Intersection Capacity Utilization

2 - Average Delay expressed in seconds per vehicle

3 - Level of Service

4 - 95th Queue length in feet

- 95th percentile volume exceeds capacity; queue may be longer.

~ - Volume exceeds capacity, queue is theoretically infinite.

TABLE 6								
OPERATIONAL CAPACITY ANALYSIS - BUILD vs MITIGATED								
DRIVEWAY/ INTERSECTION	**2026 BUILD PM PEAK HOUR**				**2026 MITIGATED PM PEAK HOUR**			
DESCRIPTION	**V/C[1]**	**Delay[2]**	**LOS[3]**	**Queue[4]**	**V/C[1]**	**Delay[2]**	**LOS[3]**	**Queue[4]**
Beacon St / Lowell St / Shawsheen Rd	**1.16**	**70.90**	**E**		**1.12**	**39.30**	**D**	
Shawsheen Rd NBL	1.19	155.4	F	#263	1.19	152.7	F	#262
Shawsheen Rd NBT	0.58	22.1	C	248.0	0.58	22.1	C	248.0
Beacon St SBT	1.27	168.1	F	#510	0.74	27.1	C	329.0
Beacon St SBL					0.46	21.1	C	97.0
Beacon St SBR	0.12	17.3	B	46.0				
Lowell St EB	0.93	38.4	D	#544	0.93	38.4	D	#544
Lowell St WB	0.38	13.5	B	159.0	0.38	13.5	B	159.0
Beacon St / South Driveway	**65.2%**	**2.80**	**C**		**59.4%**	**2.50**	**B**	
South Driveway EB	0.33	15.9	C	36.0				
South Driveway EBL					0.13	11.0	C	11.0
South Driveway EBR					0.20	19.0	B	19.0
Beacon St NB	0.04	1.0	A	3.0	0.04	3.0	A	3.0

1 - Volume to Capacity Ratio; for unsignalized intersections value is referred to as the Intersection Capacity Utilization

2 - Average Delay expressed in seconds per vehicle

3 - Level of Service

4 - 95th Queue length in feet

- 95th percentile volume exceeds capacity; queue may be longer.

~ - Volume exceeds capacity, queue is theoretically infinite.

See **Appendix D** for the intersection capacity analysis results from Synchro.

4.5 QUEUE ANALYSIS

The queue lengths were reviewed for all approaches for each intersection in the Future No-build condition and Future Build condition. The 95th percentile vehicle queue length represents the maximum queue length that can be expected at each of the critical approach lanes of the study area intersections. The queue lengths are calculated in the Synchro capacity analysis worksheets under **Appendix E**. The queue lengths are reported in feet, with the assumption of 25 feet for the average vehicle length and gap between vehicles.

See **Table 7** & **Table 8** for the queue length analysis results.

TABLE 7			
QUEUE ANALYSIS - FUTURE NO BUILD vs BUILD			
DESCRIPTION	**TYPE**	**2026 NO BUILD AM PEAK HOUR**	**2026 BUILD AM PEAK HOUR**
		95th QUEUE (ft)	**95th QUEUE (ft)**
Beacon St / Lowell St / Shawsheen Rd	**Signalized**		
Shawsheen Rd NBL		#198	#198
Shawsheen Rd NBT		144.0	182.0
Beacon St SBT		#601	#731
Beacon St SBR		69.0	80.0
Lowell St EB		#437	#507
Lowell St WB		375.0	376.0
Beacon St / South Driveway	**Unsignalized**		
South Driveway EB		58.0	289.0
Beacon St NB		13.0	27.0

1 & 2 - 95th Queue length in feet

- 95th percentile volume exceeds capacity; queue may be longer.

~ - Volume exceeds capacity, queue is theoretically infinite.

TABLE 8			
QUEUE ANALYSIS - FUTURE NO BUILD vs BUILD			
DESCRIPTION	**TYPE**	**2026 NO BUILD PM PEAK HOUR**	**2026 BUILD PM PEAK HOUR**
		95th QUEUE (ft)	**95th QUEUE (ft)**
Beacon St / Lowell St / Shawsheen Rd	**Signalized**		
Shawsheen Rd NBL		#228	#263
Shawsheen Rd NBT		238.0	248.0
Beacon St SBT		#388	#510
Beacon St SBR		36.0	46.0
Lowell St EB		#534	#544
Lowell St WB		159.0	159.0
Beacon St / South Driveway	**Unsignalized**		
South Driveway EB		16.0	36.0
Beacon St NB		2.0	3.0

1 & 2 - 95th Queue length in feet

- 95th percentile volume exceeds capacity; queue may be longer.

~ - Volume exceeds capacity, queue is theoretically infinite.

5.0 EXECUTIVE SUMMARY AND RECOMMENDATIONS

The purpose of the reconstruction of the West Elementary School is to address the overcrowding of the existing Elementary and Middle Schools. The existing West Elementary School Building is currently generating 255 trips to the site and 163 trips leaving the site in the AM Peak Hour, and then 171 trips leaving the site and 36 trips entering the site in the PM Peak Hour. The re-construction of the school at the site will result in 447 trips to the site and 286 trips leaving the site in the AM Peak Hour and then 300 trips entering the site and 63 trips leaving the site in the PM Peak hour, which is a significant increase over the existing condition.

The results of the analyses show that the proposed project will not significantly reduce operational conditions along the existing Collector Road, Beacon Street, except for the approach to the Lowell Street intersection. The South Driveway approach shows a significant reduction in LOS from a D to an F given the existing lane configurations. This reduction may be mitigated during the site design by adding a lane to the egress approach. An additional lane at the South Driveway egress will improve the Build condition.

The Lowell Street intersection performs poorly in the existing condition and the intersection is being studied by the Town for proposed improvement. The addition of the increased traffic from the West Elementary School will significantly worsen the existing condition on the Beacon Street south bound approach. The mitigation analysis for this study shows that changing the lane configuration at the south bound Beacon St. approach to have a protected left turn lane will mitigate the increase in traffic caused by the new school.

The crash rates information from the last four years indicated that the study area intersections have a lower crash rate than the Massachusetts District 4 and Statewide average crash rates for the intersections of 0.57 MEV for unsignalized intersections and 0.73 MEV for signalized intersections. The study area intersections are therefore not considered to require any mitigations from an intersection safety point of view.

Recommendations

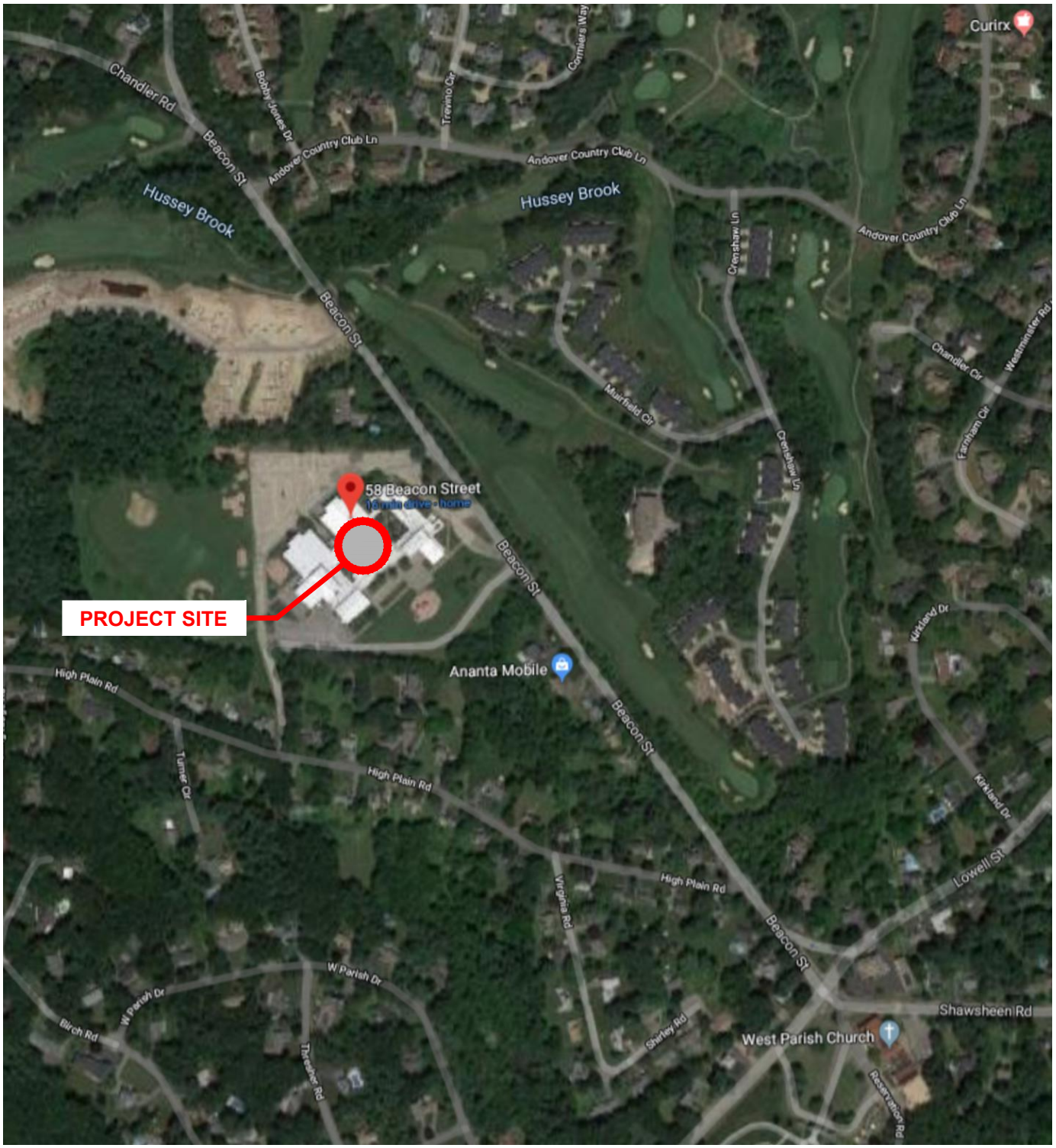
A. Reassign the Beacon St southbound approach lanes to the Lowell St intersection as described in section 4.4, Operating Capacity – Mitigation. This will alleviate the delay created by the project generated traffic. This work is presently being developed by the Town's traffic consultant.

B. The South Driveway exit will need to increase from one lane to two lanes.

C. The Schools' three driveways should be reviewed during the project design phase to provide a clear and comprehensible access and egress.

D. The Lowell St / Beacon St / Shawsheen Rd requires a more comprehensive analysis including corridor design for Lowell St (Route 133). The Town is aware of this condition.

FIGURES



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WEST ELEMENTARY SCHOOL
EXISTING CONDITION MAP

58 BEACON STREET
ANDOVER, MASSACHUSETTS

Figure:
1



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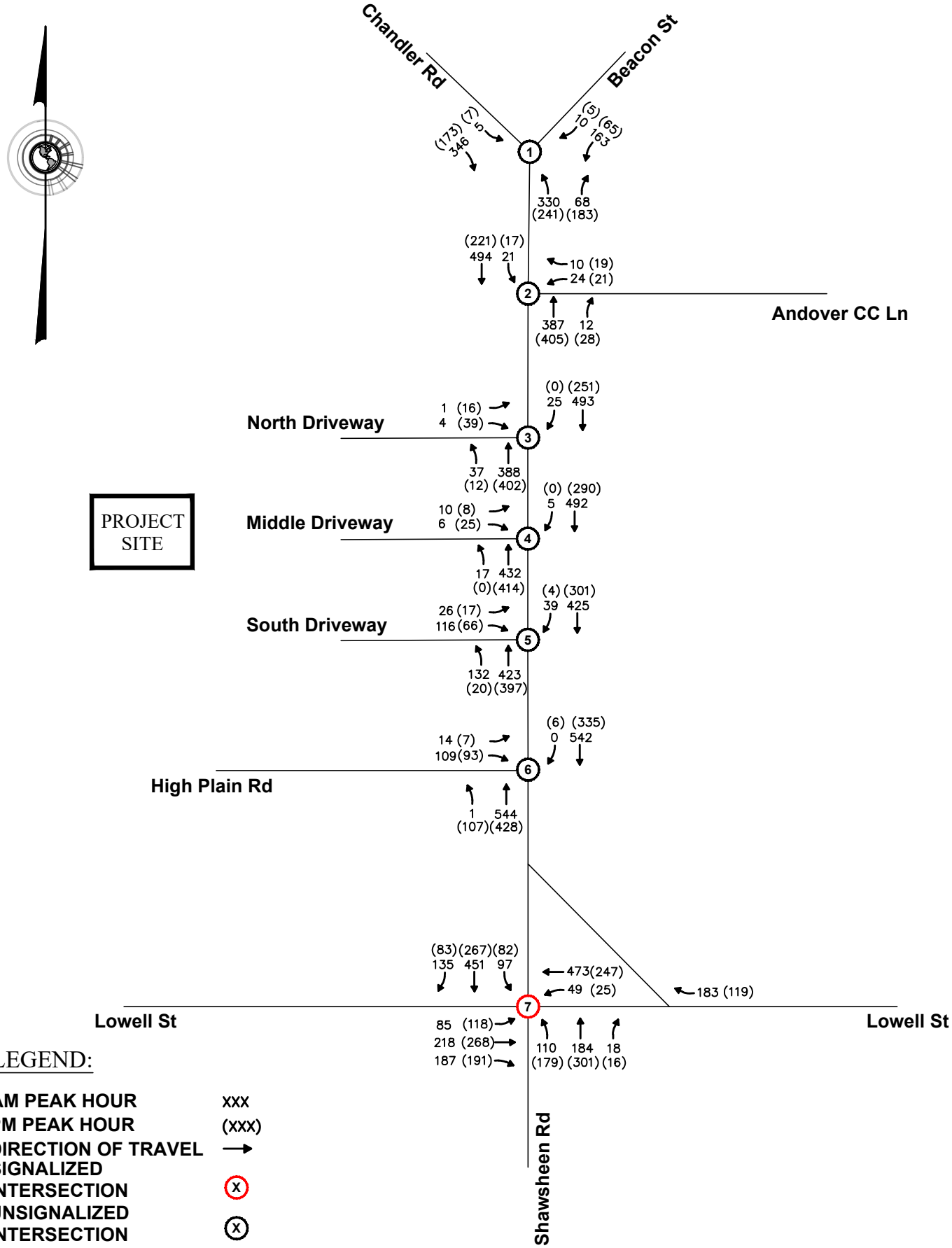
WEST ELEMENTARY SCHOOL

58 BEACON STREET
ANDOVER, MASSACHUSETTS

PROPOSED SITE PLAN

Figure:
2



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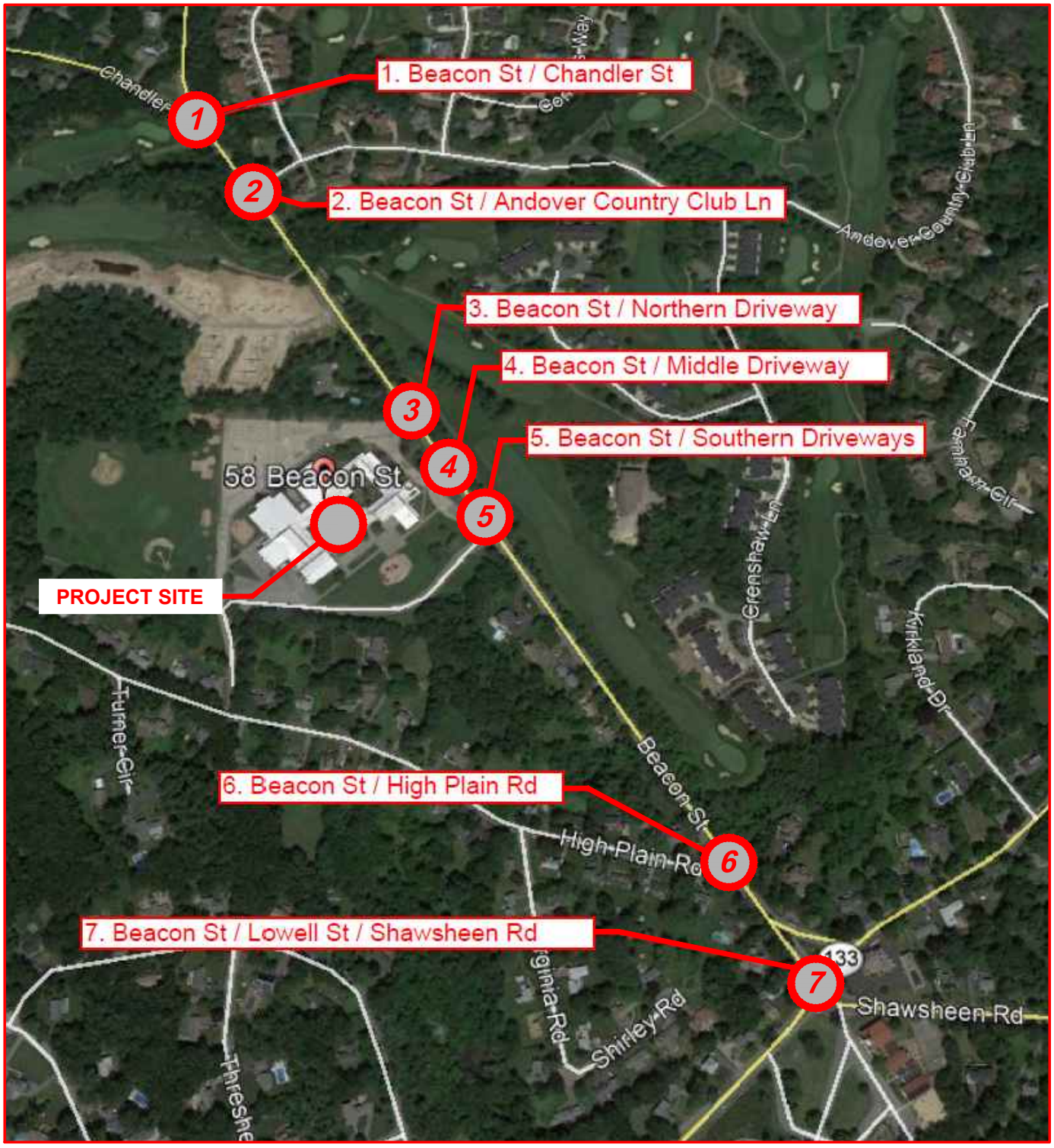
WEST ELEMENTARY SCHOOL
58 BEACON STREET, ANDOVER, MA

EXISTING WEEKDAY AM & PM PEAK HOUR VOLUMES

Figure: **3**



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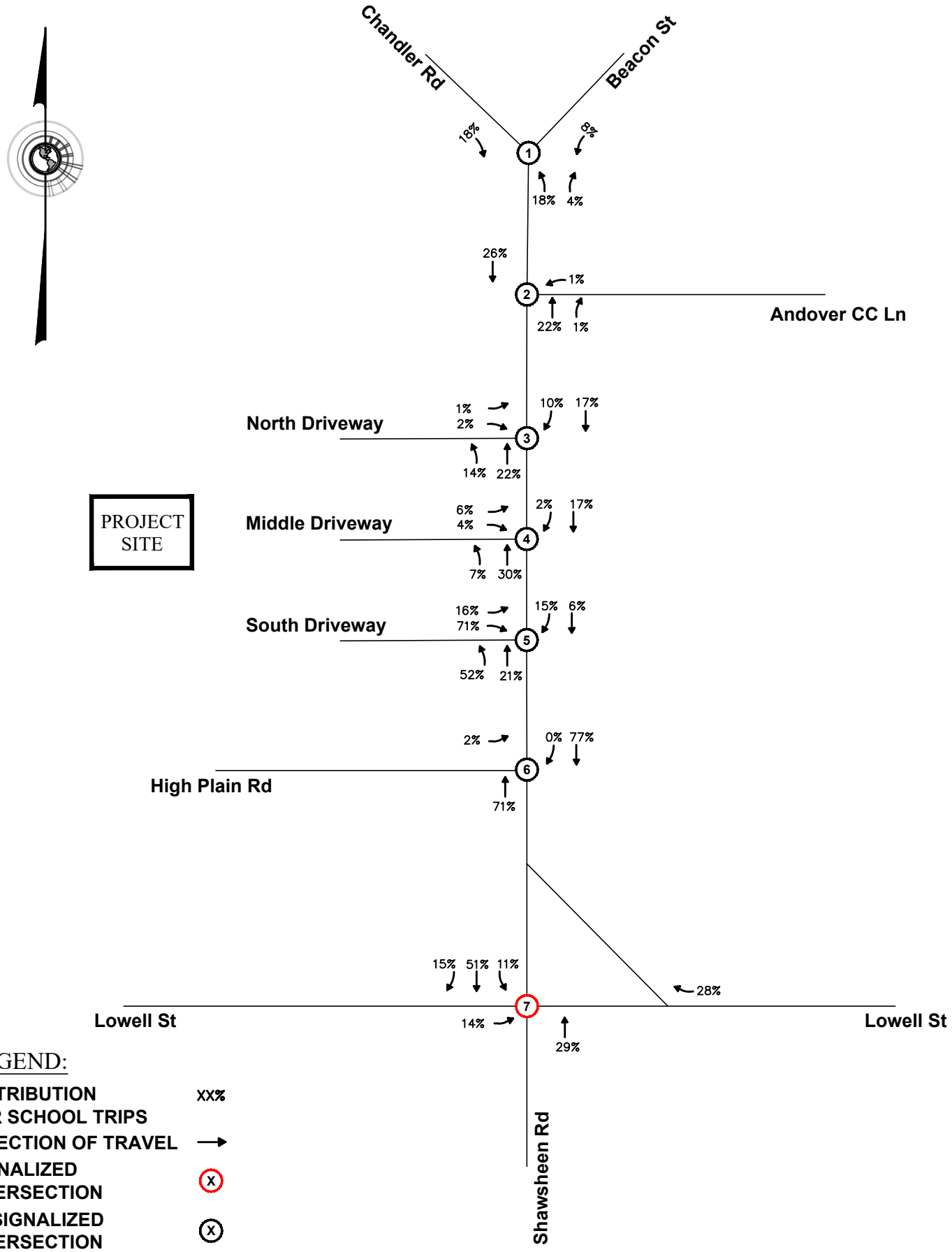
WEST ELEMENTARY SCHOOL
STUDY AREA INTERSECTIONS

58 BEACON STREET
ANDOVER, MASSACHUSETTS

Figure:
4



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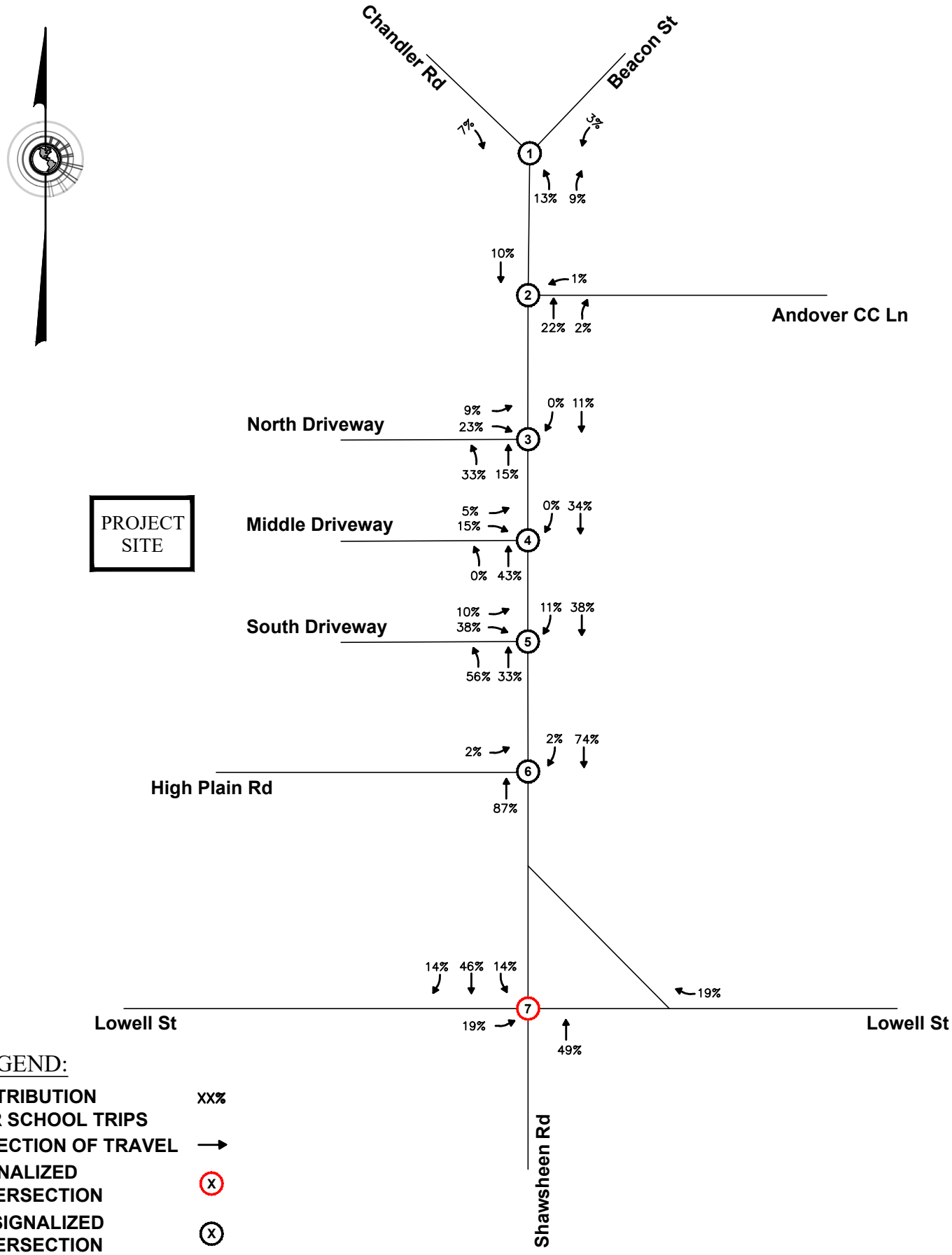
WEST ELEMENTARY SCHOOL
58 BEACON STREET, ANDOVER, MA

TRIP DISTRIBUTION AM PEAK HOUR VOLUMES

Figure: 5



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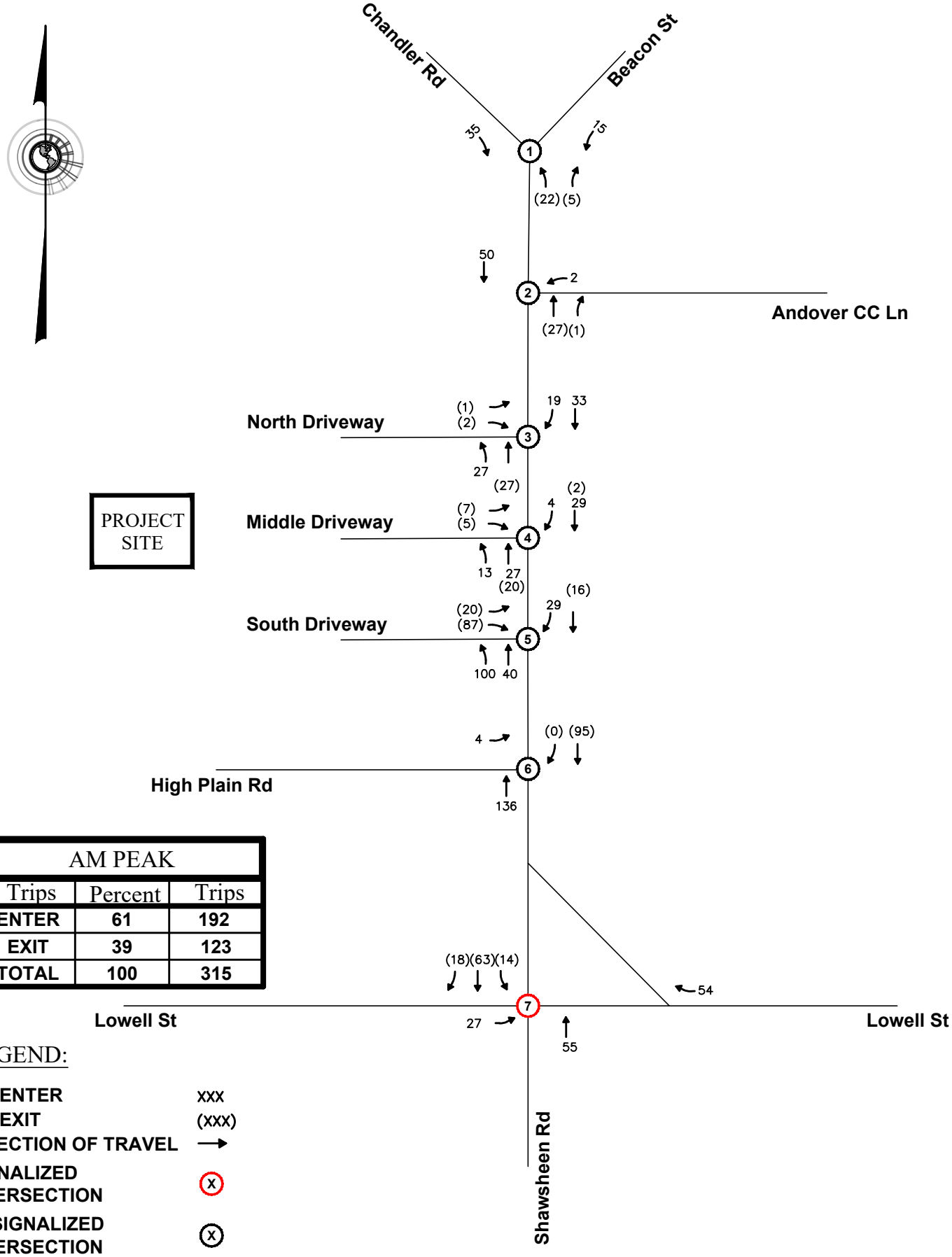
WEST ELEMENTARY SCHOOL
58 BEACON STREET, ANDOVER, MA

TRIP DISTRIBUTION PM PEAK HOUR VOLUMES

Figure: 6



AM PEAK		
Trips	Percent	Trips
ENTER	61	192
EXIT	39	123
TOTAL	100	315

LEGEND:

AM ENTER	XXX
AM EXIT	(XXX)
DIRECTION OF TRAVEL	→
SIGNALIZED INTERSECTION	X
UNSIGNALIZED INTERSECTION	X

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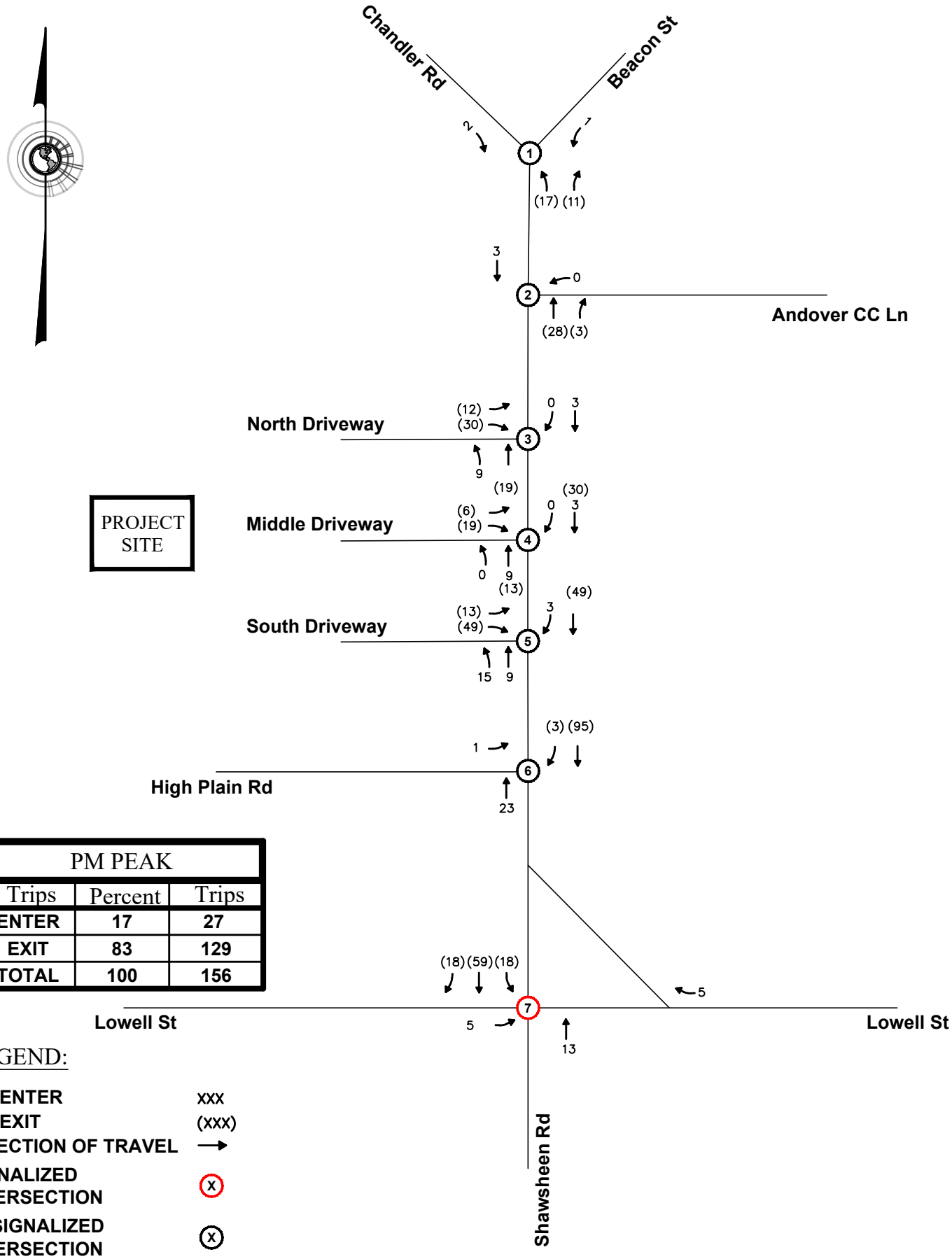
WEST ELEMENTARY SCHOOL
58 BEACON STREET, ANDOVER, MA

TRIP GENERATION AM PEAK HOUR VOLUMES

Figure: 7



PM PEAK		
Trips	Percent	Trips
ENTER	17	27
EXIT	83	129
TOTAL	100	156

LEGEND:

AM ENTER	XXX
AM EXIT	(XXX)
DIRECTION OF TRAVEL	→
SIGNALIZED INTERSECTION	(X)
UNSIGNALIZED INTERSECTION	(X)

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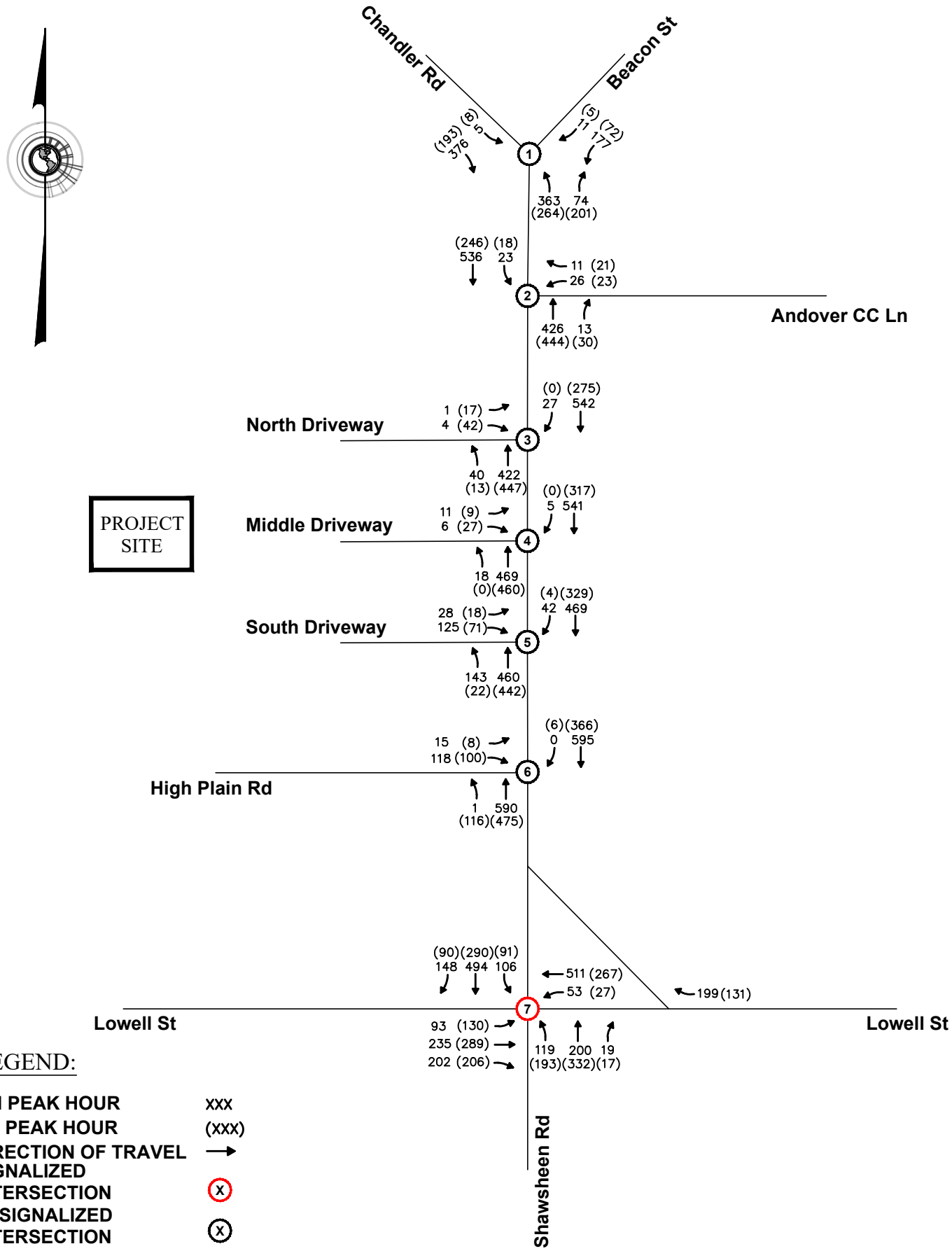
WEST ELEMENTARY SCHOOL
58 BEACON STREET, ANDOVER, MA

TRIP GENERATION PM PEAK HOUR VOLUMES

Figure: 8



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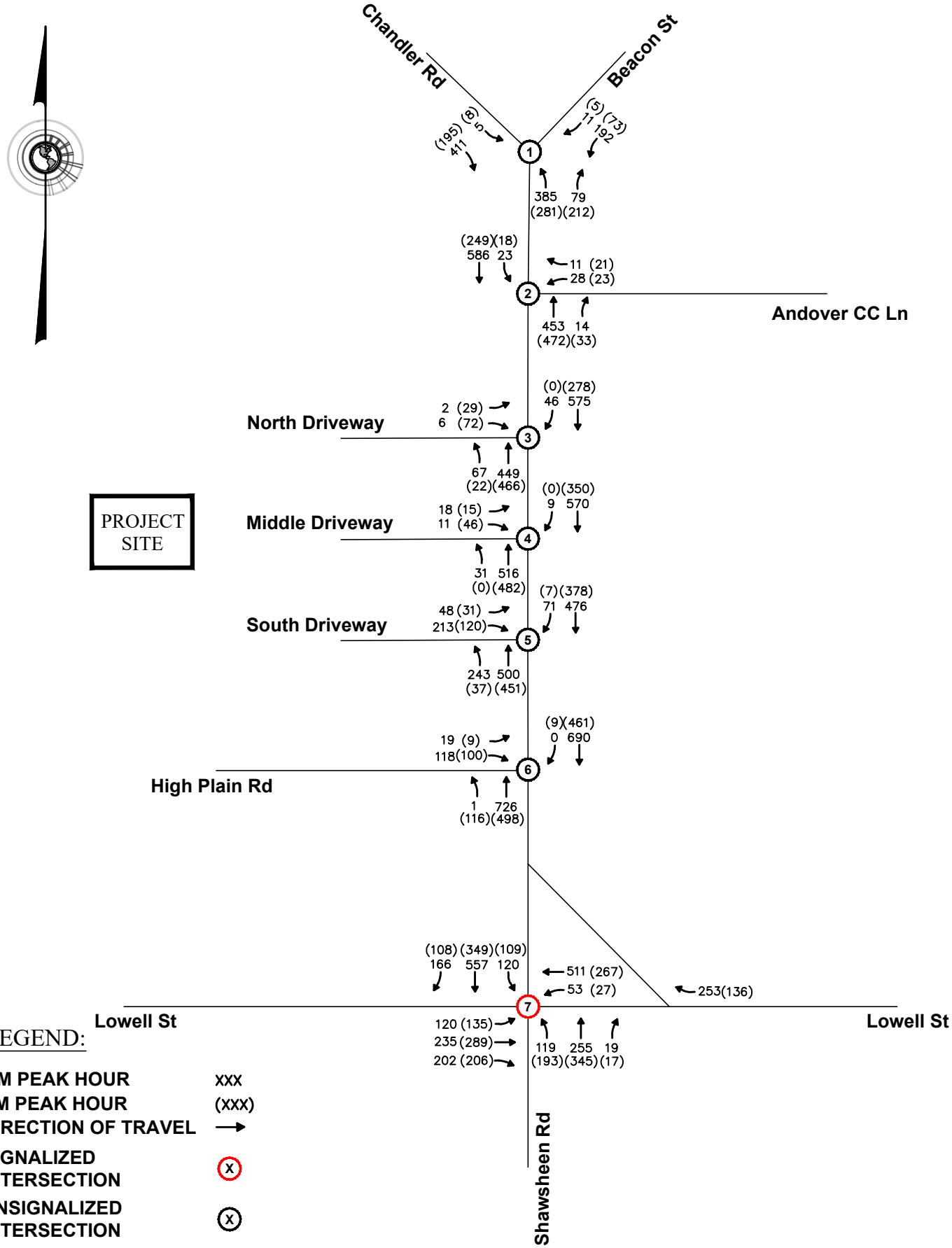
WEST ELEMENTARY SCHOOL
58 BEACON STREET, ANDOVER, MA

FUTURE NO BUILD AM & PM PEAK HOUR VOLUMES

Figure: **9**



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WEST ELEMENTARY SCHOOL
58 BEACON STREET, ANDOVER, MA

FUTURE BUILD AM & PM PEAK HOUR VOLUMES

Figure: **10**

APPENDICES

APPENDIX A
EXISTING TRAFFIC COUNT DATA

Transportation Data Corporation
Mario Perone, mperone1@verizon.net
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N/S: Beacon Street
W: Chandler Road
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268A
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Cars & Peds - Trucks & Buses - Bikes by Direction

	Beacon Street From North			Beacon Street From South			Chandler Road From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
07:00 AM	1	34	0	18	42	0	91	2	0	188
07:15 AM	2	42	1	17	64	0	73	0	0	199
07:30 AM	1	47	1	14	81	0	85	1	0	230
07:45 AM	0	37	1	11	78	1	92	1	1	222
Total	4	160	3	60	265	1	341	4	1	839
08:00 AM	5	45	0	19	74	0	86	2	0	231
08:15 AM	4	34	0	24	97	0	83	1	0	243
08:30 AM	3	31	0	13	88	0	67	3	0	205
08:45 AM	1	35	0	12	93	0	53	3	0	197
Total	13	145	0	68	352	0	289	9	0	876
Grand Total	17	305	3	128	617	1	630	13	1	1715
Apprch %	5.2	93.8	0.9	17.2	82.7	0.1	97.8	2	0.2	
Total %	1	17.8	0.2	7.5	36	0.1	36.7	0.8	0.1	
Cars & Peds	13	303	3	125	592	1	619	13	1	1670
% Cars & Peds	76.5	99.3	100	97.7	95.9	100	98.3	100	100	97.4
Trucks & Buses	4	2	0	3	24	0	11	0	0	44
% Trucks & Buses	23.5	0.7	0	2.3	3.9	0	1.7	0	0	2.6
Bikes by Direction	0	0	0	0	1	0	0	0	0	1
% Bikes by Direction	0	0	0	0	0.2	0	0	0	0	0.1

	Beacon Street From North				Beacon Street From South				Chandler Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:30 AM													
07:30 AM	1	**47**	**1**	49	14	81	0	95	85	1	0	86	230
07:45 AM	0	37	1	38	11	78	**1**	90	**92**	1	**1**	**94**	222
08:00 AM	**5**	45	0	**50**	19	74	0	93	86	**2**	0	88	231
08:15 AM	4	34	0	38	**24**	**97**	0	**121**	83	1	0	84	**243**
Total Volume	10	163	2	175	68	330	1	399	346	5	1	352	926
% App. Total	5.7	93.1	1.1		17	82.7	0.3		98.3	1.4	0.3		
PHF	.500	.867	.500	.875	.708	.851	.250	.824	.940	.625	.250	.936	.953
Cars & Peds	7	161	2	170	66	318	1	385	341	5	1	347	902
% Cars & Peds	70.0	98.8	100	97.1	97.1	96.4	100	96.5	98.6	100	100	98.6	97.4
Trucks & Buses	3	2	0	5	2	12	0	14	5	0	0	5	24
% Trucks & Buses	30.0	1.2	0	2.9	2.9	3.6	0	3.5	1.4	0	0	1.4	2.6
Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0

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Client: Brennan/C. Emilius

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Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Cars & Peds

	Beacon Street From North			Beacon Street From South			Chandler Road From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
07:00 AM	1	34	0	18	40	0	90	2	0	185
07:15 AM	2	42	1	16	63	0	69	0	0	193
07:30 AM	1	46	1	14	79	0	83	1	0	225
07:45 AM	0	36	1	11	76	1	91	1	1	218
Total	4	158	3	59	258	1	333	4	1	821
08:00 AM	3	45	0	18	73	0	85	2	0	226
08:15 AM	3	34	0	23	90	0	82	1	0	233
08:30 AM	2	31	0	13	79	0	67	3	0	195
08:45 AM	1	35	0	12	92	0	52	3	0	195
Total	9	145	0	66	334	0	286	9	0	849
Grand Total	13	303	3	125	592	1	619	13	1	1670
Apprch %	4.1	95	0.9	17.4	82.5	0.1	97.8	2.1	0.2	
Total %	0.8	18.1	0.2	7.5	35.4	0.1	37.1	0.8	0.1	

	Beacon Street From North				Beacon Street From South				Chandler Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:30 AM													
07:30 AM	1	**46**	**1**	**48**	14	79	0	93	83	1	0	84	225
07:45 AM	0	36	1	37	11	76	**1**	88	**91**	1	**1**	**93**	218
08:00 AM	**3**	45	0	48	18	73	0	91	85	**2**	0	87	226
08:15 AM	3	34	0	37	**23**	**90**	0	**113**	82	1	0	83	**233**
Total Volume	7	161	2	170	66	318	1	385	341	5	1	347	902
% App. Total	4.1	94.7	1.2		17.1	82.6	0.3		98.3	1.4	0.3		
PHF	.583	.875	.500	.885	.717	.883	.250	.852	.937	.625	.250	.933	.968

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Client: Brennan/C. Emilius

File Name : 05268A
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Trucks & Buses

	Beacon Street From North			Beacon Street From South			Chandler Road From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
07:00 AM	0	0	0	0	2	0	1	0	0	3
07:15 AM	0	0	0	1	1	0	4	0	0	6
07:30 AM	0	1	0	0	2	0	2	0	0	5
07:45 AM	0	1	0	0	2	0	1	0	0	4
Total	0	2	0	1	7	0	8	0	0	18
08:00 AM	2	0	0	1	1	0	1	0	0	5
08:15 AM	1	0	0	1	7	0	1	0	0	10
08:30 AM	1	0	0	0	8	0	0	0	0	9
08:45 AM	0	0	0	0	1	0	1	0	0	2
Total	4	0	0	2	17	0	3	0	0	26
Grand Total	4	2	0	3	24	0	11	0	0	44
Apprch %	66.7	33.3	0	11.1	88.9	0	100	0	0	
Total %	9.1	4.5	0	6.8	54.5	0	25	0	0	

	Beacon Street From North				Beacon Street From South				Chandler Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	0	**1**	0	1	0	2	0	2	**1**	0	0	**1**	4
08:00 AM	**2**	0	0	**2**	**1**	1	0	2	1	0	0	1	5
08:15 AM	1	0	0	1	1	7	0	**8**	1	0	0	1	**10**
08:30 AM	1	0	0	1	0	**8**	0	8	0	0	0	0	9
Total Volume	4	1	0	5	2	18	0	20	3	0	0	3	28
% App. Total	80	20	0		10	90	0		100	0	0		
PHF	.500	.250	.000	.625	.500	.563	.000	.625	.750	.000	.000	.750	.700

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Client: Brennan/C. Emilius

File Name : 05268A
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Bikes by Direction

	Beacon Street From North			Beacon Street From South			Chandler Road From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	1	0	0	0	0	1
08:45 AM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	1	0	0	0	0	1
Grand Total	0	0	0	0	1	0	0	0	0	1
Apprch %	0	0	0	0	100	0	0	0	0	
Total %	0	0	0	0	100	0	0	0	0	

	Beacon Street From North				Beacon Street From South				Chandler Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	**1**	0	**1**	0	0	0	0	**1**
Total Volume	0	0	0	0	0	1	0	1	0	0	0	0	1
% App. Total	0	0	0		0	100	0		0	0	0		
PHF	.000	.000	.000	.000	.000	.250	.000	.250	.000	.000	.000	.000	.250

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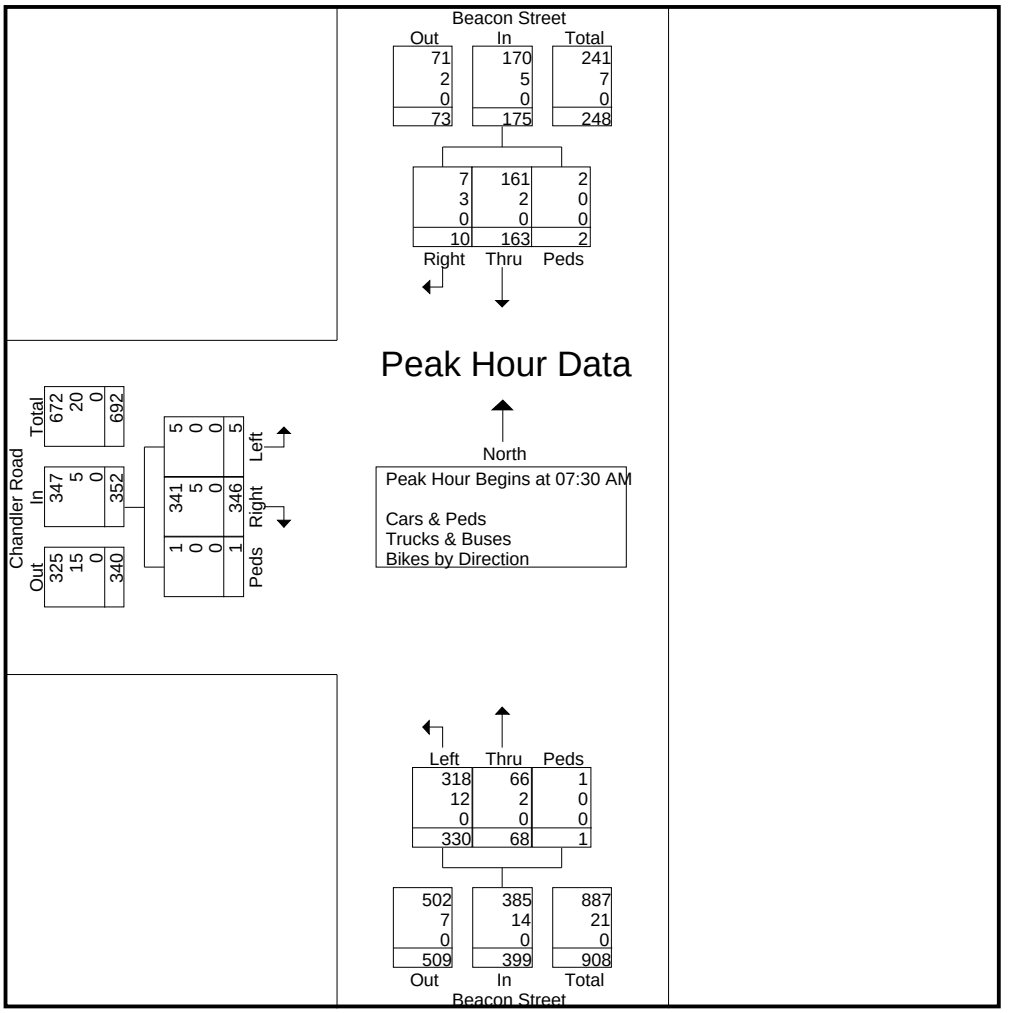
W: Chandler Road
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268A
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

	Beacon Street From North				Beacon Street From South				Chandler Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:30 AM													
07:30 AM	1	**47**	**1**	49	14	81	0	95	85	1	0	86	230
07:45 AM	0	37	1	38	11	78	**1**	90	**92**	1	**1**	**94**	222
08:00 AM	**5**	45	0	**50**	19	74	0	93	86	**2**	0	88	231
08:15 AM	4	34	0	38	**24**	**97**	0	**121**	83	1	0	84	**243**
Total Volume	10	163	2	175	68	330	1	399	346	5	1	352	926
% App. Total	5.7	93.1	1.1		17	82.7	0.3		98.3	1.4	0.3		
PHF	.500	.867	.500	.875	.708	.851	.250	.824	.940	.625	.250	.936	.953
Cars & Peds	7	161	2	170	66	318	1	385	341	5	1	347	902
% Cars & Peds	70.0	98.8	100	97.1	97.1	96.4	100	96.5	98.6	100	100	98.6	97.4
Trucks & Buses	3	2	0	5	2	12	0	14	5	0	0	5	24
% Trucks & Buses	30.0	1.2	0	2.9	2.9	3.6	0	3.5	1.4	0	0	1.4	2.6
Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0



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N/S: Beacon Street
E: Andover Country Club Lane
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268B
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Cars & Peds - Trucks & Buses - Bikes by Direction

	Beacon Street From North			Andover Country Club Lane From East			Beacon Street From South			
Start Time	Thru	Left	Peds	Right	Left	Peds	Right	Thru	Peds	Int. Total
07:00 AM	124	1	0	5	8	0	4	55	0	197
07:15 AM	105	9	0	6	12	0	4	76	0	212
07:30 AM	128	4	0	3	6	0	2	92	0	235
07:45 AM	124	5	0	1	5	0	5	87	0	227
Total	481	19	0	15	31	0	15	310	0	871
08:00 AM	125	6	0	4	9	0	4	91	0	239
08:15 AM	117	6	0	2	4	0	1	117	6	253
08:30 AM	91	6	0	3	10	2	6	98	2	218
08:45 AM	83	5	0	5	7	0	9	101	0	210
Total	416	23	0	14	30	2	20	407	8	920
Grand Total	897	42	0	29	61	2	35	717	8	1791
Apprch %	95.5	4.5	0	31.5	66.3	2.2	4.6	94.3	1.1	
Total %	50.1	2.3	0	1.6	3.4	0.1	2	40	0.4	
Cars & Peds	884	42	0	29	58	2	32	689	8	1744
% Cars & Peds	98.6	100	0	100	95.1	100	91.4	96.1	100	97.4
Trucks & Buses	13	0	0	0	3	0	3	27	0	46
% Trucks & Buses	1.4	0	0	0	4.9	0	8.6	3.8	0	2.6
Bikes by Direction	0	0	0	0	0	0	0	1	0	1
% Bikes by Direction	0	0	0	0	0	0	0	0.1	0	0.1

	Beacon Street From North				Andover Country Club Lane From East				Beacon Street From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:30 AM													
07:30 AM	**128**	4	0	**132**	3	6	0	9	2	92	0	94	235
07:45 AM	124	5	0	129	1	5	0	6	**5**	87	0	92	227
08:00 AM	125	**6**	0	131	**4**	**9**	0	**13**	4	91	0	95	239
08:15 AM	117	6	0	123	2	4	0	6	1	**117**	**6**	**124**	**253**
Total Volume	494	21	0	515	10	24	0	34	12	387	6	405	954
% App. Total	95.9	4.1	0		29.4	70.6	0		3	95.6	1.5		
PHF	.965	.875	.000	.975	.625	.667	.000	.654	.600	.827	.250	.817	.943
Cars & Peds	487	21	0	508	10	24	0	34	11	373	6	390	932
% Cars & Peds	98.6	100	0	98.6	100	100	0	100	91.7	96.4	100	96.3	97.7
Trucks & Buses	7	0	0	7	0	0	0	0	1	14	0	15	22
% Trucks & Buses	1.4	0	0	1.4	0	0	0	0	8.3	3.6	0	3.7	2.3
Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0

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N/S: Beacon Street
E: Andover Country Club Lane
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268B
Site Code : 05268
Start Date : 11/21/2019
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Groups Printed- Cars & Peds

	Beacon Street From North			Andover Country Club Lane From East			Beacon Street From South			
Start Time	Thru	Left	Peds	Right	Left	Peds	Right	Thru	Peds	Int. Total
07:00 AM	123	1	0	5	8	0	2	53	0	192
07:15 AM	101	9	0	6	9	0	4	74	0	203
07:30 AM	125	4	0	3	6	0	2	90	0	230
07:45 AM	122	5	0	1	5	0	4	85	0	222
Total	471	19	0	15	28	0	12	302	0	847
08:00 AM	124	6	0	4	9	0	4	89	0	236
08:15 AM	116	6	0	2	4	0	1	109	6	244
08:30 AM	91	6	0	3	10	2	6	89	2	209
08:45 AM	82	5	0	5	7	0	9	100	0	208
Total	413	23	0	14	30	2	20	387	8	897
Grand Total	884	42	0	29	58	2	32	689	8	1744
Apprch %	95.5	4.5	0	32.6	65.2	2.2	4.4	94.5	1.1	
Total %	50.7	2.4	0	1.7	3.3	0.1	1.8	39.5	0.5	

	Beacon Street From North				Andover Country Club Lane From East				Beacon Street From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:30 AM													
07:30 AM	**125**	4	0	129	3	6	0	9	2	90	0	92	230
07:45 AM	122	5	0	127	1	5	0	6	**4**	85	0	89	222
08:00 AM	124	**6**	0	**130**	**4**	**9**	0	**13**	4	89	0	93	236
08:15 AM	116	6	0	122	2	4	0	6	1	**109**	**6**	**116**	**244**
Total Volume	487	21	0	508	10	24	0	34	11	373	6	390	932
% App. Total	95.9	4.1	0		29.4	70.6	0		2.8	95.6	1.5		
PHF	.974	.875	.000	.977	.625	.667	.000	.654	.688	.856	.250	.841	.955

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Client: Brennan/C. Emilius

File Name : 05268B
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Trucks & Buses

	Beacon Street From North			Andover Country Club Lane From East			Beacon Street From South			
Start Time	Thru	Left	Peds	Right	Left	Peds	Right	Thru	Peds	Int. Total
07:00 AM	1	0	0	0	0	0	2	2	0	5
07:15 AM	4	0	0	0	3	0	0	2	0	9
07:30 AM	3	0	0	0	0	0	0	2	0	5
07:45 AM	2	0	0	0	0	0	1	2	0	5
Total	10	0	0	0	3	0	3	8	0	24
08:00 AM	1	0	0	0	0	0	0	2	0	3
08:15 AM	1	0	0	0	0	0	0	8	0	9
08:30 AM	0	0	0	0	0	0	0	8	0	8
08:45 AM	1	0	0	0	0	0	0	1	0	2
Total	3	0	0	0	0	0	0	19	0	22
Grand Total	13	0	0	0	3	0	3	27	0	46
Apprch %	100	0	0	0	100	0	10	90	0	
Total %	28.3	0	0	0	6.5	0	6.5	58.7	0	

	Beacon Street From North				Andover Country Club Lane From East				Beacon Street From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	**2**	0	0	**2**	0	0	0	0	**1**	2	0	3	5
08:00 AM	1	0	0	1	0	0	0	0	0	2	0	2	3
08:15 AM	1	0	0	1	0	0	0	0	0	**8**	0	**8**	**9**
08:30 AM	0	0	0	0	0	0	0	0	0	8	0	8	8
Total Volume	4	0	0	4	0	0	0	0	1	20	0	21	25
% App. Total	100	0	0		0	0	0		4.8	95.2	0		
PHF	.500	.000	.000	.500	.000	.000	.000	.000	.250	.625	.000	.656	.694

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File Name : 05268B
Site Code : 05268
Start Date : 11/21/2019
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Groups Printed- Bikes by Direction

	Beacon Street From North			Andover Country Club Lane From East			Beacon Street From South			
Start Time	Thru	Left	Peds	Right	Left	Peds	Right	Thru	Peds	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	0	0	1	0	1
08:45 AM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	1	0	1
Grand Total	0	0	0	0	0	0	0	1	0	1
Apprch %	0	0	0	0	0	0	0	100	0	
Total %	0	0	0	0	0	0	0	100	0	

	Beacon Street From North				Andover Country Club Lane From East				Beacon Street From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	0	0	0	0	**1**	0	**1**	**1**
Total Volume	0	0	0	0	0	0	0	0	0	1	0	1	1
% App. Total	0	0	0		0	0	0		0	100	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.250	.000	.250	.250

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File Name : 05268B
Site Code : 05268
Start Date : 11/21/2019
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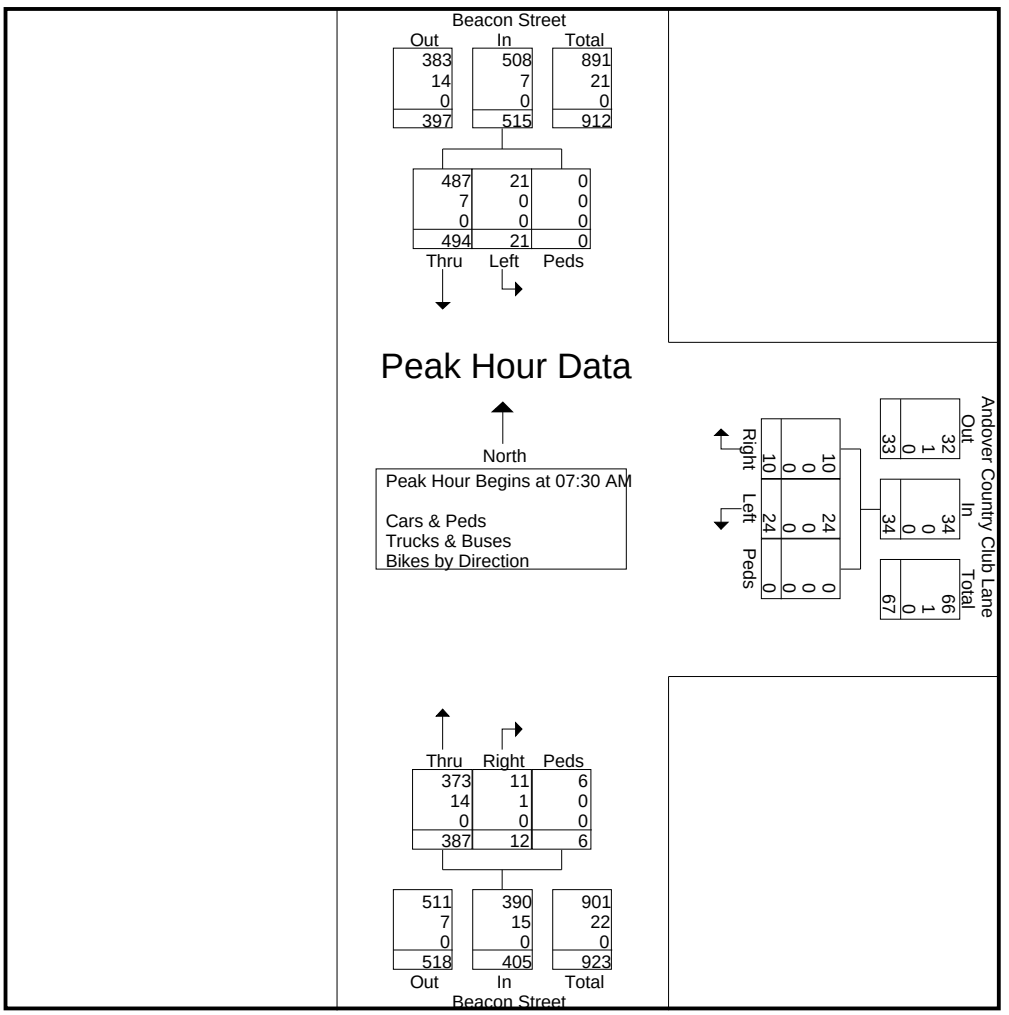
	Beacon Street From North				Andover Country Club Lane From East				Beacon Street From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:30 AM													
07:30 AM	**128**	4	0	**132**	3	6	0	9	2	92	0	94	235
07:45 AM	124	5	0	129	1	5	0	6	**5**	87	0	92	227
08:00 AM	125	**6**	0	131	**4**	**9**	0	**13**	4	91	0	95	239
08:15 AM	117	6	0	123	2	4	0	6	1	**117**	**6**	**124**	**253**
Total Volume	494	21	0	515	10	24	0	34	12	387	6	405	954
% App. Total	95.9	4.1	0		29.4	70.6	0		3	95.6	1.5		
PHF	.965	.875	.000	.975	.625	.667	.000	.654	.600	.827	.250	.817	.943
Cars & Peds	487	21	0	508	10	24	0	34	11	373	6	390	932
% Cars & Peds	98.6	100	0	98.6	100	100	0	100	91.7	96.4	100	96.3	97.7
Trucks & Buses	7	0	0	7	0	0	0	0	1	14	0	15	22
% Trucks & Buses	1.4	0	0	1.4	0	0	0	0	8.3	3.6	0	3.7	2.3
Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0



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City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268C
Site Code : 05268
Start Date : 11/21/2019
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Groups Printed- Cars & Peds - Trucks & Buses - Bikes by Direction

	Beacon Street From North			Beacon Street From South			West Elementary School (Northerly Drive) From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
07:00 AM	0	131	0	59	1	0	1	0	0	192
07:15 AM	0	115	0	82	2	0	0	0	0	199
07:30 AM	1	133	0	94	1	0	0	0	0	229
07:45 AM	5	123	0	90	6	0	1	0	1	226
Total	6	502	0	325	10	0	2	0	1	846
08:00 AM	10	124	0	95	14	0	2	0	0	245
08:15 AM	9	113	0	109	16	0	1	1	4	253
08:30 AM	3	97	0	100	5	0	2	2	0	209
08:45 AM	2	86	0	106	4	0	4	2	1	205
Total	24	420	0	410	39	0	9	5	5	912
Grand Total	30	922	0	735	49	0	11	5	6	1758
Apprch %	3.2	96.8	0	93.8	6.2	0	50	22.7	27.3	
Total %	1.7	52.4	0	41.8	2.8	0	0.6	0.3	0.3	
Cars & Peds	30	907	0	714	37	0	11	5	6	1710
% Cars & Peds	100	98.4	0	97.1	75.5	0	100	100	100	97.3
Trucks & Buses	0	15	0	20	12	0	0	0	0	47
% Trucks & Buses	0	1.6	0	2.7	24.5	0	0	0	0	2.7
Bikes by Direction	0	0	0	1	0	0	0	0	0	1
% Bikes by Direction	0	0	0	0.1	0	0	0	0	0	0.1

	Beacon Street From North				Beacon Street From South				West Elementary School (Northerly Drive) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:30 AM													
07:30 AM	1	**133**	0	**134**	94	1	0	95	0	0	0	0	229
07:45 AM	5	123	0	128	90	6	0	96	1	0	1	2	226
08:00 AM	**10**	124	0	134	95	14	0	109	**2**	0	0	2	245
08:15 AM	9	113	0	122	**109**	**16**	0	**125**	1	**1**	**4**	**6**	**253**
Total Volume	25	493	0	518	388	37	0	425	4	1	5	10	953
% App. Total	4.8	95.2	0		91.3	8.7	0		40	10	50		
PHF	.625	.927	.000	.966	.890	.578	.000	.850	.500	.250	.313	.417	.942
Cars & Peds	25	487	0	512	381	26	0	407	4	1	5	10	929
% Cars & Peds	100	98.8	0	98.8	98.2	70.3	0	95.8	100	100	100	100	97.5
Trucks & Buses	0	6	0	6	7	11	0	18	0	0	0	0	24
% Trucks & Buses	0	1.2	0	1.2	1.8	29.7	0	4.2	0	0	0	0	2.5
Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0

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Client: Brennan/C. Emilius

File Name : 05268C
Site Code : 05268
Start Date : 11/21/2019
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Groups Printed- Cars & Peds

	Beacon Street From North			Beacon Street From South			West Elementary School (Northerly Drive) From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
07:00 AM	0	130	0	56	1	0	1	0	0	188
07:15 AM	0	108	0	79	2	0	0	0	0	189
07:30 AM	1	130	0	92	1	0	0	0	0	224
07:45 AM	5	122	0	88	6	0	1	0	1	223
Total	6	490	0	315	10	0	2	0	1	824
08:00 AM	10	123	0	94	11	0	2	0	0	240
08:15 AM	9	112	0	107	8	0	1	1	4	242
08:30 AM	3	97	0	93	4	0	2	2	0	201
08:45 AM	2	85	0	105	4	0	4	2	1	203
Total	24	417	0	399	27	0	9	5	5	886
Grand Total	30	907	0	714	37	0	11	5	6	1710
Apprch %	3.2	96.8	0	95.1	4.9	0	50	22.7	27.3	
Total %	1.8	53	0	41.8	2.2	0	0.6	0.3	0.4	

	Beacon Street From North				Beacon Street From South				West Elementary School (Northerly Drive) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:30 AM													
07:30 AM	1	**130**	0	131	92	1	0	93	0	0	0	0	224
07:45 AM	5	122	0	127	88	6	0	94	1	0	1	2	223
08:00 AM	**10**	123	0	**133**	94	**11**	0	105	**2**	0	0	2	240
08:15 AM	9	112	0	121	**107**	8	0	**115**	1	**1**	**4**	**6**	**242**
Total Volume	25	487	0	512	381	26	0	407	4	1	5	10	929
% App. Total	4.9	95.1	0		93.6	6.4	0		40	10	50		
PHF	.625	.937	.000	.962	.890	.591	.000	.885	.500	.250	.313	.417	.960

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File Name : 05268C
Site Code : 05268
Start Date : 11/21/2019
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Groups Printed- Trucks & Buses

	Beacon Street From North			Beacon Street From South			West Elementary School (Northerly Drive) From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
07:00 AM	0	1	0	3	0	0	0	0	0	4
07:15 AM	0	7	0	3	0	0	0	0	0	10
07:30 AM	0	3	0	2	0	0	0	0	0	5
07:45 AM	0	1	0	2	0	0	0	0	0	3
Total	0	12	0	10	0	0	0	0	0	22
08:00 AM	0	1	0	1	3	0	0	0	0	5
08:15 AM	0	1	0	2	8	0	0	0	0	11
08:30 AM	0	0	0	6	1	0	0	0	0	7
08:45 AM	0	1	0	1	0	0	0	0	0	2
Total	0	3	0	10	12	0	0	0	0	25
Grand Total	0	15	0	20	12	0	0	0	0	47
Apprch %	0	100	0	62.5	37.5	0	0	0	0	
Total %	0	31.9	0	42.6	25.5	0	0	0	0	

	Beacon Street From North				Beacon Street From South				West Elementary School (Northerly Drive) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	0	**1**	0	**1**	2	0	0	2	0	0	0	0	3
08:00 AM	0	1	0	1	1	3	0	4	0	0	0	0	5
08:15 AM	0	1	0	1	2	**8**	0	**10**	0	0	0	0	**11**
08:30 AM	0	0	0	0	**6**	1	0	7	0	0	0	0	7
Total Volume	0	3	0	3	11	12	0	23	0	0	0	0	26
% App. Total	0	100	0		47.8	52.2	0		0	0	0		
PHF	.000	.750	.000	.750	.458	.375	.000	.575	.000	.000	.000	.000	.591

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File Name : 05268C
Site Code : 05268
Start Date : 11/21/2019
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Groups Printed- Bikes by Direction

	Beacon Street From North			Beacon Street From South			West Elementary School (Northerly Drive) From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	1	0	0	0	0	0	1
08:45 AM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	1	0	0	0	0	0	1
Grand Total	0	0	0	1	0	0	0	0	0	1
Apprch %	0	0	0	100	0	0	0	0	0	
Total %	0	0	0	100	0	0	0	0	0	

	Beacon Street From North				Beacon Street From South				West Elementary School (Northerly Drive) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	**1**	0	0	**1**	0	0	0	0	**1**
Total Volume	0	0	0	0	1	0	0	1	0	0	0	0	1
% App. Total	0	0	0		100	0	0		0	0	0		
PHF	.000	.000	.000	.000	.250	.000	.000	.250	.000	.000	.000	.000	.250

Transportation Data Corporation

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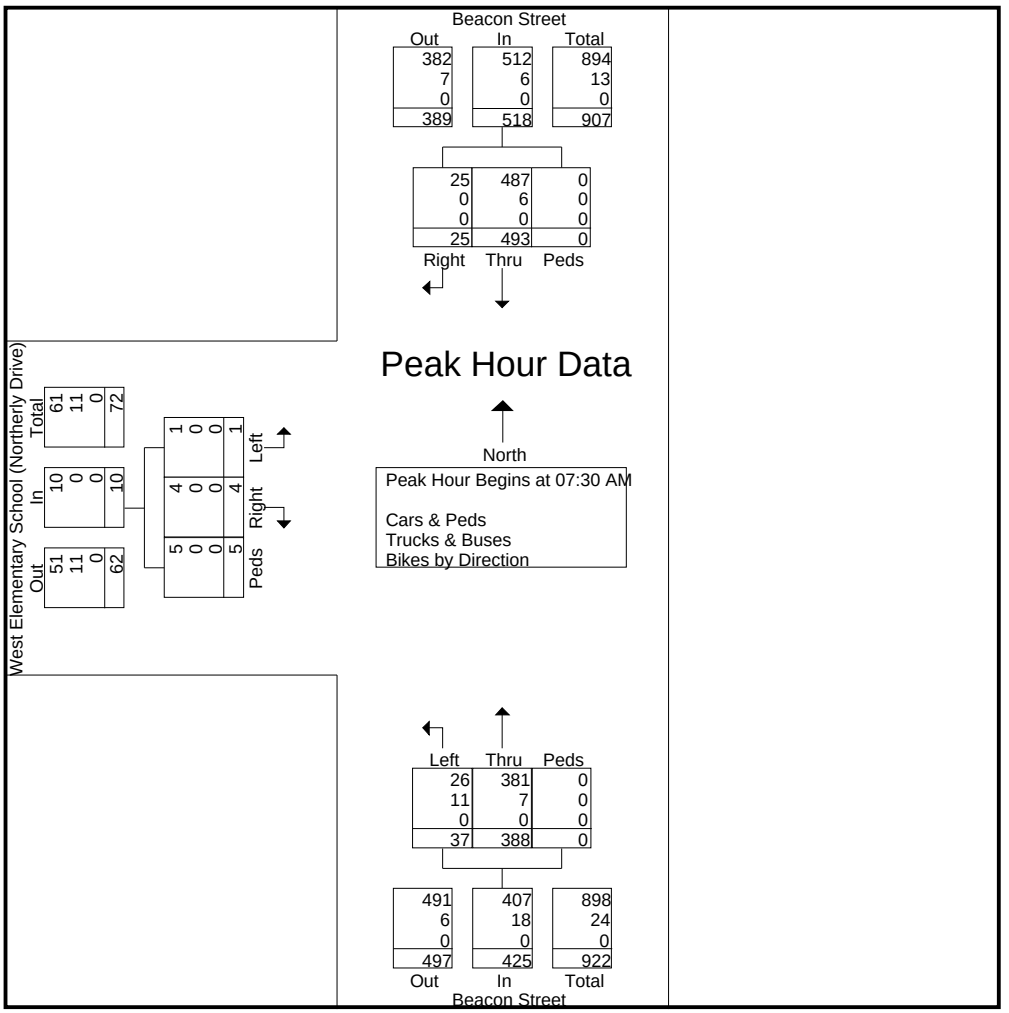
N/S: Beacon Street
W: West Elementary School (Northerly Dr)
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268C
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

	Beacon Street From North				Beacon Street From South				West Elementary School (Northerly Drive) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:30 AM													
07:30 AM	1	**133**	0	**134**	94	1	0	95	0	0	0	0	229
07:45 AM	5	123	0	128	90	6	0	96	1	0	1	2	226
08:00 AM	**10**	124	0	134	95	14	0	109	**2**	0	0	2	245
08:15 AM	9	113	0	122	**109**	**16**	0	**125**	1	**1**	**4**	**6**	**253**
Total Volume	25	493	0	518	388	37	0	425	4	1	5	10	953
% App. Total	4.8	95.2	0		91.3	8.7	0		40	10	50		
PHF	.625	.927	.000	.966	.890	.578	.000	.850	.500	.250	.313	.417	.942
Cars & Peds	25	487	0	512	381	26	0	407	4	1	5	10	929
% Cars & Peds	100	98.8	0	98.8	98.2	70.3	0	95.8	100	100	100	100	97.5
Trucks & Buses	0	6	0	6	7	11	0	18	0	0	0	0	24
% Trucks & Buses	0	1.2	0	1.2	1.8	29.7	0	4.2	0	0	0	0	2.5
Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0



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N/S: Beacon Street
W: West Elementary School (Middle Loop)
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268D
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Cars & Peds - Trucks & Buses - Bikes by Direction

	Beacon Street From North			Beacon Street From South			WES (Limited Access Staff & Buses) From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0
07:30 AM	1	0	0	0	1	0	1	0	0	3
07:45 AM	1	0	0	0	2	0	2	0	0	5
Total	2	0	0	0	3	0	3	0	0	8
08:00 AM	0	0	0	0	4	0	0	1	0	5
08:15 AM	2	0	0	0	5	0	4	7	0	18
08:30 AM	2	0	0	1	6	0	0	2	0	11
08:45 AM	1	0	0	0	2	0	0	0	0	3
Total	5	0	0	1	17	0	4	10	0	37
Grand Total	7	0	0	1	20	0	7	10	0	45
Apprch %	100	0	0	4.8	95.2	0	41.2	58.8	0	
Total %	15.6	0	0	2.2	44.4	0	15.6	22.2	0	
Cars & Peds	7	0	0	0	20	0	4	0	0	31
% Cars & Peds	100	0	0	0	100	0	57.1	0	0	68.9
Trucks & Buses	0	0	0	0	0	0	3	10	0	13
% Trucks & Buses	0	0	0	0	0	0	42.9	100	0	28.9
Bikes by Direction	0	0	0	1	0	0	0	0	0	1
% Bikes by Direction	0	0	0	100	0	0	0	0	0	2.2

	Beacon Street From North				Beacon Street From South				WES (Limited Access Staff & Buses) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	1	0	0	1	0	2	0	2	2	0	0	2	5
08:00 AM	0	0	0	0	0	4	0	4	0	1	0	1	5
08:15 AM	**2**	0	0	**2**	0	5	0	5	**4**	**7**	0	**11**	**18**
08:30 AM	2	0	0	2	**1**	**6**	0	**7**	0	2	0	2	11
Total Volume	5	0	0	5	1	17	0	18	6	10	0	16	39
% App. Total	100	0	0		5.6	94.4	0		37.5	62.5	0		
PHF	.625	.000	.000	.625	.250	.708	.000	.643	.375	.357	.000	.364	.542
Cars & Peds	5	0	0	5	0	17	0	17	3	0	0	3	25
% Cars & Peds	100	0	0	100	0	100	0	94.4	50.0	0	0	18.8	64.1
Trucks & Buses	0	0	0	0	0	0	0	0	3	10	0	13	13
% Trucks & Buses	0	0	0	0	0	0	0	0	50.0	100	0	81.3	33.3
Bikes by Direction	0	0	0	0	1	0	0	1	0	0	0	0	1
% Bikes by Direction	0	0	0	0	100	0	0	5.6	0	0	0	0	2.6

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N/S: Beacon Street
W: West Elementary School (Middle Loop)
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268D
Site Code : 05268
Start Date : 11/21/2019

Groups Printed- Cars & Peds

	Beacon Street From North			Beacon Street From South			WES (Limited Access Staff & Buses) From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0
07:30 AM	1	0	0	0	1	0	1	0	0	3
07:45 AM	1	0	0	0	2	0	1	0	0	4
Total	2	0	0	0	3	0	2	0	0	7
08:00 AM	0	0	0	0	4	0	0	0	0	4
08:15 AM	2	0	0	0	5	0	2	0	0	9
08:30 AM	2	0	0	0	6	0	0	0	0	8
08:45 AM	1	0	0	0	2	0	0	0	0	3
Total	5	0	0	0	17	0	2	0	0	24
Grand Total	7	0	0	0	20	0	4	0	0	31
Apprch %	100	0	0	0	100	0	100	0	0	
Total %	22.6	0	0	0	64.5	0	12.9	0	0	

	Beacon Street From North				Beacon Street From South				WES (Limited Access Staff & Buses) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	1	0	0	1	0	2	0	2	1	0	0	1	4
08:00 AM	0	0	0	0	0	4	0	4	0	0	0	0	4
08:15 AM	**2**	0	0	**2**	0	5	0	5	**2**	0	0	**2**	**9**
08:30 AM	2	0	0	2	0	**6**	0	**6**	0	0	0	0	8
Total Volume	5	0	0	5	0	17	0	17	3	0	0	3	25
% App. Total	100	0	0		0	100	0		100	0	0		
PHF	.625	.000	.000	.625	.000	.708	.000	.708	.375	.000	.000	.375	.694

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Client: Brennan/C. Emilius

File Name : 05268D
Site Code : 05268
Start Date : 11/21/2019

Groups Printed- Trucks & Buses

	Beacon Street From North			Beacon Street From South			WES (Limited Access Staff & Buses) From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	1	0	0	1
Total	0	0	0	0	0	0	1	0	0	1
08:00 AM	0	0	0	0	0	0	0	1	0	1
08:15 AM	0	0	0	0	0	0	2	7	0	9
08:30 AM	0	0	0	0	0	0	0	2	0	2
08:45 AM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	2	10	0	12
Grand Total	0	0	0	0	0	0	3	10	0	13
Apprch %	0	0	0	0	0	0	23.1	76.9	0	
Total %	0	0	0	0	0	0	23.1	76.9	0	

	Beacon Street From North				Beacon Street From South				WES (Limited Access Staff & Buses) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	0	0	0	0	0	0	0	0	1	0	0	1	1
08:00 AM	0	0	0	0	0	0	0	0	0	1	0	1	1
08:15 AM	0	0	0	0	0	0	0	0	**2**	**7**	0	**9**	**9**
08:30 AM	0	0	0	0	0	0	0	0	0	2	0	2	2
Total Volume	0	0	0	0	0	0	0	0	3	10	0	13	13
% App. Total	0	0	0		0	0	0		23.1	76.9	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.375	.357	.000	.361	.361

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N/S: Beacon Street
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City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268D
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Bikes by Direction

	Beacon Street From North			Beacon Street From South			WES (Limited Access Staff & Buses) From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	1	0	0	0	0	0	1
08:45 AM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	1	0	0	0	0	0	1
Grand Total	0	0	0	1	0	0	0	0	0	1
Apprch %	0	0	0	100	0	0	0	0	0	
Total %	0	0	0	100	0	0	0	0	0	

	Beacon Street From North				Beacon Street From South				WES (Limited Access Staff & Buses) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	**1**	0	0	**1**	0	0	0	0	**1**
Total Volume	0	0	0	0	1	0	0	1	0	0	0	0	1
% App. Total	0	0	0		100	0	0		0	0	0		
PHF	.000	.000	.000	.000	.250	.000	.000	.250	.000	.000	.000	.000	.250

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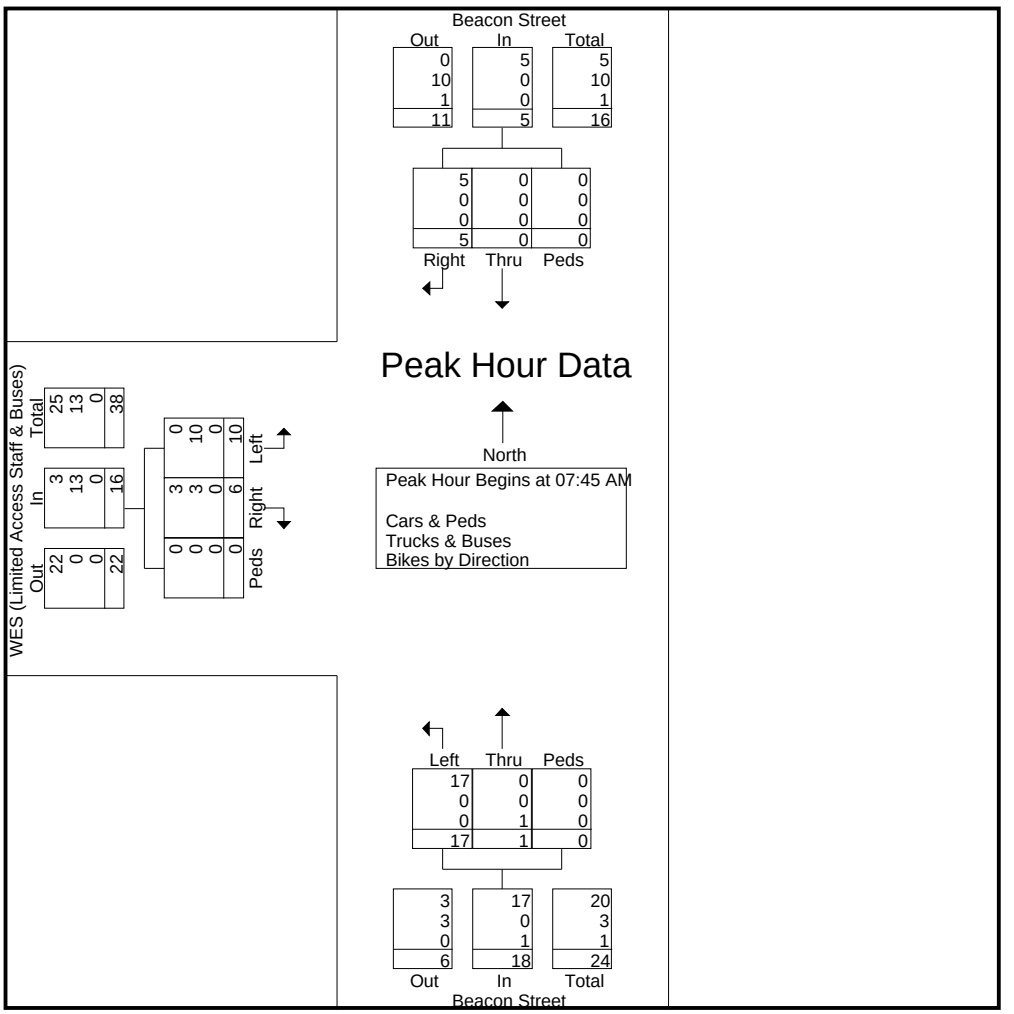
N/S: Beacon Street
W: West Elementary School (Middle Loop)
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268D
Site Code : 05268
Start Date : 11/21/2019

	Beacon Street From North				Beacon Street From South				WES (Limited Access Staff & Buses) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	1	0	0	1	0	2	0	2	2	0	0	2	5
08:00 AM	0	0	0	0	0	4	0	4	0	1	0	1	5
08:15 AM	**2**	0	0	**2**	0	5	0	5	**4**	**7**	0	**11**	**18**
08:30 AM	2	0	0	2	**1**	**6**	0	**7**	0	2	0	2	11
Total Volume	5	0	0	5	1	17	0	18	6	10	0	16	39
% App. Total	100	0	0		5.6	94.4	0		37.5	62.5	0		
PHF	.625	.000	.000	.625	.250	.708	.000	.643	.375	.357	.000	.364	.542
Cars & Peds	5	0	0	5	0	17	0	17	3	0	0	3	25
% Cars & Peds	100	0	0	100	0	100	0	94.4	50.0	0	0	18.8	64.1
Trucks & Buses	0	0	0	0	0	0	0	0	3	10	0	13	13
% Trucks & Buses	0	0	0	0	0	0	0	0	50.0	100	0	81.3	33.3
Bikes by Direction	0	0	0	0	1	0	0	1	0	0	0	0	1
% Bikes by Direction	0	0	0	0	100	0	0	5.6	0	0	0	0	2.6



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N/S: Beacon Street
W: West Elementary School (Southerly Dr)
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268E
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Cars & Peds - Trucks & Buses - Bikes by Direction

	Beacon Street From North			Beacon Street From South			West Elementary School (Southerly Drive) From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
07:00 AM	1	121	0	54	3	0	3	1	0	183
07:15 AM	4	114	0	79	8	0	7	3	0	215
07:30 AM	6	122	0	96	9	0	6	3	0	242
07:45 AM	3	131	0	103	23	0	20	1	0	281
Total	14	488	0	332	43	0	36	8	0	921
08:00 AM	9	106	0	103	32	0	17	3	0	270
08:15 AM	19	96	0	114	30	0	38	12	1	310
08:30 AM	8	92	0	103	47	0	41	10	2	303
08:45 AM	0	98	0	111	2	0	6	2	0	219
Total	36	392	0	431	111	0	102	27	3	1102
Grand Total	50	880	0	763	154	0	138	35	3	2023
Apprch %	5.4	94.6	0	83.2	16.8	0	78.4	19.9	1.7	
Total %	2.5	43.5	0	37.7	7.6	0	6.8	1.7	0.1	
Cars & Peds	50	862	0	736	154	0	138	35	3	1978
% Cars & Peds	100	98	0	96.5	100	0	100	100	100	97.8
Trucks & Buses	0	18	0	27	0	0	0	0	0	45
% Trucks & Buses	0	2	0	3.5	0	0	0	0	0	2.2
Bikes by Direction	0	0	0	0	0	0	0	0	0	0
% Bikes by Direction	0	0	0	0	0	0	0	0	0	0

	Beacon Street From North				Beacon Street From South				West Elementary School (Southerly Drive) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	3	**131**	0	**134**	103	23	0	126	20	1	0	21	281
08:00 AM	9	106	0	115	103	32	0	135	17	3	0	20	270
08:15 AM	**19**	96	0	115	**114**	30	0	144	38	**12**	1	51	**310**
08:30 AM	8	92	0	100	103	**47**	0	**150**	**41**	10	**2**	**53**	303
Total Volume	39	425	0	464	423	132	0	555	116	26	3	145	1164
% App. Total	8.4	91.6	0		76.2	23.8	0		80	17.9	2.1		
PHF	.513	.811	.000	.866	.928	.702	.000	.925	.707	.542	.375	.684	.939
Cars & Peds	39	419	0	458	404	132	0	536	116	26	3	145	1139
% Cars & Peds	100	98.6	0	98.7	95.5	100	0	96.6	100	100	100	100	97.9
Trucks & Buses	0	6	0	6	19	0	0	19	0	0	0	0	25
% Trucks & Buses	0	1.4	0	1.3	4.5	0	0	3.4	0	0	0	0	2.1
Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0

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N/S: Beacon Street
W: West Elementary School (Southerly Dr)
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268E
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Cars & Peds

	Beacon Street From North			Beacon Street From South			West Elementary School (Southerly Drive) From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
07:00 AM	1	120	0	51	3	0	3	1	0	179
07:15 AM	4	107	0	77	8	0	7	3	0	206
07:30 AM	6	119	0	94	9	0	6	3	0	237
07:45 AM	3	129	0	101	23	0	20	1	0	277
Total	14	475	0	323	43	0	36	8	0	899
08:00 AM	9	105	0	100	32	0	17	3	0	266
08:15 AM	19	93	0	106	30	0	38	12	1	299
08:30 AM	8	92	0	97	47	0	41	10	2	297
08:45 AM	0	97	0	110	2	0	6	2	0	217
Total	36	387	0	413	111	0	102	27	3	1079
Grand Total	50	862	0	736	154	0	138	35	3	1978
Apprch %	5.5	94.5	0	82.7	17.3	0	78.4	19.9	1.7	
Total %	2.5	43.6	0	37.2	7.8	0	7	1.8	0.2	

	Beacon Street From North				Beacon Street From South				West Elementary School (Southerly Drive) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	3	**129**	0	**132**	101	23	0	124	20	1	0	21	277
08:00 AM	9	105	0	114	100	32	0	132	17	3	0	20	266
08:15 AM	**19**	93	0	112	**106**	30	0	136	38	**12**	1	51	**299**
08:30 AM	8	92	0	100	97	**47**	0	**144**	**41**	10	**2**	**53**	297
Total Volume	39	419	0	458	404	132	0	536	116	26	3	145	1139
% App. Total	8.5	91.5	0		75.4	24.6	0		80	17.9	2.1		
PHF	.513	.812	.000	.867	.953	.702	.000	.931	.707	.542	.375	.684	.952

Transportation Data Corporation
Mario Perone, mperone1@verizon.net
tel (781) 587-0086 cell (781) 439-4999

N/S: Beacon Street
W: West Elementary School (Southerly Dr)
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268E
Site Code : 05268
Start Date : 11/21/2019

Groups Printed- Trucks & Buses

	Beacon Street From North			Beacon Street From South			West Elementary School (Southerly Drive) From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
07:00 AM	0	1	0	3	0	0	0	0	0	4
07:15 AM	0	7	0	2	0	0	0	0	0	9
07:30 AM	0	3	0	2	0	0	0	0	0	5
07:45 AM	0	2	0	2	0	0	0	0	0	4
Total	0	13	0	9	0	0	0	0	0	22
08:00 AM	0	1	0	3	0	0	0	0	0	4
08:15 AM	0	3	0	8	0	0	0	0	0	11
08:30 AM	0	0	0	6	0	0	0	0	0	6
08:45 AM	0	1	0	1	0	0	0	0	0	2
Total	0	5	0	18	0	0	0	0	0	23
Grand Total	0	18	0	27	0	0	0	0	0	45
Apprch %	0	100	0	100	0	0	0	0	0	
Total %	0	40	0	60	0	0	0	0	0	

	Beacon Street From North				Beacon Street From South				West Elementary School (Southerly Drive) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	0	2	0	2	2	0	0	2	0	0	0	0	4
08:00 AM	0	1	0	1	3	0	0	3	0	0	0	0	4
08:15 AM	0	**3**	0	**3**	**8**	0	0	**8**	0	0	0	0	**11**
08:30 AM	0	0	0	0	6	0	0	6	0	0	0	0	6
Total Volume	0	6	0	6	19	0	0	19	0	0	0	0	25
% App. Total	0	100	0		100	0	0		0	0	0		
PHF	.000	.500	.000	.500	.594	.000	.000	.594	.000	.000	.000	.000	.568

Transportation Data Corporation
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N/S: Beacon Street
W: West Elementary School (Southerly Dr)
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268E
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Bikes by Direction

	Beacon Street From North			Beacon Street From South			West Elementary School (Southerly Drive) From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	0	0	0	0	0
08:45 AM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	0	0	0	0	0	0	0
Apprch %	0	0	0	0	0	0	0	0	0	
Total %										

	Beacon Street From North				Beacon Street From South				West Elementary School (Southerly Drive) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:00 AM													
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0	0		0	0	0		0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

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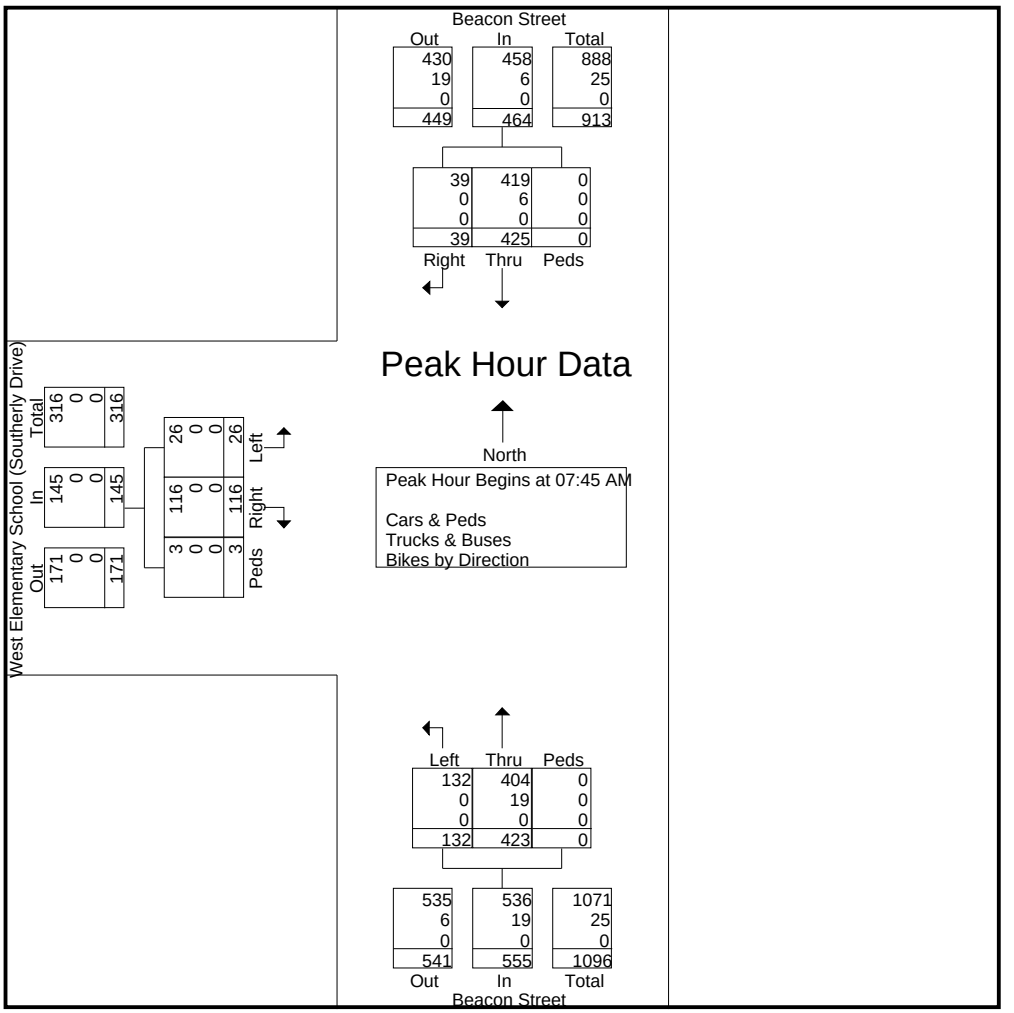
N/S: Beacon Street
W: West Elementary School (Southerly Dr)
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268E
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

	Beacon Street From North				Beacon Street From South				West Elementary School (Southerly Drive) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	3	**131**	0	**134**	103	23	0	126	20	1	0	21	281
08:00 AM	9	106	0	115	103	32	0	135	17	3	0	20	270
08:15 AM	**19**	96	0	115	**114**	30	0	144	38	**12**	1	51	**310**
08:30 AM	8	92	0	100	103	**47**	0	**150**	**41**	10	**2**	**53**	303
Total Volume	39	425	0	464	423	132	0	555	116	26	3	145	1164
% App. Total	8.4	91.6	0		76.2	23.8	0		80	17.9	2.1		
PHF	.513	.811	.000	.866	.928	.702	.000	.925	.707	.542	.375	.684	.939
Cars & Peds	39	419	0	458	404	132	0	536	116	26	3	145	1139
% Cars & Peds	100	98.6	0	98.7	95.5	100	0	96.6	100	100	100	100	97.9
Trucks & Buses	0	6	0	6	19	0	0	19	0	0	0	0	25
% Trucks & Buses	0	1.4	0	1.3	4.5	0	0	3.4	0	0	0	0	2.1
Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0



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N/S: Beacon Street
W: High Plain Road
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268F
Site Code : 05268
Start Date : 11/21/2019

Groups Printed- Cars & Peds - Trucks & Buses - Bikes by Direction

	Beacon Street From North			Beacon Street From South			High Plain Road From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
07:00 AM	2	124	0	57	2	0	34	0	0	219
07:15 AM	0	120	0	86	3	0	46	1	0	256
07:30 AM	1	128	0	103	0	0	36	2	0	270
07:45 AM	0	151	0	124	0	0	34	2	1	312
Total	3	523	0	370	5	0	150	5	1	1057
08:00 AM	0	123	0	135	0	0	33	1	0	292
08:15 AM	0	134	2	143	0	1	26	1	1	308
08:30 AM	0	134	0	142	1	0	16	10	2	305
08:45 AM	0	104	1	115	2	0	25	0	0	247
Total	0	495	3	535	3	1	100	12	3	1152
Grand Total	3	1018	3	905	8	1	250	17	4	2209
Apprch %	0.3	99.4	0.3	99	0.9	0.1	92.3	6.3	1.5	
Total %	0.1	46.1	0.1	41	0.4	0	11.3	0.8	0.2	
Cars & Peds	3	1001	3	877	7	1	241	16	4	2153
% Cars & Peds	100	98.3	100	96.9	87.5	100	96.4	94.1	100	97.5
Trucks & Buses	0	17	0	27	1	0	9	1	0	55
% Trucks & Buses	0	1.7	0	3	12.5	0	3.6	5.9	0	2.5
Bikes by Direction	0	0	0	1	0	0	0	0	0	1
% Bikes by Direction	0	0	0	0.1	0	0	0	0	0	0

	Beacon Street From North				Beacon Street From South				High Plain Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	0	**151**	0	**151**	124	0	0	124	**34**	2	1	**37**	**312**
08:00 AM	0	123	0	123	135	0	0	135	33	1	0	34	292
08:15 AM	0	134	**2**	136	**143**	0	**1**	**144**	26	1	1	28	308
08:30 AM	0	134	0	134	142	**1**	0	143	16	**10**	**2**	28	305
Total Volume	0	542	2	544	544	1	1	546	109	14	4	127	1217
% App. Total	0	99.6	0.4		99.6	0.2	0.2		85.8	11	3.1		
PHF	.000	.897	.250	.901	.951	.250	.250	.948	.801	.350	.500	.858	.975
Cars & Peds	0	536	2	538	524	1	1	526	107	13	4	124	1188
% Cars & Peds	0	98.9	100	98.9	96.3	100	100	96.3	98.2	92.9	100	97.6	97.6
Trucks & Buses	0	6	0	6	19	0	0	19	2	1	0	3	28
% Trucks & Buses	0	1.1	0	1.1	3.5	0	0	3.5	1.8	7.1	0	2.4	2.3
Bikes by Direction	0	0	0	0	1	0	0	1	0	0	0	0	1
% Bikes by Direction	0	0	0	0	0.2	0	0	0.2	0	0	0	0	0.1

Transportation Data Corporation
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N/S: Beacon Street
W: High Plain Road
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268F
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Cars & Peds

	Beacon Street From North			Beacon Street From South			High Plain Road From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
07:00 AM	2	123	0	54	2	0	30	0	0	211
07:15 AM	0	114	0	84	3	0	45	1	0	247
07:30 AM	1	125	0	101	0	0	35	2	0	264
07:45 AM	0	149	0	122	0	0	34	2	1	308
Total	3	511	0	361	5	0	144	5	1	1030
08:00 AM	0	122	0	132	0	0	33	1	0	288
08:15 AM	0	131	2	135	0	1	25	1	1	296
08:30 AM	0	134	0	135	1	0	15	9	2	296
08:45 AM	0	103	1	114	1	0	24	0	0	243
Total	0	490	3	516	2	1	97	11	3	1123
Grand Total	3	1001	3	877	7	1	241	16	4	2153
Apprch %	0.3	99.4	0.3	99.1	0.8	0.1	92.3	6.1	1.5	
Total %	0.1	46.5	0.1	40.7	0.3	0	11.2	0.7	0.2	

	Beacon Street From North				Beacon Street From South				High Plain Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	0	**149**	0	**149**	122	0	0	122	**34**	2	1	**37**	**308**
08:00 AM	0	122	0	122	132	0	0	132	33	1	0	34	288
08:15 AM	0	131	**2**	133	**135**	0	**1**	**136**	25	1	1	27	296
08:30 AM	0	134	0	134	135	**1**	0	136	15	**9**	**2**	26	296
Total Volume	0	536	2	538	524	1	1	526	107	13	4	124	1188
% App. Total	0	99.6	0.4		99.6	0.2	0.2		86.3	10.5	3.2		
PHF	.000	.899	.250	.903	.970	.250	.250	.967	.787	.361	.500	.838	.964

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N/S: Beacon Street
W: High Plain Road
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268F
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Trucks & Buses

	Beacon Street From North			Beacon Street From South			High Plain Road From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
07:00 AM	0	1	0	3	0	0	4	0	0	8
07:15 AM	0	6	0	2	0	0	1	0	0	9
07:30 AM	0	3	0	2	0	0	1	0	0	6
07:45 AM	0	2	0	2	0	0	0	0	0	4
Total	0	12	0	9	0	0	6	0	0	27
08:00 AM	0	1	0	3	0	0	0	0	0	4
08:15 AM	0	3	0	8	0	0	1	0	0	12
08:30 AM	0	0	0	6	0	0	1	1	0	8
08:45 AM	0	1	0	1	1	0	1	0	0	4
Total	0	5	0	18	1	0	3	1	0	28
Grand Total	0	17	0	27	1	0	9	1	0	55
Apprch %	0	100	0	96.4	3.6	0	90	10	0	
Total %	0	30.9	0	49.1	1.8	0	16.4	1.8	0	

	Beacon Street From North				Beacon Street From South				High Plain Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	0	2	0	2	2	0	0	2	0	0	0	0	4
08:00 AM	0	1	0	1	3	0	0	3	0	0	0	0	4
08:15 AM	0	**3**	0	**3**	**8**	0	0	**8**	**1**	0	0	1	**12**
08:30 AM	0	0	0	0	6	0	0	6	1	**1**	0	**2**	8
Total Volume	0	6	0	6	19	0	0	19	2	1	0	3	28
% App. Total	0	100	0		100	0	0		66.7	33.3	0		
PHF	.000	.500	.000	.500	.594	.000	.000	.594	.500	.250	.000	.375	.583

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N/S: Beacon Street
W: High Plain Road
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268F
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Bikes by Direction

	Beacon Street From North			Beacon Street From South			High Plain Road From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	1	0	0	0	0	0	1
08:45 AM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	1	0	0	0	0	0	1
Grand Total	0	0	0	1	0	0	0	0	0	1
Apprch %	0	0	0	100	0	0	0	0	0	
Total %	0	0	0	100	0	0	0	0	0	

	Beacon Street From North				Beacon Street From South				High Plain Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	**1**	0	0	**1**	0	0	0	0	**1**
Total Volume	0	0	0	0	1	0	0	1	0	0	0	0	1
% App. Total	0	0	0		100	0	0		0	0	0		
PHF	.000	.000	.000	.000	.250	.000	.000	.250	.000	.000	.000	.000	.250

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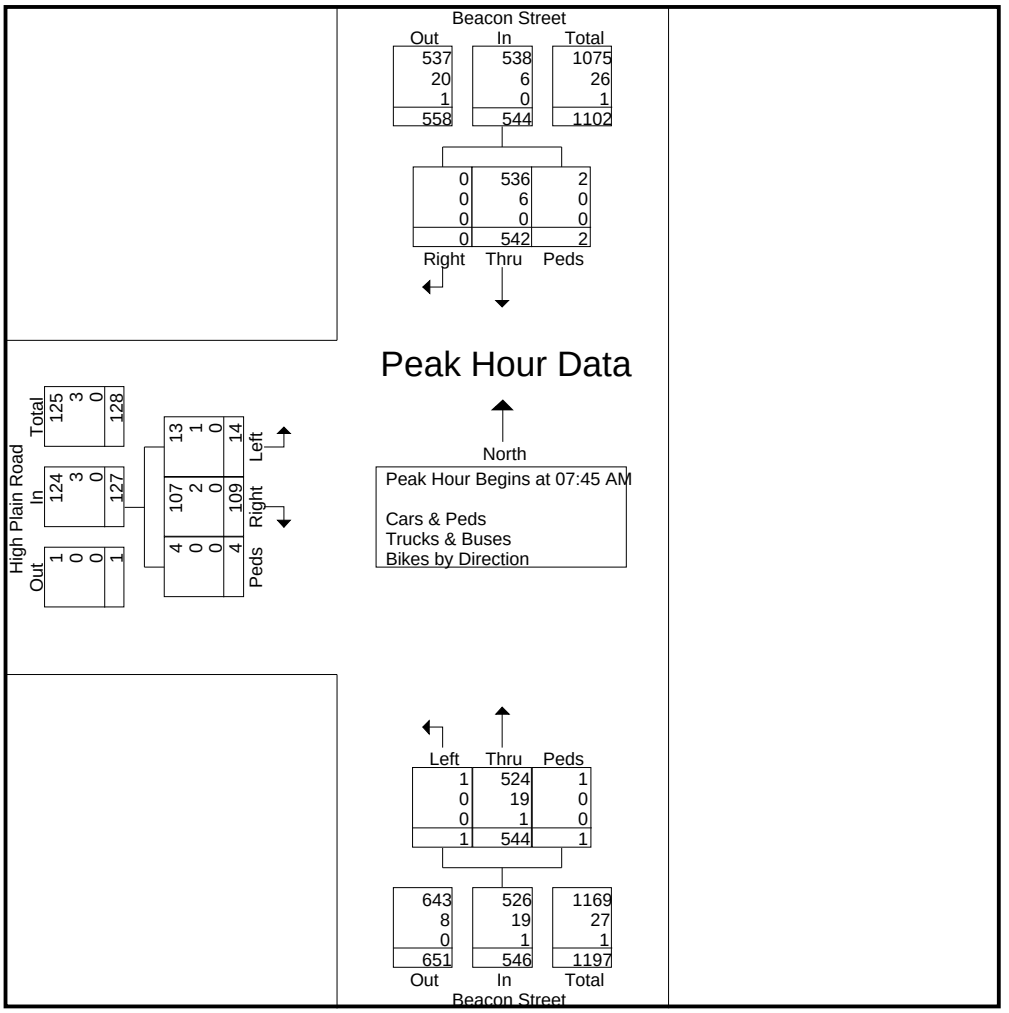
N/S: Beacon Street
W: High Plain Road
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268F
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

	Beacon Street From North				Beacon Street From South				High Plain Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 07:45 AM													
07:45 AM	0	**151**	0	**151**	124	0	0	124	**34**	2	1	**37**	**312**
08:00 AM	0	123	0	123	135	0	0	135	33	1	0	34	292
08:15 AM	0	134	**2**	136	**143**	0	**1**	**144**	26	1	1	28	308
08:30 AM	0	134	0	134	142	**1**	0	143	16	**10**	**2**	28	305
Total Volume	0	542	2	544	544	1	1	546	109	14	4	127	1217
% App. Total	0	99.6	0.4		99.6	0.2	0.2		85.8	11	3.1		
PHF	.000	.897	.250	.901	.951	.250	.250	.948	.801	.350	.500	.858	.975
Cars & Peds	0	536	2	538	524	1	1	526	107	13	4	124	1188
% Cars & Peds	0	98.9	100	98.9	96.3	100	100	96.3	98.2	92.9	100	97.6	97.6
Trucks & Buses	0	6	0	6	19	0	0	19	2	1	0	3	28
% Trucks & Buses	0	1.1	0	1.1	3.5	0	0	3.5	1.8	7.1	0	2.4	2.3
Bikes by Direction	0	0	0	0	1	0	0	1	0	0	0	0	1
% Bikes by Direction	0	0	0	0	0.2	0	0	0.2	0	0	0	0	0.1



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N/S: Beacon Street/Shawsheen Road
E,W/SW: Lowell Street/Reservation Road
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268G
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Cars & Peds - Trucks & Buses - Bikes by Direction

	Beacon Street From North					Lowell Street (Route 133) From East					Shawsheen Road From South					Reservation Road From Southwest					Lowell Street (Route 133) From West					
Start Time	Right	Bear Right	Thru	Left	Peds	Right	Thru	Bear Left	Left	Peds	Right	Thru	Left	Hard Left	Peds	Hard Right	Bear Right	Bear Left	Hard Left	Peds	Hard Right	Right	Thru	Left	Peds	Int. Total
07:00 AM	22	14	92	24	0	21	98	2	29	0	1	31	21	1	0	6	4	1	0	0	0	62	41	8	0	478
07:15 AM	32	21	105	18	0	36	104	3	18	0	7	32	18	4	0	7	0	1	2	0	3	89	41	17	0	558
07:30 AM	34	32	72	27	0	49	133	4	11	0	3	38	30	2	0	3	2	4	0	0	0	48	58	15	0	565
07:45 AM	38	32	82	26	0	44	132	3	7	0	1	56	35	0	0	3	2	5	0	0	0	21	54	24	0	565
Total	126	99	351	95	0	150	467	12	65	0	12	157	104	7	0	19	8	11	2	0	3	220	194	64	0	2166
08:00 AM	31	36	71	26	0	54	104	2	1	0	2	44	23	1	0	3	1	4	2	0	1	25	65	29	0	525
08:15 AM	25	13	89	25	0	52	91	2	3	1	1	56	26	2	0	1	0	9	0	0	0	32	61	27	0	516
08:30 AM	26	20	81	29	1	48	98	3	2	0	1	59	20	3	0	4	2	7	0	0	2	34	63	25	0	528
08:45 AM	27	16	58	32	0	45	94	5	4	1	4	50	28	4	1	5	1	4	0	0	3	37	61	17	0	497
Total	109	85	299	112	1	199	387	12	10	2	8	209	97	10	1	13	4	24	2	0	6	128	250	98	0	2066
Grand Total	235	184	650	207	1	349	854	24	75	2	20	366	201	17	1	32	12	35	4	0	9	348	444	162	0	4232
Apprch %	18.4	14.4	50.9	16.2	0.1	26.8	65.5	1.8	5.8	0.2	3.3	60.5	33.2	2.8	0.2	38.6	14.5	42.2	4.8	0	0.9	36.1	46.1	16.8	0	
Total %	5.6	4.3	15.4	4.9	0	8.2	20.2	0.6	1.8	0	0.5	8.6	4.7	0.4	0	0.8	0.3	0.8	0.1	0	0.2	8.2	10.5	3.8	0	
Cars & Peds	229	182	639	199	1	341	845	24	74	2	19	350	194	14	1	32	11	33	3	0	9	340	437	157	0	4136
% Cars & Peds	97.4	98.9	98.3	96.1	100	97.7	98.9	100	98.7	100	95	95.6	96.5	82.4	100	100	91.7	94.3	75	0	100	97.7	98.4	96.9	0	97.7
Trucks & Buses	6	2	11	7	0	8	9	0	1	0	1	15	7	3	0	0	1	2	1	0	0	8	7	5	0	94
% Trucks & Buses																										
Bikes by Direction	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
% Bikes by Direction	0	0	0	0.5	0	0	0	0	0	0	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Beacon Street From North						Lowell Street (Route 133) From East						Shawsheen Road From South						Reservation Road From Southwest						Lowell Street (Route 133) From West						
Start Time	Right	Bear Right	Thru	Le	Peds	App. Total	Right	Thru	Bear Left	Le	Peds	App. Total	Right	Thru	Le	Hard Left	Peds	App. Total	Hard Right	Bear Right	Bear Left	Hard Left	Peds	App. Total	Hard Right	Right	Thru	Le	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																															
Peak Hour for Entire Intersection Begins at 07:15 AM																															
07:15 AM	32	21	**105**	18	0	176	36	104	3	**18**	0	161	**7**	32	18	**4**	0	61	**7**	0	1	**2**	0	**10**	**3**	**89**	41	17	0	**150**	**558**
07:30 AM	34	32	72	**27**	0	165	49	**133**	**4**	11	0	**197**	**3**	**38**	**30**	**2**	**0**	**73**	**3**	**2**	4	0	0	9	0	48	58	15	0	121	**565**
07:45 AM	**38**	32	82	26	0	**178**	**44**	132	3	7	0	186	1	**56**	**35**	0	0	**92**	3	2	**5**	0	0	10	0	21	54	24	0	99	565
08:00 AM	31	**36**	71	26	0	164	**54**	104	2	1	0	161	2	44	23	1	0	70	3	1	4	2	0	10	1	25	**65**	**29**	0	120	525
Total Volume	135	121	330	97	0	683	183	473	12	37	0	705	13	170	106	7	0	296	16	5	14	4	0	39	4	183	218	85	0	490	2213
% App. Total	19.8	17.7	48.3	14.2	0		26	67.1	1.7	5.2	0		4.4	57.4	35.8	2.4	0		41	12.8	35.9	10.3	0		0.8	37.3	44.5	17.3	0		
PHF	.888	.840	.786	.898	.000	.959	.847	.889	.750	.514	.000	.895	.464	.759	.757	.438	.000	.804	.571	.625	.700	.500	.000	.975	.333	.514	.838	.733	.000	.817	.979
Cars & Peds	132	119	325	93	0	669	180	469	12	37	0	698	12	166	104	4	0	286	16	4	13	3	0	36	4	179	212	83	0	478	2167
% Cars & Peds	97.8	98.3	98.5	95.9	0	98.0	98.4	99.2	100	100	0	99.0	92.3	97.6	98.1	57.1	0	96.6	100	80.0	92.9	75.0	0	92.3	100	97.8	97.2	97.6	0	97.6	97.9
Trucks & Buses	3	2	5	4	0	14	3	4	0	0	0	7	1	4	2	3	0	10	0	1	1	1	0	3	0	4	6	2	0	12	46
% Trucks & Buses	2.2	1.7	1.5	4.1	0	2.0	1.6	0.8	0	0	0	1.0	7.7	2.4	1.9	42.9	0	3.4	0	20.0	7.1	25.0	0	7.7	0	2.2	2.8	2.4	0	2.4	2.1
Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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N/S: Beacon Street/Shawsheen Road
E,W/SW: Lowell Street/Reservation Road
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268G
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Cars & Peds

	Beacon Street From North					Lowell Street (Route 133) From East					Shawsheen Road From South					Reservation Road From Southwest					Lowell Street (Route 133) From West					
Start Time	Right	Bear Right	Thru	Left	Peds	Right	Thru	Bear Left	Left	Peds	Right	Thru	Left	Hard Left	Peds	Hard Right	Bear Right	Bear Left	Hard Left	Peds	Hard Right	Right	Thru	Left	Peds	Int. Total
07:00 AM	21	14	89	23	0	20	97	2	28	0	1	28	18	1	0	6	4	1	0	0	0	60	40	8	0	461
07:15 AM	30	20	103	16	0	36	104	3	18	0	7	31	18	1	0	7	0	1	2	0	3	86	40	16	0	542
07:30 AM	33	31	71	25	0	49	133	4	11	0	3	37	29	2	0	3	2	4	0	0	0	47	53	14	0	551
07:45 AM	38	32	81	26	0	42	130	3	7	0	0	55	35	0	0	3	1	4	0	0	0	21	54	24	0	556
Total	122	97	344	90	0	147	464	12	64	0	11	151	100	4	0	19	7	10	2	0	3	214	187	62	0	2110
08:00 AM	31	36	70	26	0	53	102	2	1	0	2	43	22	1	0	3	1	4	1	0	1	25	65	29	0	518
08:15 AM	24	13	87	24	0	50	90	2	3	1	1	53	25	2	0	1	0	8	0	0	0	31	61	25	0	501
08:30 AM	26	20	80	29	1	46	95	3	2	0	1	55	20	3	0	4	2	7	0	0	2	34	63	24	0	517
08:45 AM	26	16	58	30	0	45	94	5	4	1	4	48	27	4	1	5	1	4	0	0	3	36	61	17	0	490
Total	107	85	295	109	1	194	381	12	10	2	8	199	94	10	1	13	4	23	1	0	6	126	250	95	0	2026
Grand Total	229	182	639	199	1	341	845	24	74	2	19	350	194	14	1	32	11	33	3	0	9	340	437	157	0	4136
Apprch %	18.3	14.6	51.1	15.9	0.1	26.5	65.7	1.9	5.8	0.2	3.3	60.6	33.6	2.4	0.2	40.5	13.9	41.8	3.8	0	1	36.1	46.3	16.6	0	
Total %	5.5	4.4	15.4	4.8	0	8.2	20.4	0.6	1.8	0	0.5	8.5	4.7	0.3	0	0.8	0.3	0.8	0.1	0	0.2	8.2	10.6	3.8	0	

	Beacon Street From North						Lowell Street (Route 133) From East						Shawsheen Road From South						Reservation Road From Southwest						Lowell Street (Route 133) From West						
Start Time	Right	Bear Right	Thru	Left	Peds	App. Total	Right	Thru	Bear Left	Left	Peds	App. Total	Right	Thru	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Bear Left	Hard Left	Peds	App. Total	Hard Right	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																															
Peak Hour for Entire Intersection Begins at 07:15 AM																															
07:15 AM	30	20	**103**	16	0	169	36	104	3	**18**	0	161	**7**	31	18	1	0	57	**7**	0	1	**2**	0	**10**	**3**	**86**	40	16	0	**145**	**542**
07:30 AM	33	31	71	25	0	160	49	**133**	**4**	11	0	**197**	**3**	**37**	**29**	**2**	0	71	3	**2**	**4**	0	0	9	0	47	53	14	0	114	551
07:45 AM	**38**	32	81	**26**	0	**177**	**42**	130	3	7	0	182	0	**55**	**35**	0	0	**90**	3	1	4	0	0	8	0	21	54	24	0	99	**556**
08:00 AM	31	**36**	70	26	0	163	**53**	102	2	1	0	158	2	43	22	1	0	68	3	1	4	1	0	9	1	25	**65**	**29**	0	120	518
Total Volume	132	119	325	93	0	669	180	469	12	37	0	698	12	166	104	4	0	286	16	4	13	3	0	36	4	179	212	83	0	478	2167
% App. Total	19.7	17.8	48.6	13.9	0		25.8	67.2	1.7	5.3	0		4.2	58	36.4	1.4	0		44.4	11.1	36.1	8.3	0		0.8	37.4	44.4	17.4	0		
PHF	.868	.826	.789	.894	.000	.945	.849	.882	.750	.514	.000	.886	.429	.755	.743	.500	.000	.794	.571	.500	.813	.375	.000	.900	.333	.520	.815	.716	.000	.824	.974

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City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268G
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Trucks & Buses

	Beacon Street From North					Lowell Street (Route 133) From East					Shawsheen Road From South					Reservation Road From Southwest					Lowell Street (Route 133) From West					
Start Time	Right	Bear Right	Thru	Left	Peds	Right	Thru	Bear Left	Left	Peds	Right	Thru	Left	Hard Left	Peds	Hard Right	Bear Right	Bear Left	Hard Left	Peds	Hard Right	Right	Thru	Left	Peds	Int. Total
07:00 AM	1	0	3	1	0	1	1	0	1	0	0	3	3	0	0	0	0	0	0	0	0	2	1	0	0	17
07:15 AM	2	1	2	2	0	0	0	0	0	0	0	1	0	3	0	0	0	0	0	0	0	3	1	1	0	16
07:30 AM	1	1	1	2	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	5	1	0	14
07:45 AM	0	0	1	0	0	2	2	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	9
Total	4	2	7	5	0	3	3	0	1	0	1	6	4	3	0	0	1	1	0	0	0	6	7	2	0	56
08:00 AM	0	0	1	0	0	1	2	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	7
08:15 AM	1	0	2	1	0	2	1	0	0	0	0	3	1	0	0	0	0	1	0	0	0	1	0	2	0	15
08:30 AM	0	0	1	0	0	2	3	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	1	0	10
08:45 AM	1	0	0	1	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	1	0	0	0	6
Total	2	0	4	2	0	5	6	0	0	0	0	9	3	0	0	0	0	1	1	0	0	2	0	3	0	38
Grand Total	6	2	11	7	0	8	9	0	1	0	1	15	7	3	0	0	1	2	1	0	0	8	7	5	0	94
Apprch %	23.1	7.7	42.3	26.9	0	44.4	50	0	5.6	0	3.8	57.7	26.9	11.5	0	0	25	50	25	0	0	40	35	25	0	
Total %	6.4	2.1	11.7	7.4	0	8.5	9.6	0	1.1	0	1.1	16	7.4	3.2	0	0	1.1	2.1	1.1	0	0	8.5	7.4	5.3	0	

	Beacon Street From North						Lowell Street (Route 133) From East						Shawsheen Road From South						Reservation Road From Southwest						Lowell Street (Route 133) From West						
Start Time	Right	Bear Right	Thru	Left	Peds	App. Total	Right	Thru	Bear Left	Left	Peds	App. Total	Right	Thru	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Bear Left	Hard Left	Peds	App. Total	Hard Right	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																															
Peak Hour for Entire Intersection Begins at 07:00 AM																															
07:00 AM	1	0	**3**	1	0	5	1	1	0	**1**	0	3	0	**3**	**3**	0	0	**6**	0	0	0	0	0	0	0	2	1	0	0	3	**17**
07:15 AM	**2**	**1**	2	**2**	0	**7**	0	0	0	0	0	0	0	1	0	**3**	0	4	0	0	0	0	0	0	0	**3**	1	**1**	0	5	16
07:30 AM	1	1	1	2	0	5	0	0	0	0	0	0	0	1	1	0	0	2	0	0	0	0	0	0	0	1	**5**	1	0	**7**	14
07:45 AM	0	0	1	0	0	1	**2**	**2**	0	0	0	**4**	**1**	1	0	0	0	2	0	**1**	**1**	0	0	**2**	0	0	0	0	0	0	9
Total Volume	4	2	7	5	0	18	3	3	0	1	0	7	1	6	4	3	0	14	0	1	1	0	0	2	0	6	7	2	0	15	56
% App. Total	22.2	11.1	38.9	27.8	0		42.9	42.9	0	14.3	0		7.1	42.9	28.6	21.4	0		0	50	50	0	0		0	40	46.7	13.3	0		
PHF	.500	.500	.583	.625	.000	.643	.375	.375	.000	.250	.000	.438	.250	.500	.333	.250	.000	.583	.000	.250	.250	.000	.000	.250	.000	.500	.350	.500	.000	.536	.824

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City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268G
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Bikes by Direction

	Beacon Street From North					Lowell Street (Route 133) From East					Shawsheen Road From South					Reservation Road From Southwest					Lowell Street (Route 133) From West					
Start Time	Right	Bear Right	Thru	Left	Peds	Right	Thru	Bear Left	Left	Peds	Right	Thru	Left	Hard Left	Peds	Hard Right	Bear Right	Bear Left	Hard Left	Peds	Hard Right	Right	Thru	Left	Peds	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
08:45 AM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Total	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Grand Total	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Apprch %	0	0	0	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total %	0	0	0	50	0	0	0	0	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	

	Beacon Street From North						Lowell Street (Route 133) From East						Shawsheen Road From South						Reservation Road From Southwest						Lowell Street (Route 133) From West						
Start Time	Right	Bear Right	Thru	Left	Peds	App. Total	Right	Thru	Bear Left	Left	Peds	App. Total	Right	Thru	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Bear Left	Hard Left	Peds	App. Total	Hard Right	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																															
Peak Hour for Entire Intersection Begins at 08:00 AM																															
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	0	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	**1**
08:45 AM	0	0	0	**1**	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Total Volume	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
% App. Total	0	0	0	100	0		0	0	0	0	0		0	100	0	0	0		0	0	0	0	0		0	0	0	0	0		
PHF	.000	.000	.000	.250	.000	.250	.000	.000	.000	.000	.000	.000	.000	.250	.000	.000	.000	.250	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.500

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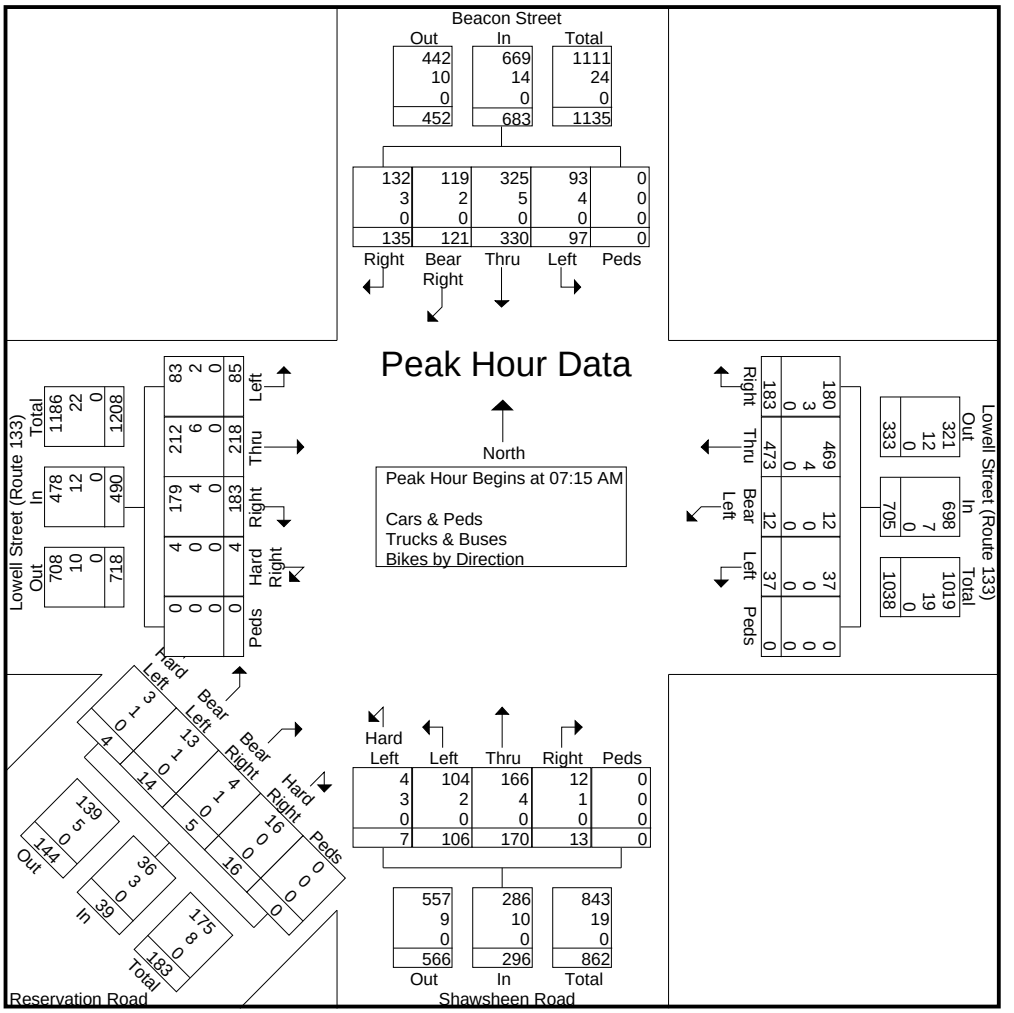
	Beacon Street From North						Lowell Street (Route 133) From East						Shawsheen Road From South						Reservation Road From Southwest						Lowell Street (Route 133) From West						
Start Time	Right	Bear Right	Thru	Left	Peds	App. Total	Right	Thru	Bear Left	Left	Peds	App. Total	Right	Thru	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Bear Left	Hard Left	Peds	App. Total	Hard Right	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																															
Peak Hour for Entire Intersection Begins at 07:15 AM																															
07:15 AM	32	21	**105**	**18**	**0**	**176**	**36**	104	3	**18**	0	161	**7**	32	18	**4**	0	61	**7**	0	1	**2**	0	**10**	**3**	**89**	41	17	0	**150**	558
07:30 AM	34	32	72	**27**	0	165	49	**133**	**4**	11	0	**197**	3	38	30	2	0	73	3	**2**	4	0	0	9	0	48	58	15	0	121	**565**
07:45 AM	**38**	32	82	26	0	**178**	44	132	3	7	0	186	1	**56**	**35**	0	0	**92**	3	2	**5**	0	0	10	0	21	54	24	0	99	565
08:00 AM	31	**36**	71	26	0	164	**54**	104	2	1	0	161	2	44	23	1	0	70	3	1	4	2	0	10	1	25	**65**	**29**	0	120	525
Total Volume	135	121	330	97	0	683	183	473	12	37	0	705	13	170	106	7	0	296	16	5	14	4	0	39	4	183	218	85	0	490	2213
% App. Total	19.8	17.7	48.3	14.2				67.1	1.7	5.2			4.4	57.4	35.8	2.4				12.8	35.9	10.3			0.8	37.3	44.5	17.3			
PHF	.888	.840	.786	.898	.000	.959	.847	.889	.750	.514	.000	.895	.464	.759	.757	.438	.000	.804	.571	.625	.700	.500	.000	.975	.333	.514	.838	.733	.000	.817	.979
Cars & Peds	132	119	325	93	0	669	180	469	12	37	0	698	12	166	104	4	0	286	16	4	13	3	0	36	4	179	212	83	0	478	2167
% Cars & Peds	97.8	98.3	98.5	95.9		98.0	98.4	99.2	100	100	0	99.0	92.3	97.6	98.1	57.1		96.6	100	80.0	92.9	75.0		92.3	100	97.8	97.2	97.6		97.6	97.9
Trucks & Buses																															
% Trucks & Buses	2.2	1.7	1.5	4.1	0	2.0	1.6	0.8	0	0	0	1.0	7.7	2.4	1.9	42.9	0	3.4	0	20.0	7.1	25.0	0	7.7	0	2.2	2.8	2.4	0	2.4	2.1
Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



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N/S: Beacon Street
W: Chandler Road
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268AA
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Cars & Peds - Trucks & Buses - Bikes by Direction

	Beacon Street From North			Beacon Street From South			Chandler Road From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
02:00 PM	1	19	0	21	38	0	39	2	0	120
02:15 PM	1	14	1	24	54	1	29	1	0	125
02:30 PM	3	20	1	31	64	1	41	1	0	162
02:45 PM	1	23	1	46	52	1	41	3	1	169
Total	6	76	3	122	208	3	150	7	1	576
03:00 PM	1	11	0	40	53	0	41	0	0	146
03:15 PM	0	17	0	44	69	2	43	0	0	175
03:30 PM	1	14	0	49	60	0	50	1	0	175
03:45 PM	3	23	0	50	59	0	39	6	0	180
Total	5	65	0	183	241	2	173	7	0	676
Grand Total	11	141	3	305	449	5	323	14	1	1252
Apprch %	7.1	91	1.9	40.2	59.2	0.7	95.6	4.1	0.3	
Total %	0.9	11.3	0.2	24.4	35.9	0.4	25.8	1.1	0.1	
Cars & Peds	9	139	3	298	433	5	309	14	1	1211
% Cars & Peds	81.8	98.6	100	97.7	96.4	100	95.7	100	100	96.7
Trucks & Buses	2	1	0	7	14	0	14	0	0	38
% Trucks & Buses	18.2	0.7	0	2.3	3.1	0	4.3	0	0	3
Bikes by Direction	0	1	0	0	2	0	0	0	0	3
% Bikes by Direction	0	0.7	0	0	0.4	0	0	0	0	0.2

	Beacon Street From North				Beacon Street From South				Chandler Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 03:00 PM													
03:00 PM	1	11	0	12	40	53	0	93	41	0	0	41	146
03:15 PM	0	17	0	17	44	**69**	**2**	**115**	43	0	0	43	175
03:30 PM	1	14	0	15	49	60	0	109	**50**	1	0	**51**	175
03:45 PM	**3**	**23**	0	**26**	**50**	59	0	109	39	**6**	0	45	**180**
Total Volume	5	65	0	70	183	241	2	426	173	7	0	180	676
% App. Total	7.1	92.9	0		43	56.6	0.5		96.1	3.9	0		
PHF	.417	.707	.000	.673	.915	.873	.250	.926	.865	.292	.000	.882	.939
Cars & Peds	4	64	0	68	178	232	2	412	171	7	0	178	658
% Cars & Peds	80.0	98.5	0	97.1	97.3	96.3	100	96.7	98.8	100	0	98.9	97.3
Trucks & Buses	1	0	0	1	5	8	0	13	2	0	0	2	16
% Trucks & Buses	20.0	0	0	1.4	2.7	3.3	0	3.1	1.2	0	0	1.1	2.4
Bikes by Direction	0	1	0	1	0	1	0	1	0	0	0	0	2
% Bikes by Direction	0	1.5	0	1.4	0	0.4	0	0.2	0	0	0	0	0.3

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N/S: Beacon Street
W: Chandler Road
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268AA
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Cars & Peds

	Beacon Street From North			Beacon Street From South			Chandler Road From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
02:00 PM	1	19	0	20	38	0	32	2	0	112
02:15 PM	1	14	1	24	51	1	28	1	0	121
02:30 PM	2	19	1	30	62	1	40	1	0	156
02:45 PM	1	23	1	46	50	1	38	3	1	164
Total	5	75	3	120	201	3	138	7	1	553
03:00 PM	1	11	0	40	52	0	40	0	0	144
03:15 PM	0	16	0	42	68	2	43	0	0	171
03:30 PM	1	14	0	47	59	0	50	1	0	172
03:45 PM	2	23	0	49	53	0	38	6	0	171
Total	4	64	0	178	232	2	171	7	0	658
Grand Total	9	139	3	298	433	5	309	14	1	1211
Apprch %	6	92.1	2	40.5	58.8	0.7	95.4	4.3	0.3	
Total %	0.7	11.5	0.2	24.6	35.8	0.4	25.5	1.2	0.1	

	Beacon Street From North				Beacon Street From South				Chandler Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 03:00 PM													
03:00 PM	1	11	0	12	40	52	0	92	40	0	0	40	144
03:15 PM	0	16	0	16	42	**68**	**2**	**112**	43	0	0	43	171
03:30 PM	1	14	0	15	47	59	0	106	**50**	1	0	**51**	**172**
03:45 PM	**2**	**23**	0	**25**	**49**	53	0	102	38	**6**	0	44	171
Total Volume	4	64	0	68	178	232	2	412	171	7	0	178	658
% App. Total	5.9	94.1	0		43.2	56.3	0.5		96.1	3.9	0		
PHF	.500	.696	.000	.680	.908	.853	.250	.920	.855	.292	.000	.873	.956

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Client: Brennan/C. Emilius

File Name : 05268AA
Site Code : 05268
Start Date : 11/21/2019

Groups Printed- Trucks & Buses

	Beacon Street From North			Beacon Street From South			Chandler Road From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
02:00 PM	0	0	0	1	0	0	7	0	0	8
02:15 PM	0	0	0	0	3	0	1	0	0	4
02:30 PM	1	1	0	1	2	0	1	0	0	6
02:45 PM	0	0	0	0	1	0	3	0	0	4
Total	1	1	0	2	6	0	12	0	0	22
03:00 PM	0	0	0	0	1	0	1	0	0	2
03:15 PM	0	0	0	2	0	0	0	0	0	2
03:30 PM	0	0	0	2	1	0	0	0	0	3
03:45 PM	1	0	0	1	6	0	1	0	0	9
Total	1	0	0	5	8	0	2	0	0	16
Grand Total	2	1	0	7	14	0	14	0	0	38
Apprch %	66.7	33.3	0	33.3	66.7	0	100	0	0	
Total %	5.3	2.6	0	18.4	36.8	0	36.8	0	0	

	Beacon Street From North				Beacon Street From South				Chandler Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 02:00 PM													
02:00 PM	0	0	0	0	**1**	0	0	1	**7**	0	0	**7**	**8**
02:15 PM	0	0	0	0	0	**3**	0	**3**	1	0	0	1	4
02:30 PM	**1**	**1**	0	**2**	1	2	0	3	1	0	0	1	6
02:45 PM	0	0	0	0	0	1	0	1	3	0	0	3	4
Total Volume	1	1	0	2	2	6	0	8	12	0	0	12	22
% App. Total	50	50	0		25	75	0		100	0	0		
PHF	.250	.250	.000	.250	.500	.500	.000	.667	.429	.000	.000	.429	.688

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Client: Brennan/C. Emilius

File Name : 05268AA
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Bikes by Direction

	Beacon Street From North			Beacon Street From South			Chandler Road From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
02:00 PM	0	0	0	0	0	0	0	0	0	0
02:15 PM	0	0	0	0	0	0	0	0	0	0
02:30 PM	0	0	0	0	0	0	0	0	0	0
02:45 PM	0	0	0	0	1	0	0	0	0	1
Total	0	0	0	0	1	0	0	0	0	1
03:00 PM	0	0	0	0	0	0	0	0	0	0
03:15 PM	0	1	0	0	1	0	0	0	0	2
03:30 PM	0	0	0	0	0	0	0	0	0	0
03:45 PM	0	0	0	0	0	0	0	0	0	0
Total	0	1	0	0	1	0	0	0	0	2
Grand Total	0	1	0	0	2	0	0	0	0	3
Apprch %	0	100	0	0	100	0	0	0	0	
Total %	0	33.3	0	0	66.7	0	0	0	0	

	Beacon Street From North				Beacon Street From South				Chandler Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 02:30 PM													
02:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
02:45 PM	0	0	0	0	0	**1**	0	**1**	0	0	0	0	1
03:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
03:15 PM	0	**1**	0	**1**	0	1	0	1	0	0	0	0	**2**
Total Volume	0	1	0	1	0	2	0	2	0	0	0	0	3
% App. Total	0	100	0		0	100	0		0	0	0		
PHF	.000	.250	.000	.250	.000	.500	.000	.500	.000	.000	.000	.000	.375

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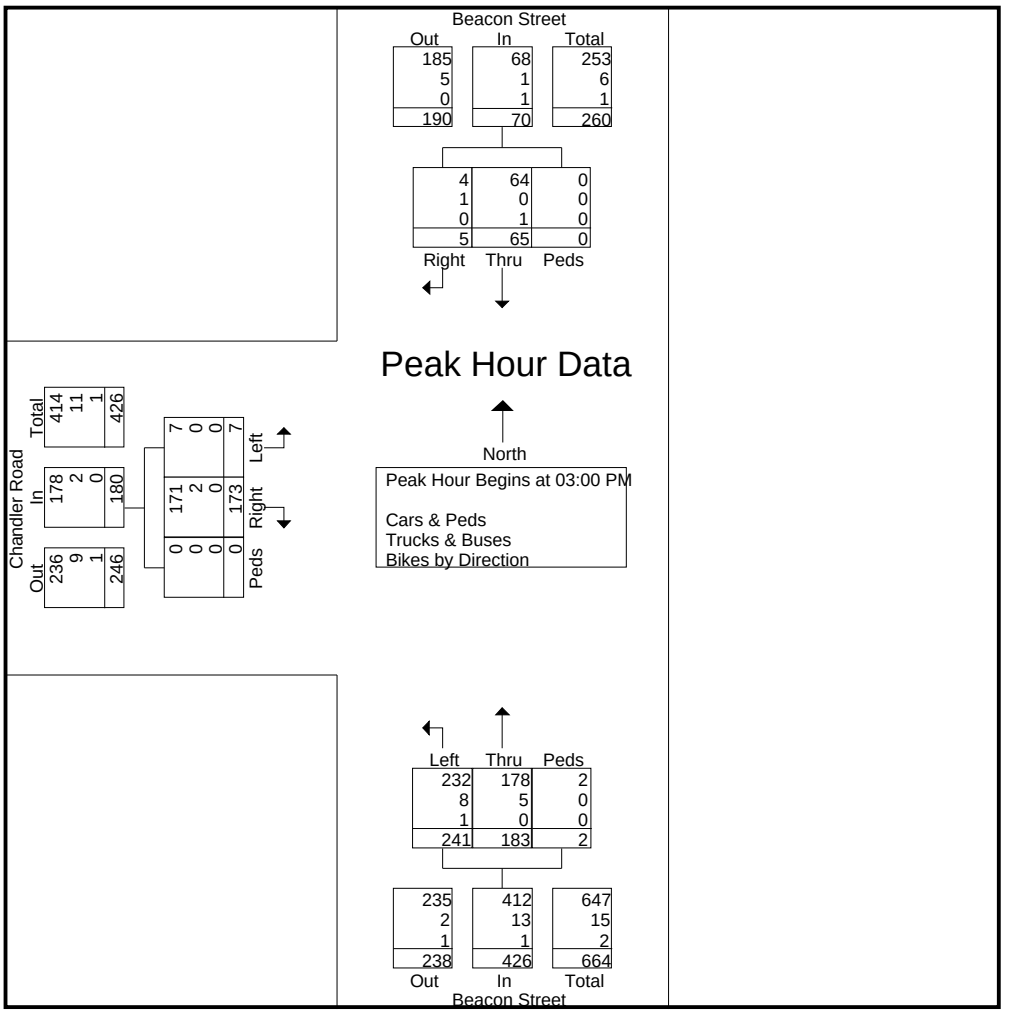
Client: Brennan/C. Emilius

File Name : 05268AA
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

	Beacon Street From North				Beacon Street From South				Chandler Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 03:00 PM													
03:00 PM	1	11	0	12	40	53	0	93	41	0	0	41	146
03:15 PM	0	17	0	17	44	**69**	**2**	**115**	43	0	0	43	175
03:30 PM	1	14	0	15	49	60	0	109	**50**	1	0	**51**	175
03:45 PM	**3**	**23**	0	**26**	**50**	59	0	109	39	**6**	0	45	**180**
Total Volume	5	65	0	70	183	241	2	426	173	7	0	180	676
% App. Total	7.1	92.9	0		43	56.6	0.5		96.1	3.9	0		
PHF	.417	.707	.000	.673	.915	.873	.250	.926	.865	.292	.000	.882	.939
Cars & Peds	4	64	0	68	178	232	2	412	171	7	0	178	658
% Cars & Peds	80.0	98.5	0	97.1	97.3	96.3	100	96.7	98.8	100	0	98.9	97.3
Trucks & Buses	1	0	0	1	5	8	0	13	2	0	0	2	16
% Trucks & Buses	20.0	0	0	1.4	2.7	3.3	0	3.1	1.2	0	0	1.1	2.4
Bikes by Direction	0	1	0	1	0	1	0	1	0	0	0	0	2
% Bikes by Direction	0	1.5	0	1.4	0	0.4	0	0.2	0	0	0	0	0.3



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N/S: Beacon Street
E: Andover Country Club Lane
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268BB
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Cars & Peds - Trucks & Buses - Bikes by Direction

	Beacon Street From North			Andover Country Club Lane From East			Beacon Street From South			
Start Time	Thru	Left	Peds	Right	Left	Peds	Right	Thru	Peds	Int. Total
02:00 PM	57	1	0	0	2	0	0	59	0	119
02:15 PM	42	1	0	4	5	0	3	74	0	129
02:30 PM	58	3	0	4	4	1	4	91	0	165
02:45 PM	62	2	0	1	1	0	6	97	0	169
Total	219	7	0	9	12	1	13	321	0	582
03:00 PM	47	5	0	9	5	0	6	84	3	159
03:15 PM	57	3	0	2	1	0	9	111	0	183
03:30 PM	61	3	0	3	9	0	7	106	3	192
03:45 PM	56	6	0	5	6	0	6	104	0	183
Total	221	17	0	19	21	0	28	405	6	717
Grand Total	440	24	0	28	33	1	41	726	6	1299
Apprch %	94.8	5.2	0	45.2	53.2	1.6	5.3	93.9	0.8	
Total %	33.9	1.8	0	2.2	2.5	0.1	3.2	55.9	0.5	
Cars & Peds	425	23	0	26	32	1	40	705	6	1258
% Cars & Peds	96.6	95.8	0	92.9	97	100	97.6	97.1	100	96.8
Trucks & Buses	15	0	0	2	0	0	1	19	0	37
% Trucks & Buses	3.4	0	0	7.1	0	0	2.4	2.6	0	2.8
Bikes by Direction	0	1	0	0	1	0	0	2	0	4
% Bikes by Direction	0	4.2	0	0	3	0	0	0.3	0	0.3

	Beacon Street From North				Andover Country Club Lane From East				Beacon Street From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 03:00 PM													
03:00 PM	47	5	0	52	**9**	5	0	**14**	6	84	**3**	93	159
03:15 PM	57	3	0	60	2	1	0	3	**9**	**111**	0	**120**	183
03:30 PM	**61**	3	0	**64**	3	**9**	0	12	7	106	3	116	**192**
03:45 PM	56	**6**	0	62	5	6	0	11	6	104	0	110	183
Total Volume	221	17	0	238	19	21	0	40	28	405	6	439	717
% App. Total	92.9	7.1	0		47.5	52.5	0		6.4	92.3	1.4		
PHF	.906	.708	.000	.930	.528	.583	.000	.714	.778	.912	.500	.915	.934
Cars & Peds	219	16	0	235	18	21	0	39	28	392	6	426	700
% Cars & Peds	99.1	94.1	0	98.7	94.7	100	0	97.5	100	96.8	100	97.0	97.6
Trucks & Buses	2	0	0	2	1	0	0	1	0	12	0	12	15
% Trucks & Buses	0.9	0	0	0.8	5.3	0	0	2.5	0	3.0	0	2.7	2.1
Bikes by Direction	0	1	0	1	0	0	0	0	0	1	0	1	2
% Bikes by Direction	0	5.9	0	0.4	0	0	0	0	0	0.2	0	0.2	0.3

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File Name : 05268BB
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Page No : 1

Groups Printed- Cars & Peds

	Beacon Street From North			Andover Country Club Lane From East			Beacon Street From South			
Start Time	Thru	Left	Peds	Right	Left	Peds	Right	Thru	Peds	Int. Total
02:00 PM	50	1	0	0	2	0	0	58	0	111
02:15 PM	41	1	0	4	5	0	3	71	0	125
02:30 PM	56	3	0	3	4	1	3	89	0	159
02:45 PM	59	2	0	1	0	0	6	95	0	163
Total	206	7	0	8	11	1	12	313	0	558
03:00 PM	46	5	0	9	5	0	6	83	3	157
03:15 PM	57	2	0	2	1	0	9	108	0	179
03:30 PM	61	3	0	2	9	0	7	104	3	189
03:45 PM	55	6	0	5	6	0	6	97	0	175
Total	219	16	0	18	21	0	28	392	6	700
Grand Total	425	23	0	26	32	1	40	705	6	1258
Apprch %	94.9	5.1	0	44.1	54.2	1.7	5.3	93.9	0.8	
Total %	33.8	1.8	0	2.1	2.5	0.1	3.2	56	0.5	

	Beacon Street From North				Andover Country Club Lane From East				Beacon Street From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 03:00 PM													
03:00 PM	46	5	0	51	**9**	5	0	**14**	6	83	**3**	92	157
03:15 PM	57	2	0	59	2	1	0	3	**9**	**108**	0	**117**	179
03:30 PM	**61**	3	0	**64**	2	**9**	0	11	7	104	3	114	**189**
03:45 PM	55	**6**	0	61	5	6	0	11	6	97	0	103	175
Total Volume	219	16	0	235	18	21	0	39	28	392	6	426	700
% App. Total	93.2	6.8	0		46.2	53.8	0		6.6	92	1.4		
PHF	.898	.667	.000	.918	.500	.583	.000	.696	.778	.907	.500	.910	.926

Transportation Data Corporation

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N/S: Beacon Street
E: Andover Country Club Lane
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268BB
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Trucks & Buses

	Beacon Street From North			Andover Country Club Lane From East			Beacon Street From South			
Start Time	Thru	Left	Peds	Right	Left	Peds	Right	Thru	Peds	Int. Total
02:00 PM	7	0	0	0	0	0	0	1	0	8
02:15 PM	1	0	0	0	0	0	0	3	0	4
02:30 PM	2	0	0	1	0	0	1	2	0	6
02:45 PM	3	0	0	0	0	0	0	1	0	4
Total	13	0	0	1	0	0	1	7	0	22
03:00 PM	1	0	0	0	0	0	0	1	0	2
03:15 PM	0	0	0	0	0	0	0	2	0	2
03:30 PM	0	0	0	1	0	0	0	2	0	3
03:45 PM	1	0	0	0	0	0	0	7	0	8
Total	2	0	0	1	0	0	0	12	0	15
Grand Total	15	0	0	2	0	0	1	19	0	37
Apprch %	100	0	0	100	0	0	5	95	0	
Total %	40.5	0	0	5.4	0	0	2.7	51.4	0	

	Beacon Street From North				Andover Country Club Lane From East				Beacon Street From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 02:00 PM													
02:00 PM	**7**	0	0	**7**	0	0	0	0	0	1	0	1	**8**
02:15 PM	1	0	0	1	0	0	0	0	0	**3**	0	**3**	4
02:30 PM	2	0	0	2	**1**	0	0	**1**	**1**	2	0	3	6
02:45 PM	3	0	0	3	0	0	0	0	0	1	0	1	4
Total Volume	13	0	0	13	1	0	0	1	1	7	0	8	22
% App. Total	100	0	0		100	0	0		12.5	87.5	0		
PHF	.464	.000	.000	.464	.250	.000	.000	.250	.250	.583	.000	.667	.688

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N/S: Beacon Street
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City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268BB
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Bikes by Direction

	Beacon Street From North			Andover Country Club Lane From East			Beacon Street From South			
Start Time	Thru	Left	Peds	Right	Left	Peds	Right	Thru	Peds	Int. Total
02:00 PM	0	0	0	0	0	0	0	0	0	0
02:15 PM	0	0	0	0	0	0	0	0	0	0
02:30 PM	0	0	0	0	0	0	0	0	0	0
02:45 PM	0	0	0	0	1	0	0	1	0	2
Total	0	0	0	0	1	0	0	1	0	2
03:00 PM	0	0	0	0	0	0	0	0	0	0
03:15 PM	0	1	0	0	0	0	0	1	0	2
03:30 PM	0	0	0	0	0	0	0	0	0	0
03:45 PM	0	0	0	0	0	0	0	0	0	0
Total	0	1	0	0	0	0	0	1	0	2
Grand Total	0	1	0	0	1	0	0	2	0	4
Apprch %	0	100	0	0	100	0	0	100	0	
Total %	0	25	0	0	25	0	0	50	0	

	Beacon Street From North				Andover Country Club Lane From East				Beacon Street From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 02:30 PM													
02:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
02:45 PM	0	0	0	0	0	**1**	0	**1**	0	**1**	0	**1**	**2**
03:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
03:15 PM	0	**1**	0	**1**	0	0	0	0	0	1	0	1	2
Total Volume	0	1	0	1	0	1	0	1	0	2	0	2	4
% App. Total	0	100	0		0	100	0		0	100	0		
PHF	.000	.250	.000	.250	.000	.250	.000	.250	.000	.500	.000	.500	.500

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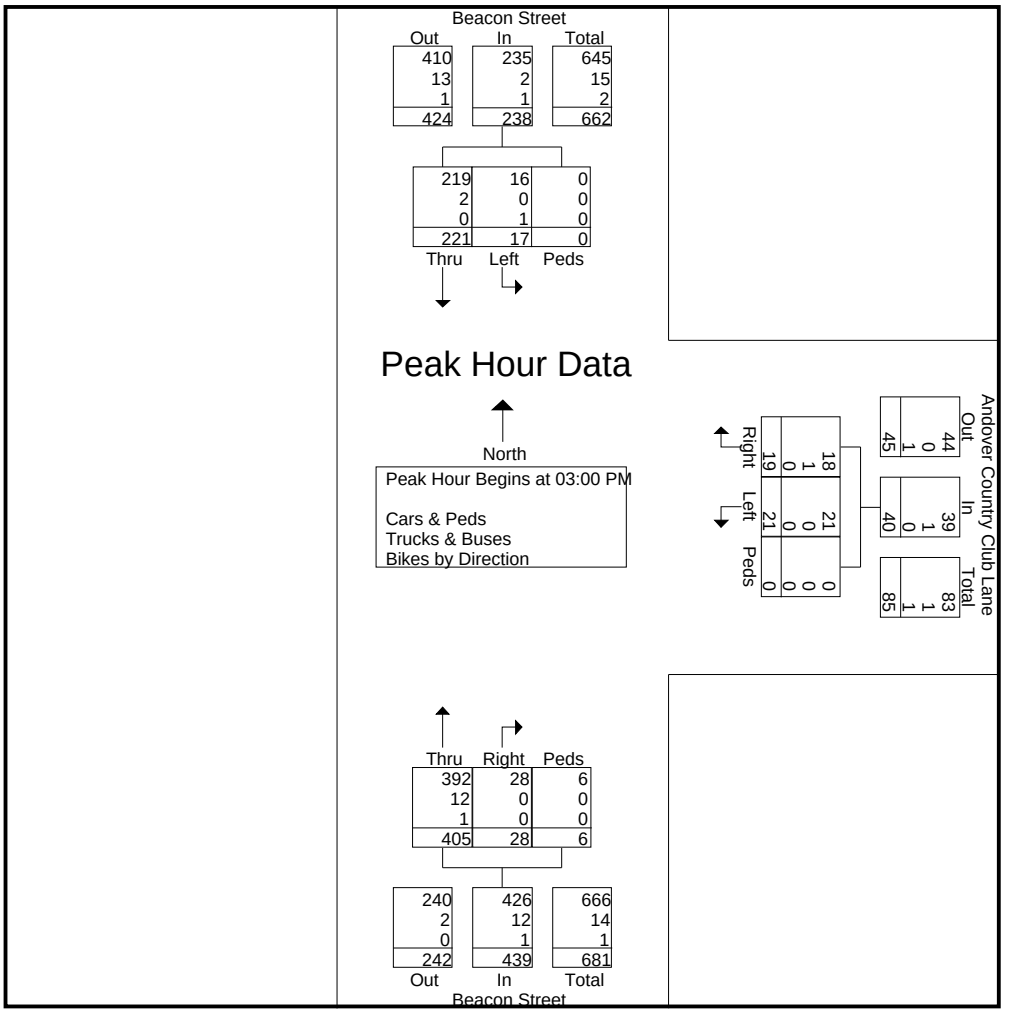
N/S: Beacon Street
E: Andover Country Club Lane
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268BB
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

	Beacon Street From North				Andover Country Club Lane From East				Beacon Street From South				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 03:00 PM													
03:00 PM	47	5	0	52	**9**	5	0	**14**	6	84	**3**	93	159
03:15 PM	57	3	0	60	2	1	0	3	**9**	**111**	0	**120**	183
03:30 PM	**61**	3	0	**64**	3	**9**	0	12	7	106	3	116	**192**
03:45 PM	56	**6**	0	62	5	6	0	11	6	104	0	110	183
Total Volume	221	17	0	238	19	21	0	40	28	405	6	439	717
% App. Total	92.9	7.1	0		47.5	52.5	0		6.4	92.3	1.4		
PHF	.906	.708	.000	.930	.528	.583	.000	.714	.778	.912	.500	.915	.934
Cars & Peds	219	16	0	235	18	21	0	39	28	392	6	426	700
% Cars & Peds	99.1	94.1	0	98.7	94.7	100	0	97.5	100	96.8	100	97.0	97.6
Trucks & Buses	2	0	0	2	1	0	0	1	0	12	0	12	15
% Trucks & Buses	0.9	0	0	0.8	5.3	0	0	2.5	0	3.0	0	2.7	2.1
Bikes by Direction	0	1	0	1	0	0	0	0	0	1	0	1	2
% Bikes by Direction	0	5.9	0	0.4	0	0	0	0	0	0.2	0	0.2	0.3



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N/S: Beacon Street
W: West Elementary School (Northerly Dr)
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268CC
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Cars & Peds - Trucks & Buses - Bikes by Direction

	Beacon Street From North			Beacon Street From South			West Elementary School (Northerly Drive) From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
02:00 PM	0	58	0	66	3	0	5	1	0	133
02:15 PM	2	43	0	77	2	0	8	0	1	133
02:30 PM	1	59	0	97	2	0	3	0	1	163
02:45 PM	4	55	0	99	3	0	6	1	1	169
Total	7	215	0	339	10	0	22	2	3	598
03:00 PM	0	55	0	94	8	0	18	5	0	180
03:15 PM	0	57	0	107	2	0	9	6	0	181
03:30 PM	0	70	0	103	0	0	6	3	0	182
03:45 PM	0	69	0	98	2	0	6	2	1	178
Total	0	251	0	402	12	0	39	16	1	721
Grand Total	7	466	0	741	22	0	61	18	4	1319
Apprch %	1.5	98.5	0	97.1	2.9	0	73.5	21.7	4.8	
Total %	0.5	35.3	0	56.2	1.7	0	4.6	1.4	0.3	
Cars & Peds	5	455	0	720	16	0	61	18	4	1279
% Cars & Peds	71.4	97.6	0	97.2	72.7	0	100	100	100	97
Trucks & Buses	2	11	0	19	6	0	0	0	0	38
% Trucks & Buses	28.6	2.4	0	2.6	27.3	0	0	0	0	2.9
Bikes by Direction	0	0	0	2	0	0	0	0	0	2
% Bikes by Direction	0	0	0	0.3	0	0	0	0	0	0.2

	Beacon Street From North				Beacon Street From South				West Elementary School (Northerly Drive) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 03:00 PM													
03:00 PM	0	55	0	55	94	**8**	0	102	**18**	5	0	**23**	180
03:15 PM	0	57	0	57	**107**	2	0	**109**	9	**6**	0	15	181
03:30 PM	0	**70**	0	**70**	103	0	0	103	6	3	0	9	**182**
03:45 PM	0	69	0	69	98	2	0	100	6	2	**1**	9	178
Total Volume	0	251	0	251	402	12	0	414	39	16	1	56	721
% App. Total	0	100	0		97.1	2.9	0		69.6	28.6	1.8		
PHF	.000	.896	.000	.896	.939	.375	.000	.950	.542	.667	.250	.609	.990
Cars & Peds	0	249	0	249	390	8	0	398	39	16	1	56	703
% Cars & Peds	0	99.2	0	99.2	97.0	66.7	0	96.1	100	100	100	100	97.5
Trucks & Buses	0	2	0	2	11	4	0	15	0	0	0	0	17
% Trucks & Buses	0	0.8	0	0.8	2.7	33.3	0	3.6	0	0	0	0	2.4
Bikes by Direction	0	0	0	0	1	0	0	1	0	0	0	0	1
% Bikes by Direction	0	0	0	0	0.2	0	0	0.2	0	0	0	0	0.1

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W: West Elementary School (Northerly Dr)
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268CC
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Cars & Peds

	Beacon Street From North			Beacon Street From South			West Elementary School (Northerly Drive) From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
02:00 PM	0	52	0	65	3	0	5	1	0	126
02:15 PM	2	42	0	74	2	0	8	0	1	129
02:30 PM	1	58	0	94	2	0	3	0	1	159
02:45 PM	2	54	0	97	1	0	6	1	1	162
Total	5	206	0	330	8	0	22	2	3	576
03:00 PM	0	54	0	92	5	0	18	5	0	174
03:15 PM	0	57	0	106	2	0	9	6	0	180
03:30 PM	0	70	0	101	0	0	6	3	0	180
03:45 PM	0	68	0	91	1	0	6	2	1	169
Total	0	249	0	390	8	0	39	16	1	703
Grand Total	5	455	0	720	16	0	61	18	4	1279
Apprch %	1.1	98.9	0	97.8	2.2	0	73.5	21.7	4.8	
Total %	0.4	35.6	0	56.3	1.3	0	4.8	1.4	0.3	

	Beacon Street From North				Beacon Street From South				West Elementary School (Northerly Drive) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 03:00 PM													
03:00 PM	0	54	0	54	92	**5**	0	97	**18**	5	0	**23**	174
03:15 PM	0	57	0	57	**106**	2	0	**108**	9	**6**	0	15	**180**
03:30 PM	0	**70**	0	**70**	101	0	0	101	6	3	0	9	180
03:45 PM	0	68	0	68	91	1	0	92	6	2	**1**	9	169
Total Volume	0	249	0	249	390	8	0	398	39	16	1	56	703
% App. Total	0	100	0		98	2	0		69.6	28.6	1.8		
PHF	.000	.889	.000	.889	.920	.400	.000	.921	.542	.667	.250	.609	.976

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City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268CC
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Trucks & Buses

	Beacon Street From North			Beacon Street From South			West Elementary School (Northerly Drive) From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
02:00 PM	0	6	0	1	0	0	0	0	0	7
02:15 PM	0	1	0	3	0	0	0	0	0	4
02:30 PM	0	1	0	3	0	0	0	0	0	4
02:45 PM	2	1	0	1	2	0	0	0	0	6
Total	2	9	0	8	2	0	0	0	0	21
03:00 PM	0	1	0	2	3	0	0	0	0	6
03:15 PM	0	0	0	1	0	0	0	0	0	1
03:30 PM	0	0	0	1	0	0	0	0	0	1
03:45 PM	0	1	0	7	1	0	0	0	0	9
Total	0	2	0	11	4	0	0	0	0	17
Grand Total	2	11	0	19	6	0	0	0	0	38
Apprch %	15.4	84.6	0	76	24	0	0	0	0	
Total %	5.3	28.9	0	50	15.8	0	0	0	0	

	Beacon Street From North				Beacon Street From South				West Elementary School (Northerly Drive) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 02:00 PM													
02:00 PM	0	**6**	0	**6**	1	0	0	1	0	0	0	0	**7**
02:15 PM	0	1	0	1	**3**	0	0	**3**	0	0	0	0	4
02:30 PM	0	1	0	1	3	0	0	3	0	0	0	0	4
02:45 PM	**2**	1	0	3	1	**2**	0	3	0	0	0	0	6
Total Volume	2	9	0	11	8	2	0	10	0	0	0	0	21
% App. Total	18.2	81.8	0		80	20	0		0	0	0		
PHF	.250	.375	.000	.458	.667	.250	.000	.833	.000	.000	.000	.000	.750

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N/S: Beacon Street
W: West Elementary School (Northerly Dr)
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268CC
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Bikes by Direction

	Beacon Street From North			Beacon Street From South			West Elementary School (Northerly Drive) From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
02:00 PM	0	0	0	0	0	0	0	0	0	0
02:15 PM	0	0	0	0	0	0	0	0	0	0
02:30 PM	0	0	0	0	0	0	0	0	0	0
02:45 PM	0	0	0	1	0	0	0	0	0	1
Total	0	0	0	1	0	0	0	0	0	1
03:00 PM	0	0	0	0	0	0	0	0	0	0
03:15 PM	0	0	0	0	0	0	0	0	0	0
03:30 PM	0	0	0	1	0	0	0	0	0	1
03:45 PM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	1	0	0	0	0	0	1
Grand Total	0	0	0	2	0	0	0	0	0	2
Apprch %	0	0	0	100	0	0	0	0	0	
Total %	0	0	0	100	0	0	0	0	0	

	Beacon Street From North				Beacon Street From South				West Elementary School (Northerly Drive) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 02:45 PM													
02:45 PM	0	0	0	0	**1**	0	0	**1**	0	0	0	0	**1**
03:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
03:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
03:30 PM	0	0	0	0	1	0	0	1	0	0	0	0	1
Total Volume	0	0	0	0	2	0	0	2	0	0	0	0	2
% App. Total	0	0	0		100	0	0		0	0	0		
PHF	.000	.000	.000	.000	.500	.000	.000	.500	.000	.000	.000	.000	.500

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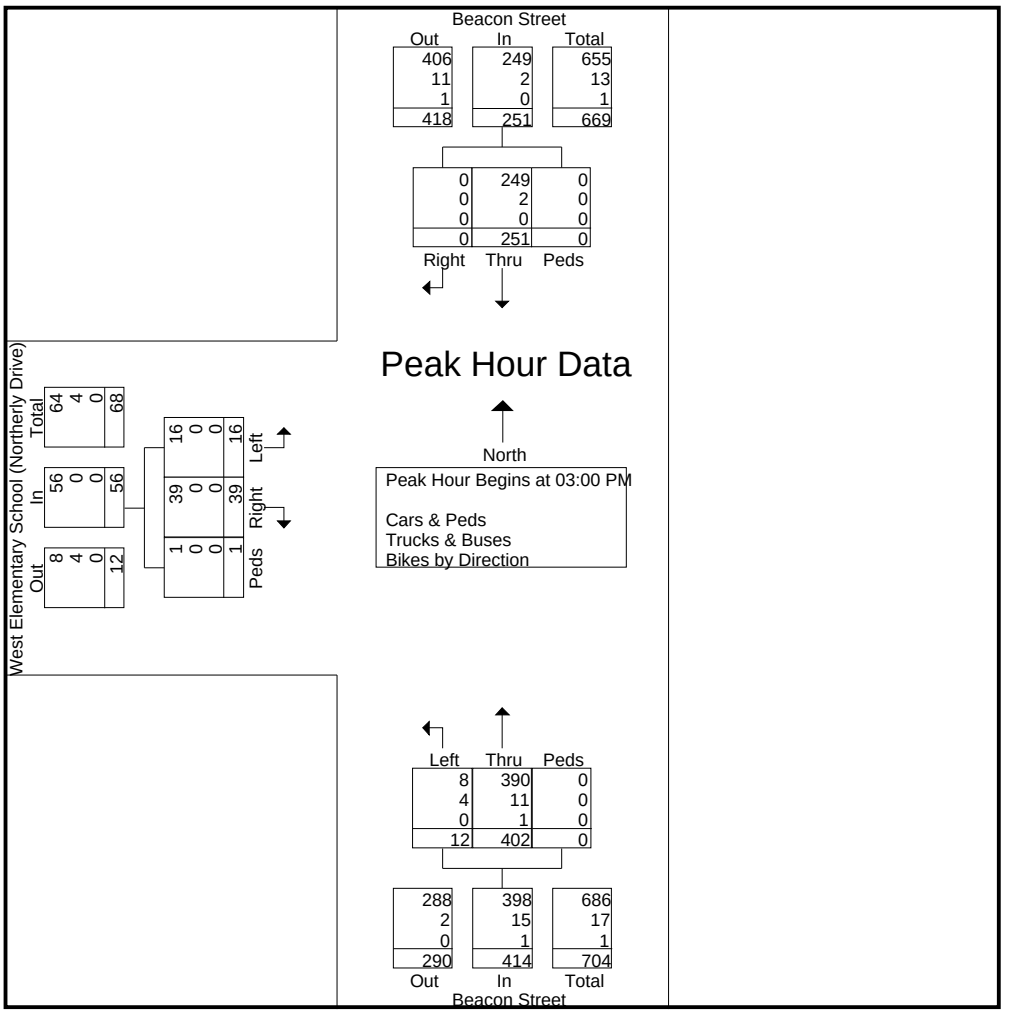
N/S: Beacon Street
W: West Elementary School (Northerly Dr)
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268CC
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

	Beacon Street From North				Beacon Street From South				West Elementary School (Northerly Drive) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 03:00 PM													
03:00 PM	0	55	0	55	94	**8**	0	102	**18**	5	0	**23**	180
03:15 PM	0	57	0	57	**107**	2	0	**109**	9	**6**	0	15	181
03:30 PM	0	**70**	0	**70**	103	0	0	103	6	3	0	9	**182**
03:45 PM	0	69	0	69	98	2	0	100	6	2	**1**	9	178
Total Volume	0	251	0	251	402	12	0	414	39	16	1	56	721
% App. Total	0	100	0		97.1	2.9	0		69.6	28.6	1.8		
PHF	.000	.896	.000	.896	.939	.375	.000	.950	.542	.667	.250	.609	.990
Cars & Peds	0	249	0	249	390	8	0	398	39	16	1	56	703
% Cars & Peds	0	99.2	0	99.2	97.0	66.7	0	96.1	100	100	100	100	97.5
Trucks & Buses	0	2	0	2	11	4	0	15	0	0	0	0	17
% Trucks & Buses	0	0.8	0	0.8	2.7	33.3	0	3.6	0	0	0	0	2.4
Bikes by Direction	0	0	0	0	1	0	0	1	0	0	0	0	1
% Bikes by Direction	0	0	0	0	0.2	0	0	0.2	0	0	0	0	0.1



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N/S: Beacon Street
W: West Elementary School (Middle Loop)
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268DD
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Cars & Peds - Trucks & Buses - Bikes by Direction

	Beacon Street From North			Beacon Street From South			WES (Limited Access Staff & Buses) From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
02:00 PM	1	0	0	0	1	0	0	0	0	2
02:15 PM	0	0	0	0	0	0	0	0	0	0
02:30 PM	1	0	0	1	0	0	1	0	0	3
02:45 PM	0	0	0	1	0	0	2	1	0	4
Total	2	0	0	2	1	0	3	1	0	9
03:00 PM	0	0	0	0	0	0	3	0	0	3
03:15 PM	0	0	0	0	0	0	13	0	0	13
03:30 PM	0	0	0	0	0	0	2	2	0	4
03:45 PM	0	0	0	0	0	0	7	6	0	13
Total	0	0	0	0	0	0	25	8	0	33
Grand Total	2	0	0	2	1	0	28	9	0	42
Apprch %	100	0	0	66.7	33.3	0	75.7	24.3	0	
Total %	4.8	0	0	4.8	2.4	0	66.7	21.4	0	
Cars & Peds	2	0	0	0	1	0	21	8	0	32
% Cars & Peds	100	0	0	0	100	0	75	88.9	0	76.2
Trucks & Buses	0	0	0	0	0	0	7	1	0	8
% Trucks & Buses	0	0	0	0	0	0	25	11.1	0	19
Bikes by Direction	0	0	0	2	0	0	0	0	0	2
% Bikes by Direction	0	0	0	100	0	0	0	0	0	4.8

	Beacon Street From North				Beacon Street From South				WES (Limited Access Staff & Buses) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 03:00 PM													
03:00 PM	0	0	0	0	0	0	0	0	3	0	0	3	3
03:15 PM	0	0	0	0	0	0	0	0	**13**	0	0	**13**	**13**
03:30 PM	0	0	0	0	0	0	0	0	2	2	0	4	4
03:45 PM	0	0	0	0	0	0	0	0	7	**6**	0	13	13
Total Volume	0	0	0	0	0	0	0	0	25	8	0	33	33
% App. Total	0	0	0		0	0	0		75.8	24.2	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.481	.333	.000	.635	.635
Cars & Peds	0	0	0	0	0	0	0	0	18	7	0	25	25
% Cars & Peds	0	0	0	0	0	0	0	0	72.0	87.5	0	75.8	75.8
Trucks & Buses	0	0	0	0	0	0	0	0	7	1	0	8	8
% Trucks & Buses	0	0	0	0	0	0	0	0	28.0	12.5	0	24.2	24.2
Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0

Transportation Data Corporation
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N/S: Beacon Street
W: West Elementary School (Middle Loop)
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268DD
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Cars & Peds

	Beacon Street From North			Beacon Street From South			WES (Limited Access Staff & Buses) From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
02:00 PM	1	0	0	0	1	0	0	0	0	2
02:15 PM	0	0	0	0	0	0	0	0	0	0
02:30 PM	1	0	0	0	0	0	1	0	0	2
02:45 PM	0	0	0	0	0	0	2	1	0	3
Total	2	0	0	0	1	0	3	1	0	7
03:00 PM	0	0	0	0	0	0	3	0	0	3
03:15 PM	0	0	0	0	0	0	6	0	0	6
03:30 PM	0	0	0	0	0	0	2	1	0	3
03:45 PM	0	0	0	0	0	0	7	6	0	13
Total	0	0	0	0	0	0	18	7	0	25
Grand Total	2	0	0	0	1	0	21	8	0	32
Apprch %	100	0	0	0	100	0	72.4	27.6	0	
Total %	6.2	0	0	0	3.1	0	65.6	25	0	

	Beacon Street From North				Beacon Street From South				WES (Limited Access Staff & Buses) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 03:00 PM													
03:00 PM	0	0	0	0	0	0	0	0	3	0	0	3	3
03:15 PM	0	0	0	0	0	0	0	0	6	0	0	6	6
03:30 PM	0	0	0	0	0	0	0	0	2	1	0	3	3
03:45 PM	0	0	0	0	0	0	0	0	**7**	**6**	0	**13**	**13**
Total Volume	0	0	0	0	0	0	0	0	18	7	0	25	25
% App. Total	0	0	0		0	0	0		72	28	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.643	.292	.000	.481	.481

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File Name : 05268DD
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Trucks & Buses

	Beacon Street From North			Beacon Street From South			WES (Limited Access Staff & Buses) From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
02:00 PM	0	0	0	0	0	0	0	0	0	0
02:15 PM	0	0	0	0	0	0	0	0	0	0
02:30 PM	0	0	0	0	0	0	0	0	0	0
02:45 PM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0
03:00 PM	0	0	0	0	0	0	0	0	0	0
03:15 PM	0	0	0	0	0	0	7	0	0	7
03:30 PM	0	0	0	0	0	0	0	1	0	1
03:45 PM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	7	1	0	8
Grand Total	0	0	0	0	0	0	7	1	0	8
Apprch %	0	0	0	0	0	0	87.5	12.5	0	
Total %	0	0	0	0	0	0	87.5	12.5	0	

	Beacon Street From North				Beacon Street From South				WES (Limited Access Staff & Buses) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 02:45 PM													
02:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
03:15 PM	0	0	0	0	0	0	0	0	**7**	0	0	**7**	**7**
03:30 PM	0	0	0	0	0	0	0	0	0	**1**	0	1	1
Total Volume	0	0	0	0	0	0	0	0	7	1	0	8	8
% App. Total	0	0	0		0	0	0		87.5	12.5	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.250	.250	.000	.286	.286

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Client: Brennan/C. Emilius

File Name : 05268DD
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Bikes by Direction

	Beacon Street From North			Beacon Street From South			WES (Limited Access Staff & Buses) From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
02:00 PM	0	0	0	0	0	0	0	0	0	0
02:15 PM	0	0	0	0	0	0	0	0	0	0
02:30 PM	0	0	0	1	0	0	0	0	0	1
02:45 PM	0	0	0	1	0	0	0	0	0	1
Total	0	0	0	2	0	0	0	0	0	2
03:00 PM	0	0	0	0	0	0	0	0	0	0
03:15 PM	0	0	0	0	0	0	0	0	0	0
03:30 PM	0	0	0	0	0	0	0	0	0	0
03:45 PM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0
Grand Total	0	0	0	2	0	0	0	0	0	2
Apprch %	0	0	0	100	0	0	0	0	0	
Total %	0	0	0	100	0	0	0	0	0	

	Beacon Street From North				Beacon Street From South				WES (Limited Access Staff & Buses) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 02:00 PM													
02:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
02:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
02:30 PM	0	0	0	0	**1**	0	0	**1**	0	0	0	0	**1**
02:45 PM	0	0	0	0	1	0	0	1	0	0	0	0	1
Total Volume	0	0	0	0	2	0	0	2	0	0	0	0	2
% App. Total	0	0	0		100	0	0		0	0	0		
PHF	.000	.000	.000	.000	.500	.000	.000	.500	.000	.000	.000	.000	.500

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N/S: Beacon Street
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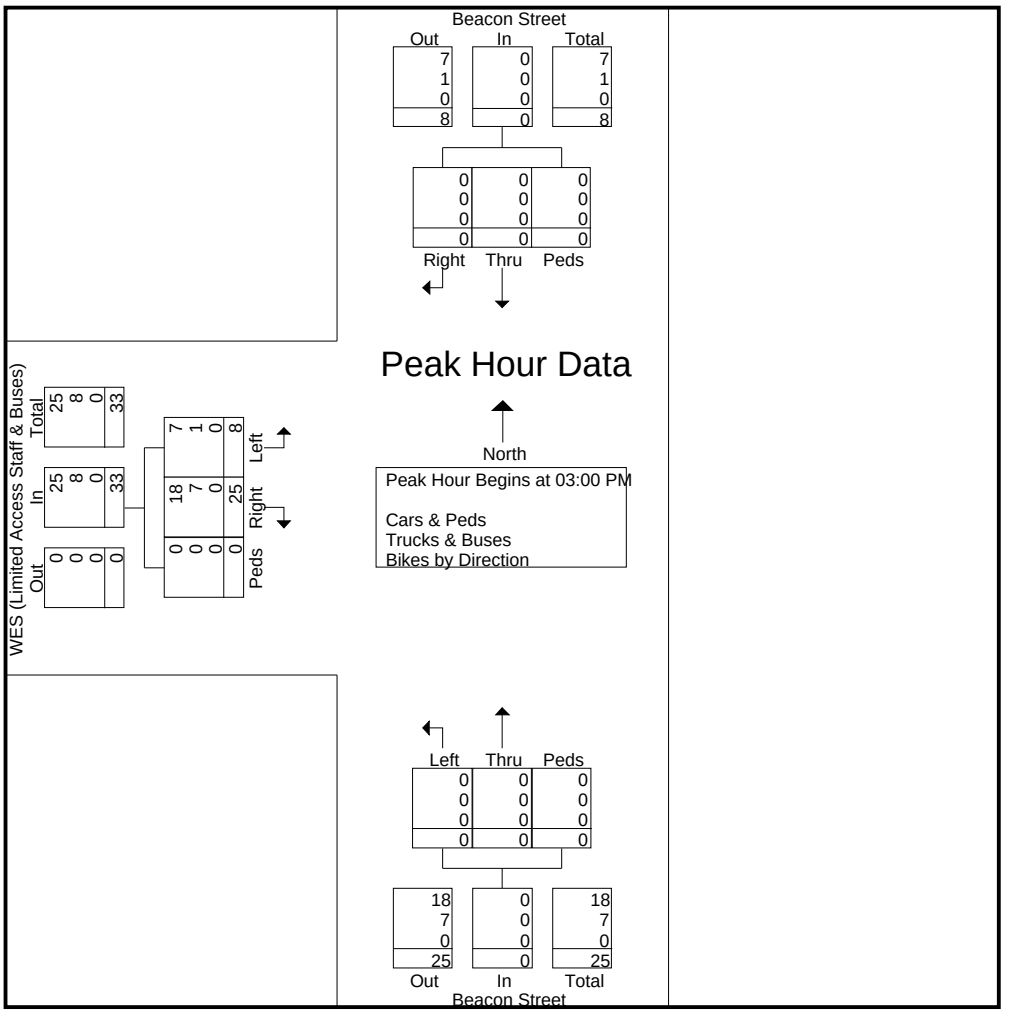
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268DD
Site Code : 05268
Start Date : 11/21/2019

	Beacon Street From North				Beacon Street From South				WES (Limited Access Staff & Buses) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 03:00 PM													
03:00 PM	0	0	0	0	0	0	0	0	3	0	0	3	3
03:15 PM	0	0	0	0	0	0	0	0	**13**	0	0	**13**	**13**
03:30 PM	0	0	0	0	0	0	0	0	2	2	0	4	4
03:45 PM	0	0	0	0	0	0	0	0	7	**6**	0	13	13
Total Volume	0	0	0	0	0	0	0	0	25	8	0	33	33
% App. Total	0	0	0		0	0	0		75.8	24.2	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.481	.333	.000	.635	.635
Cars & Peds	0	0	0	0	0	0	0	0	18	7	0	25	25
% Cars & Peds	0	0	0	0	0	0	0	0	72.0	87.5	0	75.8	75.8
Trucks & Buses	0	0	0	0	0	0	0	0	7	1	0	8	8
% Trucks & Buses	0	0	0	0	0	0	0	0	28.0	12.5	0	24.2	24.2
Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0



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N/S: Beacon Street
W: West Elementary School (Southerly Dr)
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268EE
Site Code : 05268
Start Date : 11/21/2019

Groups Printed- Cars & Peds - Trucks & Buses - Bikes by Direction

	Beacon Street From North			Beacon Street From South			West Elementary School (Southerly Drive) From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
02:00 PM	1	68	0	68	2	0	1	1	0	141
02:15 PM	2	45	0	78	5	0	0	0	0	130
02:30 PM	0	64	0	97	9	0	1	0	0	171
02:45 PM	3	67	0	107	10	0	1	1	0	189
Total	6	244	0	350	26	0	3	2	0	631
03:00 PM	3	62	0	101	14	0	1	0	0	181
03:15 PM	0	76	0	97	4	0	50	14	0	241
03:30 PM	0	83	0	101	1	0	4	3	0	192
03:45 PM	1	80	0	98	1	0	11	0	0	191
Total	4	301	0	397	20	0	66	17	0	805
Grand Total	10	545	0	747	46	0	69	19	0	1436
Apprch %	1.8	98.2	0	94.2	5.8	0	78.4	21.6	0	
Total %	0.7	38	0	52	3.2	0	4.8	1.3	0	
Cars & Peds	10	524	0	722	43	0	67	19	0	1385
% Cars & Peds	100	96.1	0	96.7	93.5	0	97.1	100	0	96.4
Trucks & Buses	0	20	0	24	3	0	2	0	0	49
% Trucks & Buses	0	3.7	0	3.2	6.5	0	2.9	0	0	3.4
Bikes by Direction	0	1	0	1	0	0	0	0	0	2
% Bikes by Direction	0	0.2	0	0.1	0	0	0	0	0	0.1

	Beacon Street From North				Beacon Street From South				West Elementary School (Southerly Drive) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 03:00 PM													
03:00 PM	**3**	62	0	65	**101**	**14**	0	**115**	1	0	0	1	181
03:15 PM	0	76	0	76	97	4	0	101	**50**	**14**	0	**64**	**241**
03:30 PM	0	**83**	0	**83**	101	1	0	102	4	3	0	7	192
03:45 PM	1	80	0	81	98	1	0	99	11	0	0	11	191
Total Volume	4	301	0	305	397	20	0	417	66	17	0	83	805
% App. Total	1.3	98.7	0		95.2	4.8	0		79.5	20.5	0		
PHF	.333	.907	.000	.919	.983	.357	.000	.907	.330	.304	.000	.324	.835
Cars & Peds	4	292	0	296	384	18	0	402	64	17	0	81	779
% Cars & Peds	100	97.0	0	97.0	96.7	90.0	0	96.4	97.0	100	0	97.6	96.8
Trucks & Buses	0	9	0	9	13	2	0	15	2	0	0	2	26
% Trucks & Buses	0	3.0	0	3.0	3.3	10.0	0	3.6	3.0	0	0	2.4	3.2
Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0

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W: West Elementary School (Southerly Dr)
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268EE
Site Code : 05268
Start Date : 11/21/2019

Groups Printed- Cars & Peds

	Beacon Street From North			Beacon Street From South			West Elementary School (Southerly Drive) From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
02:00 PM	1	60	0	67	2	0	1	1	0	132
02:15 PM	2	44	0	76	5	0	0	0	0	127
02:30 PM	0	63	0	93	9	0	1	0	0	166
02:45 PM	3	65	0	102	9	0	1	1	0	181
Total	6	232	0	338	25	0	3	2	0	606
03:00 PM	3	61	0	98	13	0	1	0	0	176
03:15 PM	0	70	0	96	4	0	48	14	0	232
03:30 PM	0	83	0	100	0	0	4	3	0	190
03:45 PM	1	78	0	90	1	0	11	0	0	181
Total	4	292	0	384	18	0	64	17	0	779
Grand Total	10	524	0	722	43	0	67	19	0	1385
Apprch %	1.9	98.1	0	94.4	5.6	0	77.9	22.1	0	
Total %	0.7	37.8	0	52.1	3.1	0	4.8	1.4	0	

	Beacon Street From North				Beacon Street From South				West Elementary School (Southerly Drive) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 02:45 PM													
02:45 PM	**3**	65	0	68	**102**	9	0	**111**	1	1	0	2	181
03:00 PM	3	61	0	64	98	**13**	0	111	1	0	0	1	176
03:15 PM	0	70	0	70	96	4	0	100	**48**	**14**	0	**62**	**232**
03:30 PM	0	**83**	0	**83**	100	0	0	100	4	3	0	7	190
Total Volume	6	279	0	285	396	26	0	422	54	18	0	72	779
% App. Total	2.1	97.9	0		93.8	6.2	0		75	25	0		
PHF	.500	.840	.000	.858	.971	.500	.000	.950	.281	.321	.000	.290	.839

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File Name : 05268EE
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Trucks & Buses

	Beacon Street From North			Beacon Street From South			West Elementary School (Southerly Drive) From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
02:00 PM	0	8	0	1	0	0	0	0	0	9
02:15 PM	0	1	0	2	0	0	0	0	0	3
02:30 PM	0	1	0	3	0	0	0	0	0	4
02:45 PM	0	1	0	5	1	0	0	0	0	7
Total	0	11	0	11	1	0	0	0	0	23
03:00 PM	0	1	0	3	1	0	0	0	0	5
03:15 PM	0	6	0	1	0	0	2	0	0	9
03:30 PM	0	0	0	1	1	0	0	0	0	2
03:45 PM	0	2	0	8	0	0	0	0	0	10
Total	0	9	0	13	2	0	2	0	0	26
Grand Total	0	20	0	24	3	0	2	0	0	49
Apprch %	0	100	0	88.9	11.1	0	100	0	0	
Total %	0	40.8	0	49	6.1	0	4.1	0	0	

	Beacon Street From North				Beacon Street From South				West Elementary School (Southerly Drive) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 03:00 PM													
03:00 PM	0	1	0	1	3	**1**	0	4	0	0	0	0	5
03:15 PM	0	**6**	0	**6**	1	0	0	1	**2**	0	0	**2**	9
03:30 PM	0	0	0	0	1	1	0	2	0	0	0	0	2
03:45 PM	0	2	0	2	**8**	0	0	**8**	0	0	0	0	**10**
Total Volume	0	9	0	9	13	2	0	15	2	0	0	2	26
% App. Total	0	100	0		86.7	13.3	0		100	0	0		
PHF	.000	.375	.000	.375	.406	.500	.000	.469	.250	.000	.000	.250	.650

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Client: Brennan/C. Emilius

File Name : 05268EE
Site Code : 05268
Start Date : 11/21/2019

Groups Printed- Bikes by Direction

	Beacon Street From North			Beacon Street From South			West Elementary School (Southerly Drive) From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
02:00 PM	0	0	0	0	0	0	0	0	0	0
02:15 PM	0	0	0	0	0	0	0	0	0	0
02:30 PM	0	0	0	1	0	0	0	0	0	1
02:45 PM	0	1	0	0	0	0	0	0	0	1
Total	0	1	0	1	0	0	0	0	0	2
03:00 PM	0	0	0	0	0	0	0	0	0	0
03:15 PM	0	0	0	0	0	0	0	0	0	0
03:30 PM	0	0	0	0	0	0	0	0	0	0
03:45 PM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0
Grand Total	0	1	0	1	0	0	0	0	0	2
Apprch %	0	100	0	100	0	0	0	0	0	
Total %	0	50	0	50	0	0	0	0	0	

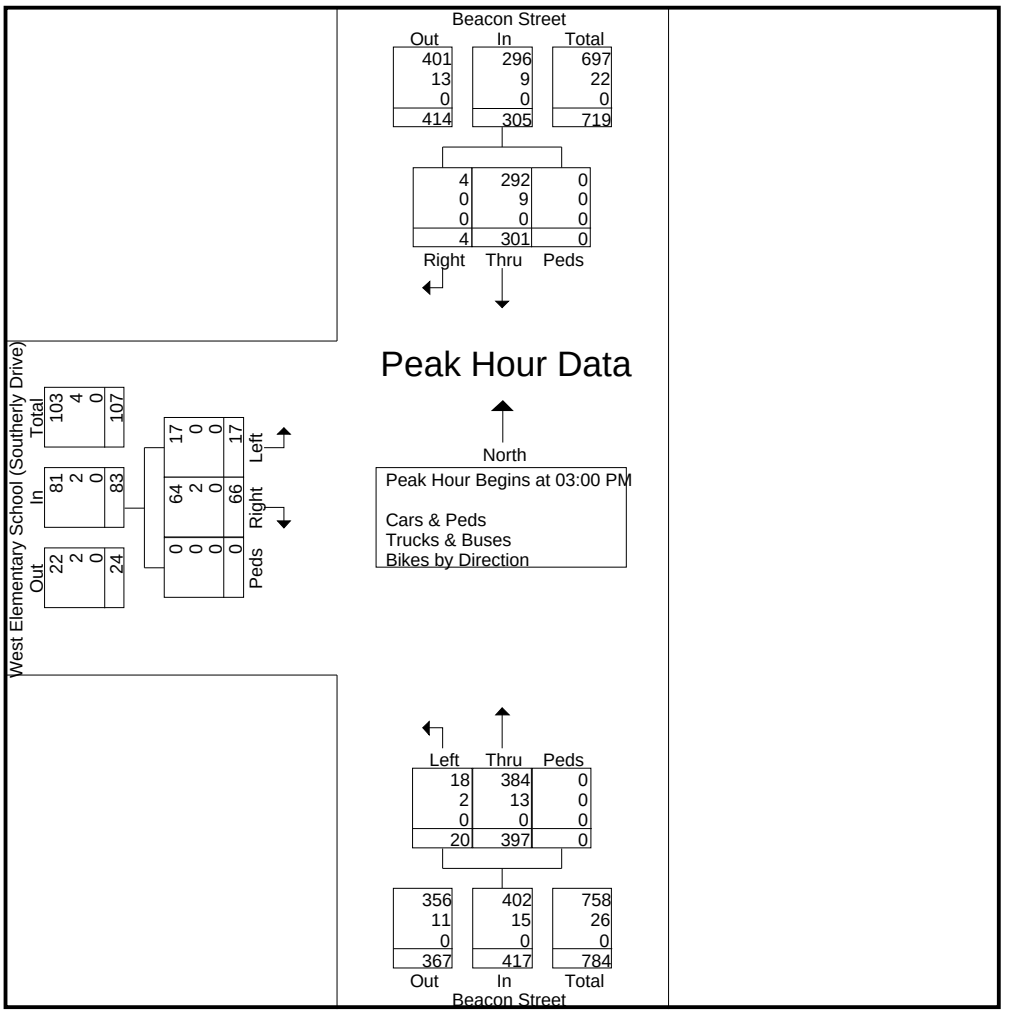
	Beacon Street From North				Beacon Street From South				West Elementary School (Southerly Drive) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 02:00 PM													
02:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
02:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
02:30 PM	0	0	0	0	**1**	0	0	**1**	0	0	0	0	**1**
02:45 PM	0	**1**	0	**1**	0	0	0	0	0	0	0	0	1
Total Volume	0	1	0	1	1	0	0	1	0	0	0	0	2
% App. Total	0	100	0		100	0	0		0	0	0		
PHF	.000	.250	.000	.250	.250	.000	.000	.250	.000	.000	.000	.000	.500

Transportation Data Corporation
Mario Perone, mperone1@verizon.net
tel (781) 587-0086 cell (781) 439-4999

N/S: Beacon Street
W: West Elementary School (Southerly Dr)
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268EE
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

	Beacon Street From North				Beacon Street From South				West Elementary School (Southerly Drive) From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 03:00 PM													
03:00 PM	**3**	62	0	65	**101**	**14**	0	**115**	1	0	0	1	181
03:15 PM	0	76	0	76	97	4	0	101	**50**	**14**	0	**64**	**241**
03:30 PM	0	**83**	0	**83**	101	1	0	102	4	3	0	7	192
03:45 PM	1	80	0	81	98	1	0	99	11	0	0	11	191
Total Volume	4	301	0	305	397	20	0	417	66	17	0	83	805
% App. Total	1.3	98.7	0		95.2	4.8	0		79.5	20.5	0		
PHF	.333	.907	.000	.919	.983	.357	.000	.907	.330	.304	.000	.324	.835
Cars & Peds	4	292	0	296	384	18	0	402	64	17	0	81	779
% Cars & Peds	100	97.0	0	97.0	96.7	90.0	0	96.4	97.0	100	0	97.6	96.8
Trucks & Buses	0	9	0	9	13	2	0	15	2	0	0	2	26
% Trucks & Buses	0	3.0	0	3.0	3.3	10.0	0	3.6	3.0	0	0	2.4	3.2
Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0
% Bikes by Direction	0	0	0	0	0	0	0	0	0	0	0	0	0



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tel (781) 587-0086 cell (781) 439-4999

N/S: Beacon Street
W: High Plain Road
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268FF
Site Code : 05268
Start Date : 11/21/2019

Groups Printed- Cars & Peds - Trucks & Buses - Bikes by Direction

	Beacon Street From North			Beacon Street From South			High Plain Road From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
02:00 PM	1	70	0	71	11	0	22	1	0	176
02:15 PM	0	44	0	82	16	0	22	1	0	165
02:30 PM	2	63	0	104	39	0	23	2	0	233
02:45 PM	0	66	4	114	28	0	24	3	0	239
Total	3	243	4	371	94	0	91	7	0	813
03:00 PM	0	63	0	111	26	0	20	3	0	223
03:15 PM	5	122	1	102	22	4	28	0	1	285
03:30 PM	1	84	0	101	31	0	21	1	0	239
03:45 PM	0	92	0	98	25	0	24	0	0	239
Total	6	361	1	412	104	4	93	4	1	986
Grand Total	9	604	5	783	198	4	184	11	1	1799
Apprch %	1.5	97.7	0.8	79.5	20.1	0.4	93.9	5.6	0.5	
Total %	0.5	33.6	0.3	43.5	11	0.2	10.2	0.6	0.1	
Cars & Peds	9	581	5	758	192	4	178	8	1	1736
% Cars & Peds	100	96.2	100	96.8	97	100	96.7	72.7	100	96.5
Trucks & Buses	0	22	0	24	6	0	6	3	0	61
% Trucks & Buses	0	3.6	0	3.1	3	0	3.3	27.3	0	3.4
Bikes by Direction	0	1	0	1	0	0	0	0	0	2
% Bikes by Direction	0	0.2	0	0.1	0	0	0	0	0	0.1

	Beacon Street From North				Beacon Street From South				High Plain Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 02:45 PM													
02:45 PM	0	66	**4**	70	**114**	28	0	**142**	24	**3**	0	27	239
03:00 PM	0	63	0	63	111	26	0	137	20	3	0	23	223
03:15 PM	**5**	**122**	1	**128**	102	22	**4**	128	**28**	0	**1**	**29**	**285**
03:30 PM	1	84	0	85	101	**31**	0	132	21	1	0	22	239
Total Volume	6	335	5	346	428	107	4	539	93	7	1	101	986
% App. Total	1.7	96.8	1.4		79.4	19.9	0.7		92.1	6.9	1		
PHF	.300	.686	.313	.676	.939	.863	.250	.949	.830	.583	.250	.871	.865
Cars & Peds	6	324	5	335	418	104	4	526	90	4	1	95	956
% Cars & Peds	100	96.7	100	96.8	97.7	97.2	100	97.6	96.8	57.1	100	94.1	97.0
Trucks & Buses	0	10	0	10	10	3	0	13	3	3	0	6	29
% Trucks & Buses	0	3.0	0	2.9	2.3	2.8	0	2.4	3.2	42.9	0	5.9	2.9
Bikes by Direction	0	1	0	1	0	0	0	0	0	0	0	0	1
% Bikes by Direction	0	0.3	0	0.3	0	0	0	0	0	0	0	0	0.1

Transportation Data Corporation
Mario Perone, mperone1@verizon.net
tel (781) 587-0086 cell (781) 439-4999

N/S: Beacon Street
W: High Plain Road
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268FF
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Cars & Peds

	Beacon Street From North			Beacon Street From South			High Plain Road From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
02:00 PM	1	62	0	70	10	0	22	1	0	166
02:15 PM	0	43	0	80	16	0	19	1	0	159
02:30 PM	2	62	0	100	38	0	23	2	0	227
02:45 PM	0	64	4	111	25	0	22	0	0	226
Total	3	231	4	361	89	0	86	4	0	778
03:00 PM	0	62	0	107	26	0	19	3	0	217
03:15 PM	5	114	1	101	22	4	28	0	1	276
03:30 PM	1	84	0	99	31	0	21	1	0	237
03:45 PM	0	90	0	90	24	0	24	0	0	228
Total	6	350	1	397	103	4	92	4	1	958
Grand Total	9	581	5	758	192	4	178	8	1	1736
Apprch %	1.5	97.6	0.8	79.5	20.1	0.4	95.2	4.3	0.5	
Total %	0.5	33.5	0.3	43.7	11.1	0.2	10.3	0.5	0.1	

	Beacon Street From North				Beacon Street From South				High Plain Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 03:00 PM													
03:00 PM	0	62	0	62	**107**	26	0	**133**	19	**3**	0	22	217
03:15 PM	**5**	**114**	**1**	**120**	101	22	**4**	127	**28**	0	**1**	**29**	**276**
03:30 PM	1	84	0	85	99	**31**	0	130	21	1	0	22	237
03:45 PM	0	90	0	90	90	24	0	114	24	0	0	24	228
Total Volume	6	350	1	357	397	103	4	504	92	4	1	97	958
% App. Total	1.7	98	0.3		78.8	20.4	0.8		94.8	4.1	1		
PHF	.300	.768	.250	.744	.928	.831	.250	.947	.821	.333	.250	.836	.868

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N/S: Beacon Street
W: High Plain Road
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268FF
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Trucks & Buses

	Beacon Street From North			Beacon Street From South			High Plain Road From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
02:00 PM	0	8	0	1	1	0	0	0	0	10
02:15 PM	0	1	0	2	0	0	3	0	0	6
02:30 PM	0	1	0	3	1	0	0	0	0	5
02:45 PM	0	1	0	3	3	0	2	3	0	12
Total	0	11	0	9	5	0	5	3	0	33
03:00 PM	0	1	0	4	0	0	1	0	0	6
03:15 PM	0	8	0	1	0	0	0	0	0	9
03:30 PM	0	0	0	2	0	0	0	0	0	2
03:45 PM	0	2	0	8	1	0	0	0	0	11
Total	0	11	0	15	1	0	1	0	0	28
Grand Total	0	22	0	24	6	0	6	3	0	61
Apprch %	0	100	0	80	20	0	66.7	33.3	0	
Total %	0	36.1	0	39.3	9.8	0	9.8	4.9	0	

	Beacon Street From North				Beacon Street From South				High Plain Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 02:00 PM													
02:00 PM	0	**8**	0	**8**	1	1	0	2	0	0	0	0	10
02:15 PM	0	1	0	1	2	0	0	2	**3**	0	0	3	6
02:30 PM	0	1	0	1	**3**	1	0	4	0	0	0	0	5
02:45 PM	0	1	0	1	3	**3**	0	**6**	2	**3**	0	**5**	**12**
Total Volume	0	11	0	11	9	5	0	14	5	3	0	8	33
% App. Total	0	100	0		64.3	35.7	0		62.5	37.5	0		
PHF	.000	.344	.000	.344	.750	.417	.000	.583	.417	.250	.000	.400	.688

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N/S: Beacon Street
W: High Plain Road
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268FF
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Bikes by Direction

	Beacon Street From North			Beacon Street From South			High Plain Road From West			
Start Time	Right	Thru	Peds	Thru	Left	Peds	Right	Left	Peds	Int. Total
02:00 PM	0	0	0	0	0	0	0	0	0	0
02:15 PM	0	0	0	0	0	0	0	0	0	0
02:30 PM	0	0	0	1	0	0	0	0	0	1
02:45 PM	0	1	0	0	0	0	0	0	0	1
Total	0	1	0	1	0	0	0	0	0	2
03:00 PM	0	0	0	0	0	0	0	0	0	0
03:15 PM	0	0	0	0	0	0	0	0	0	0
03:30 PM	0	0	0	0	0	0	0	0	0	0
03:45 PM	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0
Grand Total	0	1	0	1	0	0	0	0	0	2
Apprch %	0	100	0	100	0	0	0	0	0	
Total %	0	50	0	50	0	0	0	0	0	

	Beacon Street From North				Beacon Street From South				High Plain Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 02:00 PM													
02:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
02:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
02:30 PM	0	0	0	0	**1**	0	0	**1**	0	0	0	0	**1**
02:45 PM	0	**1**	0	**1**	0	0	0	0	0	0	0	0	1
Total Volume	0	1	0	1	1	0	0	1	0	0	0	0	2
% App. Total	0	100	0		100	0	0		0	0	0		
PHF	.000	.250	.000	.250	.250	.000	.000	.250	.000	.000	.000	.000	.500

Transportation Data Corporation

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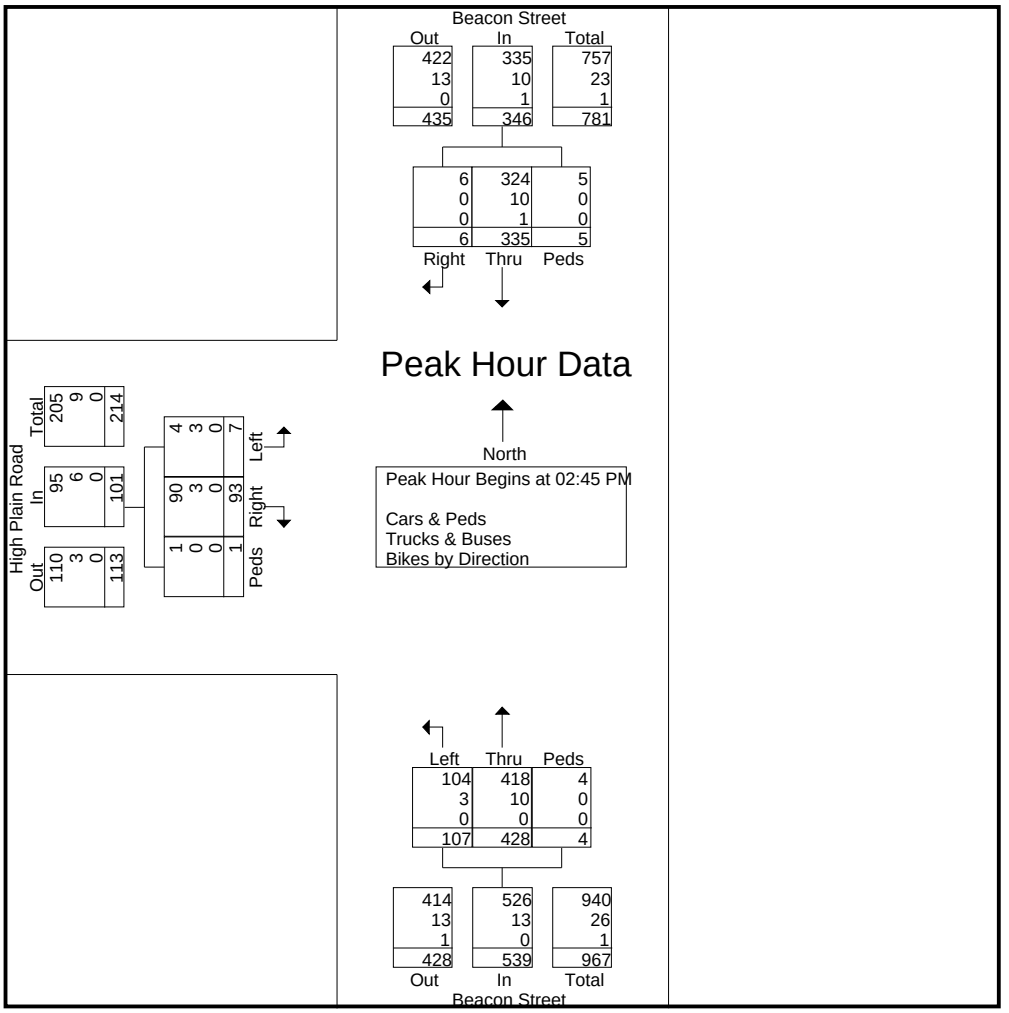
N/S: Beacon Street
W: High Plain Road
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268FF
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

	Beacon Street From North				Beacon Street From South				High Plain Road From West				
Start Time	Right	Thru	Peds	App. Total	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1													
Peak Hour for Entire Intersection Begins at 02:45 PM													
02:45 PM	0	66	**4**	70	**114**	28	0	**142**	24	**3**	0	27	239
03:00 PM	0	63	0	63	111	26	0	137	20	3	0	23	223
03:15 PM	**5**	**122**	1	**128**	102	22	**4**	128	**28**	0	**1**	**29**	**285**
03:30 PM	1	84	0	85	101	**31**	0	132	21	1	0	22	239
Total Volume	6	335	5	346	428	107	4	539	93	7	1	101	986
% App. Total	1.7	96.8	1.4		79.4	19.9	0.7		92.1	6.9	1		
PHF	.300	.686	.313	.676	.939	.863	.250	.949	.830	.583	.250	.871	.865
Cars & Peds	6	324	5	335	418	104	4	526	90	4	1	95	956
% Cars & Peds	100	96.7	100	96.8	97.7	97.2	100	97.6	96.8	57.1	100	94.1	97.0
Trucks & Buses	0	10	0	10	10	3	0	13	3	3	0	6	29
% Trucks & Buses	0	3.0	0	2.9	2.3	2.8	0	2.4	3.2	42.9	0	5.9	2.9
Bikes by Direction	0	1	0	1	0	0	0	0	0	0	0	0	1
% Bikes by Direction	0	0.3	0	0.3	0	0	0	0	0	0	0	0	0.1



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N/S: Beacon Street/Shawsheen Road
E,W/SW: Lowell Street/Reservation Road
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268GG
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Cars & Peds - Trucks & Buses - Bikes by Direction

	Beacon Street From North					Lowell Street (Route 133) From East					Shawsheen Road From South					Reservation Road From Southwest					Lowell Street (Route 133) From West					
Start Time	Right	Bear Right	Thru	Left	Peds	Right	Thru	Bear Left	Left	Peds	Right	Thru	Left	Hard Left	Peds	Hard Right	Bear Right	Bear Left	Hard Left	Peds	Hard Right	Right	Thru	Left	Peds	Int. Total
02:00 PM	16	7	47	21	0	16	66	0	5	0	0	34	42	1	0	1	0	4	0	0	1	28	51	21	0	361
02:15 PM	11	3	34	20	0	26	62	3	4	1	5	41	31	1	1	3	1	4	0	1	3	49	45	29	0	378
02:30 PM	15	5	50	14	0	34	44	3	5	0	1	68	53	2	0	6	1	6	0	0	1	32	77	33	0	450
02:45 PM	19	10	41	19	0	32	58	2	3	4	3	70	45	3	0	5	1	11	1	0	1	52	68	32	0	480
Total	61	25	172	74	0	108	230	8	17	5	9	213	171	7	1	15	3	25	1	1	6	161	241	115	0	1669
03:00 PM	10	5	53	19	0	27	66	0	4	0	3	68	51	2	0	3	3	12	1	0	1	39	53	31	1	452
03:15 PM	31	8	80	26	1	29	65	3	7	3	2	60	41	6	1	4	0	9	0	0	1	46	70	27	0	520
03:30 PM	23	3	67	18	0	31	58	3	3	0	4	63	39	1	0	3	0	8	1	0	1	50	77	28	0	481
03:45 PM	22	4	62	23	0	29	69	0	0	0	2	59	33	2	0	3	1	8	0	0	0	44	63	27	0	451
Total	86	20	262	86	1	116	258	6	14	3	11	250	164	11	1	13	4	37	2	0	3	179	263	113	1	1904
Grand Total	147	45	434	160	1	224	488	14	31	8	20	463	335	18	2	28	7	62	3	1	9	340	504	228	1	3573
Apprch %	18.7	5.7	55.1	20.3	0.1	29.3	63.8	1.8	4.1	1	2.4	55.3	40	2.1	0.2	27.7	6.9	61.4	3	1	0.8	31.4	46.6	21.1	0.1	
Total %	4.1	1.3	12.1	4.5	0	6.3	13.7	0.4	0.9	0.2	0.6	13	9.4	0.5	0.1	0.8	0.2	1.7	0.1	0	0.3	9.5	14.1	6.4	0	
Cars & Peds	143	43	418	153	1	215	477	14	30	8	20	450	325	18	2	26	7	58	3	1	9	333	502	221	1	3478
% Cars & Peds	97.3	95.6	96.3	95.6	100	96	97.7	100	96.8	100	100	97.2	97	100	100	92.9	100	93.5	100	100	100	97.9	99.6	96.9	100	97.3
Trucks & Buses	3	2	16	7	0	9	11	0	0	0	0	13	10	0	0	2	0	4	0	0	0	7	2	6	0	92
% Trucks & Buses	2	4.4	3.7	4.4	0	4	2.3	0	0	0	0	2.8	3	0	0	7.1	0	6.5	0	0	0	2.1	0.4	2.6	0	2.6
Bikes by Direction	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3
% Bikes by Direction	0.7	0	0	0	0	0	0	0	3.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.4	0	0.1

	Beacon Street From North						Lowell Street (Route 133) From East						Shawsheen Road From South						Reservation Road From Southwest						Lowell Street (Route 133) From West						
Start Time	Right	Bear Right	Thru	Left	Peds	App. Total	Right	Thru	Bear Left	Left	Peds	App. Total	Right	Thru	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Bear Left	Hard Left	Peds	App. Total	Hard Right	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1																															
Peak Hour for Entire Intersection Begins at 02:45 PM																															
02:45 PM	19	**10**	41	19	0	89	**32**	58	2	3	**4**	99	3	**70**	45	3	0	121	**5**	1	11	**1**	0	18	**1**	**52**	68	**32**	0	153	480
03:00 PM	10	5	53	19	0	87	27	**66**	0	4	0	97	3	68	**51**	2	0	**124**	3	**3**	**12**	1	0	**19**	1	39	53	31	**1**	125	452
03:15 PM	**31**	8	**80**	**26**	**1**	**146**	29	65	**3**	**7**	3	**107**	2	60	41	**6**	**1**	110	4	0	9	0	0	13	1	46	70	27	0	144	**520**
03:30 PM	23	3	67	18	0	111	31	58	3	3	0	95	**4**	63	39	1	0	107	3	0	8	1	0	12	1	50	**77**	28	0	**156**	481
Total Volume	83	26	241	82	1	433	119	247	8	17	7	398	12	261	176	12	1	462	15	4	40	3	0	62	4	187	268	118	1	578	1933
% App. Total	19.2		55.7	18.9	0.2		29.9	62.1		4.3	1.8		2.6	56.5	38.1	2.6	0.2		24.2	6.5	64.5	4.8			0.7	32.4	46.4	20.4	0.2		
PHF	.669	.650	.753	.788	.250	.741	.930	.936	.667	.607	.438	.930	.750	.932	.863	.500	.250	.931	.750	.333	.833	.750	.000	.816	1.00	.899	.870	.922	.250	.926	.929
Cars & Peds			234	78	1	419	116	240	8	16	7	387	12	255	173	12	1	453	13	4	37	3	0	57	4	184	266	116	1	571	1887
% Cars & Peds	97.6	96.2	97.1	95.1	100	96.8	97.5	97.2	100	94.1	100	97.2	100	97.7	98.3	100	100	98.1	86.7	100	92.5	100	0	91.9	100	98.4	99.3	98.3	100	98.8	97.6
Trucks & Buses																															
% Trucks & Buses	1.2	3.8	2.9	4.9	0	3.0	2.5	2.8	0	0	0	2.5	0	2.3	1.7	0	0	1.9	13.3	0	7.5	0	0	8.1	0	1.6	0.7	1.7	0	1.2	2.3
Bikes by Direction	1	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
% Bikes by Direction	1.2	0	0	0	0	0.2	0	0	0	5.9	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1

Transportation Data Corporation

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E,W/SW: Lowell Street/Reservation Road
City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268GG
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Cars & Peds

	Beacon Street From North					Lowell Street (Route 133) From East					Shawsheen Road From South					Reservation Road From Southwest					Lowell Street (Route 133) From West					
Start Time	Right	Bear Right	Thru	Left	Peds	Right	Thru	Bear Left	Left	Peds	Right	Thru	Left	Hard Left	Peds	Hard Right	Bear Right	Bear Left	Hard Left	Peds	Hard Right	Right	Thru	Left	Peds	Int. Total
02:00 PM	15	6	41	21	0	16	65	0	5	0	0	33	42	1	0	1	0	4	0	0	1	26	51	20	0	348
02:15 PM	11	3	33	17	0	24	62	3	4	1	5	41	30	1	1	3	1	4	0	1	3	49	45	28	0	370
02:30 PM	15	5	49	14	0	33	43	3	5	0	1	65	47	2	0	6	1	6	0	0	1	30	77	32	0	435
02:45 PM	18	10	39	18	0	30	56	2	2	4	3	68	43	3	0	4	1	9	1	0	1	50	68	31	0	461
Total	59	24	162	70	0	103	226	8	16	5	9	207	162	7	1	14	3	23	1	1	6	155	241	111	0	1614
03:00 PM	10	5	52	18	0	27	63	0	4	0	3	65	50	2	0	3	3	12	1	0	1	39	53	30	1	442
03:15 PM	30	7	76	24	1	29	64	3	7	3	2	60	41	6	1	3	0	8	0	0	1	45	69	27	0	507
03:30 PM	23	3	67	18	0	30	57	3	3	0	4	62	39	1	0	3	0	8	1	0	1	50	76	28	0	477
03:45 PM	21	4	61	23	0	26	67	0	0	0	2	56	33	2	0	3	1	7	0	0	0	44	63	25	0	438
Total	84	19	256	83	1	112	251	6	14	3	11	243	163	11	1	12	4	35	2	0	3	178	261	110	1	1864
Grand Total	143	43	418	153	1	215	477	14	30	8	20	450	325	18	2	26	7	58	3	1	9	333	502	221	1	3478
Apprch %	18.9	5.7	55.1	20.2	0.1	28.9	64.1	1.9	4	1.1	2.5	55.2	39.9	2.2	0.2	27.4	7.4	61.1	3.2	1.1	0.8	31.2	47.1	20.7	0.1	
Total %	4.1	1.2	12	4.4	0	6.2	13.7	0.4	0.9	0.2	0.6	12.9	9.3	0.5	0.1	0.7	0.2	1.7	0.1	0	0.3	9.6	14.4	6.4	0	

	Beacon Street From North						Lowell Street (Route 133) From East						Shawsheen Road From South						Reservation Road From Southwest						Lowell Street (Route 133) From West						
Start Time	Right	Bear Right	Thru	Left	Peds	App. Total	Right	Thru	Bear Left	Left	Peds	App. Total	Right	Thru	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Bear Left	Hard Left	Peds	App. Total	Hard Right	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1																															
Peak Hour for Entire Intersection Begins at 02:45 PM																															
02:45 PM	18	**10**	39	18	0	85	**30**	56	2	2	**4**	94	3	**68**	43	3	0	117	**4**	1	9	**1**	0	15	**1**	**50**	68	**31**	0	150	461
03:00 PM	10	5	52	18	0	85	27	63	0	4	0	94	3	65	**50**	2	0	**120**	3	**3**	**12**	1	0	**19**	1	39	53	30	**1**	124	442
03:15 PM	**30**	7	**76**	**24**	**1**	**138**	29	**64**	**3**	**7**	3	**106**	2	60	41	**6**	**1**	110	3	0	8	0	0	11	1	45	69	27	0	142	**507**
03:30 PM	23	3	67	18	0	111	30	57	3	3	0	93	**4**	62	39	1	0	106	3	0	8	1	0	12	1	50	**76**	28	0	**155**	477
Total Volume	81	25	234	78	1	419	116	240	8	16	7	387	12	255	173	12	1	453	13	4	37	3	0	57	4	184	266	116	1	571	1887
% App. Total	19.3		55.8	18.6	0.2				2.1	4.1	1.8		2.6	56.3	38.2	2.6	0.2		22.8		64.9	5.3			0.7	32.2	46.6	20.3	0.2		
PHF	.675	.625	.770	.813	.250	.759	.967	.938	.667	.571	.438	.913	.750	.938	.865	.500	.250	.944	.813	.333	.771	.750	.000	.750	1.00	.920	.875	.935	.250	.921	.930

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Client: Brennan/C. Emilius

File Name : 05268GG
Site Code : 05268
Start Date : 11/21/2019
Page No : 1

Groups Printed- Trucks & Buses

	Beacon Street From North					Lowell Street (Route 133) From East					Shawsheen Road From South					Reservation Road From Southwest					Lowell Street (Route 133) From West					
Start Time	Right	Bear Right	Thru	Left	Peds	Right	Thru	Bear Left	Left	Peds	Right	Thru	Left	Hard Left	Peds	Hard Right	Bear Right	Bear Left	Hard Left	Peds	Hard Right	Right	Thru	Left	Peds	Int. Total
02:00 PM	1	1	6	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	1	0	13
02:15 PM	0	0	1	3	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	8
02:30 PM	0	0	1	0	0	1	1	0	0	0	0	3	6	0	0	0	0	0	0	0	0	2	0	0	0	14
02:45 PM	0	0	2	1	0	2	2	0	0	0	0	2	2	0	0	1	0	2	0	0	0	2	0	1	0	17
Total	1	1	10	4	0	5	4	0	0	0	0	6	9	0	0	1	0	2	0	0	0	6	0	3	0	52
03:00 PM	0	0	1	1	0	0	3	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	1	0	10
03:15 PM	1	1	4	2	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1	0	0	13
03:30 PM	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	4
03:45 PM	1	0	1	0	0	3	2	0	0	0	0	3	0	0	0	0	0	1	0	0	0	0	0	2	0	13
Total	2	1	6	3	0	4	7	0	0	0	0	7	1	0	0	1	0	2	0	0	0	1	2	3	0	40
Grand Total	3	2	16	7	0	9	11	0	0	0	0	13	10	0	0	2	0	4	0	0	0	7	2	6	0	92
Apprch %	10.7	7.1	57.1	25	0	45	55	0	0	0	0	56.5	43.5	0	0	33.3	0	66.7	0	0	0	46.7	13.3	40	0	
Total %	3.3	2.2	17.4	7.6	0	9.8	12	0	0	0	0	14.1	10.9	0	0	2.2	0	4.3	0	0	0	7.6	2.2	6.5	0	

	Beacon Street From North						Lowell Street (Route 133) From East						Shawsheen Road From South						Reservation Road From Southwest						Lowell Street (Route 133) From West						
Start Time	Right	Bear Right	Thru	Left	Peds	App. Total	Right	Thru	Bear Left	Left	Peds	App. Total	Right	Thru	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Bear Left	Hard Left	Peds	App. Total	Hard Right	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1																															
Peak Hour for Entire Intersection Begins at 02:30 PM																															
02:30 PM	0	0	1	0	0	1	1	1	0	0	0	2	0	**3**	**6**	0	0	**9**	0	0	0	0	0	0	0	**2**	0	0	0	2	14
02:45 PM	0	0	2	1	0	3	**2**	2	0	0	0	**4**	0	2	2	0	0	4	**1**	0	**2**	0	0	**3**	0	2	0	**1**	0	**3**	**17**
03:00 PM	0	0	1	1	0	2	0	**3**	0	0	0	3	0	3	1	0	0	4	0	0	0	0	0	0	0	0	0	1	0	1	10
03:15 PM	**1**	**1**	**4**	**2**	0	**8**	0	1	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	2	0	1	**1**	0	0	2	13
Total Volume	1	1	8	4	0	14	3	7	0	0	0	10	0	8	9	0	0	17	2	0	3	0	0	5	0	5	1	2	0	8	54
% App. Total	7.1	7.1	57.1	28.6	0		30	70	0	0	0		0	47.1	52.9	0	0		40	0	60	0	0		0	62.5	12.5	25	0		
PHF	.250	.250	.500	.500	.000	.438	.375	.583	.000	.000	.000	.625	.000	.667	.375	.000	.000	.472	.500	.000	.375	.000	.000	.417	.000	.625	.250	.500	.000	.667	.794

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City, State: Andover, MA
Client: Brennan/C. Emilius

File Name : 05268GG
Site Code : 05268
Start Date : 11/21/2019

Groups Printed- Bikes by Direction

	Beacon Street From North					Lowell Street (Route 133) From East					Shawsheen Road From South					Reservation Road From Southwest					Lowell Street (Route 133) From West					
Start Time	Right	Bear Right	Thru	Left	Peds	Right	Thru	Bear Left	Left	Peds	Right	Thru	Left	Hard Left	Peds	Hard Right	Bear Right	Bear Left	Hard Left	Peds	Hard Right	Right	Thru	Left	Peds	Int. Total
02:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
02:45 PM	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Total	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3
03:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grand Total	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3
Apprch %	100	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	
Total %	33.3	0	0	0	0	0	0	0	33.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33.3	0	

	Beacon Street From North						Lowell Street (Route 133) From East						Shawsheen Road From South						Reservation Road From Southwest						Lowell Street (Route 133) From West						
Start Time	Right	Bear Right	Thru	Left	Peds	App. Total	Right	Thru	Bear Left	Left	Peds	App. Total	Right	Thru	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Bear Left	Hard Left	Peds	App. Total	Hard Right	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1																															
Peak Hour for Entire Intersection Begins at 02:00 PM																															
02:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	0	**1**	1
02:45 PM	**1**	0	0	0	0	**1**	0	0	0	**1**	0	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**2**
Total Volume	1	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	3
% App. Total	100	0	0	0	0		0	0	0	100	0		0	0	0	0	0		0	0	0	0	0		0	0	0	100	0		
PHF	.250	.000	.000	.000	.000	.250	.000	.000	.000	.250	.000	.250	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.250	.000	.250	.375

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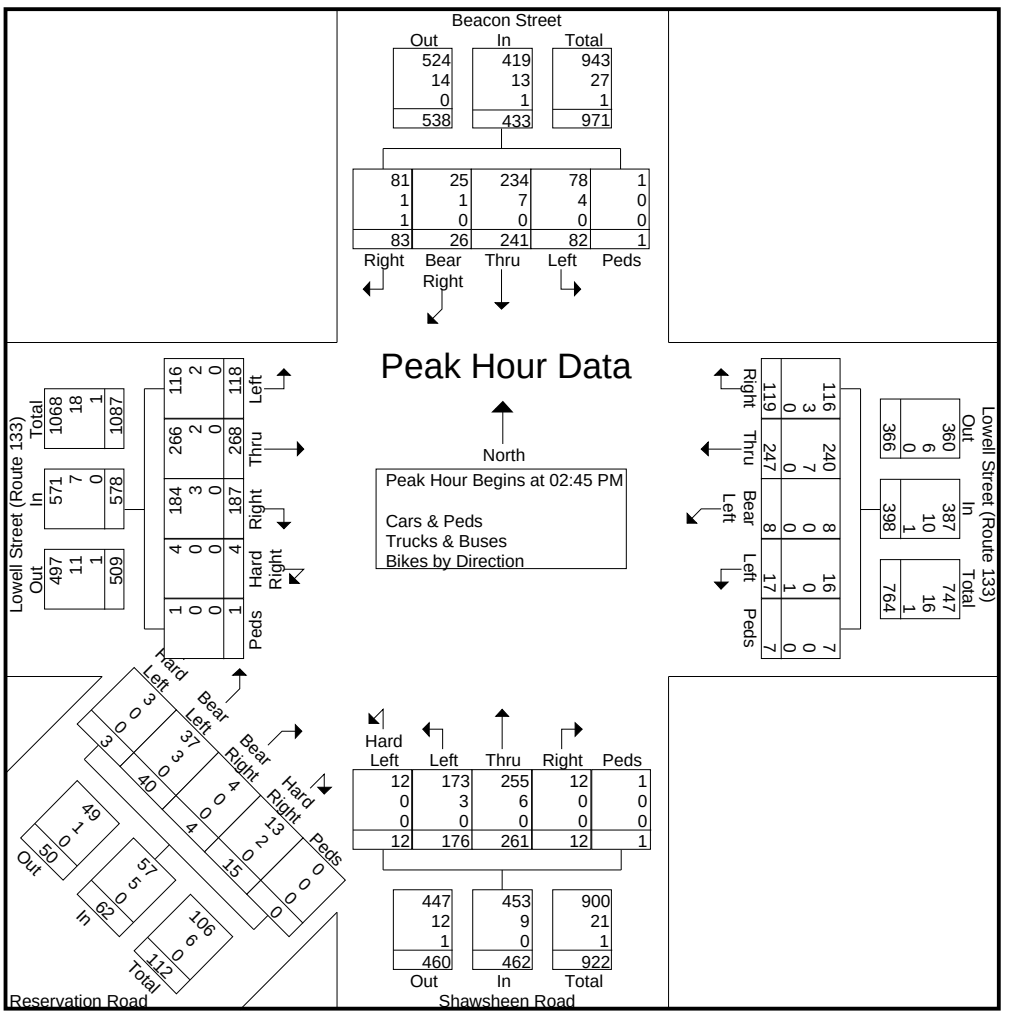
	Beacon Street From North						Lowell Street (Route 133) From East						Shawsheen Road From South						Reservation Road From Southwest						Lowell Street (Route 133) From West						
Start Time	Right	Bear Right	Thru	Left	Peds	App. Total	Right	Thru	Bear Left	Left	Peds	App. Total	Right	Thru	Left	Hard Left	Peds	App. Total	Hard Right	Bear Right	Bear Left	Hard Left	Peds	App. Total	Hard Right	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 02:00 PM to 03:45 PM - Peak 1 of 1																															
Peak Hour for Entire Intersection Begins at 02:45 PM																															
02:45 PM	19	**10**	41	19	0	89	**32**	58	2	3	**4**	99	3	**70**	45	3	0	121	**5**	1	11	**1**	0	18	**1**	**52**	68	**32**	0	153	480
03:00 PM	10	5	53	19	0	87	27	**66**	0	4	0	97	3	68	**51**	2	0	**124**	3	**3**	**12**	1	0	**19**	1	39	53	31	**1**	125	452
03:15 PM	**31**	8	**80**	**26**	**1**	**146**	29	65	**3**	**7**	3	**107**	2	60	41	**6**	**1**	110	4	0	9	0	0	13	1	46	70	27	0	144	**520**
03:30 PM	23	3	67	18	0	111	31	58	3	3	0	95	**4**	63	39	1	0	107	3	0	8	1	0	12	1	50	**77**	28	0	**156**	481
Total Volume	83	26	241	82	1	433	119	247	8	17	7	398	12	261	176	12	1	462	15	4	40	3	0	62	4	187	268	118	1	578	1933
% App. Total	19.2		55.7	18.9	0.2		29.9	62.1		4.3	1.8		2.6	56.5	38.1	2.6	0.2		24.2	6.5	64.5	4.8			0.7	32.4	46.4	20.4	0.2		
PHF	.669	.650	.753	.788	.250	.741	.930	.936	.667	.607	.438	.930	.750	.932	.863	.500	.250	.931	.750	.333	.833	.750	.000	.816	1.00	.899	.870	.922	.250	.926	.929
Cars & Peds			234	78	1	419	116	240	8	16	7	387	12	255	173	12	1	453	13	4	37	3	0	57	4	184	266	116	1	571	1887
% Cars & Peds	97.6	96.2	97.1	95.1	100	96.8	97.5	97.2	100	94.1	100	97.2	100	97.7	98.3	100	100	98.1	86.7	100	92.5	100	0	91.9	100	98.4	99.3	98.3	100	98.8	97.6
Trucks & Buses																															
% Trucks & Buses	1.2	3.8	2.9	4.9	0	3.0	2.5	2.8	0	0	0	2.5	0	2.3	1.7	0	0	1.9	13.3	0	7.5	0	0	8.1	0	1.6	0.7	1.7	0	1.2	2.3
Bikes by Direction	1	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
% Bikes by Direction	1.2	0	0	0	0	0.2	0	0	0	5.9	0	0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1



APPENDIX B
CRASH REPORTS

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : **ANDOVER** COUNT DATE : Nov-19

DISTRICT : 4 UNSIGNALIZED : X SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : **BEACON STREET**

MINOR STREET(S) : HIGH PLAIN ROAD

PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	EASTBOUND	WESTBOUND	SOUTHBOUND	NORTHBOUND		
PEAK HOURLY VOLUMES (AM/PM) :	123	0	542	545		**1,210**

" K " FACTOR : **0.090**

INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **13,444**

TOTAL # OF CRASHES : 6

OF YEARS : 3

AVERAGE # OF CRASHES PER YEAR (**A**) : **2.00**

CRASH RATE CALCULATION : **0.41**

RATE = $\frac{(A * 1{,}000{,}000)}{(V * 365)}$

Comments : AM PEAK

Project Title & Date: WEST ELEMENTARY SCHOOL January 2020

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : **ANDOVER** COUNT DATE : Nov-19

DISTRICT : 4 UNSIGNALIZED : SIGNALIZED : **X**

~ INTERSECTION DATA ~

MAJOR STREET : **LOWELL STREET**

MINOR STREET(S) : BEACON STREET AND SHAWSHEEN ROAD

PEAK HOUR VOLUMES

APPROACH :	**1**	**2**	**3**	**4**	**5**	**Total Peak Hourly Approach Volume**
DIRECTION :	EASTBOUND	WESTBOUND	SOUTHBOUND	NORTHBOUND		
PEAK HOURLY VOLUMES (AM/PM) :	683	705	683	490		**2,561**

" K " FACTOR : **0.090**

INTERSECTION ADT (**V**) = TOTAL DAILY APPROACH VOLUME : **28,456**

TOTAL # OF CRASHES : 16

OF YEARS : 3

AVERAGE # OF CRASHES PER YEAR (**A**) : **5.33**

CRASH RATE CALCULATION : **0.51**

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(V * 365)}$$

Comments : AM PEAK

Project Title & Date: WEST ELEMENTARY SCHOOL January 2020

MassDOT Crash Report for ANDOVER 2016 - 2018, report created: 12/12/2019 created: 12/12/2019

RMV Crash Number	City Town Name	Crash Date	Crash Time	Crash Severity	Maximum Injury Severity Reported	Number of Vehicles	Total Nonfatal Injuries	Total Fatal Injuries	Manner of Collision	Vehicle Action Prior to Crash	Vehicle Travel Directions	Most Harmful Events	Vehicle Configuration	Road Surface Condition	Ambient Light	Weather Condition	At Roadway Intersection	Distance From Nearest Roadway Intersection	Distance From Nearest Milemarker	Distance From Nearest Exit	Distance From Nearest Landmark	Non Motorist Type	X Cooordinate	Y Cooordinate
4216038	ANDOVER	13-Jul-2016	7:52 AM	Property damage only (none injured)	No injury	2	0	0	Rear-end	V1: Travelling straight ahead / V2: Slowing or stopped in traffic	V1: W / V2: W	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	V1:(Passenger car) / V2:(Passenger car)	Dry	Daylight	Clear		70 feet W from Intersection 181 LOWELL ST					227330.1081	934467.9031
4231047	ANDOVER	07-Aug-2016	9:29 AM	Non-fatal injury	Non-fatal injury - Non-incapacitating	2	1	0	Single vehicle crash	V1: Travelling straight ahead / V2: Entering traffic lane	V1: S / V2: S	V1:(Overturn/rollover) / V2:(Other non-collision)	V1:(Motorcycle) / V2:(Light truck(van, mini-van, pickup, sport utility))	Dry	Daylight	Clear		1 CHANDLER RD					226741.8488	935346.4297
4235625	ANDOVER	18-Aug-2016	3:37 PM	Property damage only (none injured)	No injury	2	0	0	Rear-end	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: S / V2: S	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Light truck(van, mini-van, pickup, sport utility))	Dry	Daylight	Clear/Clear		200 feet E from Intersection 217 SHAWSHEEN ROAD / LOWELL STREET Rte 133 E					227623.3467	934462.0281
4472754	ANDOVER	30-Aug-2016	9:22 AM	Property damage only (none injured)	No injury	2	0	0	Rear-end	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: S / V2: S	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	V1:(Passenger car) / V2:(Passenger car)	Dry	Daylight	Clear/Clear		100 feet N from Intersection 6 BEACON ST / Rte 133					227356.425	934527.2123
4276471	ANDOVER	26-Oct-2016	6:05 PM	Property damage only (none injured)	No injury	2	0	0	Angle	V1: Travelling straight ahead / V2: Turning left	V1: S / V2: S	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Light truck(van, mini-van, pickup, sport utility))	Dry	Dark - lighted roadway	Clear/Cloudy		175 LOWELL ST					227391.1849	934538.1546
4323384	ANDOVER	27-Jan-2017	2:44 PM	Property damage only (none injured)	No injury	2	0	0	Angle	V1: Travelling straight ahead / V2: Turning left	V1: W / V2: E	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	V1:(Passenger car) / V2:(Passenger car)	Dry	Daylight	Cloudy		175 LOWELL ST Rte 133					227395.204	934540.7584
4474104	ANDOVER	20-Apr-2017	6:38 PM	Non-fatal injury	Non-fatal injury - Possible	1	1	0	Angle	V1: Turning left	V1: S	V1:(Collision with cyclist (bicycle, tricycle, unicycle, pedal car))	V1:(Passenger car)	Dry	Daylight	Clear		175 LOWELL ST Rte 133				P3: Cyclist	227391.1849	934538.1546
4476123	ANDOVER	01-Jun-2017	7:27 AM	Non-fatal injury	Non-fatal injury - Non-incapacitating	2	1	0	Angle	V1: Turning left / V2: Travelling straight ahead	V1: S / V2: N	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	V1:(Passenger car) / V2:(Passenger car)	Dry	Daylight	Clear		175 LOWELL ST Rte 133					227391.1849	934538.1546
4383654	ANDOVER	21-Jun-2017	3:20 PM	Property damage only (none injured)	No injury	2	0	0	Rear-end	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic	V1: W / V2: W	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	V1:(Light truck(van, mini-van, pickup, sport utility)) / V2:(Light truck(van, mini-van, pickup, sport utility))	Dry	Daylight	Clear/Clear		174 LOWELL ST Rte 133					227367.049	934513.6767
4480870	ANDOVER	29-Aug-2017	1:19 PM	Non-fatal injury	Non-fatal injury - Possible	1	1	0	Single vehicle crash	V1: Travelling straight ahead	V1: N	V1:(Collision with utility pole)	V1:(Passenger car)	Dry	Daylight	Clear/Clear		50 feet S from Intersection 8 BEACON ST					227286.9678	934569.9569
4485993	ANDOVER	30-Nov-2017	6:34 PM	Property damage only (none injured)	No injury	2	0	0	Rear-end	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic	V1: N / V2: N	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	V1:(Passenger car) / V2:(Light truck(van, mini-van, pickup, sport utility))	Dry	Dusk	Clear/Cloudy		217 SHAWSHEEN RD					227623.3467	934462.0281
4589973	ANDOVER	23-Aug-2018	8:15 AM	Property damage only (none injured)	No injury	2	0	0	Rear-end	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: S / V2: S	V1:(Collision with motor vehicle in traffic) / V2:(Collision with motor vehicle in traffic)	V1:(Passenger car) / V2:(Passenger car)	Dry	Daylight	Clear/Clear		100 feet N from Intersection 58 BEACON ST					227108.7693	934829.5449

APPENDIX C
MassDOT AVERAGE CRASH RATES

use it with caution, or only as a general screening tool.

Intersection Crash Rates

The intersection average crash rates are based upon a database of signalized and unsignalized intersection crash rates that are compiled by MassDOT. The database contains intersection crash rates, obtained from crash rate worksheets that have been submitted to MassDOT as part of the review process for an Environmental Impact Report or Functional Design Report. MassDOT enters the information directly from the crash rate worksheet into the database. The statewide average crash rates merely reflect the average of those rates contained in the database and the district-wide crash rates reflect the average of those crash rates in the particular district, calculated for both signalized and unsignalized locations. The most recent average crash rates, which are updated on a nearly yearly basis, are based on all entries in the database not just those entries made within the past year.

Average Crash Rates, per Million Entering Vehicles, by Intersection Type

(Based upon crash information queried on June 26, 2018)

Location	Signalized Intersections	Unsignalized Intersections
Statewide	0.78	0.57
District 1*	0.80*	0.44*
District 2	0.89	0.62
District 3	0.89	0.61
District 4	0.73	0.57
District 5	0.75	0.57
District 6	0.71	0.52

* - District 1 should use Statewide Rates due to low sample total

APPENDIX D
ITE TRIP GENERATION GRAPHS

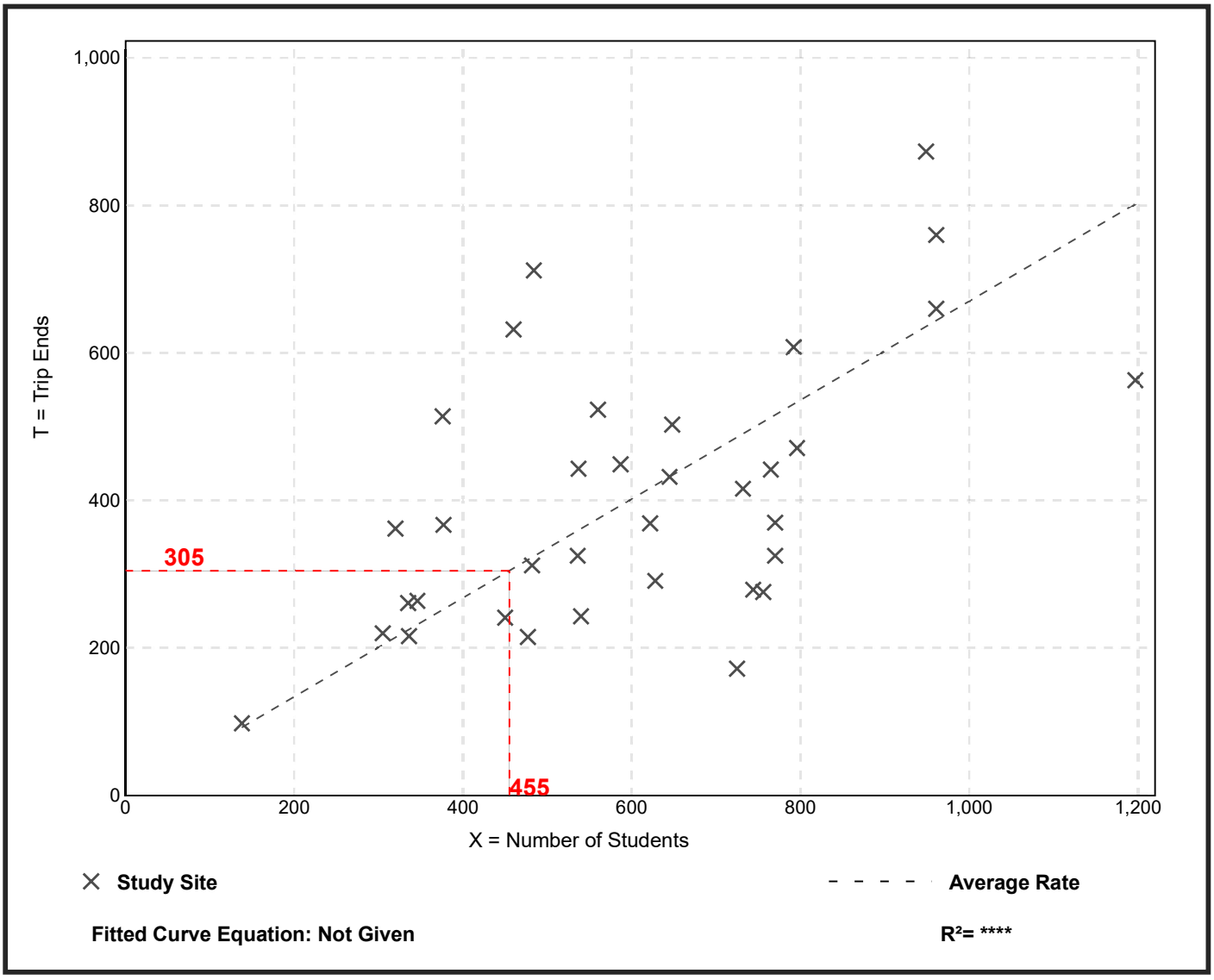
Elementary School
(520)

Vehicle Trip Ends vs:	**Students**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	35
Avg. Num. of Students:	603
Directional Distribution:	54% entering, 46% exiting

Vehicle Trip Generation per Student

Average Rate	Range of Rates	Standard Deviation
0.67	0.24 - 1.47	0.27

Data Plot and Equation



Fitted Curve Equation: Not Given

R^2= ****

Elementary School
(520)

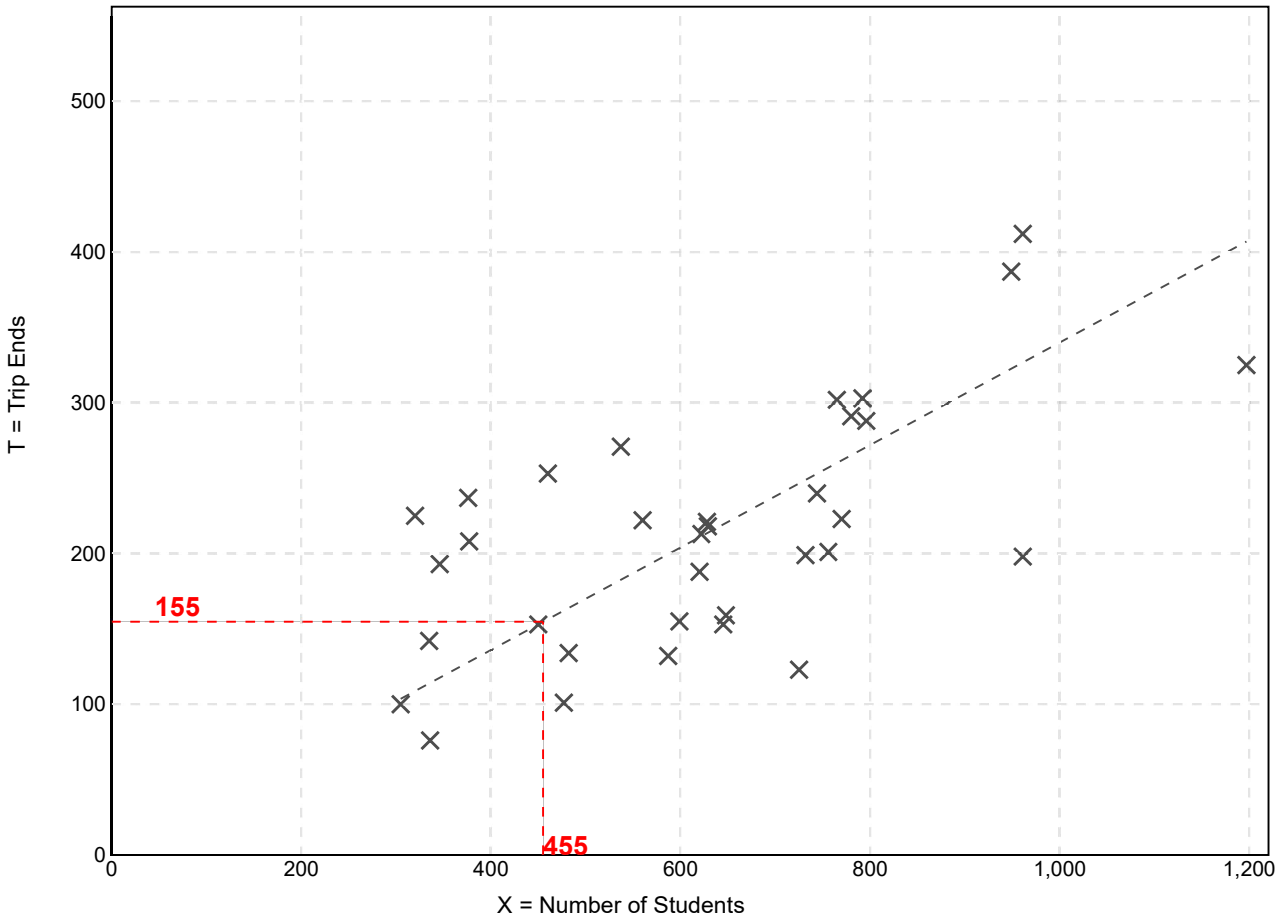
Vehicle Trip Ends vs: **Students**
On a: **Weekday,**
PM Peak Hour of Generator

Setting/Location: **General Urban/Suburban**
Number of Studies: 34
Avg. Num. of Students: 626
Directional Distribution: 45% entering, 55% exiting

Vehicle Trip Generation per Student

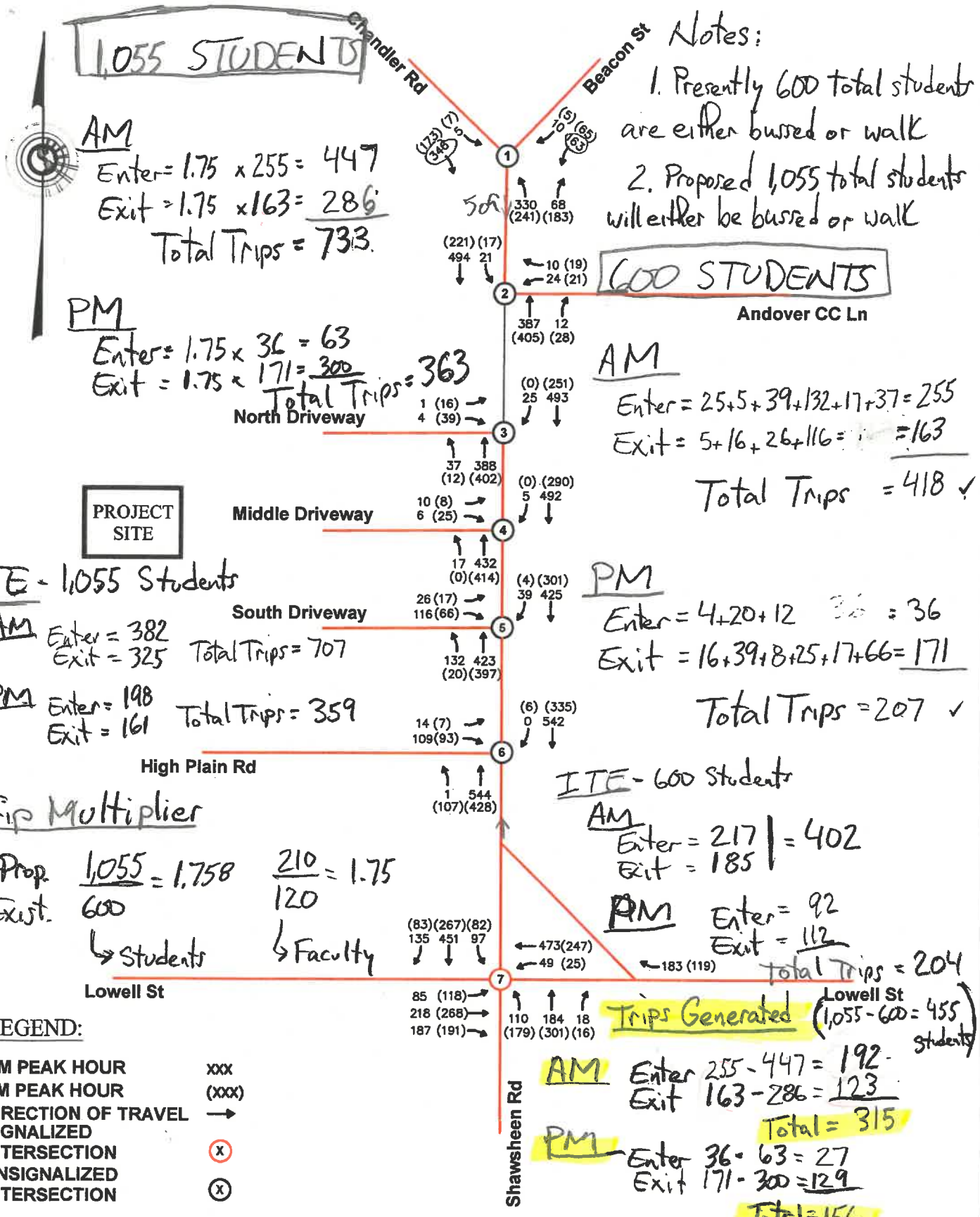
Average Rate	Range of Rates	Standard Deviation
0.34	0.17 - 0.70	0.11

Data Plot and Equation



Fitted Curve Equation: Not Given

R^2= **



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WEST ELEMENTARY SCHOOL
58 BEACON STREET, ANDOVER, MA

EXISTING WEEKDAY AM & PM PEAK HOUR VOLUMES

Figure: **3**

APPENDIX E
INTERSECTION CAPACITY AND QUEUE LENGTH ANALYSIS RESULTS

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	110	184	18	97	451	135	85	218	187	49	473	0
Future Volume (vph)	110	184	18	97	451	135	85	218	187	49	473	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0	6.0		6.0			6.0	
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00			1.00	
Frpb, ped/bikes	1.00	1.00			1.00	1.00		1.00			1.00	
Flpb, ped/bikes	1.00	1.00			1.00	1.00		1.00			1.00	
Frt	1.00	0.99			1.00	0.85		0.95			1.00	
Flt Protected	0.95	1.00			0.99	1.00		0.99			1.00	
Satd. Flow (prot)	1770	1834			1846	1583		1752			1854	
Flt Permitted	0.15	1.00			0.87	1.00		0.81			0.92	
Satd. Flow (perm)	282	1834			1628	1583		1429			1707	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	120	200	20	105	490	147	92	237	203	53	514	0
RTOR Reduction (vph)	0	3	0	0	0	50	0	16	0	0	0	0
Lane Group Flow (vph)	120	217	0	0	595	97	0	516	0	0	567	0
Confl. Peds. (#/hr)			2	2								
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2			6		6	4			8		
Actuated Green, G (s)	30.0	30.0			30.0	30.0		40.0			40.0	
Effective Green, g (s)	30.0	30.0			30.0	30.0		40.0			40.0	
Actuated g/C Ratio	0.37	0.37			0.37	0.37		0.49			0.49	
Clearance Time (s)	6.0	6.0			6.0	6.0		6.0			6.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	103	670			595	579		697			832	
v/s Ratio Prot		0.12										
v/s Ratio Perm	c0.43				0.37	0.06		c0.36			0.33	
v/c Ratio	1.17	0.32			1.00	0.17		0.74			0.68	
Uniform Delay, d1	26.0	18.7			26.0	17.6		16.8			16.1	
Progression Factor	1.00	1.00			1.00	1.00		1.00			1.00	
Incremental Delay, d2	139.8	0.3			36.9	0.1		4.1			2.3	
Delay (s)	165.8	19.0			62.9	17.7		21.0			18.4	
Level of Service	F	B			E	B		C			B	
Approach Delay (s)		70.8			53.9			21.0			18.4	
Approach LOS		E			D			C			B	

Intersection Summary			
HCM 2000 Control Delay	39.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	82.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	100.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	NBL	NBT	SBT	SBR	NET	SWT
Lane Group Flow (vph)	120	220	595	147	532	567
v/c Ratio	1.18	0.33	1.00	0.23	0.75	0.68
Control Delay	174.5	20.1	65.3	10.0	23.9	21.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	174.5	20.1	65.3	10.0	23.9	21.3
Queue Length 50th (ft)	~74	78	300	23	197	212
Queue Length 95th (ft)	#177	133	#517	62	330	330
Internal Link Dist (ft)		2424	63		1281	84
Turn Bay Length (ft)	25			50		
Base Capacity (vph)	102	673	595	629	713	833
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.18	0.33	1.00	0.23	0.75	0.68

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Volume (veh/h)	14	109	542	0	1	544
Future Volume (Veh/h)	14	109	542	0	1	544
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	15	118	589	0	1	591
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1182	589			589	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1182	589			589	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	93	77			100	
cM capacity (veh/h)	209	508			986	

Direction, Lane #	EB 1	SE 1	NW 1
Volume Total	133	589	592
Volume Left	15	0	1
Volume Right	118	0	0
cSH	438	1700	986
Volume to Capacity	0.30	0.35	0.00
Queue Length 95th (ft)	32	0	0
Control Delay (s)	16.8	0.0	0.0
Lane LOS	C		A
Approach Delay (s)	16.8	0.0	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	43.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Volume (veh/h)	26	116	425	39	132	423
Future Volume (Veh/h)	26	116	425	39	132	423
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	28	126	462	42	143	460
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1229	483			504	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1229	483			504	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	84	78			87	
cM capacity (veh/h)	170	584			1061	

Direction, Lane #	EB 1	SE 1	NW 1
Volume Total	154	504	603
Volume Left	28	0	143
Volume Right	126	42	0
cSH	405	1700	1061
Volume to Capacity	0.38	0.30	0.13
Queue Length 95th (ft)	44	0	12
Control Delay (s)	19.3	0.0	3.4
Lane LOS	C		A
Approach Delay (s)	19.3	0.0	3.4
Approach LOS	C		

Intersection Summary			
Average Delay	4.0		
Intersection Capacity Utilization	72.9%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	10	6	17	432	492	5
Future Volume (Veh/h)	10	6	17	432	492	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	7	18	470	535	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1044	538	540			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1044	538	540			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	99	98			
cM capacity (veh/h)	249	544	1028			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	18	488	540
Volume Left	11	18	0
Volume Right	7	0	5
cSH	316	1028	1700
Volume to Capacity	0.06	0.02	0.32
Queue Length 95th (ft)	5	1	0
Control Delay (s)	17.1	0.5	0.0
Lane LOS	C	A	
Approach Delay (s)	17.1	0.5	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	46.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	1	4	37	388	493	25
Future Volume (Veh/h)	1	4	37	388	493	25
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	4	40	422	536	27
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1052	550	563			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1052	550	563			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	99	96			
cM capacity (veh/h)	241	535	1008			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	5	462	563
Volume Left	1	40	0
Volume Right	4	0	27
cSH	430	1008	1700
Volume to Capacity	0.01	0.04	0.33
Queue Length 95th (ft)	1	3	0
Control Delay (s)	13.5	1.2	0.0
Lane LOS	B	A	
Approach Delay (s)	13.5	1.2	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	61.1%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis Existing AM
15: Beacon St & Andover Country Club Lane

01/17/2020



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	24	10	387	12	21	494
Future Volume (Veh/h)	24	10	387	12	21	494
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	26	11	421	13	23	537
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1010	428			434	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1010	428			434	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	90	98			98	
cM capacity (veh/h)	260	627			1126	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	37	434	560
Volume Left	26	0	23
Volume Right	11	13	0
cSH	315	1700	1126
Volume to Capacity	0.12	0.26	0.02
Queue Length 95th (ft)	10	0	2
Control Delay (s)	17.9	0.0	0.6
Lane LOS	C		A
Approach Delay (s)	17.9	0.0	0.6
Approach LOS	C		

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	53.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis

Existing AM

17: Chandler Rd & Beacon St

01/17/2020

Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	330	68	5	346	163	10
Future Volume (Veh/h)	330	68	5	346	163	10
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	359	74	5	376	177	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			433		782	396
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			433		782	396
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		51	98
cM capacity (veh/h)			1127		361	653

Direction, Lane #	NB 1	SB 1	SW 1
Volume Total	433	381	188
Volume Left	0	5	177
Volume Right	74	0	11
cSH	1700	1127	371
Volume to Capacity	0.25	0.00	0.51
Queue Length 95th (ft)	0	0	69
Control Delay (s)	0.0	0.2	24.3
Lane LOS		A	C
Approach Delay (s)	0.0	0.2	24.3
Approach LOS			C

Intersection Summary			
Average Delay	4.6		
Intersection Capacity Utilization	38.5%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis

Existing PM

4: LowellSt & Shawsheen Rd

01/17/2020

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	179	301	16	82	267	83	118	268	191	25	247	0
Future Volume (vph)	179	301	16	82	267	83	118	268	191	25	247	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0	6.0		6.0			6.0	
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00			1.00	
Frpb, ped/bikes	1.00	1.00			1.00	1.00		1.00			1.00	
Flpb, ped/bikes	1.00	1.00			1.00	1.00		1.00			1.00	
Frt	1.00	0.99			1.00	0.85		0.96			1.00	
Flt Protected	0.95	1.00			0.99	1.00		0.99			1.00	
Satd. Flow (prot)	1770	1847			1840	1583		1761			1854	
Flt Permitted	0.40	1.00			0.71	1.00		0.86			0.92	
Satd. Flow (perm)	738	1847			1314	1583		1529			1715	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	195	327	17	89	290	90	128	291	208	27	268	0
RTOR Reduction (vph)	0	1	0	0	0	50	0	13	0	0	0	0
Lane Group Flow (vph)	195	343	0	0	379	40	0	614	0	0	295	0
Confl. Peds. (#/hr)			2	2								
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2			6		6	4			8		
Actuated Green, G (s)	30.0	30.0			30.0	30.0		40.0			40.0	
Effective Green, g (s)	30.0	30.0			30.0	30.0		40.0			40.0	
Actuated g/C Ratio	0.37	0.37			0.37	0.37		0.49			0.49	
Clearance Time (s)	6.0	6.0			6.0	6.0		6.0			6.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	270	675			480	579		745			836	
v/s Ratio Prot		0.19										
v/s Ratio Perm	0.26				c0.29	0.03		c0.40			0.17	
v/c Ratio	0.72	0.51			0.79	0.07		0.82			0.35	
Uniform Delay, d1	22.4	20.2			23.2	16.9		18.0			13.0	
Progression Factor	1.00	1.00			1.00	1.00		1.00			1.00	
Incremental Delay, d2	9.2	0.6			8.4	0.1		7.4			0.3	
Delay (s)	31.6	20.9			31.6	17.0		25.3			13.3	
Level of Service	C	C			C	B		C			B	
Approach Delay (s)		24.7			28.8			25.3			13.3	
Approach LOS		C			C			C			B	

Intersection Summary			
HCM 2000 Control Delay	24.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	82.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	102.1%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Existing PM

Queues
4: LowellSt & Shawsheen Rd

01/20/2020

Lane Group	NBL	NBT	SBT	SBR	NET	SWT
Lane Group Flow (vph)	195	344	379	90	627	295
v/c Ratio	0.72	0.51	0.79	0.14	0.83	0.35
Control Delay	40.5	23.4	37.2	6.1	28.8	14.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.5	23.4	37.2	6.1	28.8	14.5
Queue Length 50th (ft)	85	134	170	4	253	89
Queue Length 95th (ft)	#192	213	#316	32	#461	145
Internal Link Dist (ft)		2424	63		1281	84
Turn Bay Length (ft)	25			50		
Base Capacity (vph)	270	677	481	629	758	837
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.72	0.51	0.79	0.14	0.83	0.35

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Volume (veh/h)	7	93	335	6	107	428
Future Volume (Veh/h)	7	93	335	6	107	428
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	8	101	364	7	116	465
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1064	368			371	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1064	368			371	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	96	85			90	
cM capacity (veh/h)	223	678			1188	

Direction, Lane #	EB 1	SE 1	NW 1
Volume Total	109	371	581
Volume Left	8	0	116
Volume Right	101	7	0
cSH	589	1700	1188
Volume to Capacity	0.18	0.22	0.10
Queue Length 95th (ft)	17	0	8
Control Delay (s)	12.5	0.0	2.6
Lane LOS	B		A
Approach Delay (s)	12.5	0.0	2.6
Approach LOS	B		

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	62.6%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Volume (veh/h)	17	66	301	4	20	397
Future Volume (Veh/h)	17	66	301	4	20	397
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	18	72	327	4	22	432
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	805	329			331	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	805	329			331	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	95	90			98	
cM capacity (veh/h)	345	712			1228	

Direction, Lane #	EB 1	SE 1	NW 1
Volume Total	90	331	454
Volume Left	18	0	22
Volume Right	72	4	0
cSH	588	1700	1228
Volume to Capacity	0.15	0.19	0.02
Queue Length 95th (ft)	13	0	1
Control Delay (s)	12.2	0.0	0.6
Lane LOS	B		A
Approach Delay (s)	12.2	0.0	0.6
Approach LOS	B		

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	48.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	8	25	0	414	290	0
Future Volume (Veh/h)	8	25	0	414	290	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	27	0	450	315	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	765	315	315			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	765	315	315			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	96	100			
cM capacity (veh/h)	371	725	1245			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	36	450	315
Volume Left	9	0	0
Volume Right	27	0	0
cSH	586	1245	1700
Volume to Capacity	0.06	0.00	0.19
Queue Length 95th (ft)	5	0	0
Control Delay (s)	11.5	0.0	0.0
Lane LOS	B		
Approach Delay (s)	11.5	0.0	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	31.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	16	39	12	402	251	0
Future Volume (Veh/h)	16	39	12	402	251	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	42	13	437	273	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	736	273	273			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	736	273	273			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	95	99			
cM capacity (veh/h)	382	766	1290			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	59	450	273
Volume Left	17	13	0
Volume Right	42	0	0
cSH	594	1290	1700
Volume to Capacity	0.10	0.01	0.16
Queue Length 95th (ft)	8	1	0
Control Delay (s)	11.7	0.3	0.0
Lane LOS	B	A	
Approach Delay (s)	11.7	0.3	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	40.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
15: Beacon St & Andover Country Club Lane

Existing PM

01/17/2020



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	21	19	405	28	17	221
Future Volume (Veh/h)	21	19	405	28	17	221
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	23	21	440	30	18	240
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	731	455			470	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	731	455			470	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	94	97			98	
cM capacity (veh/h)	382	605			1092	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	44	470	258
Volume Left	23	0	18
Volume Right	21	30	0
cSH	464	1700	1092
Volume to Capacity	0.09	0.28	0.02
Queue Length 95th (ft)	8	0	1
Control Delay (s)	13.6	0.0	0.7
Lane LOS	B		A
Approach Delay (s)	13.6	0.0	0.7
Approach LOS	B		

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	35.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	241	183	7	173	65	5
Future Volume (Veh/h)	241	183	7	173	65	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	262	199	8	188	71	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			461		566	362
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			461		566	362
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		85	99
cM capacity (veh/h)			1100		482	683

Direction, Lane #	NB 1	SB 1	SW 1
Volume Total	461	196	76
Volume Left	0	8	71
Volume Right	199	0	5
cSH	1700	1100	492
Volume to Capacity	0.27	0.01	0.15
Queue Length 95th (ft)	0	1	14
Control Delay (s)	0.0	0.4	13.7
Lane LOS		A	B
Approach Delay (s)	0.0	0.4	13.7
Approach LOS			B

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	34.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	119	200	19	106	494	148	93	235	202	53	511	0
Future Volume (vph)	119	200	19	106	494	148	93	235	202	53	511	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0	6.0		6.0			6.0	
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00			1.00	
Frpb, ped/bikes	1.00	1.00			1.00	1.00		1.00			1.00	
Flpb, ped/bikes	1.00	1.00			1.00	1.00		1.00			1.00	
Frt	1.00	0.99			1.00	0.85		0.95			1.00	
Flt Protected	0.95	1.00			0.99	1.00		0.99			1.00	
Satd. Flow (prot)	1770	1834			1846	1583		1751			1854	
Flt Permitted	0.13	1.00			0.83	1.00		0.78			0.91	
Satd. Flow (perm)	248	1834			1548	1583		1376			1694	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	129	217	21	115	537	161	101	255	220	58	555	0
RTOR Reduction (vph)	0	3	0	0	0	50	0	16	0	0	0	0
Lane Group Flow (vph)	129	235	0	0	652	111	0	560	0	0	613	0
Confl. Peds. (#/hr)			2	2								
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2			6		6	4			8		
Actuated Green, G (s)	30.0	30.0			30.0	30.0		40.0			40.0	
Effective Green, g (s)	30.0	30.0			30.0	30.0		40.0			40.0	
Actuated g/C Ratio	0.37	0.37			0.37	0.37		0.49			0.49	
Clearance Time (s)	6.0	6.0			6.0	6.0		6.0			6.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	90	670			566	579		671			826	
v/s Ratio Prot		0.13										
v/s Ratio Perm	c0.52				0.42	0.07		c0.41			0.36	
v/c Ratio	1.43	0.35			1.15	0.19		0.83			0.74	
Uniform Delay, d1	26.0	18.9			26.0	17.7		18.1			16.9	
Progression Factor	1.00	1.00			1.00	1.00		1.00			1.00	
Incremental Delay, d2	247.2	0.3			87.3	0.2		8.8			3.6	
Delay (s)	273.2	19.2			113.3	17.9		26.9			20.5	
Level of Service	F	B			F	B		C			C	
Approach Delay (s)		108.5			94.4			26.9			20.5	
Approach LOS		F			F			C			C	

Intersection Summary			
HCM 2000 Control Delay	61.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	82.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	108.0%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	NBL	NBT	SBT	SBR	NET	SWT
Lane Group Flow (vph)	129	238	652	161	576	613
v/c Ratio	1.43	0.35	1.15	0.26	0.84	0.74
Control Delay	274.3	20.5	115.3	10.8	30.5	23.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	274.3	20.5	115.3	10.8	30.5	23.7
Queue Length 50th (ft)	~91	86	~400	28	232	240
Queue Length 95th (ft)	#198	144	#601	69	#437	375
Internal Link Dist (ft)		2424	63		1281	84
Turn Bay Length (ft)	25			50		
Base Capacity (vph)	90	673	565	629	687	825
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.43	0.35	1.15	0.26	0.84	0.74

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Volume (veh/h)	15	118	595	0	1	590
Future Volume (Veh/h)	15	118	595	0	1	590
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	128	647	0	1	641
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1290	647			647	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1290	647			647	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	91	73			100	
cM capacity (veh/h)	180	471			939	

Direction, Lane #	EB 1	SE 1	NW 1
Volume Total	144	647	642
Volume Left	16	0	1
Volume Right	128	0	0
cSH	399	1700	939
Volume to Capacity	0.36	0.38	0.00
Queue Length 95th (ft)	40	0	0
Control Delay (s)	19.0	0.0	0.0
Lane LOS	C		A
Approach Delay (s)	19.0	0.0	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	46.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
9: Beacon St & South Driveway

No-Build AM

01/17/2020

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Volume (veh/h)	28	125	469	42	143	460
Future Volume (Veh/h)	28	125	469	42	143	460
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	30	136	510	46	155	500
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1343	533			556	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1343	533			556	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	79	75			85	
cM capacity (veh/h)	142	547			1015	

Direction, Lane #	EB 1	SE 1	NW 1
Volume Total	166	556	655
Volume Left	30	0	155
Volume Right	136	46	0
cSH	361	1700	1015
Volume to Capacity	0.46	0.33	0.15
Queue Length 95th (ft)	58	0	13
Control Delay (s)	23.2	0.0	3.7
Lane LOS	C		A
Approach Delay (s)	23.2	0.0	3.7
Approach LOS	C		

Intersection Summary			
Average Delay	4.6		
Intersection Capacity Utilization	78.6%	ICU Level of Service	D
Analysis Period (min)	15		

No-Build AM



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	11	6	18	469	541	5
Future Volume (Veh/h)	11	6	18	469	541	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	12	7	20	510	588	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1140	590	593			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1140	590	593			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	94	99	98			
cM capacity (veh/h)	218	507	983			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	19	530	593
Volume Left	12	20	0
Volume Right	7	0	5
cSH	276	983	1700
Volume to Capacity	0.07	0.02	0.35
Queue Length 95th (ft)	6	2	0
Control Delay (s)	19.0	0.6	0.0
Lane LOS	C	A	
Approach Delay (s)	19.0	0.6	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	49.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis

No-Build AM

13: North Driveway & Beacon St

01/17/2020

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	1	4	40	422	542	27
Future Volume (Veh/h)	1	4	40	422	542	27
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	4	43	459	589	29
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1148	604	618			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1148	604	618			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	99	96			
cM capacity (veh/h)	210	499	962			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	5	502	618
Volume Left	1	43	0
Volume Right	4	0	29
cSH	391	962	1700
Volume to Capacity	0.01	0.04	0.36
Queue Length 95th (ft)	1	4	0
Control Delay (s)	14.3	1.3	0.0
Lane LOS	B	A	
Approach Delay (s)	14.3	1.3	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	65.4%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis

No-Build AM

15: Beacon St & Andover Country Club Lane

01/17/2020



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	26	11	426	13	23	536
Future Volume (Veh/h)	26	11	426	13	23	536
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	28	12	463	14	25	583
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1103	470			477	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1103	470			477	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	88	98			98	
cM capacity (veh/h)	228	594			1085	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	40	477	608
Volume Left	28	0	25
Volume Right	12	14	0
cSH	280	1700	1085
Volume to Capacity	0.14	0.28	0.02
Queue Length 95th (ft)	12	0	2
Control Delay (s)	20.0	0.0	0.6
Lane LOS	C		A
Approach Delay (s)	20.0	0.0	0.6
Approach LOS	C		

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	56.9%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis

No - Build AM

17: Chandler Rd & Beacon St

01/17/2020

Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	363	74	5	376	177	11
Future Volume (Veh/h)	363	74	5	376	177	11
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	395	80	5	409	192	12
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			475		854	435
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			475		854	435
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		41	98
cM capacity (veh/h)			1087		328	621

Direction, Lane #	NB 1	SB 1	SW 1
Volume Total	475	414	204
Volume Left	0	5	192
Volume Right	80	0	12
cSH	1700	1087	337
Volume to Capacity	0.28	0.00	0.61
Queue Length 95th (ft)	0	0	94
Control Delay (s)	0.0	0.2	30.8
Lane LOS		A	D
Approach Delay (s)	0.0	0.2	30.8
Approach LOS			D

Intersection Summary			
Average Delay	5.8		
Intersection Capacity Utilization	40.9%	ICU Level of Service	A
Analysis Period (min)	15		

No-Build PM

HCM Signalized Intersection Capacity Analysis
4: Lowell St & Shawsheen Rd

01/17/2020

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	193	332	17	91	290	90	130	289	206	27	267	0
Future Volume (vph)	193	332	17	91	290	90	130	289	206	27	267	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0	6.0		6.0			6.0	
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00			1.00	
Frpb, ped/bikes	1.00	1.00			1.00	1.00		1.00			1.00	
Flpb, ped/bikes	1.00	1.00			1.00	1.00		1.00			1.00	
Frt	1.00	0.99			1.00	0.85		0.96			1.00	
Flt Protected	0.95	1.00			0.99	1.00		0.99			1.00	
Satd. Flow (prot)	1770	1847			1840	1583		1761			1854	
Flt Permitted	0.35	1.00			0.63	1.00		0.84			0.91	
Satd. Flow (perm)	661	1847			1172	1583		1496			1701	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	210	361	18	99	315	98	141	314	224	29	290	0
RTOR Reduction (vph)	0	1	0	0	0	50	0	13	0	0	0	0
Lane Group Flow (vph)	210	378	0	0	414	48	0	666	0	0	319	0
Confl. Peds. (#/hr)			2	2								
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2			6		6	4			8		
Actuated Green, G (s)	30.0	30.0			30.0	30.0		40.0			40.0	
Effective Green, g (s)	30.0	30.0			30.0	30.0		40.0			40.0	
Actuated g/C Ratio	0.37	0.37			0.37	0.37		0.49			0.49	
Clearance Time (s)	6.0	6.0			6.0	6.0		6.0			6.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	241	675			428	579		729			829	
v/s Ratio Prot		0.20										
v/s Ratio Perm	0.32				c0.35	0.03		c0.45			0.19	
v/c Ratio	0.87	0.56			0.97	0.08		0.91			0.38	
Uniform Delay, d1	24.2	20.7			25.5	17.0		19.4			13.2	
Progression Factor	1.00	1.00			1.00	1.00		1.00			1.00	
Incremental Delay, d2	27.2	1.0			34.7	0.1		15.9			0.3	
Delay (s)	51.5	21.7			60.2	17.1		35.3			13.5	
Level of Service	D	C			E	B		D			B	
Approach Delay (s)		32.3			51.9			35.3			13.5	
Approach LOS		C			D			D			B	

Intersection Summary			
HCM 2000 Control Delay	35.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	82.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	109.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Queues

No-Build PM

4: Lowell St & Shawsheen Rd

01/20/2020

Lane Group	NBL	NBT	SBT	SBR	NET	SWT
Lane Group Flow (vph)	210	379	414	98	679	319
v/c Ratio	0.87	0.56	0.97	0.16	0.92	0.38
Control Delay	60.4	24.5	64.4	6.7	38.7	15.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	60.4	24.5	64.4	6.7	38.7	15.0
Queue Length 50th (ft)	98	152	205	6	298	98
Queue Length 95th (ft)	#228	238	#388	36	#534	159
Internal Link Dist (ft)		2424	63		1281	84
Turn Bay Length (ft)	25			50		
Base Capacity (vph)	241	677	428	629	741	829
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.87	0.56	0.97	0.16	0.92	0.38

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Volume (veh/h)	8	100	366	6	116	475
Future Volume (Veh/h)	8	100	366	6	116	475
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	109	398	7	126	516
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1170	402			405	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1170	402			405	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	95	83			89	
cM capacity (veh/h)	190	649			1154	

Direction, Lane #	EB 1	SE 1	NW 1
Volume Total	118	405	642
Volume Left	9	0	126
Volume Right	109	7	0
cSH	548	1700	1154
Volume to Capacity	0.22	0.24	0.11
Queue Length 95th (ft)	20	0	9
Control Delay (s)	13.4	0.0	2.7
Lane LOS	B		A
Approach Delay (s)	13.4	0.0	2.7
Approach LOS	B		

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	67.7%	ICU Level of Service	C
Analysis Period (min)	15		

No-Build PM

HCM Unsignalized Intersection Capacity Analysis
9: Beacon St & South Driveway

01/17/2020

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Volume (veh/h)	18	71	329	4	22	442
Future Volume (Veh/h)	18	71	329	4	22	442
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	20	77	358	4	24	480
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	888	360			362	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	888	360			362	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	94	89			98	
cM capacity (veh/h)	308	684			1197	

Direction, Lane #	EB 1	SE 1	NW 1
Volume Total	97	362	504
Volume Left	20	0	24
Volume Right	77	4	0
cSH	547	1700	1197
Volume to Capacity	0.18	0.21	0.02
Queue Length 95th (ft)	16	0	2
Control Delay (s)	13.0	0.0	0.6
Lane LOS	B		A
Approach Delay (s)	13.0	0.0	0.6
Approach LOS	B		

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	53.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis

No - Build PM

11: Mid Driveway

01/17/2020



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	9	27	0	460	317	0
Future Volume (Veh/h)	9	27	0	460	317	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	10	29	0	500	345	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	845	345	345			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	845	345	345			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	96	100			
cM capacity (veh/h)	333	698	1214			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	39	500	345
Volume Left	10	0	0
Volume Right	29	0	0
cSH	545	1214	1700
Volume to Capacity	0.07	0.00	0.20
Queue Length 95th (ft)	6	0	0
Control Delay (s)	12.1	0.0	0.0
Lane LOS	B		
Approach Delay (s)	12.1	0.0	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	34.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis

No - Build PM

13: North Driveway & Beacon St

01/17/2020

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	17	42	13	447	275	0
Future Volume (Veh/h)	17	42	13	447	275	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	18	46	14	486	299	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	813	299	299			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	813	299	299			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	95	94	99			
cM capacity (veh/h)	344	741	1262			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	64	500	299
Volume Left	18	14	0
Volume Right	46	0	0
cSH	559	1262	1700
Volume to Capacity	0.11	0.01	0.18
Queue Length 95th (ft)	10	1	0
Control Delay (s)	12.3	0.3	0.0
Lane LOS	B	A	
Approach Delay (s)	12.3	0.3	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	44.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
15: Beacon St & Andover Country Club Lane

No-Build PM

01/17/2020



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	21	23	444	30	18	246
Future Volume (Veh/h)	21	23	444	30	18	246
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	23	25	483	33	20	267
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	806	500			516	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	806	500			516	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	93	96			98	
cM capacity (veh/h)	344	571			1050	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	48	516	287
Volume Left	23	0	20
Volume Right	25	33	0
cSH	434	1700	1050
Volume to Capacity	0.11	0.30	0.02
Queue Length 95th (ft)	9	0	1
Control Delay (s)	14.3	0.0	0.8
Lane LOS	B		A
Approach Delay (s)	14.3	0.0	0.8
Approach LOS	B		

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	37.8%	ICU Level of Service	A
Analysis Period (min)	15		

No-Build PM

HCM Unsignalized Intersection Capacity Analysis
17: Chandler Rd & Beacon St

01/17/2020

Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	264	201	8	193	72	5
Future Volume (Veh/h)	264	201	8	193	72	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	287	218	9	210	78	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			505		624	396
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			505		624	396
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		82	99
cM capacity (veh/h)			1060		445	653

Direction, Lane #	NB 1	SB 1	SW 1
Volume Total	505	219	83
Volume Left	0	9	78
Volume Right	218	0	5
cSH	1700	1060	454
Volume to Capacity	0.30	0.01	0.18
Queue Length 95th (ft)	0	1	17
Control Delay (s)	0.0	0.4	14.7
Lane LOS		A	B
Approach Delay (s)	0.0	0.4	14.7
Approach LOS			B

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	37.1%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis

Build AM

4: LowellSt & Shawsheen Rd

01/17/2020

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	119	255	19	120	557	166	120	235	202	53	511	0
Future Volume (vph)	119	255	19	120	557	166	120	235	202	53	511	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0	6.0		6.0			6.0	
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00			1.00	
Frpb, ped/bikes	1.00	1.00			1.00	1.00		1.00			1.00	
Flpb, ped/bikes	1.00	1.00			1.00	1.00		1.00			1.00	
Frt	1.00	0.99			1.00	0.85		0.95			1.00	
Flt Protected	0.95	1.00			0.99	1.00		0.99			1.00	
Satd. Flow (prot)	1770	1840			1846	1583		1752			1854	
Flt Permitted	0.13	1.00			0.74	1.00		0.71			0.91	
Satd. Flow (perm)	248	1840			1380	1583		1257			1686	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	129	277	21	130	605	180	130	255	220	58	555	0
RTOR Reduction (vph)	0	2	0	0	0	50	0	15	0	0	0	0
Lane Group Flow (vph)	129	296	0	0	735	130	0	590	0	0	613	0
Confl. Peds. (#/hr)			2	2								
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2			6		6	4			8		
Actuated Green, G (s)	30.0	30.0			30.0	30.0		40.0			40.0	
Effective Green, g (s)	30.0	30.0			30.0	30.0		40.0			40.0	
Actuated g/C Ratio	0.37	0.37			0.37	0.37		0.49			0.49	
Clearance Time (s)	6.0	6.0			6.0	6.0		6.0			6.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	90	673			504	579		613			822	
v/s Ratio Prot		0.16										
v/s Ratio Perm	0.52				c0.53	0.08		c0.47			0.36	
v/c Ratio	1.43	0.44			1.46	0.22		0.96			0.75	
Uniform Delay, d1	26.0	19.7			26.0	18.0		20.3			16.9	
Progression Factor	1.00	1.00			1.00	1.00		1.00			1.00	
Incremental Delay, d2	247.2	0.5			217.0	0.2		27.1			3.7	
Delay (s)	273.2	20.1			243.0	18.2		47.4			20.6	
Level of Service	F	C			F	B		D			C	
Approach Delay (s)		96.6			198.8			47.4			20.6	
Approach LOS		F			F			D			C	

Intersection Summary			
HCM 2000 Control Delay	103.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.26		
Actuated Cycle Length (s)	82.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	123.2%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Queues

Build AM

4: LowellSt & Shawsheen Rd

01/20/2020



Lane Group	NBL	NBT	SBT	SBR	NET	SWT
Lane Group Flow (vph)	129	298	735	180	605	613
v/c Ratio	1.43	0.44	1.46	0.29	0.96	0.75
Control Delay	274.3	22.0	242.2	11.7	49.8	23.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	274.3	22.0	242.2	11.7	49.8	23.8
Queue Length 50th (ft)	~91	112	~523	34	275	241
Queue Length 95th (ft)	#198	182	#731	80	#507	376
Internal Link Dist (ft)		2424	63		1281	84
Turn Bay Length (ft)	25			50		
Base Capacity (vph)	90	674	504	629	628	822
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.43	0.44	1.46	0.29	0.96	0.75

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Volume (veh/h)	19	118	690	0	1	726
Future Volume (Veh/h)	19	118	690	0	1	726
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	21	128	750	0	1	789
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1541	750			750	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1541	750			750	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	83	69			100	
cM capacity (veh/h)	127	411			859	

Direction, Lane #	EB 1	SE 1	NW 1
Volume Total	149	750	790
Volume Left	21	0	1
Volume Right	128	0	0
cSH	312	1700	859
Volume to Capacity	0.48	0.44	0.00
Queue Length 95th (ft)	61	0	0
Control Delay (s)	26.6	0.0	0.0
Lane LOS	D		A
Approach Delay (s)	26.6	0.0	0.0
Approach LOS	D		

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	54.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Volume (veh/h)	48	213	476	71	243	500
Future Volume (Veh/h)	48	213	476	71	243	500
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	52	232	517	77	264	543
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1626	556			594	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1626	556			594	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	37	56			73	
cM capacity (veh/h)	82	531			982	

Direction, Lane #	EB 1	SE 1	NW 1
Volume Total	284	594	807
Volume Left	52	0	264
Volume Right	232	77	0
cSH	265	1700	982
Volume to Capacity	1.07	0.35	0.27
Queue Length 95th (ft)	289	0	27
Control Delay (s)	116.6	0.0	5.9
Lane LOS	F		A
Approach Delay (s)	116.6	0.0	5.9
Approach LOS	F		

Intersection Summary			
Average Delay	22.5		
Intersection Capacity Utilization	94.9%	ICU Level of Service	F
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
11: Mid Driveway

Build AM

01/17/2020



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	18	11	31	516	570	9
Future Volume (Veh/h)	18	11	31	516	570	9
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	20	12	34	561	620	10
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1254	625	630			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1254	625	630			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	89	98	96			
cM capacity (veh/h)	183	485	952			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	32	595	630
Volume Left	20	34	0
Volume Right	12	0	10
cSH	239	952	1700
Volume to Capacity	0.13	0.04	0.37
Queue Length 95th (ft)	11	3	0
Control Delay (s)	22.4	1.0	0.0
Lane LOS	C	A	
Approach Delay (s)	22.4	1.0	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	62.5%	ICU Level of Service	B
Analysis Period (min)	15		

Build AM

HCM Unsignalized Intersection Capacity Analysis
13: North Driveway & Beacon St

01/17/2020



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	6	67	429	575	46
Future Volume (Veh/h)	2	6	67	429	575	46
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	7	73	466	625	50
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1262	650	675			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1262	650	675			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	99	92			
cM capacity (veh/h)	173	469	916			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	9	539	675
Volume Left	2	73	0
Volume Right	7	0	50
cSH	340	916	1700
Volume to Capacity	0.03	0.08	0.40
Queue Length 95th (ft)	2	6	0
Control Delay (s)	15.9	2.1	0.0
Lane LOS	C	A	
Approach Delay (s)	15.9	2.1	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	72.7%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
15: Beacon St & Andover Country Club Lane

Build AM

01/17/2020



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	28	11	453	14	23	586
Future Volume (Veh/h)	28	11	453	14	23	586
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	30	12	492	15	25	637
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1186	500			507	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1186	500			507	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	85	98			98	
cM capacity (veh/h)	203	571			1058	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	42	507	662
Volume Left	30	0	25
Volume Right	12	15	0
cSH	249	1700	1058
Volume to Capacity	0.17	0.30	0.02
Queue Length 95th (ft)	15	0	2
Control Delay (s)	22.3	0.0	0.6
Lane LOS	C		A
Approach Delay (s)	22.3	0.0	0.6
Approach LOS	C		

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	59.5%	ICU Level of Service	B
Analysis Period (min)	15		

Build AM

HCM Unsignalized Intersection Capacity Analysis
17: Chandler Rd & Beacon St

01/17/2020

Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	385	79	5	411	192	11
Future Volume (Veh/h)	385	79	5	411	192	11
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	418	86	5	447	209	12
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			504		918	461
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			504		918	461
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		30	98
cM capacity (veh/h)			1061		300	600

Direction, Lane #	NB 1	SB 1	SW 1
Volume Total	504	452	221
Volume Left	0	5	209
Volume Right	86	0	12
cSH	1700	1061	309
Volume to Capacity	0.30	0.00	0.72
Queue Length 95th (ft)	0	0	129
Control Delay (s)	0.0	0.1	41.4
Lane LOS		A	E
Approach Delay (s)	0.0	0.1	41.4
Approach LOS			E

Intersection Summary			
Average Delay	7.8		
Intersection Capacity Utilization	43.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
4: Lowell St & Shawsheen Rd

Build PM

01/17/2020

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	193	345	17	109	349	108	135	289	206	27	267	0
Future Volume (vph)	193	345	17	109	349	108	135	289	206	27	267	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0			6.0	6.0		6.0			6.0	
Lane Util. Factor	1.00	1.00			1.00	1.00		1.00			1.00	
Frpb, ped/bikes	1.00	1.00			1.00	1.00		1.00			1.00	
Flpb, ped/bikes	1.00	1.00			1.00	1.00		1.00			1.00	
Frt	1.00	0.99			1.00	0.85		0.96			1.00	
Flt Protected	0.95	1.00			0.99	1.00		0.99			1.00	
Satd. Flow (prot)	1770	1848			1840	1583		1762			1854	
Flt Permitted	0.26	1.00			0.57	1.00		0.83			0.91	
Satd. Flow (perm)	483	1848			1066	1583		1482			1700	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	210	375	18	118	379	117	147	314	224	29	290	0
RTOR Reduction (vph)	0	1	0	0	0	50	0	13	0	0	0	0
Lane Group Flow (vph)	210	392	0	0	497	67	0	672	0	0	319	0
Confl. Peds. (#/hr)			2	2								
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			4			8	
Permitted Phases	2			6		6	4			8		
Actuated Green, G (s)	30.0	30.0			30.0	30.0		40.0			40.0	
Effective Green, g (s)	30.0	30.0			30.0	30.0		40.0			40.0	
Actuated g/C Ratio	0.37	0.37			0.37	0.37		0.49			0.49	
Clearance Time (s)	6.0	6.0			6.0	6.0		6.0			6.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	176	676			390	579		722			829	
v/s Ratio Prot		0.21										
v/s Ratio Perm	0.43				c0.47	0.04		c0.45			0.19	
v/c Ratio	1.19	0.58			1.27	0.12		0.93			0.38	
Uniform Delay, d1	26.0	20.9			26.0	17.2		19.7			13.2	
Progression Factor	1.00	1.00			1.00	1.00		1.00			1.00	
Incremental Delay, d2	129.4	1.2			142.1	0.1		18.7			0.3	
Delay (s)	155.4	22.1			168.1	17.3		38.4			13.5	
Level of Service	F	C			F	B		D			B	
Approach Delay (s)		68.5			139.4			38.4			13.5	
Approach LOS		E			F			D			B	

Intersection Summary			
HCM 2000 Control Delay	70.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.16		
Actuated Cycle Length (s)	82.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	114.4%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	NBL	NBT	SBT	SBR	NET	SWT
Lane Group Flow (vph)	210	393	497	117	685	319
v/c Ratio	1.19	0.58	1.27	0.19	0.93	0.38
Control Delay	158.0	25.0	168.8	8.0	41.3	15.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	158.0	25.0	168.8	8.0	41.3	15.0
Queue Length 50th (ft)	~132	159	~327	12	305	98
Queue Length 95th (ft)	#263	248	#510	46	#544	159
Internal Link Dist (ft)		2424	63		1281	84
Turn Bay Length (ft)	25			50		
Base Capacity (vph)	176	677	390	629	735	829
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.19	0.58	1.27	0.19	0.93	0.38

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Build PM

HCM Unsignalized Intersection Capacity Analysis
3: High Plain Rd & Beacon St

01/17/2020

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Volume (veh/h)	9	100	461	9	116	498
Future Volume (Veh/h)	9	100	461	9	116	498
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	10	109	501	10	126	541
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1299	506			511	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1299	506			511	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	94	81			88	
cM capacity (veh/h)	157	566			1054	

Direction, Lane #	EB 1	SE 1	NW 1
Volume Total	119	511	667
Volume Left	10	0	126
Volume Right	109	10	0
cSH	464	1700	1054
Volume to Capacity	0.26	0.30	0.12
Queue Length 95th (ft)	25	0	10
Control Delay (s)	15.4	0.0	2.9
Lane LOS	C		A
Approach Delay (s)	15.4	0.0	2.9
Approach LOS	C		

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	74.1%	ICU Level of Service	D
Analysis Period (min)	15		

Build PM

HCM Unsignalized Intersection Capacity Analysis
9: Beacon St & South Driveway

01/17/2020

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Volume (veh/h)	31	120	378	7	37	451
Future Volume (Veh/h)	31	120	378	7	37	451
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	34	130	411	8	40	490
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	985	415			419	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	985	415			419	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	87	80			96	
cM capacity (veh/h)	265	637			1140	

Direction, Lane #	EB 1	SE 1	NW 1
Volume Total	164	419	530
Volume Left	34	0	40
Volume Right	130	8	0
cSH	494	1700	1140
Volume to Capacity	0.33	0.25	0.04
Queue Length 95th (ft)	36	0	3
Control Delay (s)	15.9	0.0	1.0
Lane LOS	C		A
Approach Delay (s)	15.9	0.0	1.0
Approach LOS	C		

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	65.2%	ICU Level of Service	C
Analysis Period (min)	15		

Build PM

HCM Unsignalized Intersection Capacity Analysis
11: Mid Driveway

01/17/2020



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	15	46	0	482	350	0
Future Volume (Veh/h)	15	46	0	482	350	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	50	0	524	380	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	904	380	380			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	904	380	380			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	95	93	100			
cM capacity (veh/h)	307	667	1178			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	66	524	380
Volume Left	16	0	0
Volume Right	50	0	0
cSH	520	1178	1700
Volume to Capacity	0.13	0.00	0.22
Queue Length 95th (ft)	11	0	0
Control Delay (s)	12.9	0.0	0.0
Lane LOS	B		
Approach Delay (s)	12.9	0.0	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	35.7%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
13: North Driveway & Beacon St

Build PM

01/17/2020



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	29	72	22	466	278	0
Future Volume (Veh/h)	29	72	22	466	278	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	32	78	24	507	302	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	857	302	302			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	857	302	302			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	90	89	98			
cM capacity (veh/h)	321	738	1259			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	110	531	302
Volume Left	32	24	0
Volume Right	78	0	0
cSH	536	1259	1700
Volume to Capacity	0.21	0.02	0.18
Queue Length 95th (ft)	19	1	0
Control Delay (s)	13.4	0.6	0.0
Lane LOS	B	A	
Approach Delay (s)	13.4	0.6	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	55.1%	ICU Level of Service	B
Analysis Period (min)	15		



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	23	21	472	33	18	249
Future Volume (Veh/h)	23	21	472	33	18	249
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	25	23	513	36	20	271
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	842	531			549	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	842	531			549	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	92	96			98	
cM capacity (veh/h)	328	548			1021	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	48	549	291
Volume Left	25	0	20
Volume Right	23	36	0
cSH	406	1700	1021
Volume to Capacity	0.12	0.32	0.02
Queue Length 95th (ft)	10	0	1
Control Delay (s)	15.0	0.0	0.8
Lane LOS	C		A
Approach Delay (s)	15.0	0.0	0.8
Approach LOS	C		

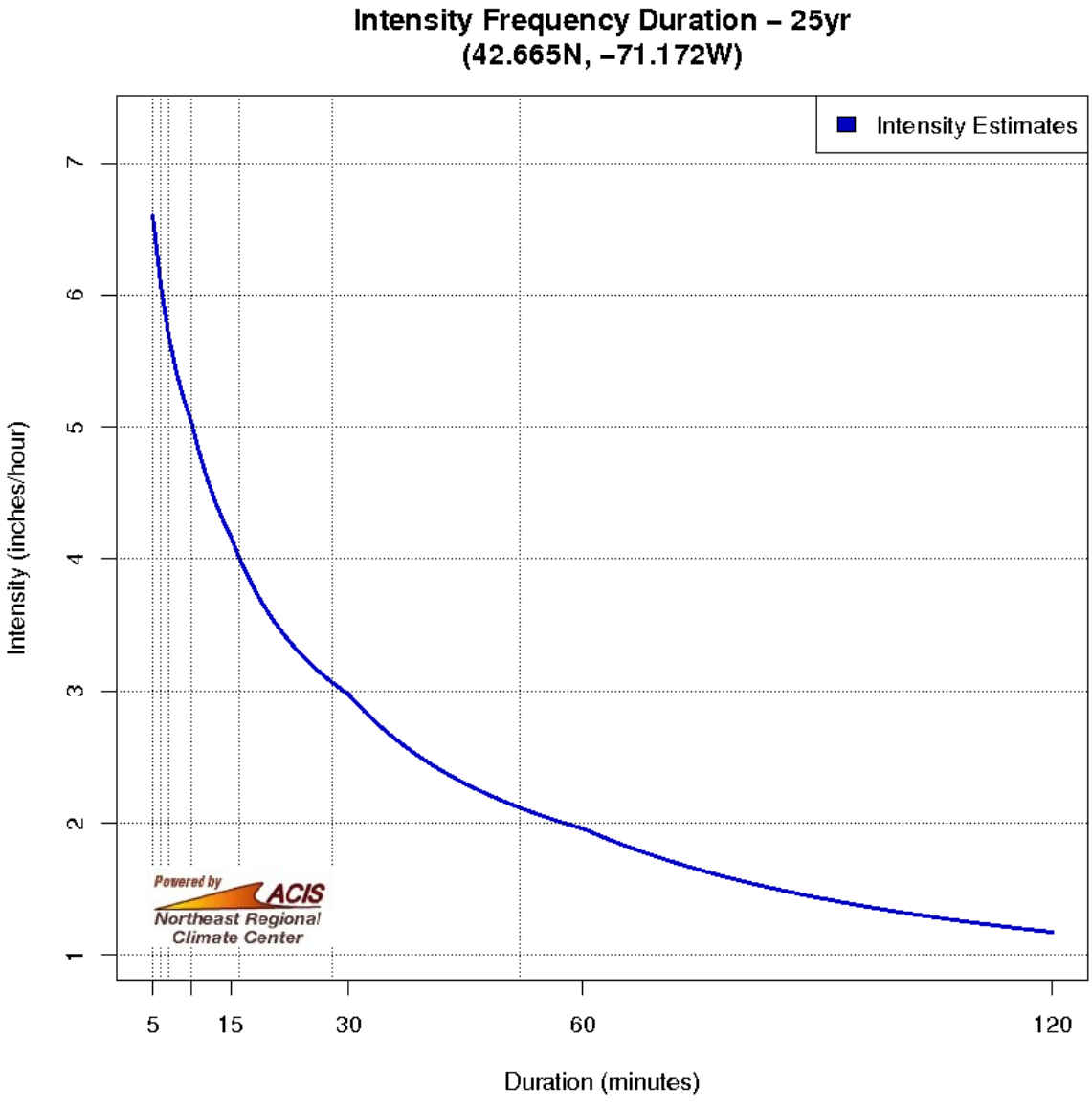
Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	37.9%	ICU Level of Service	A
Analysis Period (min)	15		

Build PM

Movement	NBT	NBR	SBL	SBT	SWL	SWR
Lane Configurations						
Traffic Volume (veh/h)	281	212	8	195	73	5
Future Volume (Veh/h)	281	212	8	195	73	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	305	230	9	212	79	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			535		650	420
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			535		650	420
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		82	99
cM capacity (veh/h)			1033		430	633

Direction, Lane #	NB 1	SB 1	SW 1
Volume Total	535	221	84
Volume Left	0	9	79
Volume Right	230	0	5
cSH	1700	1033	438
Volume to Capacity	0.31	0.01	0.19
Queue Length 95th (ft)	0	1	18
Control Delay (s)	0.0	0.4	15.1
Lane LOS		A	C
Approach Delay (s)	0.0	0.4	15.1
Approach LOS			C

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	38.8%	ICU Level of Service	A
Analysis Period (min)	15		



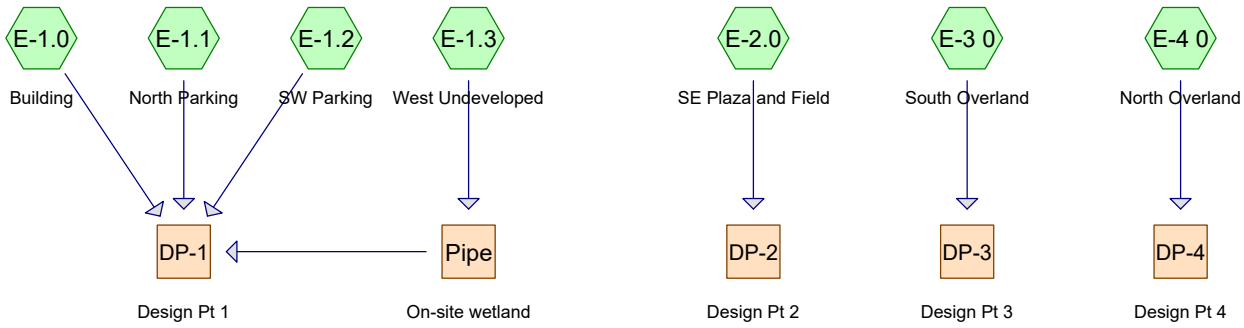
Time (mins)	Intensity (in/hr)
5	6.60
6*	6.08
7*	5.70
8*	5.42
9*	5.20
10	5.03
11*	4.79
12*	4.60
13*	4.43
14*	4.29
15	4.17
16*	4.02
17*	3.89
18*	3.77
19*	3.67
20*	3.57
21*	3.49
22*	3.41
23*	3.34

24*	3.28
25*	3.22
26*	3.16
27*	3.11
28*	3.06
29*	3.02
30	2.98
31*	2.91
32*	2.85
33*	2.79
34*	2.74
35*	2.69
36*	2.64
37*	2.59
38*	2.55
39*	2.51
40*	2.47
41*	2.43
42*	2.40
43*	2.36
44*	2.33
45*	2.30
46*	2.27
47*	2.24
48*	2.21
49*	2.19
50*	2.16
51*	2.14
52*	2.12
53*	2.09
54*	2.07
55*	2.05
56*	2.03
57*	2.01
58*	1.99
59*	1.98
60	1.96
61*	1.93
62*	1.91
63*	1.88
64*	1.86
65*	1.84
66*	1.82
67*	1.80
68*	1.77
69*	1.75
70*	1.74
71*	1.72
72*	1.70
73*	1.68
74*	1.66
75*	1.65
76*	1.63
77*	1.61
78*	1.60
79*	1.58
80*	1.57
81*	1.55
82*	1.54
83*	1.52
84*	1.51
85*	1.50
86*	1.49
87*	1.47
88*	1.46

89*	1.45
90*	1.44
91*	1.43
92*	1.41
93*	1.40
94*	1.39
95*	1.38
96*	1.37
97*	1.36
98*	1.35
99*	1.34
100*	1.33
101*	1.32
102*	1.31
103*	1.30
104*	1.30
105*	1.29
106*	1.28
107*	1.27
108*	1.26
109*	1.25
110*	1.25
111*	1.24
112*	1.23
113*	1.22
114*	1.22
115*	1.21
116*	1.20
117*	1.20
118*	1.19
119*	1.18
120	1.18

*values for noted rows are calculated estimates

Appendix C: Stormwater Calculations



Subcat Reach Pond Link

Routing Diagram for Ex HydroCAD
Prepared by SMMA, Printed 12/3/2021
HydroCAD® 10.00-20 s/n 00853 © 2017 HydroCAD Software Solutions LLC

Summary for Subcatchment E-1.0: Building

Runoff = 9.41 cfs @ 11.96 hrs, Volume= 19,115 cf, Depth= 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

	Area (sf)	CN	Description
	90,252	98	Roofs, HSG A
	13,893	39	>75% Grass cover, Good, HSG A
*	4,885	98	Courtyard pavement, HSG A
	109,030	90	Weighted Average
	13,893		12.74% Pervious Area
	95,137		87.26% Impervious Area

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

Summary for Subcatchment E-1.1: North Parking

Runoff = 6.58 cfs @ 11.96 hrs, Volume= 12,849 cf, Depth= 1.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

Area (sf)	CN	Description
76,386	98	Paved parking, HSG A
27,655	39	>75% Grass cover, Good, HSG A
104,041	82	Weighted Average
27,655		26.58% Pervious Area
76,386		73.42% Impervious Area

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

Summary for Subcatchment E-1.2: SW Parking

Runoff = 1.06 cfs @ 12.15 hrs, Volume= 6,065 cf, Depth= 0.32"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

Area (sf)	CN	Description
52,808	98	Paved parking, HSG A
38,067	55	Woods, Good, HSG B
6,686	98	Paved parking, HSG B
16,333	61	>75% Grass cover, Good, HSG B
113,271	39	>75% Grass cover, Good, HSG A
2,453	30	Woods, Good, HSG A
229,618	58	Weighted Average
170,124		74.09% Pervious Area
59,494		25.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	50	0.1200	0.14		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.13"
0.6	94	0.1380	2.60		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
6.4	306	0.0130	0.80		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.9	87	0.0480	1.53		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
0.2	108	0.0200	9.93	17.56	**Pipe Channel, E-F** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011 Concrete pipe, straight & clean
0.5	121	0.0030	3.85	6.80	**Pipe Channel, F-G** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011 Concrete pipe, straight & clean
0.6	211	0.0075	6.08	10.75	**Pipe Channel, G-H** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011 Concrete pipe, straight & clean
0.7	307	0.0130	7.09	8.70	**Pipe Channel, H-I** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011 Concrete pipe, straight & clean
0.9	237	0.0067	4.39	3.45	**Pipe Channel, I-J** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
16.9	1,521	Total			

Summary for Subcatchment E-1.3: West Undeveloped

Runoff = 0.02 cfs @ 18.04 hrs, Volume= 807 cf, Depth= 0.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

	Area (sf)	CN	Description
	43,314	55	Woods, Good, HSG B
	39,857	30	Woods, Good, HSG A
	11,479	98	Paved parking, HSG A
*	2,248	98	Sidewalk, HSG B
	18,541	61	>75% Grass cover, Good, HSG B
	150,447	39	>75% Grass cover, Good, HSG A
	265,886	45	Weighted Average
	252,159		94.84% Pervious Area
	13,727		5.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.0900	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.13"
0.6	99	0.1630	2.83		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
4.4	151	0.0066	0.57		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
7.2	233	0.0060	0.54		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
3.4	241	0.0560	1.18		**Shallow Concentrated Flow, E-F** Woodland Kv= 5.0 fps
22.4	774	Total			

Summary for Subcatchment E-2.0: SE Plaza and Field

Runoff = 0.60 cfs @ 12.10 hrs, Volume= 3,250 cf, Depth= 0.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

Area (sf)	CN	Description
41,442	98	Paved parking, HSG A
94,569	39	>75% Grass cover, Good, HSG A
136,011	57	Weighted Average
94,569		69.53% Pervious Area
41,442		30.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	50	0.0250	0.16		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.13"
4.5	240	0.0160	0.89		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
3.2	260	0.0380	1.36		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.1	21	0.0470	4.40		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
13.0	571	Total			

Summary for Subcatchment E-3 0: South Overland

Runoff = 0.08 cfs @ 12.12 hrs, Volume= 789 cf, Depth= 0.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

Area (sf)	CN	Description
641	98	Paved parking, HSG B
8,730	61	>75% Grass cover, Good, HSG B
10,636	55	Woods, Good, HSG B
7,337	98	Paved parking, HSG A
11,917	30	Woods, Good, HSG A
13,357	39	>75% Grass cover, Good, HSG A
52,618	53	Weighted Average
44,640		84.84% Pervious Area
7,978		15.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0400	0.09		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.13"
1.8	162	0.0860	1.47		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
11.3	212	Total			

Summary for Subcatchment E-4 0: North Overland

Runoff = 0.00 cfs @ 14.95 hrs, Volume= 120 cf, Depth= 0.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

Area (sf)	CN	Description
3,001	98	Paved parking, HSG A
6,531	30	Woods, Good, HSG A
1,458	61	>75% Grass cover, Good, HSG B
2,093	55	Woods, Good, HSG B
9,856	39	>75% Grass cover, Good, HSG A
22,939	47	Weighted Average
19,938		86.92% Pervious Area
3,001		13.08% Impervious Area

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

Summary for Reach DP-1: Design Pt 1

Inflow Area = 708,575 sf, 34.54% Impervious, Inflow Depth = 0.66" for 2-yr event
Inflow = 16.09 cfs @ 11.96 hrs, Volume= 38,836 cf
Outflow = 16.09 cfs @ 11.96 hrs, Volume= 38,836 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-2: Design Pt 2

Inflow Area = 136,011 sf, 30.47% Impervious, Inflow Depth = 0.29" for 2-yr event
Inflow = 0.60 cfs @ 12.10 hrs, Volume= 3,250 cf
Outflow = 0.60 cfs @ 12.10 hrs, Volume= 3,250 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-3: Design Pt 3

Inflow Area = 52,618 sf, 15.16% Impervious, Inflow Depth = 0.18" for 2-yr event
Inflow = 0.08 cfs @ 12.12 hrs, Volume= 789 cf
Outflow = 0.08 cfs @ 12.12 hrs, Volume= 789 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-4: Design Pt 4

Inflow Area = 22,939 sf, 13.08% Impervious, Inflow Depth = 0.06" for 2-yr event
Inflow = 0.00 cfs @ 14.95 hrs, Volume= 120 cf
Outflow = 0.00 cfs @ 14.95 hrs, Volume= 120 cf, Atten= 0%, Lag= 0.0 min

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

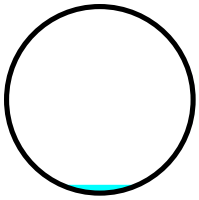
Summary for Reach Pipe: On-site wetland

Inflow Area = 265,886 sf, 5.16% Impervious, Inflow Depth = 0.04" for 2-yr event
Inflow = 0.02 cfs @ 18.04 hrs, Volume= 807 cf
Outflow = 0.02 cfs @ 18.32 hrs, Volume= 807 cf, Atten= 0%, Lag= 16.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.19 fps, Min. Travel Time= 10.1 min
Avg. Velocity = 1.02 fps, Avg. Travel Time= 11.8 min

Peak Storage= 14 cf @ 18.16 hrs
Average Depth at Peak Storage= 0.06'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 6.02 cfs

15.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 725.0' Slope= 0.0087 '/'
Inlet Invert= 149.30', Outlet Invert= 143.00'



Summary for Subcatchment E-1.0: Building

Runoff = 16.54 cfs @ 11.96 hrs, Volume= 34,869 cf, Depth= 3.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

	Area (sf)	CN	Description
	90,252	98	Roofs, HSG A
	13,893	39	>75% Grass cover, Good, HSG A
*	4,885	98	Courtyard pavement, HSG A
	109,030	90	Weighted Average
	13,893		12.74% Pervious Area
	95,137		87.26% Impervious Area

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

Summary for Subcatchment E-1.1: North Parking

Runoff = 13.20 cfs @ 11.96 hrs, Volume= 26,386 cf, Depth= 3.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

Area (sf)	CN	Description
76,386	98	Paved parking, HSG A
27,655	39	>75% Grass cover, Good, HSG A
104,041	82	Weighted Average
27,655		26.58% Pervious Area
76,386		73.42% Impervious Area

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

Summary for Subcatchment E-1.2: SW Parking

Runoff = 6.48 cfs @ 12.11 hrs, Volume= 21,945 cf, Depth= 1.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

Area (sf)	CN	Description
52,808	98	Paved parking, HSG A
38,067	55	Woods, Good, HSG B
6,686	98	Paved parking, HSG B
16,333	61	>75% Grass cover, Good, HSG B
113,271	39	>75% Grass cover, Good, HSG A
2,453	30	Woods, Good, HSG A
229,618	58	Weighted Average
170,124		74.09% Pervious Area
59,494		25.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	50	0.1200	0.14		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.13"
0.6	94	0.1380	2.60		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
6.4	306	0.0130	0.80		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.9	87	0.0480	1.53		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
0.2	108	0.0200	9.93	17.56	**Pipe Channel, E-F** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011 Concrete pipe, straight & clean
0.5	121	0.0030	3.85	6.80	**Pipe Channel, F-G** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011 Concrete pipe, straight & clean
0.6	211	0.0075	6.08	10.75	**Pipe Channel, G-H** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011 Concrete pipe, straight & clean
0.7	307	0.0130	7.09	8.70	**Pipe Channel, H-I** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011 Concrete pipe, straight & clean
0.9	237	0.0067	4.39	3.45	**Pipe Channel, I-J** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
16.9	1,521	Total			

Summary for Subcatchment E-1.3: West Undeveloped

Runoff = 1.15 cfs @ 12.25 hrs, Volume= 9,514 cf, Depth= 0.43"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

	Area (sf)	CN	Description
	43,314	55	Woods, Good, HSG B
	39,857	30	Woods, Good, HSG A
	11,479	98	Paved parking, HSG A
*	2,248	98	Sidewalk, HSG B
	18,541	61	>75% Grass cover, Good, HSG B
	150,447	39	>75% Grass cover, Good, HSG A
	265,886	45	Weighted Average
	252,159		94.84% Pervious Area
	13,727		5.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.0900	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.13"
0.6	99	0.1630	2.83		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
4.4	151	0.0066	0.57		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
7.2	233	0.0060	0.54		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
3.4	241	0.0560	1.18		**Shallow Concentrated Flow, E-F** Woodland Kv= 5.0 fps
22.4	774	Total			

Summary for Subcatchment E-2.0: SE Plaza and Field

Runoff = 4.14 cfs @ 12.07 hrs, Volume= 12,278 cf, Depth= 1.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

Area (sf)	CN	Description
41,442	98	Paved parking, HSG A
94,569	39	>75% Grass cover, Good, HSG A
136,011	57	Weighted Average
94,569		69.53% Pervious Area
41,442		30.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	50	0.0250	0.16		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.13"
4.5	240	0.0160	0.89		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
3.2	260	0.0380	1.36		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.1	21	0.0470	4.40		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
13.0	571	Total			

Summary for Subcatchment E-3 0: South Overland

Runoff = 1.21 cfs @ 12.06 hrs, Volume= 3,693 cf, Depth= 0.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

Area (sf)	CN	Description
641	98	Paved parking, HSG B
8,730	61	>75% Grass cover, Good, HSG B
10,636	55	Woods, Good, HSG B
7,337	98	Paved parking, HSG A
11,917	30	Woods, Good, HSG A
13,357	39	>75% Grass cover, Good, HSG A
52,618	53	Weighted Average
44,640		84.84% Pervious Area
7,978		15.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0400	0.09		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.13"
1.8	162	0.0860	1.47		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
11.3	212	Total			

Summary for Subcatchment E-4 0: North Overland

Runoff = 0.35 cfs @ 11.99 hrs, Volume= 1,000 cf, Depth= 0.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

Area (sf)	CN	Description
3,001	98	Paved parking, HSG A
6,531	30	Woods, Good, HSG A
1,458	61	>75% Grass cover, Good, HSG B
2,093	55	Woods, Good, HSG B
9,856	39	>75% Grass cover, Good, HSG A
22,939	47	Weighted Average
19,938		86.92% Pervious Area
3,001		13.08% Impervious Area

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

Summary for Reach DP-1: Design Pt 1

Inflow Area = 708,575 sf, 34.54% Impervious, Inflow Depth = 1.57" for 10-yr event
Inflow = 32.37 cfs @ 11.96 hrs, Volume= 92,713 cf
Outflow = 32.37 cfs @ 11.96 hrs, Volume= 92,713 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-2: Design Pt 2

Inflow Area = 136,011 sf, 30.47% Impervious, Inflow Depth = 1.08" for 10-yr event
Inflow = 4.14 cfs @ 12.07 hrs, Volume= 12,278 cf
Outflow = 4.14 cfs @ 12.07 hrs, Volume= 12,278 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-3: Design Pt 3

Inflow Area = 52,618 sf, 15.16% Impervious, Inflow Depth = 0.84" for 10-yr event
Inflow = 1.21 cfs @ 12.06 hrs, Volume= 3,693 cf
Outflow = 1.21 cfs @ 12.06 hrs, Volume= 3,693 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-4: Design Pt 4

Inflow Area = 22,939 sf, 13.08% Impervious, Inflow Depth = 0.52" for 10-yr event
Inflow = 0.35 cfs @ 11.99 hrs, Volume= 1,000 cf
Outflow = 0.35 cfs @ 11.99 hrs, Volume= 1,000 cf, Atten= 0%, Lag= 0.0 min

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

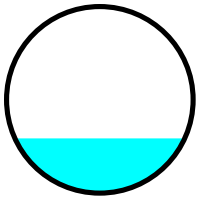
Summary for Reach Pipe: On-site wetland

Inflow Area = 265,886 sf, 5.16% Impervious, Inflow Depth = 0.43" for 10-yr event
Inflow = 1.15 cfs @ 12.25 hrs, Volume= 9,514 cf
Outflow = 1.12 cfs @ 12.35 hrs, Volume= 9,514 cf, Atten= 3%, Lag= 5.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.76 fps, Min. Travel Time= 3.2 min
Avg. Velocity = 1.94 fps, Avg. Travel Time= 6.2 min

Peak Storage= 217 cf @ 12.30 hrs
Average Depth at Peak Storage= 0.37'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 6.02 cfs

15.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 725.0' Slope= 0.0087 '/'
Inlet Invert= 149.30', Outlet Invert= 143.00'



Summary for Subcatchment E-1.0: Building

Runoff = 20.94 cfs @ 11.96 hrs, Volume= 44,914 cf, Depth= 4.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

	Area (sf)	CN	Description
	90,252	98	Roofs, HSG A
	13,893	39	>75% Grass cover, Good, HSG A
*	4,885	98	Courtyard pavement, HSG A
	109,030	90	Weighted Average
	13,893		12.74% Pervious Area
	95,137		87.26% Impervious Area

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

Summary for Subcatchment E-1.1: North Parking

Runoff = 17.44 cfs @ 11.96 hrs, Volume= 35,367 cf, Depth= 4.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

Area (sf)	CN	Description
76,386	98	Paved parking, HSG A
27,655	39	>75% Grass cover, Good, HSG A
104,041	82	Weighted Average
27,655		26.58% Pervious Area
76,386		73.42% Impervious Area

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

Summary for Subcatchment E-1.2: SW Parking

Runoff = 11.02 cfs @ 12.11 hrs, Volume= 34,814 cf, Depth= 1.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

Area (sf)	CN	Description
52,808	98	Paved parking, HSG A
38,067	55	Woods, Good, HSG B
6,686	98	Paved parking, HSG B
16,333	61	>75% Grass cover, Good, HSG B
113,271	39	>75% Grass cover, Good, HSG A
2,453	30	Woods, Good, HSG A
229,618	58	Weighted Average
170,124		74.09% Pervious Area
59,494		25.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	50	0.1200	0.14		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.13"
0.6	94	0.1380	2.60		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
6.4	306	0.0130	0.80		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.9	87	0.0480	1.53		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
0.2	108	0.0200	9.93	17.56	**Pipe Channel, E-F** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011 Concrete pipe, straight & clean
0.5	121	0.0030	3.85	6.80	**Pipe Channel, F-G** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011 Concrete pipe, straight & clean
0.6	211	0.0075	6.08	10.75	**Pipe Channel, G-H** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011 Concrete pipe, straight & clean
0.7	307	0.0130	7.09	8.70	**Pipe Channel, H-I** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011 Concrete pipe, straight & clean
0.9	237	0.0067	4.39	3.45	**Pipe Channel, I-J** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
16.9	1,521	Total			

Summary for Subcatchment E-1.3: West Undeveloped

Runoff = 3.48 cfs @ 12.22 hrs, Volume= 18,648 cf, Depth= 0.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

	Area (sf)	CN	Description
	43,314	55	Woods, Good, HSG B
	39,857	30	Woods, Good, HSG A
	11,479	98	Paved parking, HSG A
*	2,248	98	Sidewalk, HSG B
	18,541	61	>75% Grass cover, Good, HSG B
	150,447	39	>75% Grass cover, Good, HSG A
	265,886	45	Weighted Average
	252,159		94.84% Pervious Area
	13,727		5.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.0900	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.13"
0.6	99	0.1630	2.83		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
4.4	151	0.0066	0.57		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
7.2	233	0.0060	0.54		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
3.4	241	0.0560	1.18		**Shallow Concentrated Flow, E-F** Woodland Kv= 5.0 fps
22.4	774	Total			

Summary for Subcatchment E-2.0: SE Plaza and Field

Runoff = 7.12 cfs @ 12.06 hrs, Volume= 19,688 cf, Depth= 1.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

Area (sf)	CN	Description
41,442	98	Paved parking, HSG A
94,569	39	>75% Grass cover, Good, HSG A
136,011	57	Weighted Average
94,569		69.53% Pervious Area
41,442		30.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	50	0.0250	0.16		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.13"
4.5	240	0.0160	0.89		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
3.2	260	0.0380	1.36		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.1	21	0.0470	4.40		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
13.0	571	Total			

Summary for Subcatchment E-3 0: South Overland

Runoff = 2.30 cfs @ 12.05 hrs, Volume= 6,220 cf, Depth= 1.42"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

Area (sf)	CN	Description
641	98	Paved parking, HSG B
8,730	61	>75% Grass cover, Good, HSG B
10,636	55	Woods, Good, HSG B
7,337	98	Paved parking, HSG A
11,917	30	Woods, Good, HSG A
13,357	39	>75% Grass cover, Good, HSG A
52,618	53	Weighted Average
44,640		84.84% Pervious Area
7,978		15.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0400	0.09		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.13"
1.8	162	0.0860	1.47		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
11.3	212	Total			

Summary for Subcatchment E-4 0: North Overland

Runoff = 0.82 cfs @ 11.98 hrs, Volume= 1,869 cf, Depth= 0.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

Area (sf)	CN	Description
3,001	98	Paved parking, HSG A
6,531	30	Woods, Good, HSG A
1,458	61	>75% Grass cover, Good, HSG B
2,093	55	Woods, Good, HSG B
9,856	39	>75% Grass cover, Good, HSG A
22,939	47	Weighted Average
19,938		86.92% Pervious Area
3,001		13.08% Impervious Area

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

Summary for Reach DP-1: Design Pt 1

Inflow Area = 708,575 sf, 34.54% Impervious, Inflow Depth = 2.26" for 25-yr event
Inflow = 43.74 cfs @ 11.96 hrs, Volume= 133,743 cf
Outflow = 43.74 cfs @ 11.96 hrs, Volume= 133,743 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-2: Design Pt 2

Inflow Area = 136,011 sf, 30.47% Impervious, Inflow Depth = 1.74" for 25-yr event
Inflow = 7.12 cfs @ 12.06 hrs, Volume= 19,688 cf
Outflow = 7.12 cfs @ 12.06 hrs, Volume= 19,688 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-3: Design Pt 3

Inflow Area = 52,618 sf, 15.16% Impervious, Inflow Depth = 1.42" for 25-yr event
Inflow = 2.30 cfs @ 12.05 hrs, Volume= 6,220 cf
Outflow = 2.30 cfs @ 12.05 hrs, Volume= 6,220 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-4: Design Pt 4

Inflow Area = 22,939 sf, 13.08% Impervious, Inflow Depth = 0.98" for 25-yr event
Inflow = 0.82 cfs @ 11.98 hrs, Volume= 1,869 cf
Outflow = 0.82 cfs @ 11.98 hrs, Volume= 1,869 cf, Atten= 0%, Lag= 0.0 min

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

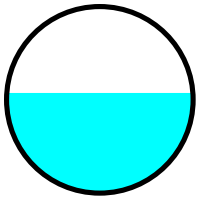
Summary for Reach Pipe: On-site wetland

Inflow Area = 265,886 sf, 5.16% Impervious, Inflow Depth = 0.84" for 25-yr event
Inflow = 3.48 cfs @ 12.22 hrs, Volume= 18,648 cf
Outflow = 3.40 cfs @ 12.28 hrs, Volume= 18,648 cf, Atten= 2%, Lag= 4.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.06 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 2.28 fps, Avg. Travel Time= 5.3 min

Peak Storage= 488 cf @ 12.24 hrs
Average Depth at Peak Storage= 0.67'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 6.02 cfs

15.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 725.0' Slope= 0.0087 '/'
Inlet Invert= 149.30', Outlet Invert= 143.00'



Summary for Subcatchment E-1.0: Building

Runoff = 27.64 cfs @ 11.96 hrs, Volume= 60,493 cf, Depth= 6.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

	Area (sf)	CN	Description
	90,252	98	Roofs, HSG A
	13,893	39	>75% Grass cover, Good, HSG A
*	4,885	98	Courtyard pavement, HSG A
	109,030	90	Weighted Average
	13,893		12.74% Pervious Area
	95,137		87.26% Impervious Area

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

Summary for Subcatchment E-1.1: North Parking

Runoff = 23.95 cfs @ 11.96 hrs, Volume= 49,571 cf, Depth= 5.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

Area (sf)	CN	Description
76,386	98	Paved parking, HSG A
27,655	39	>75% Grass cover, Good, HSG A
104,041	82	Weighted Average
27,655		26.58% Pervious Area
76,386		73.42% Impervious Area

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

Summary for Subcatchment E-1.2: SW Parking

Runoff = 18.92 cfs @ 12.10 hrs, Volume= 57,478 cf, Depth= 3.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

Area (sf)	CN	Description
52,808	98	Paved parking, HSG A
38,067	55	Woods, Good, HSG B
6,686	98	Paved parking, HSG B
16,333	61	>75% Grass cover, Good, HSG B
113,271	39	>75% Grass cover, Good, HSG A
2,453	30	Woods, Good, HSG A
229,618	58	Weighted Average
170,124		74.09% Pervious Area
59,494		25.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	50	0.1200	0.14		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.13"
0.6	94	0.1380	2.60		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
6.4	306	0.0130	0.80		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.9	87	0.0480	1.53		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
0.2	108	0.0200	9.93	17.56	**Pipe Channel, E-F** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011 Concrete pipe, straight & clean
0.5	121	0.0030	3.85	6.80	**Pipe Channel, F-G** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011 Concrete pipe, straight & clean
0.6	211	0.0075	6.08	10.75	**Pipe Channel, G-H** 18.0" Round Area= 1.8 sf Perim= 4.7' r= 0.38' n= 0.011 Concrete pipe, straight & clean
0.7	307	0.0130	7.09	8.70	**Pipe Channel, H-I** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.011 Concrete pipe, straight & clean
0.9	237	0.0067	4.39	3.45	**Pipe Channel, I-J** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.011 Concrete pipe, straight & clean
16.9	1,521	Total			

Summary for Subcatchment E-1.3: West Undeveloped

Runoff = 8.68 cfs @ 12.18 hrs, Volume= 36,728 cf, Depth= 1.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

	Area (sf)	CN	Description
	43,314	55	Woods, Good, HSG B
	39,857	30	Woods, Good, HSG A
	11,479	98	Paved parking, HSG A
*	2,248	98	Sidewalk, HSG B
	18,541	61	>75% Grass cover, Good, HSG B
	150,447	39	>75% Grass cover, Good, HSG A
	265,886	45	Weighted Average
	252,159		94.84% Pervious Area
	13,727		5.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.0900	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.13"
0.6	99	0.1630	2.83		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
4.4	151	0.0066	0.57		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
7.2	233	0.0060	0.54		**Shallow Concentrated Flow, D-E** Short Grass Pasture Kv= 7.0 fps
3.4	241	0.0560	1.18		**Shallow Concentrated Flow, E-F** Woodland Kv= 5.0 fps
22.4	774	Total			

Summary for Subcatchment E-2.0: SE Plaza and Field

Runoff = 12.34 cfs @ 12.06 hrs, Volume= 32,824 cf, Depth= 2.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

Area (sf)	CN	Description
41,442	98	Paved parking, HSG A
94,569	39	>75% Grass cover, Good, HSG A
136,011	57	Weighted Average
94,569		69.53% Pervious Area
41,442		30.47% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.2	50	0.0250	0.16		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.13"
4.5	240	0.0160	0.89		**Shallow Concentrated Flow, B-C** Short Grass Pasture Kv= 7.0 fps
3.2	260	0.0380	1.36		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
0.1	21	0.0470	4.40		**Shallow Concentrated Flow, D-E** Paved Kv= 20.3 fps
13.0	571	Total			

Summary for Subcatchment E-3 0: South Overland

Runoff = 4.26 cfs @ 12.04 hrs, Volume= 10,834 cf, Depth= 2.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

Area (sf)	CN	Description
641	98	Paved parking, HSG B
8,730	61	>75% Grass cover, Good, HSG B
10,636	55	Woods, Good, HSG B
7,337	98	Paved parking, HSG A
11,917	30	Woods, Good, HSG A
13,357	39	>75% Grass cover, Good, HSG A
52,618	53	Weighted Average
44,640		84.84% Pervious Area
7,978		15.16% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0400	0.09		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.13"
1.8	162	0.0860	1.47		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
11.3	212	Total			

Summary for Subcatchment E-4 0: North Overland

Runoff = 1.74 cfs @ 11.97 hrs, Volume= 3,546 cf, Depth= 1.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

Area (sf)	CN	Description
3,001	98	Paved parking, HSG A
6,531	30	Woods, Good, HSG A
1,458	61	>75% Grass cover, Good, HSG B
2,093	55	Woods, Good, HSG B
9,856	39	>75% Grass cover, Good, HSG A
22,939	47	Weighted Average
19,938		86.92% Pervious Area
3,001		13.08% Impervious Area

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

Summary for Reach DP-1: Design Pt 1

Inflow Area = 708,575 sf, 34.54% Impervious, Inflow Depth = 3.46" for 100-yr event
Inflow = 62.54 cfs @ 11.97 hrs, Volume= 204,270 cf
Outflow = 62.54 cfs @ 11.97 hrs, Volume= 204,270 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-2: Design Pt 2

Inflow Area = 136,011 sf, 30.47% Impervious, Inflow Depth = 2.90" for 100-yr event
Inflow = 12.34 cfs @ 12.06 hrs, Volume= 32,824 cf
Outflow = 12.34 cfs @ 12.06 hrs, Volume= 32,824 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-3: Design Pt 3

Inflow Area = 52,618 sf, 15.16% Impervious, Inflow Depth = 2.47" for 100-yr event
Inflow = 4.26 cfs @ 12.04 hrs, Volume= 10,834 cf
Outflow = 4.26 cfs @ 12.04 hrs, Volume= 10,834 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-4: Design Pt 4

Inflow Area = 22,939 sf, 13.08% Impervious, Inflow Depth = 1.86" for 100-yr event
Inflow = 1.74 cfs @ 11.97 hrs, Volume= 3,546 cf
Outflow = 1.74 cfs @ 11.97 hrs, Volume= 3,546 cf, Atten= 0%, Lag= 0.0 min

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

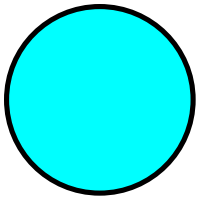
Summary for Reach Pipe: On-site wetland

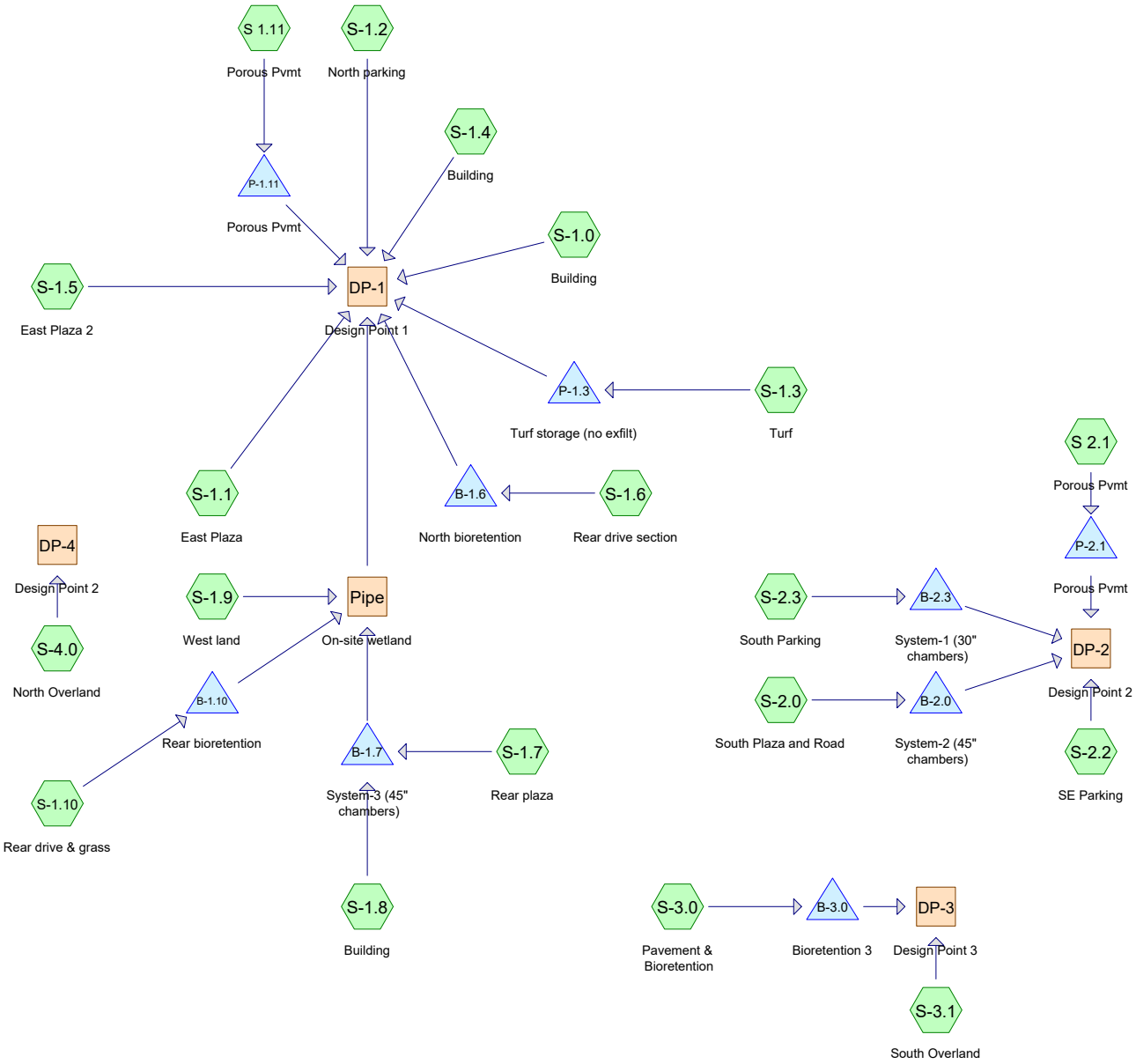
Inflow Area = 265,886 sf, 5.16% Impervious, Inflow Depth = 1.66" for 100-yr event
Inflow = 8.68 cfs @ 12.18 hrs, Volume= 36,728 cf
Outflow = 6.38 cfs @ 12.15 hrs, Volume= 36,728 cf, Atten= 27%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.59 fps, Min. Travel Time= 2.2 min
Avg. Velocity = 2.64 fps, Avg. Travel Time= 4.6 min

Peak Storage= 890 cf @ 12.13 hrs
Average Depth at Peak Storage= 1.25'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 6.02 cfs

15.0" Round Pipe
n= 0.013 Concrete pipe, bends & connections
Length= 725.0' Slope= 0.0087 '/'
Inlet Invert= 149.30', Outlet Invert= 143.00'





Routing Diagram for Pr HydroCAD
Prepared by SMMA, Printed 12/3/2021
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Summary for Subcatchment S 1.11: Porous Pvmt

Runoff = 0.79 cfs @ 13.11 hrs, Volume= 8,261 cf, Depth= 2.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

	Area (sf)	CN	Description
*	34,965	98	Porous pavement, HSG A
	602	39	>75% Grass cover, Good, HSG A
	35,567	97	Weighted Average
	602		1.69% Pervious Area
	34,965		98.31% Impervious Area

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

Summary for Subcatchment S 2.1: Porous Pvmt

Runoff = 0.52 cfs @ 13.11 hrs, Volume= 5,168 cf, Depth= 2.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

	Area (sf)	CN	Description
*	24,343	98	Porous pavement, HSG A
	2,805	39	>75% Grass cover, Good, HSG A
	27,148	92	Weighted Average
	2,805		10.33% Pervious Area
	24,343		89.67% Impervious Area

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

Summary for Subcatchment S-1.0: Building

Runoff = 4.11 cfs @ 11.96 hrs, Volume= 9,477 cf, Depth= 2.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

Area (sf)	CN	Description
39,244	98	Roofs, HSG A
39,244		100.00% Impervious Area

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

Summary for Subcatchment S-1.1: East Plaza

Runoff = 2.76 cfs @ 11.96 hrs, Volume= 5,779 cf, Depth= 2.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

Area (sf)	CN	Description
2,403	39	>75% Grass cover, Good, HSG A
26,753	98	Unconnected pavement, HSG A
29,156	93	Weighted Average
2,403		8.24% Pervious Area
26,753		91.76% Impervious Area
26,753		100.00% Unconnected

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

Summary for Subcatchment S-1.10: Rear drive & grass

Runoff = 0.00 cfs @ 15.45 hrs, Volume= 121 cf, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

Area (sf)	CN	Adj	Description
7,399	98		Unconnected pavement, HSG A
22,304	39		>75% Grass cover, Good, HSG A
29,703	54	46	Weighted Average, UI Adjusted
22,304			75.09% Pervious Area
7,399			24.91% Impervious Area
7,399			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0060	0.09		**Sheet Flow, A-B**
					Grass: Short n= 0.150 P2= 3.13"
5.8	204	0.0070	0.59		**Shallow Concentrated Flow, B-C**
					Short Grass Pasture Kv= 7.0 fps
15.0	254	Total			

Summary for Subcatchment S-1.2: North parking

Runoff = 4.14 cfs @ 11.96 hrs, Volume= 8,062 cf, Depth= 1.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

	Area (sf)	CN	Description
*	3,810	65	Rubber playground, HSG A
	43,283	98	Unconnected pavement, HSG A
*	8,146	65	Porous pavement, HSG A
	15,769	39	>75% Grass cover, Good, HSG A
	747	98	Unconnected pavement, HSG B
	71,755	80	Weighted Average
	27,725		38.64% Pervious Area
	44,030		61.36% Impervious Area
	44,030		100.00% Unconnected

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

Summary for Subcatchment S-1.3: Turf

Runoff = 3.45 cfs @ 12.46 hrs, Volume= 19,880 cf, Depth= 1.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

	Area (sf)	CN	Description
*	141,677	85	Synthetic Turf, HSG A
*	12,044	65	Porous pavement, HSG A
	153,721	83	Weighted Average
	153,721		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
47.3	255	0.0067	0.09		**Sheet Flow, Synthetic Turf Surface** Grass: Dense n= 0.240 P2= 3.13"

Summary for Subcatchment S-1.4: Building

Runoff = 2.75 cfs @ 11.96 hrs, Volume= 6,334 cf, Depth= 2.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

Area (sf)	CN	Description
26,232	98	Roofs, HSG A
26,232		100.00% Impervious Area

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

Summary for Subcatchment S-1.5: East Plaza 2

Runoff = 1.85 cfs @ 11.96 hrs, Volume= 3,755 cf, Depth= 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

Area (sf)	CN	Description
18,620	98	Unconnected pavement, HSG A
2,798	39	>75% Grass cover, Good, HSG A
21,418	90	Weighted Average
2,798		13.06% Pervious Area
18,620		86.94% Impervious Area
18,620		100.00% Unconnected

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

Summary for Subcatchment S-1.6: Rear drive section

Runoff = 0.96 cfs @ 11.97 hrs, Volume= 1,896 cf, Depth= 0.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

Area (sf)	CN	Description
9,328	39	>75% Grass cover, Good, HSG A
13,609	98	Unconnected pavement, HSG A
22,937	74	Weighted Average
9,328		40.67% Pervious Area
13,609		59.33% Impervious Area
13,609		100.00% Unconnected

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

Summary for Subcatchment S-1.7: Rear plaza

Runoff = 0.71 cfs @ 11.97 hrs, Volume= 1,382 cf, Depth= 1.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

	Area (sf)	CN	Description
	2,180	39	>75% Grass cover, Good, HSG A
*	5,187	65	Rubber playground, HSG A
	6,901	98	Unconnected pavement, HSG A
	14,268	77	Weighted Average
	7,367		51.63% Pervious Area
	6,901		48.37% Impervious Area
	6,901		100.00% Unconnected

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

Summary for Subcatchment S-1.8: Building

Runoff = 3.39 cfs @ 11.96 hrs, Volume= 7,817 cf, Depth= 2.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

Area (sf)	CN	Description
32,373	98	Roofs, HSG A
32,373		100.00% Impervious Area

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

Summary for Subcatchment S-1.9: West land

Runoff = 0.03 cfs @ 15.56 hrs, Volume= 906 cf, Depth= 0.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

	Area (sf)	CN	Description
	63,797	55	Woods, Good, HSG B
	26,031	61	>75% Grass cover, Good, HSG B
	3,111	98	Unconnected pavement, HSG B
	28,640	30	Woods, Good, HSG A
	1,770	98	Unconnected pavement, HSG A
	96,784	39	>75% Grass cover, Good, HSG A
*	2,490	39	Boardwalk, HSG A
	222,623	46	Weighted Average
	217,742		97.81% Pervious Area
	4,881		2.19% Impervious Area
	4,881		100.00% Unconnected

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

Summary for Subcatchment S-2.0: South Plaza and Road

Runoff = 2.85 cfs @ 12.00 hrs, Volume= 6,538 cf, Depth= 0.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

	Area (sf)	CN	Description
	18,613	61	>75% Grass cover, Good, HSG B
	11,130	98	Unconnected pavement, HSG B
	30,646	98	Unconnected pavement, HSG A
	15,302	55	Woods, Good, HSG B
*	3,539	65	Rubber playground, HSG A
	26,724	39	>75% Grass cover, Good, HSG A
	105,954	69	Weighted Average
	64,178		60.57% Pervious Area
	41,776		39.43% Impervious Area
	41,776		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.0900	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.13"
0.3	32	0.1250	1.77		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.5	88	0.1870	3.03		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
7.6	170	Total			

Summary for Subcatchment S-2.2: SE Parking

Runoff = 0.31 cfs @ 11.99 hrs, Volume= 813 cf, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

	Area (sf)	CN	Description
*	613	65	Porous pavement, HSG A
	8,695	98	Unconnected pavement, HSG A
	16,262	39	>75% Grass cover, Good, HSG A
	25,570	60	Weighted Average
	16,875		66.00% Pervious Area
	8,695		34.00% Impervious Area
	8,695		100.00% Unconnected

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

Summary for Subcatchment S-2.3: South Parking

Runoff = 0.77 cfs @ 11.96 hrs, Volume= 1,785 cf, Depth= 2.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

Area (sf)	CN	Description
7,394	98	Unconnected pavement, HSG A
7,394		100.00% Impervious Area
7,394		100.00% Unconnected

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

Summary for Subcatchment S-3.0: Pavement & Bioretention

Runoff = 0.12 cfs @ 12.00 hrs, Volume= 452 cf, Depth= 0.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

Area (sf)	CN	Adj	Description
1,692	98		Unconnected pavement, HSG B
7,178	61		>75% Grass cover, Good, HSG B
4,006	98		Unconnected pavement, HSG A
8,145	39		>75% Grass cover, Good, HSG A
21,021	63	56	Weighted Average, UI Adjusted
15,323			72.89% Pervious Area
5,698			27.11% Impervious Area
5,698			100.00% Unconnected

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

Summary for Subcatchment S-3.1: South Overland

Runoff = 0.00 cfs @ 24.12 hrs, Volume= 0 cf, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

Area (sf)	CN	Description
10,037	30	Woods, Good, HSG A
5,264	55	Woods, Good, HSG B
1,644	39	>75% Grass cover, Good, HSG A
16,945	39	Weighted Average
16,945		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0400	0.09		**Sheet Flow, A-B**
					Woods: Light underbrush n= 0.400 P2= 3.13"
1.8	162	0.0860	1.47		**Shallow Concentrated Flow, B-C**
					Woodland Kv= 5.0 fps
11.3	212	Total			

Summary for Subcatchment S-4.0: North Overland

Runoff = 0.00 cfs @ 14.95 hrs, Volume= 90 cf, Depth= 0.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 2-yr Rainfall=3.13"

	Area (sf)	CN	Description
	2,688	30	Woods, Good, HSG A
*	2,184	98	Porous pavement, HSG A
	11,126	39	>75% Grass cover, Good, HSG A
	1,116	61	>75% Grass cover, Good, HSG B
	17,114	47	Weighted Average
	14,930		87.24% Pervious Area
	2,184		12.76% Impervious Area

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

Summary for Reach DP-1: Design Point 1

Inflow Area = 698,997 sf, 36.48% Impervious, Inflow Depth = 0.93" for 2-yr event
Inflow = 15.85 cfs @ 11.96 hrs, Volume= 54,196 cf
Outflow = 15.85 cfs @ 11.96 hrs, Volume= 54,196 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-2: Design Point 2

Inflow Area = 166,066 sf, 49.50% Impervious, Inflow Depth = 0.06" for 2-yr event
Inflow = 0.31 cfs @ 11.99 hrs, Volume= 815 cf
Outflow = 0.31 cfs @ 11.99 hrs, Volume= 815 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-3: Design Point 3

Inflow Area = 37,966 sf, 15.01% Impervious, Inflow Depth = 0.00" for 2-yr event
Inflow = 0.00 cfs @ 24.12 hrs, Volume= 0 cf
Outflow = 0.00 cfs @ 24.12 hrs, Volume= 0 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-4: Design Point 2

Inflow Area = 17,114 sf, 12.76% Impervious, Inflow Depth = 0.06" for 2-yr event
Inflow = 0.00 cfs @ 14.95 hrs, Volume= 90 cf
Outflow = 0.00 cfs @ 14.95 hrs, Volume= 90 cf, Atten= 0%, Lag= 0.0 min

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

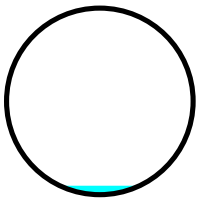
Summary for Reach Pipe: On-site wetland

Inflow Area = 298,967 sf, 17.24% Impervious, Inflow Depth = 0.04" for 2-yr event
Inflow = 0.03 cfs @ 15.56 hrs, Volume= 906 cf
Outflow = 0.03 cfs @ 15.64 hrs, Volume= 906 cf, Atten= 0%, Lag= 5.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.86 fps, Min. Travel Time= 1.8 min
Avg. Velocity = 1.69 fps, Avg. Travel Time= 2.0 min

Peak Storage= 3 cf @ 15.61 hrs
Average Depth at Peak Storage= 0.05'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 5.80 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 200.0' Slope= 0.0265 '/'
Inlet Invert= 149.30', Outlet Invert= 144.00'



Summary for Pond B-1.10: Rear bioretention

Inflow Area = 29,703 sf, 24.91% Impervious, Inflow Depth = 0.05" for 2-yr event
Inflow = 0.00 cfs @ 15.45 hrs, Volume= 121 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 154.71' @ 24.84 hrs Surf.Area= 613 sf Storage= 121 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	154.50'	2,530 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)
154.50	544	102.0	0	0	544
155.00	715	120.0	314	314	867
156.00	1,094	153.0	898	1,212	1,597
157.00	1,557	163.0	1,319	2,530	1,894

Device	Routing	Invert	Outlet Devices
#1	Primary	156.50'	**10.0' long x 4.0' 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 5.00 5.50
Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66
2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=154.50' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond B-1.6: North bioretention

Inflow Area = 22,937 sf, 59.33% Impervious, Inflow Depth = 0.99" for 2-yr event
Inflow = 0.96 cfs @ 11.97 hrs, Volume= 1,896 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 151.76' @ 24.29 hrs Surf.Area= 2,729 sf Storage= 1,896 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	151.00'	5,780 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)
151.00	2,268	189.0	0	0	2,268
152.00	2,883	213.0	2,569	2,569	3,062
153.00	3,549	231.0	3,210	5,780	3,735

Device	Routing	Invert	Outlet Devices
#1	Primary	152.50'	**7.0' long x 7.0' 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 5.00 5.50
			Coef. (English) 2.40 2.52 2.70 2.68 2.68 2.67 2.66 2.65 2.65 2.65 2.66 2.65 2.66 2.68 2.70 2.73 2.78

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=151.00' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond B-1.7: System-3 (45" chambers)

Inflow Area = 46,641 sf, 84.20% Impervious, Inflow Depth = 2.37" for 2-yr event
Inflow = 4.09 cfs @ 11.96 hrs, Volume= 9,199 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 158.35' @ 24.29 hrs Surf.Area= 5,646 sf Storage= 9,199 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
#1A	156.00'	7,863 cf	**44.25'W x 127.59'L x 5.50'H Field A** 31,052 cf Overall - 11,394 cf Embedded = 19,658 cf x 40.0% Voids
#2A	156.75'	11,394 cf	**ADS_StormTech MC-3500 d +Cap** x 102 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 6 Rows of 17 Chambers Cap Storage= +14.9 cf x 2 x 6 rows = 178.8 cf
		19,257 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	156.75'	**24.0" Round Culvert** L= 200.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 156.75' / 152.00' S= 0.0238 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	160.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 1	159.50'	**6.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=156.00' (Free Discharge)
└**1=Culvert** (Controls 0.00 cfs)
└**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
└**3=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond B-2.0: System-2 (45" chambers)

Inflow Area = 105,954 sf, 39.43% Impervious, Inflow Depth = 0.74" for 2-yr event
Inflow = 2.85 cfs @ 12.00 hrs, Volume= 6,538 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 151.20' @ 24.45 hrs Surf.Area= 4,997 sf Storage= 6,538 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
#1A	149.25'	6,976 cf	**37.08'W x 134.76'L x 5.50'H Field A** 27,485 cf Overall - 10,045 cf Embedded = 17,441 cf x 40.0% Voids
#2A	150.00'	10,045 cf	**ADS_StormTech MC-3500 d +Cap** x 90 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 5 Rows of 18 Chambers Cap Storage= +14.9 cf x 2 x 5 rows = 149.0 cf
		17,021 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	151.25'	**12.0" Round Culvert** L= 600.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 151.25' / 144.00' S= 0.0121 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	153.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 1	151.50'	**12.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#4	Primary	152.50'	**18.0" W x 9.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=149.25' (Free Discharge)
- **1=Culvert** (Controls 0.00 cfs)
  - **2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  - **3=Orifice/Grate** (Controls 0.00 cfs)
- **4=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond B-2.3: System-1 (30" chambers)

Inflow Area = 7,394 sf,100.00% Impervious, Inflow Depth = 2.90" for 2-yr event
Inflow = 0.77 cfs @ 11.96 hrs, Volume= 1,785 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 141.90' @ 24.29 hrs Surf.Area= 1,403 sf Storage= 1,786 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
#1A	140.00'	1,302 cf	**15.75'W x 89.06'L x 3.50'H Field A** 4,909 cf Overall - 1,654 cf Embedded = 3,255 cf x 40.0% Voids
#2A	140.50'	1,654 cf	**ADS_StormTech SC-740 +Cap** x 36 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 3 Rows of 12 Chambers
		2,956 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	143.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	140.50'	**12.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 140.50' / 139.50' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=140.00' (Free Discharge)
- **2=Culvert** (Controls 0.00 cfs)
  - **1=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Summary for Pond B-3.0: Bioretention 3

Inflow Area = 21,021 sf, 27.11% Impervious, Inflow Depth = 0.26" for 2-yr event
Inflow = 0.12 cfs @ 12.00 hrs, Volume= 452 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 143.94' @ 24.29 hrs Surf.Area= 1,166 sf Storage= 452 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	143.50'	2,060 cf	**Bioretention basin (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
143.50	877	214.0	0	0	877
144.00	1,205	224.0	518	518	1,242
145.00	1,904	242.0	1,541	2,060	1,949

Device	Routing	Invert	Outlet Devices
#1	Primary	144.50'	**5.0' long x 8.0' 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 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=143.50' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond P-1.11: Porous Pvmt

Inflow Area = 35,567 sf, 98.31% Impervious, Inflow Depth = 2.79" for 2-yr event
Inflow = 0.79 cfs @ 13.11 hrs, Volume= 8,261 cf
Outflow = 0.79 cfs @ 13.12 hrs, Volume= 8,261 cf, Atten= 0%, Lag= 0.5 min
Discarded = 0.79 cfs @ 13.12 hrs, Volume= 8,259 cf
Primary = 0.00 cfs @ 13.12 hrs, Volume= 2 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 148.25' @ 13.12 hrs Surf.Area= 27,745 sf Storage= 50 cf

Plug-Flow detention time= 1.0 min calculated for 8,260 cf (100% of inflow)
Center-of-Mass det. time= 1.0 min (851.1 - 850.1)

Volume	Invert	Avail.Storage	Storage Description
#1	148.24'	22,793 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
148.24	27,745	0.0	0	0
148.25	27,745	35.0	97	97
148.83	27,745	30.0	4,828	4,925
149.08	27,745	25.0	1,734	6,659
150.08	27,745	40.0	11,098	17,757
150.41	27,745	35.0	3,205	20,961
150.74	27,745	20.0	1,831	22,793

Device	Routing	Invert	Outlet Devices
#1	Discarded	148.24'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	148.24'	**12.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 148.24' / 145.00' S= 0.0324 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=1.55 cfs @ 13.12 hrs HW=148.25' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 1.55 cfs)

Primary OutFlow Max=0.00 cfs @ 13.12 hrs HW=148.25' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.00 cfs @ 0.19 fps)

Summary for Pond P-1.3: Turf storage (no exfilt)

Inflow Area = 153,721 sf, 0.00% Impervious, Inflow Depth = 1.55" for 2-yr event
Inflow = 3.45 cfs @ 12.46 hrs, Volume= 19,880 cf
Outflow = 3.06 cfs @ 12.64 hrs, Volume= 19,880 cf, Atten= 11%, Lag= 10.7 min
Primary = 3.06 cfs @ 12.64 hrs, Volume= 19,880 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 147.71' @ 12.64 hrs Surf.Area= 10,078 sf Storage= 2,496 cf

Plug-Flow detention time= 27.7 min calculated for 19,877 cf (100% of inflow)
Center-of-Mass det. time= 27.8 min (896.9 - 869.1)

Volume	Invert	Avail.Storage	Storage Description
#1	146.77'	15,360 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 51,200 cf Overall x 30.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
146.77	7,680	0	0
147.77	10,240	8,960	8,960
148.77	12,800	11,520	20,480
149.77	15,360	14,080	34,560
150.77	17,920	16,640	51,200

Device	Routing	Invert	Outlet Devices
#1	Primary	146.77'	**15.0" Round Culvert** L= 20.0' CPP, end-section conforming to fill, Ke= 0.500

Inlet / Outlet Invert= 146.77' / 146.50' S= 0.0135 '/' Cc= 0.900
n= 0.010, Flow Area= 1.23 sf

Primary OutFlow Max=3.06 cfs @ 12.64 hrs HW=147.71' (Free Discharge)
1=Culvert (Barrel Controls 3.06 cfs @ 4.31 fps)

Summary for Pond P-2.1: Porous Pvmt

Inflow Area = 27,148 sf, 89.67% Impervious, Inflow Depth = 2.28" for 2-yr event
Inflow = 0.52 cfs @ 13.11 hrs, Volume= 5,168 cf
Outflow = 0.52 cfs @ 13.13 hrs, Volume= 5,168 cf, Atten= 0%, Lag= 1.0 min
Discarded = 0.52 cfs @ 13.13 hrs, Volume= 5,166 cf
Primary = 0.00 cfs @ 13.13 hrs, Volume= 2 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 146.30' @ 13.13 hrs Surf.Area= 15,856 sf Storage= 32 cf

Plug-Flow detention time= 1.0 min calculated for 5,168 cf (100% of inflow)
Center-of-Mass det. time= 1.0 min (883.6 - 882.6)

Volume	Invert	Avail.Storage	Storage Description
#1	146.29'	13,034 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
146.29	15,856	0.0	0	0
146.30	15,856	35.0	55	55
146.88	15,856	30.0	2,759	2,814
147.13	15,856	25.0	991	3,805
148.13	15,856	40.0	6,342	10,148
148.45	15,856	35.0	1,776	11,924
148.80	15,856	20.0	1,110	13,034

Device	Routing	Invert	Outlet Devices
#1	Discarded	146.29'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	146.29'	**12.0" Round Culvert**
			L= 100.0' CPP, projecting, no headwall, Ke= 0.900
			Inlet / Outlet Invert= 146.29' / 145.00' S= 0.0129 '/' Cc= 0.900
			n= 0.013, Flow Area= 0.79 sf

Discarded OutFlow Max=0.88 cfs @ 13.13 hrs HW=146.30' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.88 cfs)

Primary OutFlow Max=0.00 cfs @ 13.13 hrs HW=146.30' (Free Discharge)
2=Culvert (Barrel Controls 0.00 cfs @ 0.26 fps)

Summary for Subcatchment S 1.11: Porous Pvmt

Runoff = 1.29 cfs @ 13.11 hrs, Volume= 13,655 cf, Depth= 4.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

	Area (sf)	CN	Description
*	34,965	98	Porous pavement, HSG A
	602	39	>75% Grass cover, Good, HSG A
	35,567	97	Weighted Average
	602		1.69% Pervious Area
	34,965		98.31% Impervious Area

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

Summary for Subcatchment S 2.1: Porous Pvmt

Runoff = 0.90 cfs @ 13.11 hrs, Volume= 9,163 cf, Depth= 4.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

	Area (sf)	CN	Description
*	24,343	98	Porous pavement, HSG A
	2,805	39	>75% Grass cover, Good, HSG A
	27,148	92	Weighted Average
	2,805		10.33% Pervious Area
	24,343		89.67% Impervious Area

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

Summary for Subcatchment S-1.0: Building

Runoff = 6.56 cfs @ 11.96 hrs, Volume= 15,447 cf, Depth= 4.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

Area (sf)	CN	Description
39,244	98	Roofs, HSG A
39,244		100.00% Impervious Area

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

Summary for Subcatchment S-1.1: East Plaza

Runoff = 4.64 cfs @ 11.96 hrs, Volume= 10,104 cf, Depth= 4.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

Area (sf)	CN	Description
2,403	39	>75% Grass cover, Good, HSG A
26,753	98	Unconnected pavement, HSG A
29,156	93	Weighted Average
2,403		8.24% Pervious Area
26,753		91.76% Impervious Area
26,753		100.00% Unconnected

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

Summary for Subcatchment S-1.10: Rear drive & grass

Runoff = 0.21 cfs @ 12.13 hrs, Volume= 1,177 cf, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

Area (sf)	CN	Adj	Description
7,399	98		Unconnected pavement, HSG A
22,304	39		>75% Grass cover, Good, HSG A
29,703	54	46	Weighted Average, UI Adjusted
22,304			75.09% Pervious Area
7,399			24.91% Impervious Area
7,399			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0060	0.09		**Sheet Flow, A-B**
					Grass: Short n= 0.150 P2= 3.13"
5.8	204	0.0070	0.59		**Shallow Concentrated Flow, B-C**
					Short Grass Pasture Kv= 7.0 fps
15.0	254	Total			

Summary for Subcatchment S-1.2: North parking

Runoff = 8.62 cfs @ 11.96 hrs, Volume= 17,090 cf, Depth= 2.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

	Area (sf)	CN	Description
*	3,810	65	Rubber playground, HSG A
	43,283	98	Unconnected pavement, HSG A
*	8,146	65	Porous pavement, HSG A
	15,769	39	>75% Grass cover, Good, HSG A
	747	98	Unconnected pavement, HSG B
	71,755	80	Weighted Average
	27,725		38.64% Pervious Area
	44,030		61.36% Impervious Area
	44,030		100.00% Unconnected

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

Summary for Subcatchment S-1.3: Turf

Runoff = 7.07 cfs @ 12.46 hrs, Volume= 40,197 cf, Depth= 3.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

	Area (sf)	CN	Description
*	141,677	85	Synthetic Turf, HSG A
*	12,044	65	Porous pavement, HSG A
	153,721	83	Weighted Average
	153,721		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
47.3	255	0.0067	0.09		**Sheet Flow, Synthetic Turf Surface** Grass: Dense n= 0.240 P2= 3.13"

Summary for Subcatchment S-1.4: Building

Runoff = 4.39 cfs @ 11.96 hrs, Volume= 10,325 cf, Depth= 4.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

Area (sf)	CN	Description
26,232	98	Roofs, HSG A
26,232		100.00% Impervious Area

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

Summary for Subcatchment S-1.5: East Plaza 2

Runoff = 3.25 cfs @ 11.96 hrs, Volume= 6,850 cf, Depth= 3.84"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

Area (sf)	CN	Description
18,620	98	Unconnected pavement, HSG A
2,798	39	>75% Grass cover, Good, HSG A
21,418	90	Weighted Average
2,798		13.06% Pervious Area
18,620		86.94% Impervious Area
18,620		100.00% Unconnected

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

Summary for Subcatchment S-1.6: Rear drive section

Runoff = 2.28 cfs @ 11.96 hrs, Volume= 4,458 cf, Depth= 2.33"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

Area (sf)	CN	Description
9,328	39	>75% Grass cover, Good, HSG A
13,609	98	Unconnected pavement, HSG A
22,937	74	Weighted Average
9,328		40.67% Pervious Area
13,609		59.33% Impervious Area
13,609		100.00% Unconnected

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

Summary for Subcatchment S-1.7: Rear plaza

Runoff = 1.57 cfs @ 11.96 hrs, Volume= 3,079 cf, Depth= 2.59"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

	Area (sf)	CN	Description
	2,180	39	>75% Grass cover, Good, HSG A
*	5,187	65	Rubber playground, HSG A
	6,901	98	Unconnected pavement, HSG A
	14,268	77	Weighted Average
	7,367		51.63% Pervious Area
	6,901		48.37% Impervious Area
	6,901		100.00% Unconnected

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

Summary for Subcatchment S-1.8: Building

Runoff = 5.41 cfs @ 11.96 hrs, Volume= 12,742 cf, Depth= 4.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

Area (sf)	CN	Description
32,373	98	Roofs, HSG A
32,373		100.00% Impervious Area

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

Summary for Subcatchment S-1.9: West land

Runoff = 1.20 cfs @ 12.24 hrs, Volume= 8,821 cf, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

	Area (sf)	CN	Description
	63,797	55	Woods, Good, HSG B
	26,031	61	>75% Grass cover, Good, HSG B
	3,111	98	Unconnected pavement, HSG B
	28,640	30	Woods, Good, HSG A
	1,770	98	Unconnected pavement, HSG A
	96,784	39	>75% Grass cover, Good, HSG A
*	2,490	39	Boardwalk, HSG A
	222,623	46	Weighted Average
	217,742		97.81% Pervious Area
	4,881		2.19% Impervious Area
	4,881		100.00% Unconnected

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

Summary for Subcatchment S-2.0: South Plaza and Road

Runoff = 7.89 cfs @ 12.00 hrs, Volume= 17,026 cf, Depth= 1.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

	Area (sf)	CN	Description
	18,613	61	>75% Grass cover, Good, HSG B
	11,130	98	Unconnected pavement, HSG B
	30,646	98	Unconnected pavement, HSG A
	15,302	55	Woods, Good, HSG B
*	3,539	65	Rubber playground, HSG A
	26,724	39	>75% Grass cover, Good, HSG A
	105,954	69	Weighted Average
	64,178		60.57% Pervious Area
	41,776		39.43% Impervious Area
	41,776		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.0900	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.13"
0.3	32	0.1250	1.77		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.5	88	0.1870	3.03		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
7.6	170	Total			

Summary for Subcatchment S-2.2: SE Parking

Runoff = 1.35 cfs @ 11.97 hrs, Volume= 2,723 cf, Depth= 1.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

	Area (sf)	CN	Description
*	613	65	Porous pavement, HSG A
	8,695	98	Unconnected pavement, HSG A
	16,262	39	>75% Grass cover, Good, HSG A
	25,570	60	Weighted Average
	16,875		66.00% Pervious Area
	8,695		34.00% Impervious Area
	8,695		100.00% Unconnected

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

Summary for Subcatchment S-2.3: South Parking

Runoff = 1.24 cfs @ 11.96 hrs, Volume= 2,910 cf, Depth= 4.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

Area (sf)	CN	Description
7,394	98	Unconnected pavement, HSG A
7,394		100.00% Impervious Area
7,394		100.00% Unconnected

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

Summary for Subcatchment S-3.0: Pavement & Bioretention

Runoff = 0.85 cfs @ 11.97 hrs, Volume= 1,789 cf, Depth= 1.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

Area (sf)	CN	Adj	Description
1,692	98		Unconnected pavement, HSG B
7,178	61		>75% Grass cover, Good, HSG B
4,006	98		Unconnected pavement, HSG A
8,145	39		>75% Grass cover, Good, HSG A
21,021	63	56	Weighted Average, UI Adjusted
15,323			72.89% Pervious Area
5,698			27.11% Impervious Area
5,698			100.00% Unconnected

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

Summary for Subcatchment S-3.1: South Overland

Runoff = 0.01 cfs @ 12.47 hrs, Volume= 271 cf, Depth= 0.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

Area (sf)	CN	Description
10,037	30	Woods, Good, HSG A
5,264	55	Woods, Good, HSG B
1,644	39	>75% Grass cover, Good, HSG A
16,945	39	Weighted Average
16,945		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0400	0.09		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.13"
1.8	162	0.0860	1.47		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
11.3	212	Total			

Summary for Subcatchment S-4.0: North Overland

Runoff = 0.26 cfs @ 11.99 hrs, Volume= 746 cf, Depth= 0.52"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 10-yr Rainfall=4.96"

	Area (sf)	CN	Description
	2,688	30	Woods, Good, HSG A
*	2,184	98	Porous pavement, HSG A
	11,126	39	>75% Grass cover, Good, HSG A
	1,116	61	>75% Grass cover, Good, HSG B
	17,114	47	Weighted Average
	14,930		87.24% Pervious Area
	2,184		12.76% Impervious Area

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

Summary for Reach DP-1: Design Point 1

Inflow Area = 698,997 sf, 36.48% Impervious, Inflow Depth = 1.91" for 10-yr event
Inflow = 28.36 cfs @ 11.96 hrs, Volume= 111,053 cf
Outflow = 28.36 cfs @ 11.96 hrs, Volume= 111,053 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-2: Design Point 2

Inflow Area = 166,066 sf, 49.50% Impervious, Inflow Depth = 0.88" for 10-yr event
Inflow = 1.35 cfs @ 11.97 hrs, Volume= 12,247 cf
Outflow = 1.35 cfs @ 11.97 hrs, Volume= 12,247 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-3: Design Point 3

Inflow Area = 37,966 sf, 15.01% Impervious, Inflow Depth = 0.27" for 10-yr event
Inflow = 0.03 cfs @ 15.93 hrs, Volume= 858 cf
Outflow = 0.03 cfs @ 15.93 hrs, Volume= 858 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-4: Design Point 2

Inflow Area = 17,114 sf, 12.76% Impervious, Inflow Depth = 0.52" for 10-yr event
Inflow = 0.26 cfs @ 11.99 hrs, Volume= 746 cf
Outflow = 0.26 cfs @ 11.99 hrs, Volume= 746 cf, Atten= 0%, Lag= 0.0 min

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

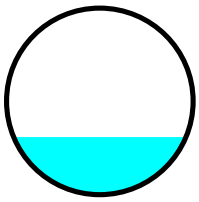
Summary for Reach Pipe: On-site wetland

Inflow Area = 298,967 sf, 17.24% Impervious, Inflow Depth = 0.43" for 10-yr event
Inflow = 1.20 cfs @ 12.24 hrs, Volume= 10,671 cf
Outflow = 1.20 cfs @ 12.26 hrs, Volume= 10,671 cf, Atten= 0%, Lag= 1.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.82 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 1.79 fps, Avg. Travel Time= 1.9 min

Peak Storage= 41 cf @ 12.25 hrs
Average Depth at Peak Storage= 0.31'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 5.80 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 200.0' Slope= 0.0265 '/'
Inlet Invert= 149.30', Outlet Invert= 144.00'



Summary for Pond B-1.10: Rear bioretention

Inflow Area = 29,703 sf, 24.91% Impervious, Inflow Depth = 0.48" for 10-yr event
Inflow = 0.21 cfs @ 12.13 hrs, Volume= 1,177 cf
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0 cf, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 0.00 hrs, Volume= 0 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 155.97' @ 24.84 hrs Surf.Area= 1,081 sf Storage= 1,177 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	154.50'	2,530 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)
154.50	544	102.0	0	0	544
155.00	715	120.0	314	314	867
156.00	1,094	153.0	898	1,212	1,597
157.00	1,557	163.0	1,319	2,530	1,894

Device	Routing	Invert	Outlet Devices
#1	Primary	156.50'	**10.0' long x 4.0' 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 5.00 5.50
Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66
2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=0.00 cfs @ 0.00 hrs HW=154.50' (Free Discharge)
1=Broad-Crested Rectangular Weir (Controls 0.00 cfs)

Summary for Pond B-1.6: North bioretention

Inflow Area = 22,937 sf, 59.33% Impervious, Inflow Depth = 2.33" for 10-yr event
Inflow = 2.28 cfs @ 11.96 hrs, Volume= 4,458 cf
Outflow = 0.03 cfs @ 21.64 hrs, Volume= 367 cf, Atten= 99%, Lag= 580.4 min
Primary = 0.03 cfs @ 21.64 hrs, Volume= 367 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 152.51' @ 21.64 hrs Surf.Area= 3,214 sf Storage= 4,126 cf

Plug-Flow detention time= 667.3 min calculated for 367 cf (8% of inflow)
Center-of-Mass det. time= 508.0 min (1,341.6 - 833.7)

Volume	Invert	Avail.Storage	Storage Description
#1	151.00'	5,780 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)
151.00	2,268	189.0	0	0	2,268
152.00	2,883	213.0	2,569	2,569	3,062
153.00	3,549	231.0	3,210	5,780	3,735

Device	Routing	Invert	Outlet Devices
#1	Primary	152.50'	**7.0' long x 7.0' 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 5.00 5.50
			Coef. (English) 2.40 2.52 2.70 2.68 2.68 2.67 2.66 2.65 2.65 2.65 2.66 2.65 2.66 2.68 2.70 2.73 2.78

Primary OutFlow Max=0.02 cfs @ 21.64 hrs HW=152.51' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 0.02 cfs @ 0.25 fps)

Summary for Pond B-1.7: System-3 (45" chambers)

Inflow Area = 46,641 sf, 84.20% Impervious, Inflow Depth = 4.07" for 10-yr event
Inflow = 6.98 cfs @ 11.96 hrs, Volume= 15,821 cf
Outflow = 0.07 cfs @ 19.87 hrs, Volume= 1,850 cf, Atten= 99%, Lag= 474.7 min
Primary = 0.07 cfs @ 19.87 hrs, Volume= 1,850 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 159.62' @ 19.87 hrs Surf.Area= 5,646 sf Storage= 14,418 cf

Plug-Flow detention time= 914.9 min calculated for 1,850 cf (12% of inflow)

Center-of-Mass det. time= 573.9 min (1,333.2 - 759.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	156.00'	7,863 cf	**44.25'W x 127.59'L x 5.50'H Field A** 31,052 cf Overall - 11,394 cf Embedded = 19,658 cf x 40.0% Voids
#2A	156.75'	11,394 cf	**ADS_StormTech MC-3500 d +Cap** x 102 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 6 Rows of 17 Chambers Cap Storage= +14.9 cf x 2 x 6 rows = 178.8 cf
		19,257 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	156.75'	**24.0" Round Culvert** L= 200.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 156.75' / 152.00' S= 0.0238 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	160.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 1	159.50'	**6.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.07 cfs @ 19.87 hrs HW=159.62' (Free Discharge)
↑**1=Culvert** (Passes 0.07 cfs of 16.34 cfs potential flow)
↑**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
3=Orifice/Grate (Orifice Controls 0.07 cfs @ 1.12 fps)

Summary for Pond B-2.0: System-2 (45" chambers)

Inflow Area = 105,954 sf, 39.43% Impervious, Inflow Depth = 1.93" for 10-yr event
Inflow = 7.89 cfs @ 12.00 hrs, Volume= 17,026 cf
Outflow = 0.53 cfs @ 12.95 hrs, Volume= 9,286 cf, Atten= 93%, Lag= 57.1 min
Primary = 0.53 cfs @ 12.95 hrs, Volume= 9,286 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 151.80' @ 12.95 hrs Surf.Area= 4,997 sf Storage= 8,921 cf

Plug-Flow detention time= 290.7 min calculated for 9,286 cf (55% of inflow)
Center-of-Mass det. time= 162.1 min (1,011.0 - 848.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	149.25'	6,976 cf	**37.08'W x 134.76'L x 5.50'H Field A** 27,485 cf Overall - 10,045 cf Embedded = 17,441 cf x 40.0% Voids
#2A	150.00'	10,045 cf	**ADS_StormTech MC-3500 d +Cap** x 90 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 5 Rows of 18 Chambers Cap Storage= +14.9 cf x 2 x 5 rows = 149.0 cf
		17,021 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	151.25'	**12.0" Round Culvert** L= 600.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 151.25' / 144.00' S= 0.0121 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	153.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 1	151.50'	**12.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#4	Primary	152.50'	**18.0" W x 9.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.53 cfs @ 12.95 hrs HW=151.80' (Free Discharge)
- **1=Culvert** (Passes 0.53 cfs of 0.89 cfs potential flow)
  - **2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  - **3=Orifice/Grate** (Orifice Controls 0.53 cfs @ 1.76 fps)
- **4=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond B-2.3: System-1 (30" chambers)

Inflow Area = 7,394 sf,100.00% Impervious, Inflow Depth = 4.72" for 10-yr event
Inflow = 1.24 cfs @ 11.96 hrs, Volume= 2,910 cf
Outflow = 0.01 cfs @ 18.59 hrs, Volume= 235 cf, Atten= 99%, Lag= 397.9 min
Primary = 0.01 cfs @ 18.59 hrs, Volume= 235 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 143.01' @ 18.59 hrs Surf.Area= 1,403 sf Storage= 2,681 cf

Plug-Flow detention time= 942.5 min calculated for 235 cf (8% of inflow)
Center-of-Mass det. time= 519.0 min (1,262.2 - 743.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	140.00'	1,302 cf	**15.75'W x 89.06'L x 3.50'H Field A** 4,909 cf Overall - 1,654 cf Embedded = 3,255 cf x 40.0% Voids
#2A	140.50'	1,654 cf	**ADS_StormTech SC-740 +Cap** x 36 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 3 Rows of 12 Chambers
		2,956 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	143.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	140.50'	**12.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 140.50' / 139.50' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.01 cfs @ 18.59 hrs HW=143.01' (Free Discharge)
- **2=Culvert** (Passes 0.01 cfs of 4.23 cfs potential flow)
  - **1=Sharp-Crested Rectangular Weir** (Weir Controls 0.01 cfs @ 0.33 fps)

Summary for Pond B-3.0: Bioretention 3

Inflow Area = 21,021 sf, 27.11% Impervious, Inflow Depth = 1.02" for 10-yr event
Inflow = 0.85 cfs @ 11.97 hrs, Volume= 1,789 cf
Outflow = 0.03 cfs @ 15.97 hrs, Volume= 587 cf, Atten= 97%, Lag= 239.7 min
Primary = 0.03 cfs @ 15.97 hrs, Volume= 587 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 144.52' @ 15.97 hrs Surf.Area= 1,546 sf Storage= 1,226 cf

Plug-Flow detention time= 442.9 min calculated for 587 cf (33% of inflow)
Center-of-Mass det. time= 275.2 min (1,161.2 - 886.0)

Volume	Invert	Avail.Storage	Storage Description
#1	143.50'	2,060 cf	**Bioretention basin (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
143.50	877	214.0	0	0	877
144.00	1,205	224.0	518	518	1,242
145.00	1,904	242.0	1,541	2,060	1,949

Device	Routing	Invert	Outlet Devices
#1	Primary	144.50'	**5.0' long x 8.0' 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 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=0.02 cfs @ 15.97 hrs HW=144.52' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.02 cfs @ 0.31 fps)

Summary for Pond P-1.11: Porous Pvmt

Inflow Area = 35,567 sf, 98.31% Impervious, Inflow Depth = 4.61" for 10-yr event
Inflow = 1.29 cfs @ 13.11 hrs, Volume= 13,655 cf
Outflow = 1.28 cfs @ 13.11 hrs, Volume= 13,655 cf, Atten= 0%, Lag= 0.4 min
Discarded = 1.28 cfs @ 13.11 hrs, Volume= 13,652 cf
Primary = 0.00 cfs @ 13.11 hrs, Volume= 3 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 148.25' @ 13.11 hrs Surf.Area= 27,745 sf Storage= 81 cf

Plug-Flow detention time= 1.0 min calculated for 13,654 cf (100% of inflow)
Center-of-Mass det. time= 1.0 min (840.2 - 839.2)

Volume	Invert	Avail.Storage	Storage Description
#1	148.24'	22,793 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
148.24	27,745	0.0	0	0
148.25	27,745	35.0	97	97
148.83	27,745	30.0	4,828	4,925
149.08	27,745	25.0	1,734	6,659
150.08	27,745	40.0	11,098	17,757
150.41	27,745	35.0	3,205	20,961
150.74	27,745	20.0	1,831	22,793

Device	Routing	Invert	Outlet Devices
#1	Discarded	148.24'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	148.24'	**12.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 148.24' / 145.00' S= 0.0324 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=1.55 cfs @ 13.11 hrs HW=148.25' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 1.55 cfs)

Primary OutFlow Max=0.00 cfs @ 13.11 hrs HW=148.25' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.00 cfs @ 0.24 fps)

Summary for Pond P-1.3: Turf storage (no exfilt)

Inflow Area = 153,721 sf, 0.00% Impervious, Inflow Depth = 3.14" for 10-yr event
Inflow = 7.07 cfs @ 12.46 hrs, Volume= 40,197 cf
Outflow = 5.94 cfs @ 12.66 hrs, Volume= 40,197 cf, Atten= 16%, Lag= 12.2 min
Primary = 5.94 cfs @ 12.66 hrs, Volume= 40,197 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 148.41' @ 12.66 hrs Surf.Area= 11,870 sf Storage= 4,800 cf

Plug-Flow detention time= 22.0 min calculated for 40,197 cf (100% of inflow)
Center-of-Mass det. time= 21.9 min (870.9 - 849.0)

Volume	Invert	Avail.Storage	Storage Description
#1	146.77'	15,360 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 51,200 cf Overall x 30.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
146.77	7,680	0	0
147.77	10,240	8,960	8,960
148.77	12,800	11,520	20,480
149.77	15,360	14,080	34,560
150.77	17,920	16,640	51,200

Device	Routing	Invert	Outlet Devices
#1	Primary	146.77'	**15.0" Round Culvert** L= 20.0' CPP, end-section conforming to fill, Ke= 0.500

Inlet / Outlet Invert= 146.77' / 146.50' S= 0.0135 '/' Cc= 0.900
n= 0.010, Flow Area= 1.23 sf

Primary OutFlow Max=5.94 cfs @ 12.66 hrs HW=148.41' (Free Discharge)
1=Culvert (Inlet Controls 5.94 cfs @ 4.84 fps)

Summary for Pond P-2.1: Porous Pvmt

Inflow Area = 27,148 sf, 89.67% Impervious, Inflow Depth = 4.05" for 10-yr event
Inflow = 0.90 cfs @ 13.11 hrs, Volume= 9,163 cf
Outflow = 0.89 cfs @ 13.25 hrs, Volume= 9,163 cf, Atten= 2%, Lag= 8.6 min
Discarded = 0.88 cfs @ 12.98 hrs, Volume= 9,159 cf
Primary = 0.00 cfs @ 13.25 hrs, Volume= 4 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 146.30' @ 13.25 hrs Surf.Area= 15,856 sf Storage= 70 cf

Plug-Flow detention time= 1.1 min calculated for 9,163 cf (100% of inflow)
Center-of-Mass det. time= 1.1 min (867.9 - 866.8)

Volume	Invert	Avail.Storage	Storage Description
#1	146.29'	13,034 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
146.29	15,856	0.0	0	0
146.30	15,856	35.0	55	55
146.88	15,856	30.0	2,759	2,814
147.13	15,856	25.0	991	3,805
148.13	15,856	40.0	6,342	10,148
148.45	15,856	35.0	1,776	11,924
148.80	15,856	20.0	1,110	13,034

Device	Routing	Invert	Outlet Devices
#1	Discarded	146.29'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	146.29'	**12.0" Round Culvert**
			L= 100.0' CPP, projecting, no headwall, Ke= 0.900
			Inlet / Outlet Invert= 146.29' / 145.00' S= 0.0129 '/' Cc= 0.900
			n= 0.013, Flow Area= 0.79 sf

Discarded OutFlow Max=0.88 cfs @ 12.98 hrs HW=146.30' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.88 cfs)

Primary OutFlow Max=0.00 cfs @ 13.25 hrs HW=146.30' (Free Discharge)
2=Culvert (Barrel Controls 0.00 cfs @ 0.45 fps)

Summary for Subcatchment S 1.11: Porous Pvmt

Runoff = 1.59 cfs @ 13.11 hrs, Volume= 17,025 cf, Depth= 5.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

	Area (sf)	CN	Description
*	34,965	98	Porous pavement, HSG A
	602	39	>75% Grass cover, Good, HSG A
	35,567	97	Weighted Average
	602		1.69% Pervious Area
	34,965		98.31% Impervious Area

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

Summary for Subcatchment S 2.1: Porous Pvmt

Runoff = 1.14 cfs @ 13.11 hrs, Volume= 11,691 cf, Depth= 5.17"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

	Area (sf)	CN	Description
*	24,343	98	Porous pavement, HSG A
	2,805	39	>75% Grass cover, Good, HSG A
	27,148	92	Weighted Average
	2,805		10.33% Pervious Area
	24,343		89.67% Impervious Area

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

Summary for Subcatchment S-1.0: Building

Runoff = 8.09 cfs @ 11.96 hrs, Volume= 19,170 cf, Depth= 5.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

Area (sf)	CN	Description
39,244	98	Roofs, HSG A
39,244		100.00% Impervious Area

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

Summary for Subcatchment S-1.1: East Plaza

Runoff = 5.80 cfs @ 11.96 hrs, Volume= 12,832 cf, Depth= 5.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

Area (sf)	CN	Description
2,403	39	>75% Grass cover, Good, HSG A
26,753	98	Unconnected pavement, HSG A
29,156	93	Weighted Average
2,403		8.24% Pervious Area
26,753		91.76% Impervious Area
26,753		100.00% Unconnected

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

Summary for Subcatchment S-1.10: Rear drive & grass

Runoff = 0.58 cfs @ 12.11 hrs, Volume= 2,250 cf, Depth= 0.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

Area (sf)	CN	Adj	Description
7,399	98		Unconnected pavement, HSG A
22,304	39		>75% Grass cover, Good, HSG A
29,703	54	46	Weighted Average, UI Adjusted
22,304			75.09% Pervious Area
7,399			24.91% Impervious Area
7,399			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0060	0.09		**Sheet Flow, A-B**
					Grass: Short n= 0.150 P2= 3.13"
5.8	204	0.0070	0.59		**Shallow Concentrated Flow, B-C**
					Short Grass Pasture Kv= 7.0 fps
15.0	254	Total			

Summary for Subcatchment S-1.2: North parking

Runoff = 11.52 cfs @ 11.96 hrs, Volume= 23,151 cf, Depth= 3.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

	Area (sf)	CN	Description
*	3,810	65	Rubber playground, HSG A
	43,283	98	Unconnected pavement, HSG A
*	8,146	65	Porous pavement, HSG A
	15,769	39	>75% Grass cover, Good, HSG A
	747	98	Unconnected pavement, HSG B
	71,755	80	Weighted Average
	27,725		38.64% Pervious Area
	44,030		61.36% Impervious Area
	44,030		100.00% Unconnected

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

Summary for Subcatchment S-1.3: Turf

Runoff = 9.39 cfs @ 12.45 hrs, Volume= 53,601 cf, Depth= 4.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

	Area (sf)	CN	Description
*	141,677	85	Synthetic Turf, HSG A
*	12,044	65	Porous pavement, HSG A
	153,721	83	Weighted Average
	153,721		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
47.3	255	0.0067	0.09		**Sheet Flow, Synthetic Turf Surface** Grass: Dense n= 0.240 P2= 3.13"

Summary for Subcatchment S-1.4: Building

Runoff = 5.41 cfs @ 11.96 hrs, Volume= 12,814 cf, Depth= 5.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

Area (sf)	CN	Description
26,232	98	Roofs, HSG A
26,232		100.00% Impervious Area

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

Summary for Subcatchment S-1.5: East Plaza 2

Runoff = 4.11 cfs @ 11.96 hrs, Volume= 8,823 cf, Depth= 4.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

Area (sf)	CN	Description
18,620	98	Unconnected pavement, HSG A
2,798	39	>75% Grass cover, Good, HSG A
21,418	90	Weighted Average
2,798		13.06% Pervious Area
18,620		86.94% Impervious Area
18,620		100.00% Unconnected

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

Summary for Subcatchment S-1.6: Rear drive section

Runoff = 3.17 cfs @ 11.96 hrs, Volume= 6,249 cf, Depth= 3.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

Area (sf)	CN	Description
9,328	39	>75% Grass cover, Good, HSG A
13,609	98	Unconnected pavement, HSG A
22,937	74	Weighted Average
9,328		40.67% Pervious Area
13,609		59.33% Impervious Area
13,609		100.00% Unconnected

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

Summary for Subcatchment S-1.7: Rear plaza

Runoff = 2.14 cfs @ 11.96 hrs, Volume= 4,241 cf, Depth= 3.57"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

	Area (sf)	CN	Description
	2,180	39	>75% Grass cover, Good, HSG A
*	5,187	65	Rubber playground, HSG A
	6,901	98	Unconnected pavement, HSG A
	14,268	77	Weighted Average
	7,367		51.63% Pervious Area
	6,901		48.37% Impervious Area
	6,901		100.00% Unconnected

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

Summary for Subcatchment S-1.8: Building

Runoff = 6.67 cfs @ 11.96 hrs, Volume= 15,814 cf, Depth= 5.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

Area (sf)	CN	Description
32,373	98	Roofs, HSG A
32,373		100.00% Impervious Area

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

Summary for Subcatchment S-1.9: West land

Runoff = 3.30 cfs @ 12.21 hrs, Volume= 16,860 cf, Depth= 0.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

	Area (sf)	CN	Description
	63,797	55	Woods, Good, HSG B
	26,031	61	>75% Grass cover, Good, HSG B
	3,111	98	Unconnected pavement, HSG B
	28,640	30	Woods, Good, HSG A
	1,770	98	Unconnected pavement, HSG A
	96,784	39	>75% Grass cover, Good, HSG A
*	2,490	39	Boardwalk, HSG A
	222,623	46	Weighted Average
	217,742		97.81% Pervious Area
	4,881		2.19% Impervious Area
	4,881		100.00% Unconnected

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

Summary for Subcatchment S-2.0: South Plaza and Road

Runoff = 11.45 cfs @ 11.99 hrs, Volume= 24,642 cf, Depth= 2.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

	Area (sf)	CN	Description
	18,613	61	>75% Grass cover, Good, HSG B
	11,130	98	Unconnected pavement, HSG B
	30,646	98	Unconnected pavement, HSG A
	15,302	55	Woods, Good, HSG B
*	3,539	65	Rubber playground, HSG A
	26,724	39	>75% Grass cover, Good, HSG A
	105,954	69	Weighted Average
	64,178		60.57% Pervious Area
	41,776		39.43% Impervious Area
	41,776		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.0900	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.13"
0.3	32	0.1250	1.77		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.5	88	0.1870	3.03		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
7.6	170	Total			

Summary for Subcatchment S-2.2: SE Parking

Runoff = 2.16 cfs @ 11.97 hrs, Volume= 4,235 cf, Depth= 1.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

	Area (sf)	CN	Description
*	613	65	Porous pavement, HSG A
	8,695	98	Unconnected pavement, HSG A
	16,262	39	>75% Grass cover, Good, HSG A
	25,570	60	Weighted Average
	16,875		66.00% Pervious Area
	8,695		34.00% Impervious Area
	8,695		100.00% Unconnected

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

Summary for Subcatchment S-2.3: South Parking

Runoff = 1.52 cfs @ 11.96 hrs, Volume= 3,612 cf, Depth= 5.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

Area (sf)	CN	Description
7,394	98	Unconnected pavement, HSG A
7,394		100.00% Impervious Area
7,394		100.00% Unconnected

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

Summary for Subcatchment S-3.0: Pavement & Bioretention

Runoff = 1.45 cfs @ 11.97 hrs, Volume= 2,901 cf, Depth= 1.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

Area (sf)	CN	Adj	Description
1,692	98		Unconnected pavement, HSG B
7,178	61		>75% Grass cover, Good, HSG B
4,006	98		Unconnected pavement, HSG A
8,145	39		>75% Grass cover, Good, HSG A
21,021	63	56	Weighted Average, UI Adjusted
15,323			72.89% Pervious Area
5,698			27.11% Impervious Area
5,698			100.00% Unconnected

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

Summary for Subcatchment S-3.1: South Overland

Runoff = 0.11 cfs @ 12.09 hrs, Volume= 670 cf, Depth= 0.47"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

Area (sf)	CN	Description
10,037	30	Woods, Good, HSG A
5,264	55	Woods, Good, HSG B
1,644	39	>75% Grass cover, Good, HSG A
16,945	39	Weighted Average
16,945		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0400	0.09		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.13"
1.8	162	0.0860	1.47		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
11.3	212	Total			

Summary for Subcatchment S-4.0: North Overland

Runoff = 0.61 cfs @ 11.98 hrs, Volume= 1,394 cf, Depth= 0.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-yr Rainfall=6.10"

	Area (sf)	CN	Description
	2,688	30	Woods, Good, HSG A
*	2,184	98	Porous pavement, HSG A
	11,126	39	>75% Grass cover, Good, HSG A
	1,116	61	>75% Grass cover, Good, HSG B
	17,114	47	Weighted Average
	14,930		87.24% Pervious Area
	2,184		12.76% Impervious Area

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

Summary for Reach DP-1: Design Point 1

Inflow Area = 698,997 sf, 36.48% Impervious, Inflow Depth = 2.68" for 25-yr event
Inflow = 36.50 cfs @ 11.96 hrs, Volume= 155,932 cf
Outflow = 36.50 cfs @ 11.96 hrs, Volume= 155,932 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-2: Design Point 2

Inflow Area = 166,066 sf, 49.50% Impervious, Inflow Depth = 1.60" for 25-yr event
Inflow = 2.18 cfs @ 12.20 hrs, Volume= 22,201 cf
Outflow = 2.18 cfs @ 12.20 hrs, Volume= 22,201 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-3: Design Point 3

Inflow Area = 37,966 sf, 15.01% Impervious, Inflow Depth = 0.75" for 25-yr event
Inflow = 0.17 cfs @ 12.51 hrs, Volume= 2,369 cf
Outflow = 0.17 cfs @ 12.51 hrs, Volume= 2,369 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-4: Design Point 2

Inflow Area = 17,114 sf, 12.76% Impervious, Inflow Depth = 0.98" for 25-yr event
Inflow = 0.61 cfs @ 11.98 hrs, Volume= 1,394 cf
Outflow = 0.61 cfs @ 11.98 hrs, Volume= 1,394 cf, Atten= 0%, Lag= 0.0 min

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

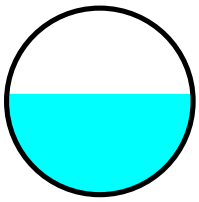
Summary for Reach Pipe: On-site wetland

Inflow Area = 298,967 sf, 17.24% Impervious, Inflow Depth = 0.94" for 25-yr event
Inflow = 3.30 cfs @ 12.21 hrs, Volume= 23,380 cf
Outflow = 3.30 cfs @ 12.22 hrs, Volume= 23,380 cf, Atten= 0%, Lag= 0.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.62 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.08 fps, Avg. Travel Time= 1.6 min

Peak Storage= 87 cf @ 12.22 hrs
Average Depth at Peak Storage= 0.54'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 5.80 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 200.0' Slope= 0.0265 '/'
Inlet Invert= 149.30', Outlet Invert= 144.00'



Summary for Pond B-1.10: Rear bioretention

Inflow Area = 29,703 sf, 24.91% Impervious, Inflow Depth = 0.91" for 25-yr event
Inflow = 0.58 cfs @ 12.11 hrs, Volume= 2,250 cf
Outflow = 0.03 cfs @ 19.14 hrs, Volume= 436 cf, Atten= 96%, Lag= 422.0 min
Primary = 0.03 cfs @ 19.14 hrs, Volume= 436 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 156.51' @ 19.14 hrs Surf.Area= 1,319 sf Storage= 1,822 cf

Plug-Flow detention time= 561.0 min calculated for 436 cf (19% of inflow)
Center-of-Mass det. time= 369.5 min (1,286.2 - 916.7)

Volume	Invert	Avail.Storage	Storage Description
#1	154.50'	2,530 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)
154.50	544	102.0	0	0	544
155.00	715	120.0	314	314	867
156.00	1,094	153.0	898	1,212	1,597
157.00	1,557	163.0	1,319	2,530	1,894

Device	Routing	Invert	Outlet Devices
#1	Primary	156.50'	**10.0' long x 4.0' 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 5.00 5.50
Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66
2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=0.01 cfs @ 19.14 hrs HW=156.51' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.01 cfs @ 0.20 fps)

Summary for Pond B-1.6: North bioretention

Inflow Area = 22,937 sf, 59.33% Impervious, Inflow Depth = 3.27" for 25-yr event
Inflow = 3.17 cfs @ 11.96 hrs, Volume= 6,249 cf
Outflow = 0.11 cfs @ 13.69 hrs, Volume= 2,157 cf, Atten= 96%, Lag= 103.8 min
Primary = 0.11 cfs @ 13.69 hrs, Volume= 2,157 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 152.54' @ 13.69 hrs Surf.Area= 3,231 sf Storage= 4,205 cf

Plug-Flow detention time= 353.1 min calculated for 2,157 cf (35% of inflow)
Center-of-Mass det. time= 226.6 min (1,050.6 - 824.0)

Volume	Invert	Avail.Storage	Storage Description
#1	151.00'	5,780 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)
151.00	2,268	189.0	0	0	2,268
152.00	2,883	213.0	2,569	2,569	3,062
153.00	3,549	231.0	3,210	5,780	3,735

Device	Routing	Invert	Outlet Devices
#1	Primary	152.50'	**7.0' long x 7.0' 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 5.00 5.50
			Coef. (English) 2.40 2.52 2.70 2.68 2.68 2.67 2.66 2.65 2.65 2.65 2.66 2.65 2.66 2.68 2.70 2.73 2.78

Primary OutFlow Max=0.11 cfs @ 13.69 hrs HW=152.54' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.11 cfs @ 0.45 fps)

Summary for Pond B-1.7: System-3 (45" chambers)

Inflow Area = 46,641 sf, 84.20% Impervious, Inflow Depth = 5.16" for 25-yr event
Inflow = 8.80 cfs @ 11.96 hrs, Volume= 20,054 cf
Outflow = 0.25 cfs @ 13.92 hrs, Volume= 6,083 cf, Atten= 97%, Lag= 117.9 min
Primary = 0.25 cfs @ 13.92 hrs, Volume= 6,083 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 159.79' @ 13.92 hrs Surf.Area= 5,646 sf Storage= 15,013 cf

Plug-Flow detention time= 504.8 min calculated for 6,083 cf (30% of inflow)

Center-of-Mass det. time= 320.9 min (1,077.0 - 756.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	156.00'	7,863 cf	**44.25'W x 127.59'L x 5.50'H Field A** 31,052 cf Overall - 11,394 cf Embedded = 19,658 cf x 40.0% Voids
#2A	156.75'	11,394 cf	**ADS_StormTech MC-3500 d +Cap** x 102 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 6 Rows of 17 Chambers Cap Storage= +14.9 cf x 2 x 6 rows = 178.8 cf
		19,257 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	156.75'	**24.0" Round Culvert** L= 200.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 156.75' / 152.00' S= 0.0238 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	160.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 1	159.50'	**6.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=0.25 cfs @ 13.92 hrs HW=159.79' (Free Discharge)
└**1=Culvert** (Passes 0.25 cfs of 17.06 cfs potential flow)
  ├**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  └**3=Orifice/Grate** (Orifice Controls 0.25 cfs @ 1.73 fps)

Summary for Pond B-2.0: System-2 (45" chambers)

Inflow Area = 105,954 sf, 39.43% Impervious, Inflow Depth = 2.79" for 25-yr event
Inflow = 11.45 cfs @ 11.99 hrs, Volume= 24,642 cf
Outflow = 1.87 cfs @ 12.25 hrs, Volume= 16,901 cf, Atten= 84%, Lag= 15.4 min
Primary = 1.87 cfs @ 12.25 hrs, Volume= 16,901 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 152.36' @ 12.25 hrs Surf.Area= 4,997 sf Storage= 11,004 cf

Plug-Flow detention time= 209.9 min calculated for 16,901 cf (69% of inflow)
Center-of-Mass det. time= 101.2 min (939.2 - 838.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	149.25'	6,976 cf	**37.08'W x 134.76'L x 5.50'H Field A** 27,485 cf Overall - 10,045 cf Embedded = 17,441 cf x 40.0% Voids
#2A	150.00'	10,045 cf	**ADS_StormTech MC-3500 d +Cap** x 90 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 5 Rows of 18 Chambers Cap Storage= +14.9 cf x 2 x 5 rows = 149.0 cf
		17,021 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	151.25'	**12.0" Round Culvert** L= 600.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 151.25' / 144.00' S= 0.0121 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	153.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 1	151.50'	**12.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#4	Primary	152.50'	**18.0" W x 9.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=1.87 cfs @ 12.25 hrs HW=152.36' (Free Discharge)
- **1=Culvert** (Passes 1.87 cfs of 2.33 cfs potential flow)
  - **2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  - **3=Orifice/Grate** (Orifice Controls 1.87 cfs @ 3.74 fps)
- **4=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond B-2.3: System-1 (30" chambers)

Inflow Area = 7,394 sf,100.00% Impervious, Inflow Depth = 5.86" for 25-yr event
Inflow = 1.52 cfs @ 11.96 hrs, Volume= 3,612 cf
Outflow = 0.07 cfs @ 12.95 hrs, Volume= 936 cf, Atten= 95%, Lag= 59.5 min
Primary = 0.07 cfs @ 12.95 hrs, Volume= 936 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 143.03' @ 12.95 hrs Surf.Area= 1,403 sf Storage= 2,691 cf

Plug-Flow detention time= 493.8 min calculated for 936 cf (26% of inflow)
Center-of-Mass det. time= 269.0 min (1,008.8 - 739.8)

Volume	Invert	Avail.Storage	Storage Description
#1A	140.00'	1,302 cf	**15.75'W x 89.06'L x 3.50'H Field A** 4,909 cf Overall - 1,654 cf Embedded = 3,255 cf x 40.0% Voids
#2A	140.50'	1,654 cf	**ADS_StormTech SC-740 +Cap** x 36 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 3 Rows of 12 Chambers
		2,956 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	143.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	140.50'	**12.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 140.50' / 139.50' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=0.06 cfs @ 12.95 hrs HW=143.03' (Free Discharge)
- **2=Culvert** (Passes 0.06 cfs of 4.25 cfs potential flow)
  - **1=Sharp-Crested Rectangular Weir** (Weir Controls 0.06 cfs @ 0.55 fps)

Summary for Pond B-3.0: Bioretention 3

Inflow Area = 21,021 sf, 27.11% Impervious, Inflow Depth = 1.66" for 25-yr event
Inflow = 1.45 cfs @ 11.97 hrs, Volume= 2,901 cf
Outflow = 0.13 cfs @ 12.54 hrs, Volume= 1,699 cf, Atten= 91%, Lag= 33.9 min
Primary = 0.13 cfs @ 12.54 hrs, Volume= 1,699 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 144.55' @ 12.54 hrs Surf.Area= 1,569 sf Storage= 1,278 cf

Plug-Flow detention time= 256.1 min calculated for 1,699 cf (59% of inflow)
Center-of-Mass det. time= 120.1 min (988.8 - 868.7)

Volume	Invert	Avail.Storage	Storage Description
#1	143.50'	2,060 cf	**Bioretention basin (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
143.50	877	214.0	0	0	877
144.00	1,205	224.0	518	518	1,242
145.00	1,904	242.0	1,541	2,060	1,949

Device	Routing	Invert	Outlet Devices
#1	Primary	144.50'	**5.0' long x 8.0' 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 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=0.13 cfs @ 12.54 hrs HW=144.55' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.13 cfs @ 0.54 fps)

Summary for Pond P-1.11: Porous Pvmt

Inflow Area = 35,567 sf, 98.31% Impervious, Inflow Depth = 5.74" for 25-yr event
Inflow = 1.59 cfs @ 13.11 hrs, Volume= 17,025 cf
Outflow = 1.55 cfs @ 13.25 hrs, Volume= 17,025 cf, Atten= 3%, Lag= 8.8 min
Discarded = 1.55 cfs @ 12.96 hrs, Volume= 17,020 cf
Primary = 0.00 cfs @ 13.25 hrs, Volume= 4 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 148.25' @ 13.25 hrs Surf.Area= 27,745 sf Storage= 130 cf

Plug-Flow detention time= 1.1 min calculated for 17,022 cf (100% of inflow)
Center-of-Mass det. time= 1.1 min (836.1 - 835.0)

Volume	Invert	Avail.Storage	Storage Description
#1	148.24'	22,793 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
148.24	27,745	0.0	0	0
148.25	27,745	35.0	97	97
148.83	27,745	30.0	4,828	4,925
149.08	27,745	25.0	1,734	6,659
150.08	27,745	40.0	11,098	17,757
150.41	27,745	35.0	3,205	20,961
150.74	27,745	20.0	1,831	22,793

Device	Routing	Invert	Outlet Devices
#1	Discarded	148.24'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	148.24'	**12.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 148.24' / 145.00' S= 0.0324 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=1.55 cfs @ 12.96 hrs HW=148.25' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 1.55 cfs)

Primary OutFlow Max=0.00 cfs @ 13.25 hrs HW=148.25' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.00 cfs @ 0.32 fps)

Summary for Pond P-1.3: Turf storage (no exfilt)

Inflow Area = 153,721 sf, 0.00% Impervious, Inflow Depth = 4.18" for 25-yr event
Inflow = 9.39 cfs @ 12.45 hrs, Volume= 53,601 cf
Outflow = 7.41 cfs @ 12.69 hrs, Volume= 53,601 cf, Atten= 21%, Lag= 14.3 min
Primary = 7.41 cfs @ 12.69 hrs, Volume= 53,601 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 148.97' @ 12.69 hrs Surf.Area= 13,310 sf Storage= 6,924 cf

Plug-Flow detention time= 20.6 min calculated for 53,593 cf (100% of inflow)
Center-of-Mass det. time= 20.7 min (861.6 - 840.8)

Volume	Invert	Avail.Storage	Storage Description
#1	146.77'	15,360 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 51,200 cf Overall x 30.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
146.77	7,680	0	0
147.77	10,240	8,960	8,960
148.77	12,800	11,520	20,480
149.77	15,360	14,080	34,560
150.77	17,920	16,640	51,200

Device	Routing	Invert	Outlet Devices
#1	Primary	146.77'	**15.0" Round Culvert** L= 20.0' CPP, end-section conforming to fill, Ke= 0.500

Inlet / Outlet Invert= 146.77' / 146.50' S= 0.0135 '/' Cc= 0.900
n= 0.010, Flow Area= 1.23 sf

Primary OutFlow Max=7.41 cfs @ 12.69 hrs HW=148.97' (Free Discharge)
1=Culvert (Inlet Controls 7.41 cfs @ 6.04 fps)

Summary for Pond P-2.1: Porous Pvmt

Inflow Area = 27,148 sf, 89.67% Impervious, Inflow Depth = 5.17" for 25-yr event
Inflow = 1.14 cfs @ 13.11 hrs, Volume= 11,691 cf
Outflow = 0.93 cfs @ 13.57 hrs, Volume= 11,691 cf, Atten= 18%, Lag= 27.4 min
Discarded = 0.88 cfs @ 12.70 hrs, Volume= 11,563 cf
Primary = 0.05 cfs @ 13.57 hrs, Volume= 129 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 146.41' @ 13.57 hrs Surf.Area= 15,856 sf Storage= 565 cf

Plug-Flow detention time= 3.4 min calculated for 11,690 cf (100% of inflow)
Center-of-Mass det. time= 3.4 min (863.7 - 860.4)

Volume	Invert	Avail.Storage	Storage Description
#1	146.29'	13,034 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
146.29	15,856	0.0	0	0
146.30	15,856	35.0	55	55
146.88	15,856	30.0	2,759	2,814
147.13	15,856	25.0	991	3,805
148.13	15,856	40.0	6,342	10,148
148.45	15,856	35.0	1,776	11,924
148.80	15,856	20.0	1,110	13,034

Device	Routing	Invert	Outlet Devices
#1	Discarded	146.29'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	146.29'	**12.0" Round Culvert**
			L= 100.0' CPP, projecting, no headwall, Ke= 0.900
			Inlet / Outlet Invert= 146.29' / 145.00' S= 0.0129 '/' Cc= 0.900
			n= 0.013, Flow Area= 0.79 sf

Discarded OutFlow Max=0.88 cfs @ 12.70 hrs HW=146.30' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.88 cfs)

Primary OutFlow Max=0.05 cfs @ 13.57 hrs HW=146.41' (Free Discharge)
2=Culvert (Inlet Controls 0.05 cfs @ 0.92 fps)

Summary for Subcatchment S 1.11: Porous Pvmt

Runoff = 2.05 cfs @ 13.11 hrs, Volume= 22,202 cf, Depth= 7.49"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

	Area (sf)	CN	Description
*	34,965	98	Porous pavement, HSG A
	602	39	>75% Grass cover, Good, HSG A
	35,567	97	Weighted Average
	602		1.69% Pervious Area
	34,965		98.31% Impervious Area

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

Summary for Subcatchment S 2.1: Porous Pvmt

Runoff = 1.51 cfs @ 13.11 hrs, Volume= 15,599 cf, Depth= 6.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

	Area (sf)	CN	Description
*	24,343	98	Porous pavement, HSG A
	2,805	39	>75% Grass cover, Good, HSG A
	27,148	92	Weighted Average
	2,805		10.33% Pervious Area
	24,343		89.67% Impervious Area

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

Summary for Subcatchment S-1.0: Building

Runoff = 10.42 cfs @ 11.96 hrs, Volume= 24,888 cf, Depth= 7.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

Area (sf)	CN	Description
39,244	98	Roofs, HSG A
39,244		100.00% Impervious Area

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

Summary for Subcatchment S-1.1: East Plaza

Runoff = 7.57 cfs @ 11.96 hrs, Volume= 17,041 cf, Depth= 7.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

Area (sf)	CN	Description
2,403	39	>75% Grass cover, Good, HSG A
26,753	98	Unconnected pavement, HSG A
29,156	93	Weighted Average
2,403		8.24% Pervious Area
26,753		91.76% Impervious Area
26,753		100.00% Unconnected

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

Summary for Subcatchment S-1.10: Rear drive & grass

Runoff = 1.36 cfs @ 12.09 hrs, Volume= 4,346 cf, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

Area (sf)	CN	Adj	Description
7,399	98		Unconnected pavement, HSG A
22,304	39		>75% Grass cover, Good, HSG A
29,703	54	46	Weighted Average, UI Adjusted
22,304			75.09% Pervious Area
7,399			24.91% Impervious Area
7,399			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.2	50	0.0060	0.09		**Sheet Flow, A-B**
					Grass: Short n= 0.150 P2= 3.13"
5.8	204	0.0070	0.59		**Shallow Concentrated Flow, B-C**
					Short Grass Pasture Kv= 7.0 fps
15.0	254	Total			

Summary for Subcatchment S-1.2: North parking

Runoff = 16.01 cfs @ 11.96 hrs, Volume= 32,795 cf, Depth= 5.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

	Area (sf)	CN	Description
*	3,810	65	Rubber playground, HSG A
	43,283	98	Unconnected pavement, HSG A
*	8,146	65	Porous pavement, HSG A
	15,769	39	>75% Grass cover, Good, HSG A
	747	98	Unconnected pavement, HSG B
	71,755	80	Weighted Average
	27,725		38.64% Pervious Area
	44,030		61.36% Impervious Area
	44,030		100.00% Unconnected

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

Summary for Subcatchment S-1.3: Turf

Runoff = 12.99 cfs @ 12.45 hrs, Volume= 74,738 cf, Depth= 5.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

	Area (sf)	CN	Description
*	141,677	85	Synthetic Turf, HSG A
*	12,044	65	Porous pavement, HSG A
	153,721	83	Weighted Average
	153,721		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
47.3	255	0.0067	0.09		**Sheet Flow, Synthetic Turf Surface** Grass: Dense n= 0.240 P2= 3.13"

Summary for Subcatchment S-1.4: Building

Runoff = 6.97 cfs @ 11.96 hrs, Volume= 16,636 cf, Depth= 7.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

Area (sf)	CN	Description
26,232	98	Roofs, HSG A
26,232		100.00% Impervious Area

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

Summary for Subcatchment S-1.5: East Plaza 2

Runoff = 5.43 cfs @ 11.96 hrs, Volume= 11,883 cf, Depth= 6.66"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

Area (sf)	CN	Description
18,620	98	Unconnected pavement, HSG A
2,798	39	>75% Grass cover, Good, HSG A
21,418	90	Weighted Average
2,798		13.06% Pervious Area
18,620		86.94% Impervious Area
18,620		100.00% Unconnected

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

Summary for Subcatchment S-1.6: Rear drive section

Runoff = 4.59 cfs @ 11.96 hrs, Volume= 9,159 cf, Depth= 4.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

Area (sf)	CN	Description
9,328	39	>75% Grass cover, Good, HSG A
13,609	98	Unconnected pavement, HSG A
22,937	74	Weighted Average
9,328		40.67% Pervious Area
13,609		59.33% Impervious Area
13,609		100.00% Unconnected

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

Summary for Subcatchment S-1.7: Rear plaza

Runoff = 3.02 cfs @ 11.96 hrs, Volume= 6,108 cf, Depth= 5.14"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

	Area (sf)	CN	Description
	2,180	39	>75% Grass cover, Good, HSG A
*	5,187	65	Rubber playground, HSG A
	6,901	98	Unconnected pavement, HSG A
	14,268	77	Weighted Average
	7,367		51.63% Pervious Area
	6,901		48.37% Impervious Area
	6,901		100.00% Unconnected

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

Summary for Subcatchment S-1.8: Building

Runoff = 8.60 cfs @ 11.96 hrs, Volume= 20,531 cf, Depth= 7.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

Area (sf)	CN	Description
32,373	98	Roofs, HSG A
32,373		100.00% Impervious Area

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

Summary for Subcatchment S-1.9: West land

Runoff = 7.89 cfs @ 12.18 hrs, Volume= 32,575 cf, Depth= 1.76"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

	Area (sf)	CN	Description
	63,797	55	Woods, Good, HSG B
	26,031	61	>75% Grass cover, Good, HSG B
	3,111	98	Unconnected pavement, HSG B
	28,640	30	Woods, Good, HSG A
	1,770	98	Unconnected pavement, HSG A
	96,784	39	>75% Grass cover, Good, HSG A
*	2,490	39	Boardwalk, HSG A
	222,623	46	Weighted Average
	217,742		97.81% Pervious Area
	4,881		2.19% Impervious Area
	4,881		100.00% Unconnected

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

Summary for Subcatchment S-2.0: South Plaza and Road

Runoff = 17.23 cfs @ 11.99 hrs, Volume= 37,282 cf, Depth= 4.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

	Area (sf)	CN	Description
	18,613	61	>75% Grass cover, Good, HSG B
	11,130	98	Unconnected pavement, HSG B
	30,646	98	Unconnected pavement, HSG A
	15,302	55	Woods, Good, HSG B
*	3,539	65	Rubber playground, HSG A
	26,724	39	>75% Grass cover, Good, HSG A
	105,954	69	Weighted Average
	64,178		60.57% Pervious Area
	41,776		39.43% Impervious Area
	41,776		100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	50	0.0900	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.13"
0.3	32	0.1250	1.77		**Shallow Concentrated Flow, B-C** Woodland Kv= 5.0 fps
0.5	88	0.1870	3.03		**Shallow Concentrated Flow, C-D** Short Grass Pasture Kv= 7.0 fps
7.6	170	Total			

Summary for Subcatchment S-2.2: SE Parking

Runoff = 3.52 cfs @ 11.96 hrs, Volume= 6,864 cf, Depth= 3.22"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

	Area (sf)	CN	Description
*	613	65	Porous pavement, HSG A
	8,695	98	Unconnected pavement, HSG A
	16,262	39	>75% Grass cover, Good, HSG A
	25,570	60	Weighted Average
	16,875		66.00% Pervious Area
	8,695		34.00% Impervious Area
	8,695		100.00% Unconnected

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

Summary for Subcatchment S-2.3: South Parking

Runoff = 1.96 cfs @ 11.96 hrs, Volume= 4,689 cf, Depth= 7.61"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

Area (sf)	CN	Description
7,394	98	Unconnected pavement, HSG A
7,394		100.00% Impervious Area
7,394		100.00% Unconnected

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

Summary for Subcatchment S-3.0: Pavement & Bioretention

Runoff = 2.50 cfs @ 11.97 hrs, Volume= 4,885 cf, Depth= 2.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

Area (sf)	CN	Adj	Description
1,692	98		Unconnected pavement, HSG B
7,178	61		>75% Grass cover, Good, HSG B
4,006	98		Unconnected pavement, HSG A
8,145	39		>75% Grass cover, Good, HSG A
21,021	63	56	Weighted Average, UI Adjusted
15,323			72.89% Pervious Area
5,698			27.11% Impervious Area
5,698			100.00% Unconnected

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

Summary for Subcatchment S-3.1: South Overland

Runoff = 0.46 cfs @ 12.06 hrs, Volume= 1,546 cf, Depth= 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

Area (sf)	CN	Description
10,037	30	Woods, Good, HSG A
5,264	55	Woods, Good, HSG B
1,644	39	>75% Grass cover, Good, HSG A
16,945	39	Weighted Average
16,945		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.5	50	0.0400	0.09		**Sheet Flow, A-B**
					Woods: Light underbrush n= 0.400 P2= 3.13"
1.8	162	0.0860	1.47		**Shallow Concentrated Flow, B-C**
					Woodland Kv= 5.0 fps
11.3	212	Total			

Summary for Subcatchment S-4.0: North Overland

Runoff = 1.30 cfs @ 11.97 hrs, Volume= 2,646 cf, Depth= 1.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-yr Rainfall=7.85"

	Area (sf)	CN	Description
	2,688	30	Woods, Good, HSG A
*	2,184	98	Porous pavement, HSG A
	11,126	39	>75% Grass cover, Good, HSG A
	1,116	61	>75% Grass cover, Good, HSG B
	17,114	47	Weighted Average
	14,930		87.24% Pervious Area
	2,184		12.76% Impervious Area

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

Summary for Reach DP-1: Design Point 1

Inflow Area = 698,997 sf, 36.48% Impervious, Inflow Depth = 3.97" for 100-yr event
Inflow = 50.01 cfs @ 11.96 hrs, Volume= 231,021 cf
Outflow = 50.01 cfs @ 11.96 hrs, Volume= 231,021 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-2: Design Point 2

Inflow Area = 166,066 sf, 49.50% Impervious, Inflow Depth = 2.85" for 100-yr event
Inflow = 9.73 cfs @ 12.06 hrs, Volume= 39,458 cf
Outflow = 9.73 cfs @ 12.06 hrs, Volume= 39,458 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-3: Design Point 3

Inflow Area = 37,966 sf, 15.01% Impervious, Inflow Depth = 1.65" for 100-yr event
Inflow = 1.83 cfs @ 12.04 hrs, Volume= 5,230 cf
Outflow = 1.83 cfs @ 12.04 hrs, Volume= 5,230 cf, Atten= 0%, Lag= 0.0 min

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

Summary for Reach DP-4: Design Point 2

Inflow Area = 17,114 sf, 12.76% Impervious, Inflow Depth = 1.86" for 100-yr event
Inflow = 1.30 cfs @ 11.97 hrs, Volume= 2,646 cf
Outflow = 1.30 cfs @ 11.97 hrs, Volume= 2,646 cf, Atten= 0%, Lag= 0.0 min

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

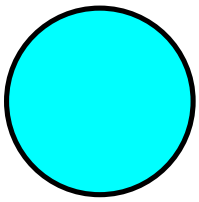
Summary for Reach Pipe: On-site wetland

Inflow Area = 298,967 sf, 17.24% Impervious, Inflow Depth = 1.92" for 100-yr event
Inflow = 8.60 cfs @ 12.18 hrs, Volume= 47,776 cf
Outflow = 6.12 cfs @ 12.09 hrs, Volume= 47,776 cf, Atten= 29%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Max. Velocity= 8.41 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.34 fps, Avg. Travel Time= 1.4 min

Peak Storage= 157 cf @ 12.09 hrs
Average Depth at Peak Storage= 1.00'
Bank-Full Depth= 1.00' Flow Area= 0.8 sf, Capacity= 5.80 cfs

12.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 200.0' Slope= 0.0265 '/'
Inlet Invert= 149.30', Outlet Invert= 144.00'



Summary for Pond B-1.10: Rear bioretention

Inflow Area = 29,703 sf, 24.91% Impervious, Inflow Depth = 1.76" for 100-yr event
Inflow = 1.36 cfs @ 12.09 hrs, Volume= 4,346 cf
Outflow = 0.19 cfs @ 12.80 hrs, Volume= 2,533 cf, Atten= 86%, Lag= 42.5 min
Primary = 0.19 cfs @ 12.80 hrs, Volume= 2,533 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 156.54' @ 12.80 hrs Surf.Area= 1,333 sf Storage= 1,865 cf

Plug-Flow detention time= 261.7 min calculated for 2,533 cf (58% of inflow)
Center-of-Mass det. time= 119.8 min (1,009.9 - 890.0)

Volume	Invert	Avail.Storage	Storage Description
#1	154.50'	2,530 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)
154.50	544	102.0	0	0	544
155.00	715	120.0	314	314	867
156.00	1,094	153.0	898	1,212	1,597
157.00	1,557	163.0	1,319	2,530	1,894

Device	Routing	Invert	Outlet Devices
#1	Primary	156.50'	**10.0' long x 4.0' 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 5.00 5.50
Coef. (English) 2.38 2.54 2.69 2.68 2.67 2.67 2.65 2.66 2.66
2.68 2.72 2.73 2.76 2.79 2.88 3.07 3.32

Primary OutFlow Max=0.18 cfs @ 12.80 hrs HW=156.54' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 0.18 cfs @ 0.47 fps)

Summary for Pond B-1.6: North bioretention

Inflow Area = 22,937 sf, 59.33% Impervious, Inflow Depth = 4.79" for 100-yr event
Inflow = 4.59 cfs @ 11.96 hrs, Volume= 9,159 cf
Outflow = 1.04 cfs @ 12.10 hrs, Volume= 5,068 cf, Atten= 77%, Lag= 8.1 min
Primary = 1.04 cfs @ 12.10 hrs, Volume= 5,068 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 152.66' @ 12.10 hrs Surf.Area= 3,313 sf Storage= 4,602 cf

Plug-Flow detention time= 223.7 min calculated for 5,068 cf (55% of inflow)
Center-of-Mass det. time= 110.8 min (923.9 - 813.1)

Volume	Invert	Avail.Storage	Storage Description
#1	151.00'	5,780 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)
151.00	2,268	189.0	0	0	2,268
152.00	2,883	213.0	2,569	2,569	3,062
153.00	3,549	231.0	3,210	5,780	3,735

Device	Routing	Invert	Outlet Devices
#1	Primary	152.50'	**7.0' long x 7.0' 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 5.00 5.50
			Coef. (English) 2.40 2.52 2.70 2.68 2.68 2.67 2.66 2.65 2.65 2.65 2.66 2.65 2.66 2.68 2.70 2.73 2.78

Primary OutFlow Max=1.04 cfs @ 12.10 hrs HW=152.66' (Free Discharge)
↑—**1=Broad-Crested Rectangular Weir** (Weir Controls 1.04 cfs @ 0.95 fps)

Summary for Pond B-1.7: System-3 (45" chambers)

Inflow Area = 46,641 sf, 84.20% Impervious, Inflow Depth = 6.85" for 100-yr event
Inflow = 11.62 cfs @ 11.96 hrs, Volume= 26,638 cf
Outflow = 1.04 cfs @ 12.40 hrs, Volume= 12,667 cf, Atten= 91%, Lag= 26.3 min
Primary = 1.04 cfs @ 12.40 hrs, Volume= 12,667 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 160.58' @ 12.40 hrs Surf.Area= 5,646 sf Storage= 17,169 cf

Plug-Flow detention time= 345.8 min calculated for 12,667 cf (48% of inflow)

Center-of-Mass det. time= 211.9 min (964.3 - 752.4)

Volume	Invert	Avail.Storage	Storage Description
#1A	156.00'	7,863 cf	**44.25'W x 127.59'L x 5.50'H Field A** 31,052 cf Overall - 11,394 cf Embedded = 19,658 cf x 40.0% Voids
#2A	156.75'	11,394 cf	**ADS_StormTech MC-3500 d +Cap** x 102 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 6 Rows of 17 Chambers Cap Storage= +14.9 cf x 2 x 6 rows = 178.8 cf
		19,257 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	156.75'	**24.0" Round Culvert** L= 200.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 156.75' / 152.00' S= 0.0238 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 3.14 sf
#2	Device 1	160.50'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 1	159.50'	**6.0" W x 4.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=1.03 cfs @ 12.40 hrs HW=160.58' (Free Discharge)
↑**1=Culvert** (Passes 1.03 cfs of 20.07 cfs potential flow)
↑**2=Sharp-Crested Rectangular Weir** (Weir Controls 0.27 cfs @ 0.90 fps)
3=Orifice/Grate (Orifice Controls 0.76 cfs @ 4.58 fps)

Summary for Pond B-2.0: System-2 (45" chambers)

Inflow Area = 105,954 sf, 39.43% Impervious, Inflow Depth = 4.22" for 100-yr event
Inflow = 17.23 cfs @ 11.99 hrs, Volume= 37,282 cf
Outflow = 7.96 cfs @ 12.10 hrs, Volume= 29,542 cf, Atten= 54%, Lag= 6.3 min
Primary = 7.96 cfs @ 12.10 hrs, Volume= 29,542 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 153.63' @ 12.10 hrs Surf.Area= 4,997 sf Storage= 14,778 cf

Plug-Flow detention time= 154.0 min calculated for 29,538 cf (79% of inflow)
Center-of-Mass det. time= 68.8 min (894.9 - 826.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	149.25'	6,976 cf	**37.08'W x 134.76'L x 5.50'H Field A** 27,485 cf Overall - 10,045 cf Embedded = 17,441 cf x 40.0% Voids
#2A	150.00'	10,045 cf	**ADS_StormTech MC-3500 d +Cap** x 90 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 5 Rows of 18 Chambers Cap Storage= +14.9 cf x 2 x 5 rows = 149.0 cf
		17,021 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Primary	151.25'	**12.0" Round Culvert** L= 600.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 151.25' / 144.00' S= 0.0121 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf
#2	Device 1	153.75'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#3	Device 1	151.50'	**12.0" W x 6.0" H Vert. Orifice/Grate** C= 0.600
#4	Primary	152.50'	**18.0" W x 9.0" H Vert. Orifice/Grate** C= 0.600

Primary OutFlow Max=7.95 cfs @ 12.10 hrs HW=153.63' (Free Discharge)
- **1=Culvert** (Passes 3.30 cfs of 4.07 cfs potential flow)
  - **2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)
  - **3=Orifice/Grate** (Orifice Controls 3.30 cfs @ 6.60 fps)
- **4=Orifice/Grate** (Orifice Controls 4.66 cfs @ 4.14 fps)

Summary for Pond B-2.3: System-1 (30" chambers)

Inflow Area = 7,394 sf,100.00% Impervious, Inflow Depth = 7.61" for 100-yr event
Inflow = 1.96 cfs @ 11.96 hrs, Volume= 4,689 cf
Outflow = 1.14 cfs @ 12.03 hrs, Volume= 2,014 cf, Atten= 42%, Lag= 4.6 min
Primary = 1.14 cfs @ 12.03 hrs, Volume= 2,014 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 143.20' @ 12.03 hrs Surf.Area= 1,403 sf Storage= 2,786 cf

Plug-Flow detention time= 314.2 min calculated for 2,014 cf (43% of inflow)
Center-of-Mass det. time= 162.2 min (898.5 - 736.3)

Volume	Invert	Avail.Storage	Storage Description
#1A	140.00'	1,302 cf	**15.75'W x 89.06'L x 3.50'H Field A** 4,909 cf Overall - 1,654 cf Embedded = 3,255 cf x 40.0% Voids
#2A	140.50'	1,654 cf	**ADS_StormTech SC-740 +Cap** x 36 Inside #1 Effective Size= 44.6"W x 30.0"H => 6.45 sf x 7.12'L = 45.9 cf Overall Size= 51.0"W x 30.0"H x 7.56'L with 0.44' Overlap 3 Rows of 12 Chambers
		2,956 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Device 2	143.00'	**4.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)
#2	Primary	140.50'	**12.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 140.50' / 139.50' S= 0.0100 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Primary OutFlow Max=1.13 cfs @ 12.03 hrs HW=143.20' (Free Discharge)
- **2=Culvert** (Passes 1.13 cfs of 4.43 cfs potential flow)
  - **1=Sharp-Crested Rectangular Weir** (Weir Controls 1.13 cfs @ 1.45 fps)

Summary for Pond B-3.0: Bioretention 3

Inflow Area = 21,021 sf, 27.11% Impervious, Inflow Depth = 2.79" for 100-yr event
Inflow = 2.50 cfs @ 11.97 hrs, Volume= 4,885 cf
Outflow = 1.39 cfs @ 12.04 hrs, Volume= 3,684 cf, Atten= 45%, Lag= 4.5 min
Primary = 1.39 cfs @ 12.04 hrs, Volume= 3,684 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 144.73' @ 12.04 hrs Surf.Area= 1,702 sf Storage= 1,580 cf

Plug-Flow detention time= 156.2 min calculated for 3,684 cf (75% of inflow)
Center-of-Mass det. time= 56.7 min (908.8 - 852.1)

Volume	Invert	Avail.Storage	Storage Description
#1	143.50'	2,060 cf	**Bioretention basin (Irregular)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
143.50	877	214.0	0	0	877
144.00	1,205	224.0	518	518	1,242
145.00	1,904	242.0	1,541	2,060	1,949

Device	Routing	Invert	Outlet Devices
#1	Primary	144.50'	**5.0' long x 8.0' 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 5.00 5.50 Coef. (English) 2.43 2.54 2.70 2.69 2.68 2.68 2.66 2.64 2.64 2.64 2.65 2.65 2.66 2.66 2.68 2.70 2.74

Primary OutFlow Max=1.38 cfs @ 12.04 hrs HW=144.73' (Free Discharge)
1=Broad-Crested Rectangular Weir (Weir Controls 1.38 cfs @ 1.18 fps)

Summary for Pond P-1.11: Porous Pvmt

Inflow Area = 35,567 sf, 98.31% Impervious, Inflow Depth = 7.49" for 100-yr event
Inflow = 2.05 cfs @ 13.11 hrs, Volume= 22,202 cf
Outflow = 1.62 cfs @ 13.60 hrs, Volume= 22,202 cf, Atten= 21%, Lag= 29.5 min
Discarded = 1.55 cfs @ 12.66 hrs, Volume= 22,006 cf
Primary = 0.07 cfs @ 13.60 hrs, Volume= 196 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 148.38' @ 13.60 hrs Surf.Area= 27,745 sf Storage= 1,188 cf

Plug-Flow detention time= 3.9 min calculated for 22,199 cf (100% of inflow)
Center-of-Mass det. time= 3.9 min (834.4 - 830.5)

Volume	Invert	Avail.Storage	Storage Description
#1	148.24'	22,793 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
148.24	27,745	0.0	0	0
148.25	27,745	35.0	97	97
148.83	27,745	30.0	4,828	4,925
149.08	27,745	25.0	1,734	6,659
150.08	27,745	40.0	11,098	17,757
150.41	27,745	35.0	3,205	20,961
150.74	27,745	20.0	1,831	22,793

Device	Routing	Invert	Outlet Devices
#1	Discarded	148.24'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	148.24'	**12.0" Round Culvert** L= 100.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 148.24' / 145.00' S= 0.0324 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.79 sf

Discarded OutFlow Max=1.55 cfs @ 12.66 hrs HW=148.25' (Free Discharge)
↑—**1=Exfiltration** (Exfiltration Controls 1.55 cfs)

Primary OutFlow Max=0.07 cfs @ 13.60 hrs HW=148.38' (Free Discharge)
↑—**2=Culvert** (Inlet Controls 0.07 cfs @ 1.01 fps)

Summary for Pond P-1.3: Turf storage (no exfilt)

Inflow Area = 153,721 sf, 0.00% Impervious, Inflow Depth = 5.83" for 100-yr event
Inflow = 12.99 cfs @ 12.45 hrs, Volume= 74,738 cf
Outflow = 9.35 cfs @ 12.74 hrs, Volume= 74,738 cf, Atten= 28%, Lag= 17.1 min
Primary = 9.35 cfs @ 12.74 hrs, Volume= 74,738 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 149.90' @ 12.74 hrs Surf.Area= 15,697 sf Storage= 10,980 cf

Plug-Flow detention time= 20.4 min calculated for 74,727 cf (100% of inflow)
Center-of-Mass det. time= 20.5 min (851.9 - 831.4)

Volume	Invert	Avail.Storage	Storage Description
#1	146.77'	15,360 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc) 51,200 cf Overall x 30.0% Voids

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
146.77	7,680	0	0
147.77	10,240	8,960	8,960
148.77	12,800	11,520	20,480
149.77	15,360	14,080	34,560
150.77	17,920	16,640	51,200

Device	Routing	Invert	Outlet Devices
#1	Primary	146.77'	**15.0" Round Culvert** L= 20.0' CPP, end-section conforming to fill, Ke= 0.500

Inlet / Outlet Invert= 146.77' / 146.50' S= 0.0135 '/' Cc= 0.900
n= 0.010, Flow Area= 1.23 sf

Primary OutFlow Max=9.35 cfs @ 12.74 hrs HW=149.90' (Free Discharge)
1=Culvert (Inlet Controls 9.35 cfs @ 7.62 fps)

Summary for Pond P-2.1: Porous Pvmt

Inflow Area = 27,148 sf, 89.67% Impervious, Inflow Depth = 6.90" for 100-yr event
Inflow = 1.51 cfs @ 13.11 hrs, Volume= 15,599 cf
Outflow = 1.16 cfs @ 13.63 hrs, Volume= 15,599 cf, Atten= 23%, Lag= 31.1 min
Discarded = 0.88 cfs @ 12.53 hrs, Volume= 14,560 cf
Primary = 0.28 cfs @ 13.63 hrs, Volume= 1,038 cf

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.01 hrs
Peak Elev= 146.58' @ 13.63 hrs Surf.Area= 15,856 sf Storage= 1,399 cf

Plug-Flow detention time= 7.7 min calculated for 15,597 cf (100% of inflow)
Center-of-Mass det. time= 7.7 min (860.8 - 853.2)

Volume	Invert	Avail.Storage	Storage Description
#1	146.29'	13,034 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Voids (%)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
146.29	15,856	0.0	0	0
146.30	15,856	35.0	55	55
146.88	15,856	30.0	2,759	2,814
147.13	15,856	25.0	991	3,805
148.13	15,856	40.0	6,342	10,148
148.45	15,856	35.0	1,776	11,924
148.80	15,856	20.0	1,110	13,034

Device	Routing	Invert	Outlet Devices
#1	Discarded	146.29'	**2.410 in/hr Exfiltration over Surface area**
#2	Primary	146.29'	**12.0" Round Culvert**
			L= 100.0' CPP, projecting, no headwall, Ke= 0.900
			Inlet / Outlet Invert= 146.29' / 145.00' S= 0.0129 '/' Cc= 0.900
			n= 0.013, Flow Area= 0.79 sf

Discarded OutFlow Max=0.88 cfs @ 12.53 hrs HW=146.30' (Free Discharge)
1=Exfiltration (Exfiltration Controls 0.88 cfs)

Primary OutFlow Max=0.28 cfs @ 13.63 hrs HW=146.58' (Free Discharge)
2=Culvert (Inlet Controls 0.28 cfs @ 1.45 fps)

| ARCHITECTURE | ENGINEERING | INTERIOR DESIGN | PLANNING

SMMA

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CAMBRIDGE, MASSACHUSETTS 02138
T: 617.547.5400

Water Quality Volume Calculations

Andover West Elementary and Shawsheen Preschool
SMMA Job No. 19146
12/7/2021
Calc by: JLO

Best Management Practice	Contributing Impervious Area (SF)	Required 1" depth WQV (CF)	Provided WQV below lowest outlet (CF)
Bioretention Area 1	7399	617	1797
Bioretention Area 2	13609	1134	4087
Bioretention Area 3	5698	475	1160
Subsurface Detention System-1	7394	616	2675
Subsurface Detention System-2	41776	3481	7701
Subsurface Detention System-3	6901	575	13971

Water Quality Flowrate (WQF) Calculations

Andover WESP
SMMA Job No. 19146
Last Updated: 12/7/2021
Calc by: TPA
Checked By:

Equation
WQF = (qu)*A*WQV

	Unit	**WQU 1-1**	**WQU 1-2**	**WQU 1-3**	**WQU 2-1**	**WQU 2-2**	**WQU 2-3**	**WQU 2-4**
Contributing Impervious Area	A (acre)	1.48	0.33	0.26	0.88	0.17	0.17	0.22
Water Quality Volume (1 in.)	(in)	1	1	1	1	1	1	1
Time of Concentration	Tc (min)	5	5	5	5	5	5	5
Unit Peak Discharge	qu (csm/in)	774	774	774	774	774	774	774
Required WQF Rate	**cfs**	**1.79**	**0.40**	**0.31**	**1.06**	**0.20**	**0.21**	**0.27**

*Each Water Quality Unit selected for the Project will have a design water quality flow that exceeds the required shown above.

INSTRUCTINSTRUCTIONS: INSTRUCTIONS: INSTRUCTIONS: INSTRUCTIONS: INSTRUCTIONS:

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

Type: Catch Basin to Water Quality Unit

Location: Several

TSS Removal Calculation Worksheet

B	C	D	E	F
	TSS Removal	Starting TSS	Amount	Remaining
BMP[1]	Rate[1]	Load*	Removed (C*D)	Load (D-E)
Deep Sump and Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
WQU - Permitting	**0.75**	**0.75**	**0.56**	**0.19**
	0.00	**0.19**	**0.00**	**0.19**
	0.00	**0.19**	**0.00**	**0.19**
	0.00	**0.19**	**0.00**	**0.19**

Total TSS Removal = **81%**

Project: **Andover WESP**

INSTRUCTINSTRUCTIONS: INSTRUCTIONS: INSTRUCTIONS: INSTRUCTIONS: INSTRUCTIONS:

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

Type: Porous Pavement (Bituminous Concrete and Concrete)

Location: North Parking Lot & South Parking Lot

TSS Removal Calculation Worksheet

B	C	D	E	F
	TSS Removal	Starting TSS	Amount	Remaining
BMP[1]	Rate[1]	Load*	Removed (C*D)	Load (D-E)
Porous Pavement - Concrete	**0.80**	**1.00**	**0.80**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**
	0.00	**0.20**	**0.00**	**0.20**

Total TSS Removal = 80%

Project: **Andover WESP**

INSTRUCTINSTRUCTIONS: INSTRUCTIONS: INSTRUCTIONS: INSTRUCTIONS: INSTRUCTIONS:

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

Type: Impervious Pavement to Bioretention Area

Location: South Parking Lot area and West drive aisle

TSS Removal Calculation Worksheet

B	C	D	E	F
BMP[1]	TSS Removal Rate[1]	Starting TSS Load*	Amount Removed (C*D)	Remaining Load (D-E)
Grass Channel	0.50	1.00	0.50	0.50
Bioretention Area	0.90	0.50	0.45	0.05
	0.00	0.05	0.00	0.05
	0.00	0.05	0.00	0.05
	0.00	0.05	0.00	0.05

Total TSS Removal = 95%

Project: Andover WESP

SYMMES, MAINI & McKEE ASSOCIATES, INC.
CLOSED DRAINAGE SYSTEM CALCULATIONS
25-YEAR FREQUENCY

Project: Andover WESP
Proj. #: 19146
Date: 12/07/2021
By: TPA/JLO

Notes: n= 0.013 for RCP
n= 0.011 for high density polyethylene pipe (smooth interior) & CIP
C= 0.90 (for impervious areas)
C= 0.35 (for open space)

Line		Length	Imperv. Area	Perv. Area	CA	SUM	Time of Conc.	Rainfall	Req. Cap.	Pipe	Slope	Flow Full		Design Vel.	Rim	Inv. Elevations		Qd/Qf	Pipe	Time in
From	To	(ft)	(acres)	(acres)		CA	(min.)	I (in./hr.)	Qd (cfs)	(in)	(ft/ft)	Qf (cfs)	Vf (fps)	Vd (fps)	Elev.(ft)	Upper	Lower		Cover	Pipe
RD-1	DMH 1-1	65	0.40	0.00	0.36	0.36	5.00	6.60	2.37	12	0.011	4.38	5.58	4.9	162.0	157.0	156.3	0.54	4.00	0.22
RD-2	DMH 1-1	136	0.34	0.00	0.30	0.30	5.00	6.60	2.00	12	0.005	3.02	3.85	3.6	162.0	157.0	156.3	0.66	4.00	0.63
DMH 1-1	DMH 1-2	42	0.14	0.00	0.13	0.79	5.63	6.27	4.93	18	0.006	9.57	5.41	4.7	160.5	156.3	156.1	0.52	2.70	0.15
DMH 1-2	SDS-3	3	0.00	0.00	0.00	0.79	5.78	6.19	4.87	18	0.004	7.56	4.28	3.9	167.5	156.0	156.0	0.64	10.00	0.01
SDS-3	OCS 1-1	3	0.00	0.00	0.00	0.79	5.80	6.19	4.86	18	0.004	7.86	4.45	4.1	160.5	156.8	156.7	0.62	2.25	0.01
OCS 1-1	FES 1-1	200	0.00	0.00	0.00	0.79	5.81	6.18	4.86	24	0.029	45.38	14.45	7.9	167.5	156.7	151.0	0.11	8.76	0.42
FES 1-2	FES 1-3	13	0.33	0.27	0.39	0.39	5.00	6.60	2.55	12	0.007	3.63	4.62	4.4	159.5	158.2	158.1	0.70	0.30	0.05
OCS 1-2	FES 1-4	18	0.00	0.16	0.06	0.06	5.00	6.60	0.36	12	0.014	5.02	6.39	3.1	156.3	152.5	152.3	0.07	2.75	0.09
CB 1-1	DMH 1-14	88	0.14	0.00	0.13	0.10	5.00	6.60	0.66	12	0.006	3.18	4.04	2.7	156.3	152.3	151.8	0.21	3.00	0.54
TD 1-1	DMH 1-14	71	0.14	0.01	0.13	0.13	5.00	6.60	0.84	12	0.025	6.68	8.51	4.9	158.5	156.0	154.2	0.13	1.50	0.24
DMH 1-14	DMH 1-15	91	0.00	0.00	0.00	0.23	5.24	6.47	1.47	12	0.010	4.19	5.34	4.1	158.2	153.4	152.5	0.35	3.80	0.37
DMH 1-15	WQU 1-1	49	0.00	0.00	0.00	0.23	5.61	6.28	1.43	12	0.010	4.25	5.41	4.1	160.0	152.4	151.9	0.34	6.60	0.20
CB 1-3	DMH 1-16	11	0.18	0.06	0.18	0.18	5.00	6.60	1.20	12	0.011	4.36	5.55	4.0	160.7	157.0	156.9	0.28	2.70	0.05
CB 1-4	DMH 1-16	33	0.10	0.01	0.09	0.09	5.00	6.60	0.60	12	0.010	4.27	5.44	3.2	160.2	157.0	156.7	0.14	2.20	0.17
DMH 1-16	DMH 1-17	21	0.00	0.00	0.00	0.27	5.17	6.51	1.78	12	0.009	4.10	5.21	4.3	160.5	156.3	156.1	0.44	3.20	0.08
CB 1-5	DMH 1-17	13	0.07	0.01	0.07	0.07	5.00	6.60	0.45	12	0.011	4.45	5.66	3.1	160.7	156.8	156.7	0.10	2.90	0.07
CB 1-6	DMH 1-17	13	0.04	0.01	0.04	0.04	5.00	6.60	0.26	12	0.011	4.34	5.53	2.5	160.6	156.8	156.7	0.06	2.80	0.09
DMH 1-17	DMH 1-18	71	0.00	0.00	0.00	0.38	5.09	6.56	2.50	12	0.010	4.17	5.31	4.8	160.7	156.0	155.3	0.60	3.70	0.25
CB 1-7	DMH 1-18	12	0.15	0.02	0.14	0.14	5.00	6.60	0.94	12	0.010	4.30	5.47	3.7	160.4	156.8	156.7	0.22	2.60	0.06
CB 1-8	DMH 1-18	12	0.05	0.01	0.05	0.05	5.00	6.60	0.33	12	0.011	4.32	5.50	2.7	160.4	156.8	156.7	0.08	2.60	0.07
DMH 1-18	DMH 1-19	47	0.00	0.00	0.00	0.57	5.07	6.56	3.77	15	0.011	7.90	6.44	5.4	160.6	155.2	154.7	0.48	4.15	0.14
CB 1-9	DMH 1-19	16	0.27	0.05	0.26	0.26	5.00	6.60	1.73	12	0.011	4.37	5.57	4.5	160.0	156.9	156.7	0.39	2.10	0.06
CB 1-10	DMH 1-19	31	0.08	0.01	0.07	0.07	5.00	6.60	0.48	12	0.010	4.24	5.40	3.0	160.4	156.9	156.6	0.11	2.50	0.17
DMH 1-19	DMH 1-20	204	0.00	0.00	0.00	0.91	5.17	6.51	5.91	18	0.010	12.29	6.95	5.9	160.1	154.6	152.6	0.48	4.00	0.58
CB 1-11	DMH 1-20	27	0.04	0.01	0.04	0.04	5.00	6.60	0.24	12	0.010	4.29	5.46	2.5	158.1	153.7	153.4	0.06	3.40	0.18
CB 1-12	DMH 1-20	20	0.10	0.00	0.09	0.09	5.00	6.60	0.59	12	0.011	4.32	5.50	3.2	158.0	153.6	153.4	0.14	3.40	0.10
DMH 1-20	DMH 1-21	43	0.00	0.00	0.00	1.03	5.10	6.55	6.77	18	0.009	11.97	6.77	6.0	158.0	152.5	152.1	0.57	4.00	0.12
CB 1-2	DMH 1-21	27	0.08	0.11	0.11	0.11	5.00	6.60	0.73	12	0.011	4.40	5.61	3.5	156.4	152.4	152.1	0.17	3.00	0.13
CB 1-24	DMH 1-21	13	0.04	0.01	0.04	0.04	5.00	6.60	0.26	12	0.008	3.70	4.71	2.3	156.4	152.2	152.1	0.07	3.20	0.10
DMH 1-21	WQU 1-1	10	0.00	0.00	0.00	1.18	5.10	6.55	7.76	18	0.010	12.26	6.94	6.4	156.4	152.0	151.9	0.63	2.90	0.03
WQU 1-1	DMH 1-22	43	0.00	0.00	0.00	1.41	5.12	6.54	9.23	24	0.009	25.94	8.26	6.4	155.5	148.2	147.8	0.36	5.30	0.11
RD-3	DMH 1-3	30	0.56	0.00	0.51	0.51	5.00	6.60	3.34	15	0.010	7.67	6.25	5.1	162.0	157.0	156.7	0.44	3.75	0.10
DMH 1-3	DMH 1-4	43	0.03	0.06	0.05	0.55	5.10	6.55	3.61	15	0.012	8.25	6.72	5.5	160.2	156.6	156.1	0.44	2.35	0.13
DMH 1-4	DMH 1-5	142	0.00	0.00	0.00	0.55	5.23	6.48	3.58	15	0.010	7.58	6.17	5.2	160.8	156.0	154.6	0.47	3.55	0.46
DMH 1-5	DMH 1-6	54	0.00	0.00	0.00	0.55	5.68	6.25	3.45	15	0.013	8.72	7.11	5.7	158.7	153.2	152.5	0.40	4.25	0.16
DMH 1-6	DMH 1-13	141	0.00	0.00	0.00	0.55	5.84	6.16	3.40	15	0.020	10.75	8.76	6.6	157.3	152.1	149.3	0.32	3.95	0.36
RD-4	DMH 1-8	11	0.80	0.00	0.72	0.72	5.00	6.60	4.74	15	0.009	7.33	5.98	5.5	162.0	157.0	156.9	0.65	3.75	0.03
DMH 1-8	DMH 1-9	44	0.00	0.00	0.00	0.72	5.03	6.58	4.73	15	0.009	7.32	5.96	5.5	161.6	156.7	156.3	0.65	3.65	0.13
DMH 1-9	DMH 1-10	140	0.00	0.00	0.00	0.72	5.16	6.51	4.68	15	0.010	7.65	6.23	5.7	160.9	156.2	154.8	0.61	3.45	0.41
DMH 1-10	DMH 1-11	85	0.00	0.00	0.00	0.72	5.58	6.30	4.52	15	0.009	7.40	6.03	5.5	160.0	154.7	153.9	0.61	4.05	0.26
DMH 1-11	DMH 1-12	100	0.00	0.00	0.00	0.72	5.84	6.17	4.43	15	0.005	5.40	4.40	4.3	160.2	153.8	153.3	0.82	5.15	0.38
DMH 1-12	DMH 1-13	96	0.00	0.00	0.00	0.72	6.22	6.00	4.31	15	0.042	15.59	12.70	9.2	156.5	153.3	149.3	0.28	1.95	0.17
DMH 1-13	DMH 1-22	71	0.00	0.00	0.00	1.27	6.39	5.93	7.53	15	0.020	10.73	8.74	8.3	156.1	149.2	147.8	0.70	5.65	0.14
DMH 1-22	DMH 1-23	164	0.00	0.00	0.00	2.68	6.54	5.88	15.76	24	0.020	37.99	12.09	9.8	155.0	147.7	144.4	0.41	5.30	0.28
DMH 1-23	DMH 1-31	126	0.00	0.00	0.00	2.68	6.81	5.77	15.47	24	0.010	27.23	8.67	7.7	150.5	143.5	142.2	0.57	5.00	0.27
CB 1-13	DMH 1-24	9	0.14	0.08	0.15	0.15	5.00	6.60	1.00	12	0.011	4.47	5.69	3.9	153.4	149.4	149.3	0.22	3.00	0.04
CB 1-14	DMH 1-24	9	0.06	0.04	0.07	0.07	5.00	6.60	0.43	12	0.011	4.36	5.55	3.0	153.4	149.4	149.3	0.10	3.00	0.05
DMH 1-24	DMH 1-25	195	0.00	0.00	0.00	0.22	5.05	6.57	1.43	12	0.010	4.26	5.43	4.1	153.3	144.7	142.7	0.33	7.60	0.79
CB 1-15	DMH 1-25	6	0.06	0.02	0.06	0.06	5.00	6.60	0.39	12	0.016	5.30	6.75	3.3	146.8	142.8	142.7	0.07	3.00	0.03

CB 1-16	DMH 1-25	5	0.07	0.04	0.08	0.08	5.00	6.60	0.51	12	0.019	5.74	7.30	3.8	146.8	142.8	142.7	0.09	3.00	0.02
DMH 1-25	WQU 1-2	3	0.00	0.00	0.00	0.35	5.02	6.59	2.33	12	0.020	5.94	7.57	6.0	146.9	142.7	142.6	0.39	3.25	0.01
WQU 1-2	DMH 1-32	31	0.00	0.00	0.00	0.35	5.03	6.58	2.33	12	0.010	4.14	5.27	4.7	146.6	142.5	142.2	0.56	3.10	0.11
CB 1-17	DMH 1-26	10	0.06	0.00	0.06	0.06	5.00	6.60	0.38	12	0.010	4.31	5.49	2.8	153.3	148.4	148.3	0.09	3.90	0.06
CB 1-18	DMH 1-26	10	0.06	0.07	0.08	0.08	5.00	6.60	0.52	12	0.010	4.21	5.36	3.1	153.3	148.4	148.3	0.12	3.90	0.05
CB 1-19	DMH 1-26	16	0.00	0.02	0.01	0.01	5.00	6.60	0.06	12	0.006	3.36	4.28	1.4	152.4	148.4	148.3	0.02	3.00	0.19
DMH 1-26	DMH 1-27	105	0.00	0.00	0.00	0.14	5.19	6.50	0.94	12	0.010	4.31	5.49	3.7	153.0	147.3	146.2	0.22	4.70	0.47
CB 1-20	DMH 1-27	18	0.00	0.01	0.00	0.00	5.00	6.60	0.01	12	0.011	4.42	5.63	1.1	150.4	146.4	146.2	0.00	3.00	0.27
DMH 1-27	WQU 1-3	4	0.00	0.00	0.00	0.15	5.00	6.60	0.97	12	0.742	36.26	46.17	16.9	150.6	146.1	143.2	0.03	3.50	0.00
CB 1-21	DMH 1-28	16	0.07	0.09	0.10	0.10	5.00	6.60	0.63	12	0.013	4.72	6.01	3.5	148.5	144.5	144.3	0.13	3.00	0.08
CB 1-22	DMH 1-28	17	0.07	0.00	0.06	0.06	5.00	6.60	0.43	12	0.012	4.59	5.84	3.1	148.5	144.5	144.3	0.09	3.00	0.09
DMH 1-28	WQU 1-3	124	0.00	0.00	0.00	0.16	5.09	6.55	1.06	12	0.008	3.88	4.93	3.5	149.5	144.2	143.2	0.27	4.30	0.58
WQU 1-3	DMH 1-30	9	0.00	0.00	0.00	0.31	5.67	6.25	1.92	12	0.012	4.52	5.75	4.7	151.0	142.9	142.8	0.43	7.10	0.03
FIELD	DMH 1-29	25	0.01	0.37	0.14	0.14	5.70	6.23	0.86	12	0.008	3.78	4.81	3.3	151.9	147.1	146.9	0.23	3.84	0.13
DMH 1-29	DMH 1-30	121	0.00	0.00	0.00	0.14	5.83	6.17	0.85	12	0.010	4.19	5.33	3.5	151.4	146.9	145.7	0.20	3.50	0.57
DMH 1-30	DMH 1-31	6	0.00	0.00	0.00	0.45	6.40	5.93	2.64	12	0.035	7.86	10.01	7.6	150.5	143.0	142.8	0.34	6.50	0.01
DMH 1-31	DMH 1-32	43	0.00	0.00	0.00	3.13	6.42	5.92	18.52	24	0.012	28.89	9.20	8.5	149.0	142.7	142.2	0.64	4.30	0.08
CB 1-23	DMH 1-33	47	0.20	0.07	0.20	0.20	5.00	6.60	1.35	12	0.006	3.36	4.28	3.4	159.8	156.8	156.5	0.40	2.00	0.23
DMH 1-33	DMH 1-34	134	0.00	0.00	0.00	0.20	5.23	6.48	1.32	12	0.006	3.15	4.01	3.3	160.5	156.5	155.7	0.42	3.05	0.68
DMH 1-34	DMH 1-35	85	0.00	0.00	0.00	0.20	5.91	6.13	1.25	12	0.006	3.23	4.11	3.3	160.8	155.7	155.2	0.39	4.10	0.43
DMH 1-35	FES 1-6	21	0.00	0.00	0.00	0.20	6.34	5.95	1.21	12	0.057	10.05	12.80	7.3	159.1	155.2	154.0	0.12	2.90	0.05
OCS 1-3	FES 1-5	34	0.00	0.16	0.06	0.06	6.39	5.93	0.33	12	0.006	3.21	4.08	2.2	152.3	149.0	148.8	0.10	2.25	0.26
CB 2-1	DMH 2-1	17	0.02	0.01	0.02	0.02	5.00	6.60	0.16	12	0.015	5.11	6.51	2.5	160.7	156.7	156.5	0.03	3.00	0.11
CB 2-2	DMH 2-1	25	0.01	0.00	0.01	0.01	5.00	6.60	0.09	12	0.010	4.18	5.33	1.8	160.7	156.7	156.5	0.02	3.00	0.23
DMH 2-1	DMH 2-2	84	0.07	0.13	0.11	0.15	5.23	6.48	0.94	12	0.005	3.08	3.92	2.9	160.9	156.5	156.0	0.31	3.45	0.48
DMH 2-2	DMH 2-3	121	0.11	0.00	0.10	0.25	5.71	6.23	1.53	12	0.005	2.96	3.77	3.3	161.7	155.9	155.3	0.52	4.80	0.62
CB 2-3	DMH 2-3	16	0.06	0.07	0.08	0.08	5.00	6.60	0.53	12	0.012	4.68	5.95	3.3	163.5	155.5	155.3	0.11	7.00	0.08
CB 2-4	DMH 2-3	2	0.08	0.00	0.08	0.08	5.00	6.60	0.50	12	0.049	9.35	11.90	5.3	163.5	155.4	155.3	0.05	7.10	0.01
DMH 2-3	DMH 2-5	53	0.00	0.00	0.00	0.40	5.01	6.60	2.65	15	0.006	5.73	4.67	3.9	163.3	155.2	154.9	0.46	6.85	0.23
CB 2-5	DMH 2-4	17	0.07	0.00	0.06	0.06	5.00	6.60	0.43	12	0.012	4.61	5.87	3.1	168.0	156.9	156.7	0.09	10.10	0.09
CB 2-6	DMH 2-4	15	0.08	0.00	0.07	0.07	5.00	6.60	0.47	12	0.013	4.83	6.15	3.3	168.0	156.9	156.7	0.10	10.10	0.08
DMH 2-4	DMH 2-5	86	0.00	0.00	0.00	0.14	5.08	6.56	0.89	12	0.020	5.91	7.53	4.6	167.0	156.6	154.9	0.15	9.40	0.32
DMH 2-5	DMH 2-6	79	0.06	0.14	0.10	0.64	5.39	6.40	4.08	15	0.010	7.68	6.26	5.5	163.6	154.8	154.0	0.53	7.55	0.24
CB 2-7	DMH 2-6	11	0.06	0.00	0.06	0.06	5.00	6.60	0.37	12	0.009	4.02	5.12	2.7	161.6	154.1	154.0	0.09	6.50	0.07
CB 2-8	DMH 2-6	11	0.11	0.00	0.09	0.09	5.00	6.60	0.62	12	0.009	4.05	5.16	3.1	161.6	154.1	154.0	0.15	6.50	0.06
DMH 2-6	DMH 2-7	66	0.00	0.00	0.00	0.79	5.06	6.57	5.18	15	0.011	7.87	6.41	5.9	162.0	153.9	153.2	0.66	6.85	0.18
CB 2-9	DMH 2-7	40	0.08	0.01	0.07	0.07	5.00	6.60	0.47	12	0.010	4.21	5.35	3.0	159.4	153.6	153.2	0.11	4.80	0.22
DMH 2-7	WQU 2-1	18	0.00	0.00	0.00	0.86	5.22	6.48	5.57	15	0.011	8.06	6.57	6.2	160.1	153.1	152.9	0.69	5.75	0.05
CB 2-10	WQU 2-1	23	0.07	0.01	0.06	0.06	5.00	6.60	0.42	12	0.009	3.91	4.97	2.7	158.9	153.1	152.9	0.11	4.80	0.14
WQU 2-1	SDS-2	7	0.00	0.00	0.00	0.92	5.14	6.53	6.02	18	0.005	9.17	5.19	4.8	159.3	152.9	152.9	0.66	4.90	0.03
CB 2-11	WQU 2-2	17	0.10	0.01	0.09	0.09	5.00	6.60	0.62	12	0.011	4.51	5.74	3.4	155.5	150.3	150.1	0.14	4.20	0.09
CB 2-12	WQU 2-2	67	0.07	0.06	0.08	0.08	5.00	6.60	0.55	12	0.006	3.24	4.13	2.6	153.9	150.9	150.5	0.17	2.00	0.43
WQU 2-2	SDS-2	3	0.00	0.00	0.00	0.18	5.43	6.37	1.13	12	0.004	2.66	3.39	2.8	156.0	150.5	150.5	0.43	4.50	0.02
SDS-2	OCS 2-1	17	0.00	0.00	0.00	1.10	5.45	6.37	1.87	12	0.006	3.20	4.07	3.6	153.8	150.0	149.9	0.58	2.75	0.08
OCS 2-1	DMH 2-9	60	0.00	0.00	0.00	1.10	5.53	6.33	1.87	12	0.010	4.22	5.37	4.4	155.2	149.9	149.3	0.44	4.30	0.22
DMH 2-9	DMH 2-10	194	0.00	0.00	0.00	1.10	5.75	6.21	1.87	12	0.010	4.27	5.44	4.5	153.8	147.1	145.1	0.44	5.70	0.72
DMH 2-10	DMH 2-11	125	0.00	0.00	0.00	1.10	6.48	5.90	1.87	12	0.010	4.29	5.46	4.5	149.1	141.7	140.4	0.44	6.40	0.47
CB 2-13	WQU 2-3	7	0.05	0.00	0.05	0.05	5.00	6.60	0.30	12	0.013	4.86	6.19	2.9	145.0	140.9	140.8	0.06	3.10	0.04
CB 2-14	WQU 2-3	40	0.12	0.00	0.11	0.11	5.00	6.60	0.73	12	0.005	2.97	3.78	2.6	144.0	141.0	140.8	0.25	2.00	0.25
WQU 2-3	DMH 2-12	19	0.00	0.00	0.00	0.16	5.25	6.47	1.02	12	0.011	4.32	5.50	3.8	145.5	140.7	140.5	0.24	3.80	0.08
DMH 2-12	SDS-1	3	0.00	0.00	0.00	0.16	5.34	6.42	1.01	12	0.004	2.60	3.31	2.6	145.5	140.7	140.7	0.39	3.80	0.02
SDS-1	OCS 2-2	3	0.00	0.00	0.00	0.16	5.35	6.42	1.01	12	0.004	2.66	3.39	2.7	146.3	140.5	140.5	0.38	4.80	0.02
OCS 2-2	DMH 2-11	10	0.00	0.00	0.00	0.16	5.37	6.41	1.01	12	0.009	3.93	5.00	3.5	146.3	140.5	140.4	0.26	4.81	0.05
DMH 2-11	DMH 2-16	106	0.00	0.00	0.00	1.26	5.42	6.38	1.94	12	0.011	4.48	5.70	4.7	145.8	140.3	139.1	0.43	4.50	0.38
CB 2-15	DMH 2-13	14	0.05	0.00	0.04	0.04	5.00	6.60	0.28	12	0.007	3.57	4.55	2.3	145.9	141.8	141.7	0.08	3.10	0.10
CB 2-16	DMH 2-13	28	0.05	0.01	0.05	0.05	5.00	6.60	0.30	12	0.007	3.58	4.55	2.3	145.9	141.9	141.7	0.08	3.00	0.20
DMH 2-13	DMH 2-14	103	0.00	0.00	0.00	0.09	5.20	6.50	0.58	12	0.013	4.73	6.02	3.4	145.8	141.2	139.9	0.12	3.60	0.50
CB 2-18	DMH 2-14	9	0.08	0.07	0.09	0.09	5.00	6.60	0.60	12	0.011	4.51	5.74	3.36	143.2	140.0	139.9	0.13	2.2	0.04
CB 2-17	DMH 2-14	12	0.04	0.00	0.03	0.03	5.00	6.60	0.22	12	0.017	5.46	6.96	2.86	143.2	139.7	139.5	0.04	2.5	0.07
DMH 2-14	WQU 2-4	26	0.00	0.00	0.00	0.21	5.07	6.56	1.40	12	0.012	4.52	5.75	4.29	144.2	139.8	139.5	0.31	3.4	0.10
WQU 2-4	DMH 2-16	12	0.00	0.00	0.00	0.21	5.17	6.51	1.39	12	11.701	143.98	183.32	49.95	143.6	139.3	139.1	0.01	3.35	0.00

Appendix D: Construction Management Plan (prepared by Gilbane Building Company)

West Elementary School, Shawsheen Pre-School
58 Beacon Street
Andover, MA 01810

CONSTRUCTION MANAGEMENT PLAN

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SUMMARY NARRATIVE:

This Construction Management Plan has been developed to adhere to Town of Andover, MA STORMWATER MANAGEMENT AND EROSION CONTROL REGULATIONS – Amended 05/11/21. In the event of a conflict between site planning and Town of Andover, MA REGULATIONS, the Town of Andover, MA REGULATIONS shall govern. Plan shall be executed in accordance with NPDES General Construction Permit.

While the intent of this plan is an overview of proposed work activities, a separate, formal Stormwater Pollution Prevention Plan will be provided.

1 PROJECT INFORMATION

1.1 Project Location/Access

The Project is located at 58 Beacon Street, Andover, MA 01810.

Vehicle Access: Trade and Delivery Access into the site shall be from the north along Beacon Street. (See attached **Map A**)

Travel route shall be via Rte. 495, to Route 28, to Mt. Vernon Street, to Beacon Street, and reverse upon exiting the site.

NOTE: NO CONSTRUCTION SITE VEHICLE ACCESS DURING THE TIME OF SCHOOL DROP-OFF FROM 8:15AM - 9:00AM AND SCHOOL PICK-UP FROM 3:15PM - 4:00PM DURING OCCUPIED SCHOOL YEAR

1.2 Project Work Hours:

Project consists of construction of new West Elementary School and Shawsheen Pre-School, demolition and removal of existing school structure, and construction of new parking and athletic field.

Business Work Hours
Monday through Friday 6:30 AM – 6:00 PM

Trade Work Hours
Monday through Friday 7:00 AM – 6:00 PM; after 6:00PM or Weekends with Approval

*An exception for extended work hours shall be proposed in advance for any prolonged work activities, such as concrete finishing.

1.3 Construction Contact Information:

Walt Kincaid – Senior Project Executive, Gilbane Building Company
wkincaid@gilbaneco.com 617-960-2936

Katie Strumolo – Senior Pre-Construction Executive, Gilbane Building Company
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Michael Marcella – Project Executive, Gilbane Building Company
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Sam Nehamkin – Senior General Superintendent, Gilbane Building Company
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Mark Winslow – Project Executive Environmental Solutions, Gilbane Building Company
mwinslow@gilbaneco.com 401-456-5506

2 SITE PLANNING

2.1 Project/Site Separation

Construction Site Separation shall be performed with chain link fencing and secure entry gates. Select chain link fence locations shall have applied windscreen fabric with straw wattles or applied windscreen at the chain link facing occupied school areas. (see attached Map B)

2.2 Nature of Construction Activities

The project involves development and construction of new Elementary, Kindergarten and Pre-School structure. Work entails removal of existing playing fields, stripping of loam and soil, excavation for new building foundations using hydraulic sitework equipment. New building construction shall be new steel framed and concrete structure with exterior walls, envelope, roofs, and fenestrations using a variety of hydraulic equipment, aerial lifts, shoring and scaffolding.

Removal of existing building shall consist of existing hazardous material abatement, demolition of former steel, concrete and masonry structure using hydraulic demolition and site equipment. Demolition materials to be removed, properly disposed or recycled from site.

Construction of new parking area and athletic field shall consist of grading, drainage, site improvements shall use site equipment.

2.3 Phasing/Sequence and Estimated Dates of Construction Activities

Phase 0 – Site Enabling, Environmental Protection, Project Set-up = April 2022 - June 2022 (Map B)

- Area disturbed during work = existing athletic fields
- Environmental Protection = Existing Stormwater System Inlet Protection/Fabric/Sediment Trap Control, Perimeter protection barrier, and Stockpile barriers

Phase 1 – Construction of new school = June 2022 – August 2024 (Map C)

- Area disturbed during work = former athletic field, portions of school parking lot/drive, former and new play areas
- Environmental Protection = Existing and New Stormwater System inlet protection/Fabric/Sediment Trap Control, Perimeter protection barrier, and Stockpile barriers

Phase 2 – Demolition of existing structure, develop remaining space into new parking and athletic fields = July 2024 – May 2025

- Area disturbed during work = former school structure and portions of school parking lot/drive
- Environmental Protection = Existing and New Stormwater System inlet protection/Fabric/Sediment Trap Control, Perimeter protection barrier, and Stockpile barriers

3 PROPOSED EROSION AND SEDIMENT CONTROLS

3.1 Perimeter Controls and Wetlands/Buffers Protection

The site will be enclosed by a temporary construction fence as shown in Maps B and C. Construction gates will be located at the site entrances. Work shall be performed in accordance with NPDES General Construction Permit. All gates will have stabilized construction access entrance/exit to mitigate tracking of mud and dirt onto Town of Andover roads. Any sediment tracked shall be removed by the end of the same workday.

Specific Perimeter Controls:

- Site Fencing adjacent to abutters and vegetated areas shall consist of chain link fencing with windscreen applied and straw wattles. This shall be installed prior to the start of Construction and shall be inspected every 14 days and within 24 hours of a storm event of ¼" or greater. This

shall be maintained in effective condition for the duration of the project and shall be maintained with any sediment removed before it has accumulated to ½ of the above-ground height of the wattle control.

- Site fencing adjacent to, and facing, existing school operations shall be chain link fencing with windscreen applied for dust control. This shall be installed prior to the start of Construction and shall be maintained in effective condition for the duration of the project.

- On site soil stockpiles shall receive perimeter straw wattles at base of soil pile immediately after pile is established. Stockpile wattles shall be inspected every 14 days and within 24 hours of a storm event of ¼" or greater.

- Wetlands and Buffer Zone Protection shall consist of Silt Fence entrenched along existing subsoil with Straw Bales entrenched and staked. This shall be installed prior to the start of Construction and shall be inspected every 14 days and within 24 hours of a storm event of ¼" or greater. This shall be maintained in effective condition for the duration of the project and shall be maintained with any sediment removed before it has accumulated to ½ of the above-ground height of the wattle control.

3.2 Sediment Track-Out

Gates #1 and #2 shall be located, as shown on Maps B and C, to allow for construction vehicle access. Gate #1 shall be the primary construction site entrance and exit. Gate #2 will be established for secondary/emergency use. Gates and access points shall have a stabilized construction entrance/exit to minimize the track-out of sediment onto Town of Andover sidewalks or streets from vehicles exiting the construction site. Where sediment has been tracked out from the site, all deposited sediment shall be removed the same business day in which the track-out occurs. All track-out shall be removed via sweeping, shoveling or other effective means of sediment removal. No sediment shall be allowed to be hosed into any stormwater conveyance.

Specific Track-Out Control

- Street Sweeping Method – all areas adjacent to the site shall be inspected daily to determine if street sweeping is required.

- Stabilized Construction Entrance – shall be installed prior to the start of Construction and shall be inspected every 14 days and within 24 hours of a storm event of ¼" or greater. This shall be maintained in effective condition for the duration of the project and in a condition that will

prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic topdressing with additional stone and re-shaping of pad to ensure effectiveness.

3.3 Stockpiled Sediment or Soil

All sediment or soil stockpiles shall be located outside of any natural or protected buffers and away from existing and proposed catch basins, area drains, and outside of proposed infiltration system footprints. A straw wattle sediment barrier shall be installed along all downgradient perimeter areas. For stockpiles that will remain inactive for 14 or more calendar days, a tarp cover, jute stabilizing matting, hydroseeding when temperatures permit, or soil tackifier shall be used to provide temporary pile stabilization. Stockpile control shall be inspected every 14 days and within 24 hours of a storm event of ¼" or greater. This shall be maintained in effective condition for the duration of the project and in a condition that will prevent tracking or flowing of sediment onto public rights-of-way.

3.4 Stabilization/Minimizing Disturbance of Steep Slopes

No steep slopes are proposed as part of this project. In the event of any slopes at 15% or greater, jute stabilizing matting, hydroseeding when temperatures permit, or soil tackifier shall be used to provide stabilization. Slopes shall be inspected every 14 days and within 24 hours of a storm event of ¼" or greater. This shall be maintained in effective condition for the duration of the project and in a condition that will prevent tracking or flowing of sediment onto public rights-of-way.

3.5 Preservation of Native Topsoil, Turf, and Vegetative Buffer

Onsite native topsoil, turf, and vegetative buffer shall be preserved or maintained for as long as possible prior to stripping topsoil. Construction sequencing shall be performed such that earth materials are exposed for a minimum amount of time before they are covered, seeded, or otherwise stabilized.

3.6 Minimize Soil Compaction

In areas where infiltration practices will be installed or areas of the site where final vegetative stabilization will occur, soil compaction shall be minimized. This shall include restricting all vehicle and equipment access or use.

Areas used for post-construction infiltration shall be constructed after all ground surfaces are fully stabilized, where feasible. If proposed infiltration areas are compacted prior to the site being fully

stabilized, additional erosion controls shall be installed. All soil stockpiles and material storage areas shall be located outside of the areas proposed for post-construction infiltration.

3.7 Storm Drain Inlets

All existing and proposed storm drain inlets affected by construction activities shall be protected using an Inlet Sediment Trap Filter. Inlet Sediment Trap Filters shall be checked weekly, cleaned, or

removed/replaced as sediment accumulates, the filter becomes clogged and/or performance is compromised. Where there is evidence of sediment accumulation adjacent to the inlet protection, remove the deposited sediment by the end of the same business day in which it found.

3.8 Dewatering Practices

Site dewatering shall occur in a way that minimizes the discharge of pollutants into ground water or accumulated stormwater that is removed from excavations, trenches, vaults, or other similar points of accumulation. Dewatering shall be performed in accordance, and dewatering water shall be treated and shall comply, with Construction Dewatering Requirements Part 2.4 of NPDES 2017 General Construction Permit. Water with visible floating solids or foam may not be discharged.

- Dewatering controls shall consist of Sediment Basins, Sediment Socks, Dewatering Tanks, and Filtration Systems. Controls shall be inspected every 14 days and within 24 hours of a storm event of ¼" or greater and shall be maintained in effective condition for the duration of the project work activities.

SECTION 4: POLLUTION PREVENTION

4.1 Fueling and Maintenance of Equipment or Vehicles

Minor vehicle and equipment emergency maintenance can be performed on site away from drainage structures and away from Wetlands Areas. No vehicle fueling shall be allowed within 25 feet of drainage structures. Fueling shall only be performed in contained, designated area and fueling is prohibited within 100 feet of Wetlands Area protection.

Major vehicle and equipment maintenance shall not be performed on site. Equipment/vehicle storage areas and any onsite storage tanks shall be inspected weekly and after storm events. Equipment will be inspected for leaks, equipment damage, and other service problems each day of use. Any leaks will be repaired immediately, or the equipment/vehicle shall be removed from the site. Drip pans, drip cloths,

or absorbent pads shall be used when repairing leaks or replacing spent fluids. Fluids shall be collected and stored/disposed of offsite.

4.2 Spill Prevention and Response

The Construction Manager/Site Contractor shall designate someone onsite to serve as the Spill Cleanup Coordinator. At least two other personnel shall be designated as alternate spill coordinators. All spill

control personnel shall be trained in spill prevention, control, and cleanup. The names of the responsible personnel will be posted at the jobsite office of the Construction Manager.

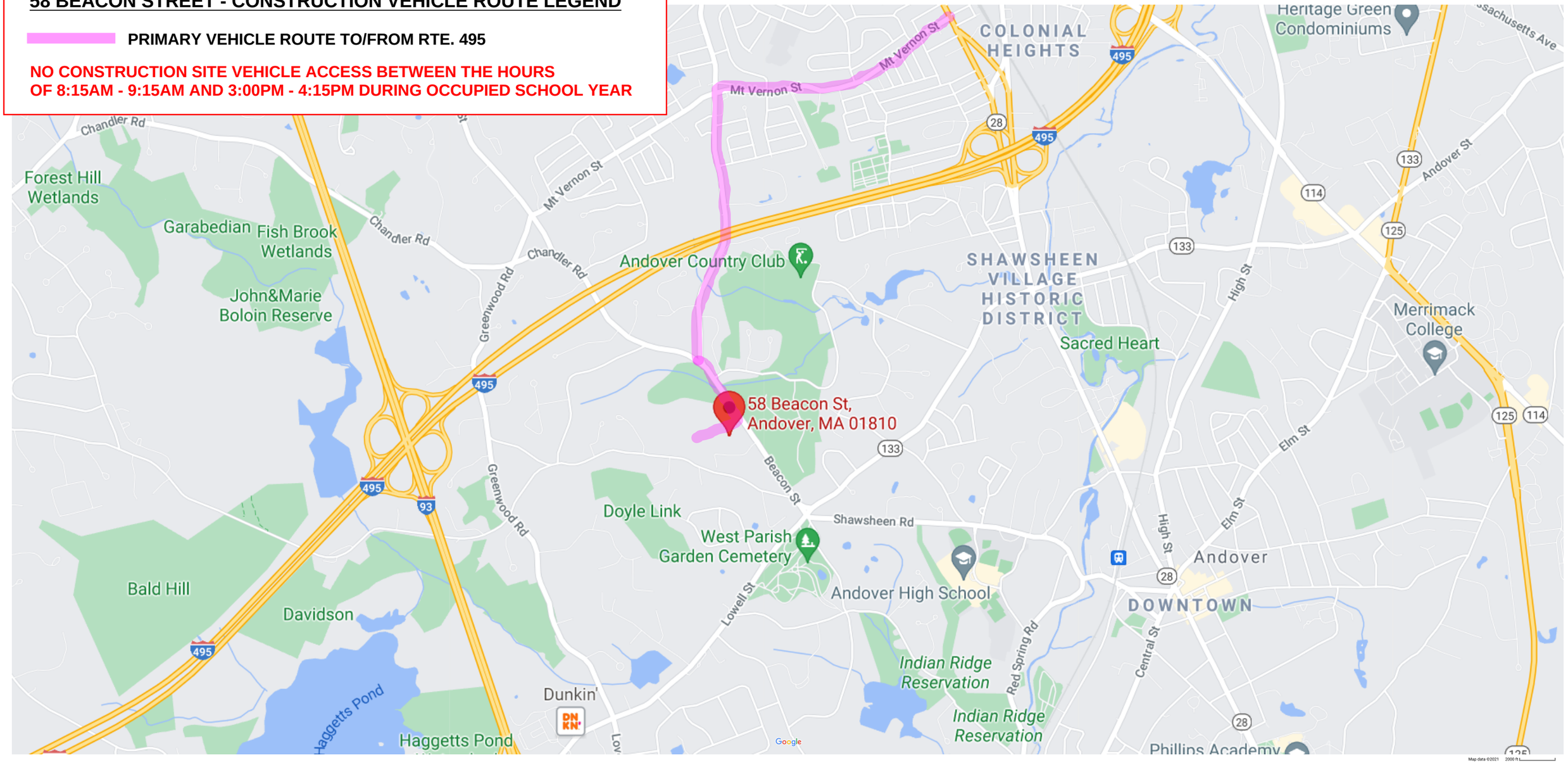
Spill Prevention and Control

- Manufacturers' recommended spill control methods will be posted on site and site personnel will be made aware of the requirements.
- Spill kits and cleanup supplies will be kept on site in a materials storage area. This equipment will include, at a minimum – goggles, brooms, dustpans, mops, rags, gloves, oil absorbent, sawdust, plastic and metal trash cans, and other materials specifically designated for cleanup.
- All spills will be immediately cleaned up upon discovery.
- The spill area shall be well ventilated.
- Cleanup personnel will wear suitable protective clothing.
- Spills of toxic and/or hazardous material will be reported to state, local, and Federal authorities, as required by law. Spills shall also be reported immediately to the Owner.
- A spill will be recorded and filed, detailing the amount and extent of the spill, material(s) involved, and effectiveness of the cleanup. This report will be on file at the Construction Manager's office, and a copy shall be provided to the designated Spill Cleanup Coordinator.

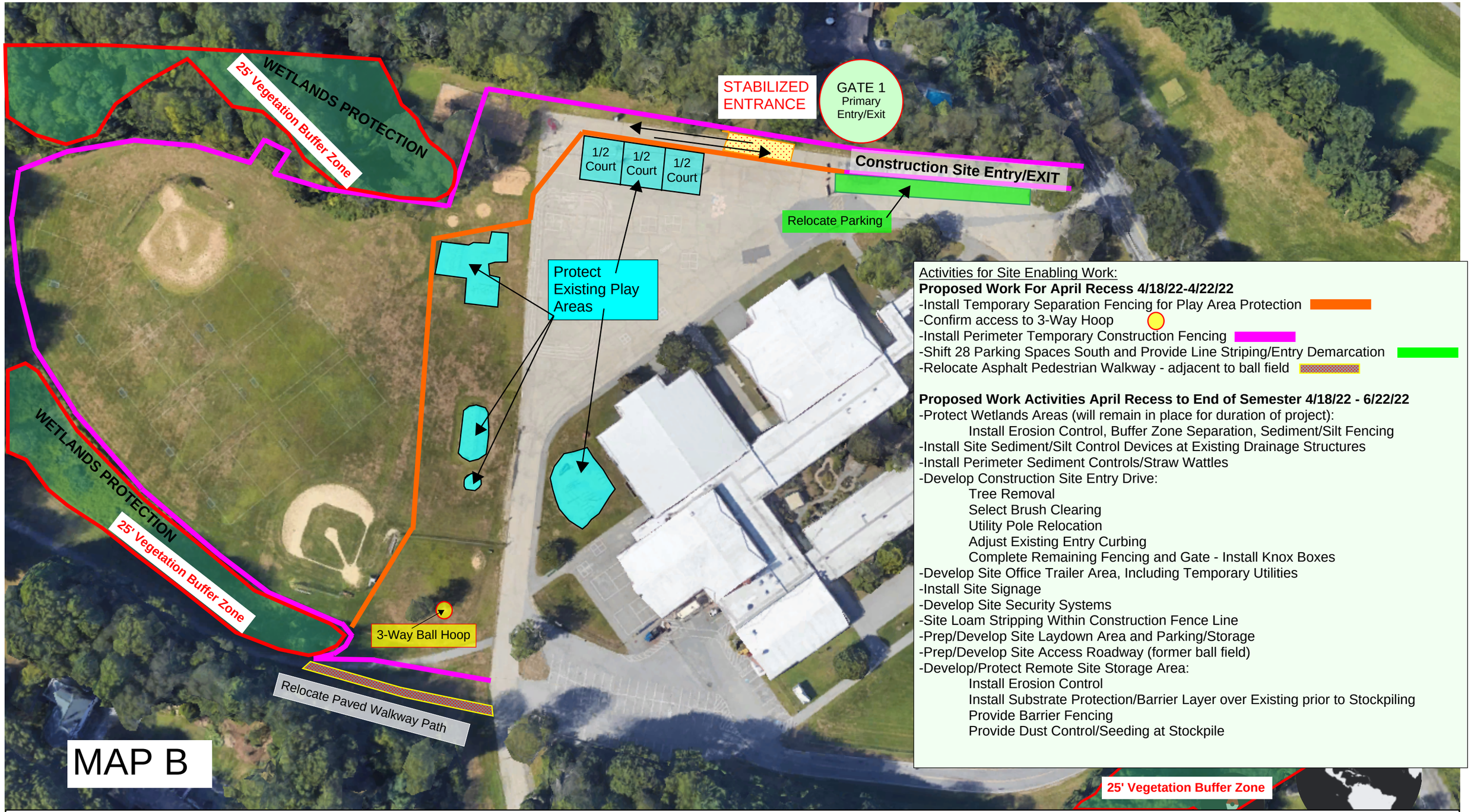
58 BEACON STREET - CONSTRUCTION VEHICLE ROUTE LEGEND

PRIMARY VEHICLE ROUTE TO/FROM RTE. 495

NO CONSTRUCTION SITE VEHICLE ACCESS BETWEEN THE HOURS OF 8:15AM - 9:15AM AND 3:00PM - 4:15PM DURING OCCUPIED SCHOOL YEAR



MAP A - VEHICLE TRAVEL ROUTE



Activities for Site Enabling Work:

Proposed Work For April Recess 4/18/22-4/22/22

-Install Temporary Separation Fencing for Play Area Protection

-Confirm access to 3-Way Hoop

-Install Perimeter Temporary Construction Fencing

-Shift 28 Parking Spaces South and Provide Line Striping/Entry Demarcation

-Relocate Asphalt Pedestrian Walkway - adjacent to ball field

Proposed Work Activities April Recess to End of Semester 4/18/22 - 6/22/22

-Protect Wetlands Areas (will remain in place for duration of project):
- Install Erosion Control, Buffer Zone Separation, Sediment/Silt Fencing

-Install Site Sediment/Silt Control Devices at Existing Drainage Structures

-Install Perimeter Sediment Controls/Straw Wattles

-Develop Construction Site Entry Drive:
- Tree Removal
- Select Brush Clearing
- Utility Pole Relocation
- Adjust Existing Entry Curbing
- Complete Remaining Fencing and Gate - Install Knox Boxes

-Develop Site Office Trailer Area, Including Temporary Utilities

-Install Site Signage

-Develop Site Security Systems

-Site Loam Stripping Within Construction Fence Line

-Prep/Develop Site Laydown Area and Parking/Storage

-Prep/Develop Site Access Roadway (former ball field)

-Develop/Protect Remote Site Storage Area:
- Install Erosion Control
- Install Substrate Protection/Barrier Layer over Existing prior to Stockpiling
- Provide Barrier Fencing
- Provide Dust Control/Seeding at Stockpile

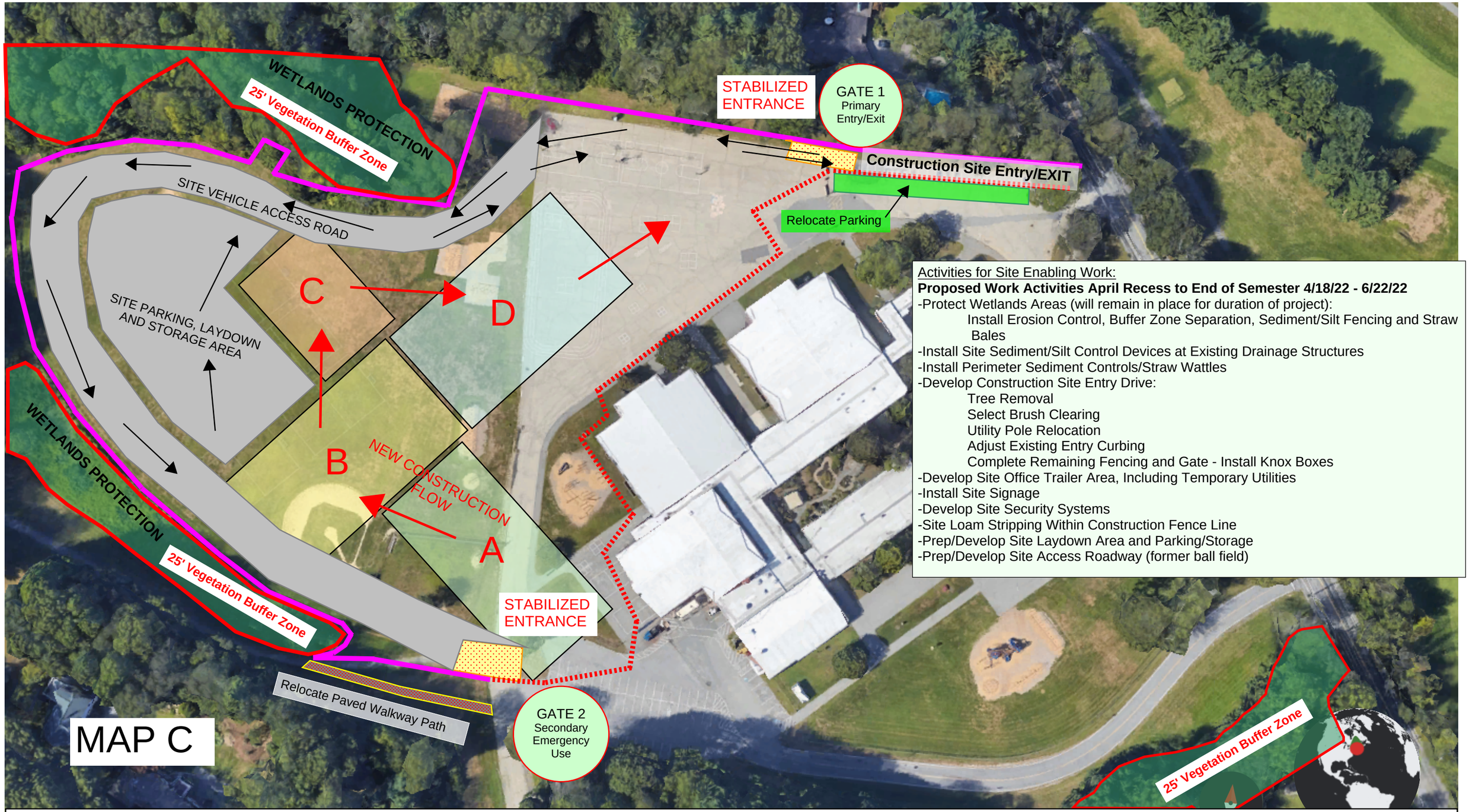
Temporary Construction Fencing
4/18/22 for project duration

Temporary Play Area Separation Fencing
4/18/22 to 6/22/22

Existing Play Area
4/18/22 to 6/22/22

Wetlands Protection
4/18/22 until project duration

Gilbane



Activities for Site Enabling Work:

Proposed Work Activities April Recess to End of Semester 4/18/22 - 6/22/22

-Protect Wetlands Areas (will remain in place for duration of project):
  Install Erosion Control, Buffer Zone Separation, Sediment/Silt Fencing and Straw Bales
-Install Site Sediment/Silt Control Devices at Existing Drainage Structures
-Install Perimeter Sediment Controls/Straw Wattles
-Develop Construction Site Entry Drive:
  Tree Removal
  Select Brush Clearing
  Utility Pole Relocation
  Adjust Existing Entry Curbing
  Complete Remaining Fencing and Gate - Install Knox Boxes
-Develop Site Office Trailer Area, Including Temporary Utilities
-Install Site Signage
-Develop Site Security Systems
-Site Loam Stripping Within Construction Fence Line
-Prep/Develop Site Laydown Area and Parking/Storage
-Prep/Develop Site Access Roadway (former ball field)

Wetlands Protection - Silt Fence with Straw Bales
Installed 4/18/22 and maintained for project duration

Temporary Construction Fencing with Windscreen and Straw Wattles
Installed 4/18/22 and maintained for project duration

Temporary Construction Separation Fencing with Windscreen
Installed 4/18/22 to 6/22/22

Stabilized Construction Entrance/Exit

Gilbane

Appendix E: Operation and Maintenance Plan

SMMA

Operation & Maintenance Plan

Introduction

This Operation and Maintenance (O&M) Plan has been developed in accordance with the Massachusetts DEP Stormwater Management Standard No. 9 to ensure that the stormwater management system functions as designed.

Owner and Responsible Party

As the owner, the Town of Andover shall be the party responsible for adherence to the DEP Stormwater Management Policy after to completion of construction and until a Certificate of Compliance is issued by the Conservation Commission. The Andover School District shall designate a Site Supervisor who shall assume responsibility for this maintenance plan, post construction, after a Certificate of Compliance has been issued.

If the property owner changes, it shall be the responsibility of the Town of Andover to notify the future owner of the stormwater management system and its components, as well as the requirements for operation and maintenance.

The Town of Andover Conservation Commission shall be allowed to enter the property at reasonable times and in a reasonable manner for the purposes of inspection of the systems.

Illicit Discharges

Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater, and any illicit discharge to the stormwater management system is prohibited. The stormwater management system conveys, treats, and infiltrates on-site stormwater and includes stormwater best management practices and any pipes intended to transport stormwater to the groundwater, a surface water, or municipal separate storm sewer system. Notwithstanding the foregoing, an illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated groundwater, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing and water used to clean residential buildings without detergents.

Stormwater Maintenance Activities

The following site maintenance activities are required to maintain optimal pollutant attenuation by the drainage system. A maintenance schedule follows in the next section.

Catch Basins and Manholes

Proper maintenance includes inspection of all grates, sumps, and outlets. Any debris or obstructions should be removed. Structural damage should be recorded and reported. The amount of sediment in each structure should be recorded. The sumps shall be cleaned when they are half full of sediment or debris (approximately 2 feet below outlet pipe.)

Pavement and Grass Areas

The pavement areas should be swept to remove solids and reduce levels of suspended solids in stormwater runoff. All accumulated trash and litter throughout the site should be collected and discarded.

Water Quality Units

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument.

The water quality system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. Performance will not be impacted until 100% of the sump capacity is exceeded; however, it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine whether the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning of the systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole cover and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be cleaned to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Polluted water or sediments removed from the CDS is to be disposed of in accordance with all applicable local, state and federal laws and regulations including M.G.L.c. 21C and 310 CMR 30.00.

Bioretention Areas

Bioretention areas are prone to clogging and failure, so it is imperative to develop and implement aggressive maintenance plans and schedules. Perform inspections and preventive maintenance at least twice a year, and after every time drainage discharges through the high outlet orifice. Inspect the pretreatment BMPs in accordance with the minimal requirements specified for those practices and after every major storm event. A major storm event is defined as a storm that is equal to or greater than the 2-year, 24-hour storm (generally 2.9 to 3.6 inches in a 24-hour period, depending in geographic location in Massachusetts).

Once the bioretention area is in use, inspect it after every major storm for the first few months to ensure it is stabilized and functioning properly and if necessary, take corrective action. Note how long water remains standing in the basin after a storm; standing water within the basin 48 to 72 hours after a storm indicates that the infiltration capacity may have been overestimated. If the ponding is due to clogging, immediately address the reasons for the clogging (such as upland sediment erosion, excessive compaction of soils, or low spots).

Thereafter, inspect the area at least twice per year. Important items to check during the inspection include:

- Signs of differential settlement,
- Cracking,
- Erosion,
- Leakage in the embankments,
- Tree growth on the embankments,
- Condition of riprap,
- Sediment accumulation and
- The health of the turf.

At least twice a year, mow the buffer area, side slopes, and basin bottom. Remove grass clippings and accumulated organic matter to prevent an impervious organic mat from forming. Remove trash and debris at the same time. Use deep tilling to break up clogged surfaces and revegetate immediately.

Remove sediment from the bioretention area as necessary but wait until the floor of the basin is thoroughly dry. Use light equipment to remove the top layer so as to not compact the underlying soil. Deeply till the remaining soil and revegetate as soon as possible. Inspect and clean pretreatment devices associated with basins at least twice a year, and ideally every other month.

The bioretention areas should be inspected and cleaned of any trash or debris on a periodic basis. Plant material in poor health, damaged or dead should be removed and replaced. Grasses which are subsiding or dead will require reseeding with the appropriate seed mixtures. If the bioretention area fails, then all soil media and vegetation shall be removed and replaced per the specified planting plan. Snow should never be stored in the bioretention area.

Subsurface Detention Systems

The inlet and outlet of the system should be inspected and cleared of any debris that might clog the system. The system should be checked to ensure functionality after installation. The area above and immediately adjacent to the infiltration system should be checked for depressions. The area above and adjacent to the system should also be inspected to ensure that no unauthorized modifications have been made.

Synthetic Turf Field

Snow Removal

The equipment and experience requirements for snow removal are such that the field designer, JJA Sports, strongly recommends this work be performed by experienced professionals only. A snow and ice management plan requires that proper equipment is used, staff are properly trained, adequate time is provided for proper execution of the work, and that an off-of-the-sports-surface location to store removed snow and ice is available. Check with you turf and track manufacturer for specific instructions to remove snow and ice. Each manufacturer may have requirements that differ from this guide. Further, the removal of snow and ice from a field or track surface may void portions of the warranty if done incorrectly.

The goal of this plan should be:

- In low accumulation storm events on a turf field, less than 2 inches total, with sun pending over the following days it is often necessary to only expose the surface of the turf to the sun which will quickly melt the snow. Twenty or more areas of 20 feet by 20 feet, equally spread out of the surface, will typically generate enough heat to melt the remaining snow.
- Remove dry snow before it accumulates to a 6-inch depth **and always drive straight**.

- Remove wet snow before it accumulates to a 3-inch depth **and always drive straight**. The weight of wet snows in-parts large wheel loads that can damage a turf field surface.
- Minimize pushing snow and ice across main seams of the field system to the extent practical.
- Push the snow to the sidelines from the middle of the field out to avoid long pushes. In cases where the push must go to one side, push the near half first and then push the furthest section afterwards or push snow at one half the depth noted above (4" for dry snow and 2" for wet snow.
- Snow blow accumulated piles of snow off the field edge of the synthetic turf field to a natural grass location to the extent possible before they freeze. Snow blowers shall have synthetic runners to keep blower off the surface.
- Where snow has a crusty surface, it is recommended to break up this surface by driving a Gator or similar vehicle until all areas are broken-up by the action of the tires on the crusty snow.
- A dry crystallize snow can sometimes be removed with the use of backpack or trailer style leaf blowers.
- Never let the snow get ahead of the effort.
- Never carry wet snow in a loading bucket or trailer over any sport surface. The effective load extended out in the bucket creates, multiplies the front wheel loading significantly, and can result in rutting of the turf.
- Never leave piles of snow and or ice on the sports surface.

Ice Removal

See product specific maintenance recommendations for ice removal. Before attempting to remove ice break it up and allow time for warmer air to access the turf surface and initiate melting. Expose small areas of the turf to allow solar radiation to warm the surface and melt the frozen connects to the fibers. Always dig test holes through the full depth of the snow/ice cover to determine conditions before commencing. Recommended removal equipment:

- 40 to 60 hp 4-wheel drive tractor with a PTO and front-end loader with turf tires.
- A ProTech SPO6T synthetic turf specific plow blade. Use this to push snow to the side lines from the center. This can be mounted on the tractor front bucket arms.
- A 6-foot-wide to 7-foot wide high flow rate PTO driven snow blower for removal of sideline piles and general removal of snow from the sports surfaces. Requires surface runners to protect the synthetic turf surface and track. Blower must be capable of throwing snow 40 to 50 feet.
- Backpack or trailer type leaf blower for dry crystalized snow.

Key conditions to avoid:

- Never turn the wheels of a vehicle on a sport surface unless the vehicle is moving.
- Allowing snow and ice to build up over extended periods of time results in the accumulation of snow, heavy wet snow, and ice on the surface. The matrix of these materials is a heavy material with ice freezing the snow to the turf fibers and infill material.
- Rain and slush storms create a layer of ice which freezes to the turf fibers and infill material. Attempting to remove frozen materials from the surface without completely breaking up the surface will remove infill material and turf fibers from your field. Break up this frozen material before attempting remove it.
- Never allow piles of snow to sit on a synthetic sport surface. The weight of these piles is significant and can result in settlements of the surface and differential frost movement in underlying soils. Failure to remove snow piles prior to frost leaving the top surface of the field or track surface can result in wheel rutting the stone base during removal.
- Pushing too large an amount of snow and ice with a plow places excessive pressures on the sports surface/tire interface and can split seams, move turf panels, damage the turf, move sport lines, and tear the track surface. This applies to a deep snow section and too long of a push.
- Starting and stopping the plowing or snow blowing vehicle too quickly, and turning too sharp will shift the center of gravity of your vehicle causing movement of sport-lines, and or tear the turf or track surface. A turn coupled with breaking, force the front corner of your snow removal equipment down and into the into the sport surface with significant force which can cause damage.

- Never lift **wet** snow with a loader if wheels are on the synthetic turf surface or synthetic track surface.
- In cases where snow must be pushed to one side start with the half of the field adjacent to the direction of the push. The far side should be pushed over and past the cleared side. This will decrease the snow load associated with a long width snow cover.

Maintenance of Lawn and Landscaped Areas

The maintenance plan recommendations provided below are intended to provide guidance in maintaining healthy and aesthetic landscape areas. Aspects of this plan may need to be supplemented or adjusted as necessary based on site conditions, weather impacts and general tree, shrub, and turf observations.

Lawns

General lawn areas should be mowed to a height of 2-1/2" to 3". A good practice for determining mowing frequency is to never remove more than 1/3 of the grass blade length in one mowing. Removing more than 1/2 of the grass plant at a time can put the plant into shock, thus making it more susceptible to stress, disease and weed infestation. Mowing frequency will vary with the growing season and should be set by the plant height and not a set date. It will often be necessary to mow twice a week during periods of surge growth to help maintain plant health and color. Mowing should be cut back during periods of stress and slow growth.

Grass clippings should be left on the lawn for it provides nutrients to the soil and helps retain moisture. If clippings are thick enough to layer the lawn, however, they should be removed. Heavily clumped grass clippings are a sign of infrequent mowing, calling for an adjustment in the mowing schedule.

Vary the mowing pattern to help keep blades upright and to provide for an even cut. To prevent tearing of the blades and loss of color, keep mowing blades sharp.

Aerate annually in the fall, more often in high traffic areas. Aeration reduces compaction and encourages better drainage and incorporation of nutrients.

Native Grass Stands / Prairie Areas or Naturalized Grasslands

Mown maintenance areas along edges of the Native Grass Stands should be mown to a height of 3" to 4" using a sharp blade.

Low maintenance area should be cut once a year. Mowing as low as possible with a mower conditioner or a flail type mower. Timing of the mowing is dependent on the aesthetic and ecological goal. Mowing in late winter / early spring allows food and habitat for overwintering birds and animals. If the early spring window is missed, waiting until after June 30 is recommended because this is when most ground nesting birds have completed incubation and left their nest sites. Fall mowing provides a cleaner look, however it is recommended to leave the cuttings on the ground until spring to provide food for birds. Remove as much of the old plant litter as possible to stimulate new growth. Periodic removal of the lower litter layer is a necessary treatment to achieve new grown and maintain a healthy ecosystem function within the grassland. Removal of old plant litter should occur when the accumulation reaches a 2" to 3" continuous layer of cover on the ground or every three years. If mowing or haying do not provide sufficient impact on old plant litter, scarification of the soil surface with heavy harrows or similar equipment may enhance the treatment effect.

Trees and Shrubs

Tree pruning should be performed on branches that are dead, broken, scarred or crossing. All cuts should be made at the collar and cut flush with the base. Coordinate time of pruning with the following:

- Deciduous shade trees: Late winter or early spring for most except for Maples, Elms and Birches, which are best pruned in the fall.

Mulch areas

Maintain a 2"-3" maximum depth and keep free of weeds by hand weeding. Old mulch should be removed in order to maintain a maximum depth of 3". Edges should be maintained in a cleanly edged fashion.

Snow Management

Snow removal operations will adhere to the MassDEP Snow Removal Guidance, dated March 8, 2001. Snow shall be stockpiled as far away from resource areas as possible and removed as necessary under larger snow events. Snow is to be stockpiled along the edges of drives and parking areas. Stockpiling snow in this manner will allow melt-water to enter the drainage system and thereby receive pretreatment prior to discharging to receiving resource areas. Refer to the *Synthetic Turf Field* Section above for specific snow-related maintenance practices on the synthetic turf field.

Snow and ice that has accumulated around catch basin grates shall be removed in accordance with the Stormwater Operation & Maintenance Procedures of this plan.

Winter Salt & Sand Use

Application of deicing materials and sand is to be administered as outlined below.

- Porous pavement plazas and walkways:
    - Snow is to be removed by mechanical means including snow blowing and sweeping as the main means of snow removal.
    - Abrasives such as winter sand are not to be used.
    - Chlorides (salts) including Sodium Chloride (road salt), Magnesium Chloride, Calcium Chloride and Potassium Chloride are only to be used after mechanical means have been used and icy conditions still exist, as determined by the School. If salts are used, they shall be applied by hand spreading. Salt is to be evenly spread using the minimal amount necessary to provide adequate melting based on the ice conditions, temperature, and location.
- Standard pavement parking and drives:
    - Snow is to be removed by mechanical means including snow plowing and/or snow blowing.
    - Plowed or blown snow is to be deposited in landscaped areas that drain to the drive/parking area drainage/treatment system.
    - A sand/salt mix is to be spread evenly using mechanical spreaders applying the minimal amount necessary to provide adequate melting based on the ice conditions, temperature, and location.
- Standard pavement walkways:
    - Snow is to be removed by mechanical means including plow, snow blowing and sweeping as the main means of snow removal.

- Removed snow is to be deposited so that melt water is directed onto the drive and parking area into the drainage/treatment system.
- Chlorides (salts) including Sodium Chloride (road salt), Magnesium Chloride, Calcium Chloride and Potassium Chloride are only to be used after mechanical means have been used and icy conditions still exist, as determined by the School. If salts are used, they shall be applied by hand spreading. Salt is to be evenly spread using the minimal amount necessary to provide adequate melting based on the ice conditions, temperature, and location.

Maintenance Schedule

Catch Basins and Manholes	
Inspect for depth of sediment, obstructions, structural damage, or other malfunction	Quarterly in the first year; at least twice per year after
Clean sumps of accumulated sediment	When structures are ½ full of sediment/debris (approximately two feet below outlet pipe) once per year minimum
Bioretention Areas	
Preventative maintenance	Twice per year
Inspect to ensure proper functioning	After every major storm during first 3 months of operation and twice a year thereafter and when there are discharges through the high outlet orifice
Mow the buffer area, side slopes, and basin bottom if grassed floor; rake if stone bottom; remove trash and debris, remove grass clipping and accumulated organic matter	Twice per year
Inspect and clean pretreatment devices	Every other month recommended and at least twice per year and after every major storm event.
Pavement and Grass Areas	
Sweep pavement areas	At least twice per year: after final snow melt and after final leaf fall and as necessary in summer months
Remove accumulated litter, debris, and discarded materials throughout the site	Once per week
Subsurface Detention Structure	
Inspect inlets and outlet and remove any debris	Quarterly in first year; at least twice per year after
Inspect system for functionality	After first major rainfall following installation

Check for depressions in areas above and surrounding the system	Once per year
Confirm that no unauthorized modifications have been performed to the site around (including over) the system	Once per year
Inspect interior of system	Once per year
Water Quality Units	
Inspect for depth of sediment, obstructions, structural damage, and other malfunction	Twice per year in spring and fall
Remove sediment and pollutants	When level of sediment in structure's sump reaches 75% of capacity or when appreciable level of hydrocarbons and debris has accumulated; at a minimum of once per year
Grassed Channels	
Inspect vegetation establishment	Periodically for the first few months after installation
Inspect swales/channels for slope integrity, soil moisture, vegetative health, soil stability, soil compaction, soil erosion, ponding, and sedimentation	Twice per year
Perform regular maintenance including mowing, fertilizing, liming, watering, pruning, and weed and pest control	Twice per year
Remove sediment and debris, and periodically re-seed when doing so if necessary	At least once per year

The following is a Check List outlines the minimum suggested maintenance practices required to properly maintain the turf sport field. Recommended maintenance practices vary from manufacturer to manufacturer and it is the Owner's responsibility confirm that the following is suitable for their selected surface and that these activities, if performed as directed by the manufacturer, will not impact the provided system warranty.

Activity	**Frequency of Activity**

Turf Field Maintenance Table	**Daily**	**Weekly**	**Seasonally**	**Yearly**	**Other**
Sweeping Using Lawn Sweeper or Equal		♦			Once Every Week
Pick Up Trash		♦			Once Every Week
Soft Broom Fiber and Infill Grooming					80 to 100 Use Hours

Check and Fill Infill Low Spots	♦	♦			Daily and Before Games
Adjust High Wear Goal Locations (ex. Lacrosse)		♦			Before Practices and Games
Clean Spills					On Occurrence
Clean Bodily Fluids					On Occurrence
Seam and Inlay Inspections			♦	♦	
Metal Tine Infill Decompaction				♦	Conditions may Warrant Higher Frequency
Painted Sport Field Marking Installation			♦		
Painted Sport Field Marking Removal			♦		
Field Infill Depth Checks			♦		
Inspect Fiber Wear			♦	♦	
Clean Infill and Fiber From Adjacent Trench Drains			♦	♦	
Remove Metals with Magnetic Sweep			♦	♦	Football Season Perform Twice
Replace Excessive High Wear Goal and Base Areas					2 to 4 Years
Premium Grooming				♦	Only if Necessary
Attach Manufacturer Specific Activities:					

1. Some of the above activities may not be part of the maintenance recommendations provided by your Synthetic Turf Manufacturer or may impact warranty coverage. Confirm with your provider prior to executing any of the above.
2. Migration of infill and loose fibers can impact performance of surrounding drainage systems which should be cleaned yearly. Groom infill away for trench drain edges at the end of each sports season.
3. Excessive High Wear Goal and Base Areas include areas such as men's lacrosse goal mouths, baseball and softball batter's and catcher's boxes, and pitchers mounds. The combination of infill migration and fiber damage in these areas may warrant replacement of the synthetic turf in these areas prior to field replacement.
4. Maintain infill depth to allow ½ to ⅝ inch of exposed fiber. Confirm with Manufacturer.
5. Maintain a log of all maintenance activities to assure compliance with Warranty Requirements.
6. **See Infill Synthetic Turf Snow Removal Recommended Practices Guidelines**

Reporting and Documentation

The designated Site Supervisor for The Town of Andover shall be responsible for maintaining an accurate Site Maintenance Log. The Site Maintenance Log shall be located on site and made available to the Town of Andover Conservation Commission upon request.

The Site Maintenance Log shall:

- Document the completion of planned maintenance tasks
- Identify the person responsible for the completion of tasks
- Identify any outstanding problem, malfunction, or inconsistency identified during the course of routine maintenance

The Site Supervisor shall be responsible for ensuring that the scheduled tasks area appropriately completed as described in this plan and the Site Maintenance Log accurately represents activities carried out as described in this plan.

Site Maintenance Log

A Site Maintenance Log shall be completed as described above and shall, at a minimum, include the following items:

- Completed Inspection Checklist
- Date of activity performed
- Specific maintenance task
- Structural components maintained, as identified on the O&M Plan
- Staff person or contractor performing activity on behalf of The Town of Andover
- Supervisor verification of maintenance activity
- Recommended additional maintenance task
- Means to document identified areas of concern, erosion, or system discrepancies requiring attention

Public Safety Features

On-site public safety features include the following:

- Heavy-duty covers and grates on all manholes and catch basins designed to withstand H20 loading
- Maintain or reduce peak stormwater runoff rates from pre-development to post-development
- Creation and implementation of an O&M Plan to ensure the ability of the stormwater management system to continue to operate as designed.

Inspection Checklist

Date of Inspection _____ Checklist Completed By_____

Reviewed by Supervisor _____

Catch Basins and Manholes		
Inspect for depth of sediment, obstructions, structural damage, or other malfunction	Quarterly in the first year; at least twice per year after	
Clean sumps of accumulated sediment	When structures are ½ full of sediment/debris (approximately two feet below outlet pipe) once per year minimum	
Bioretention Areas		
Preventative maintenance	Twice per year	
Inspect to ensure proper functioning	After every major storm during first 3 months of operation and twice a year thereafter and when there are discharges through the high outlet orifice	
Mow the buffer area, side slopes, and basin bottom if grassed floor; rake if stone bottom; remove trash and debris, remove grass clipping and accumulated organic matter	Twice per year	
Inspect and clean pretreatment devices	Every other month recommended and at least twice per year and after every major storm event.	
Pavement and Grass Areas		

Sweep pavement areas	At least twice per year: after final snow melt and after final leaf fall and as necessary in summer months	
Remove accumulated litter, debris, and discarded materials throughout the site	Once per week	
Subsurface Detention Systems		
Inspect inlets and outlet and remove any debris	Quarterly in first year; at least twice per year after	
Inspect system for functionality	After first major rainfall following installation	
Check for depressions in areas above and surrounding the system	Once per year	
Confirm that no unauthorized modifications have been performed to the site around (including over) the system	Once per year	
Inspect interior of system	Once per year	
Water Quality Units		
Inspect for depth of sediment, obstructions, structural damage, and other malfunction	Twice per year in spring and fall	
Remove sediment and pollutants	When level of sediment in structure's sump reaches 75% of capacity or when appreciable level of hydrocarbons and debris has accumulated; at a minimum of once per year	
Grassed Channels		
Inspect vegetation establishment	Periodically for the first few months after installation	

Inspect channels/swales for slope integrity, soil moisture, vegetative health, soil stability, soil compaction, soil erosion, ponding, and sedimentation	Twice per year	
Perform regular maintenance including mowing, fertilizing, liming, watering, pruning, and weed and pest control	Twice per year	
Remove sediment and debris, and periodically re-seed when doing so if necessary	At least once per year	

Appendix F: Phase II Environmental Site Assessment

ADS Environmental Engineering, LLC

Subsurface Exploration Program
West Elementary School
58 Beacon Street
Andover, Massachusetts

Prepared For:

Symmes Maini & McKee Associates
Cambridge, Massachusetts

Prepared By:

ADS Environmental Engineering, LLC
Sherborn, Massachusetts

File No. 0200.01
September 2021

205 Woodland Street | Sherborn, MA 01770 | tel. 781-727-6646
www.adslsp.com

ADS Environmental Engineering, LLC

September 16, 2021
File No. 0200.01

Symmes Maini & McKee Associates
1000 Massachusetts Avenue
Cambridge, MA 02138

Attention: Mr. John C. Hart, PE, COT, LEED AP

RE: Phase II - Environmental Site Assessment
Andover West Elementary School
58 Beacon Street
Andover, MA 01810
SMMA P.O. No. 1914600_24

Dear John:

ADS Environmental Engineering, LLC (ADS) is pleased to present this report on the subsurface exploration and analytical testing program at the Andover West Elementary School located in Andover, Massachusetts. The objective of this work was to assess areas where up to four #2 fuel oil underground storage tanks (USTs) were removed from the property according to records developed during the Phase 1 Environmental Site Assessment. Explorations were also conducted elsewhere on the property in the areas of the proposed new school development and where grade cuts are anticipated, in order to characterize soils that may need to be removed from the site for reuse/disposal. This work was conducted in general accordance with our proposal dated June 22, 2021 and the Limitations of work attached in Appendix A.

BACKGROUND

The school is currently heated with natural gas, however records were found at the Andover Fire Prevention Office and other municipal departments, of the removal of up to four underground storage tanks from areas adjacent to the two boiler rooms in the school. There were two fuel oil USTs, a 550 gallon and a 10,000 gallon tank, that were documented to have been removed in 1990 from outside the boiler room at the east end of the school building, and ADS found documentation of the removal of another tank in 1998, an 8,0000 gallon fuel oil UST, from the second boiler room at the western end of the school building. A plan shows a second smaller UST adjacent to the 8,000 gallon tank that also may have been removed although there was no record of its removal found. ADS has not found reports on the condition of the tanks or the subsurface soil around the tanks upon their removal. In addition, an above ground fuel oil tank previously existed outside the western boiler room, adjacent to the exterior wall of the gymnasium; this tank has also since been removed.

SUBSURFACE EXPLORATIONS AND ANALYTICAL TESTING

Due to the abundance of underground utilities adjacent to the school building, on July 15, 2021 ADS observed a Ground Penetrating Radar and electromagnetic survey conducted by Geosearch Environmental Contractors to trace and mark underground utilities. On July 27 and 28, 2021 ADS and Geosearch Environmental Contractors returned to the property to conduct Geoprobe explorations to assess site conditions and to collect soil samples for analytical laboratory testing. Vacuum pre-excavation was completed in selected locations to a depth of five feet for utility clearance where underground utilities are abundant. Attached Figure 1 is the Site Locus Plan, and Figure 2 is a Site Plan. Figure 3 is a plan showing the school building and the location of former underground and above ground fuel oil storage tanks, and Figure 4 is the Exploration Location Plan. Geoprobe exploration logs and screening data are attached in Appendix B.

As mentioned above, the Andover Fire Prevention Office had permits for the removal of three underground tanks: a 500 gallon diesel and a 10,000 gallon diesel tank from outside the boiler room at the east side of the school building in 1990; and, a 10,000 gallon fuel oil tank (also referenced as 8,000 on the permit) from outside the boiler room at the western end of the school building in 1998. ADS has not found reports on the condition of the tanks or the subsurface soil around the tanks upon their removal.

Fifteen Geoprobe explorations were completed during the subsurface exploration program on July 27 and 28, 2021. Geoprobes GP-1 through GP-3 were conducted outside the boiler room at the west end of the school building. According to plans provided by SMMA and reviewed by ADS as part of the Phase I Environmental Site Assessment of the subject property (Phase I Report dated December 2019), plans dated 1968 show storage tanks outside this western boiler room. A plan titled *Floor Plan – Part C*, dated August 12, 1968, shows the outline of two tanks south of the gymnasium and west of the western boiler room, with the note “Oil Tanks Location”. It is not specified if both of these tanks were underground tanks, but it is presumed that at least the larger tank was underground. Drawings showing the former tank locations are attached in Appendix C.

In addition, a permit for the removal of an above ground storage tank (AST) at 58-60 Beacon Street was also found in the Andover Building Department files (permit ST-16-22), dated April 21, 2016. It is presumed this tank was the one ADS was informed had been located outside this western boiler room, adjacent to the exterior wall of the gymnasium.

Access to assess this area of the property was limited by the presence of three large metal storage containers that had been placed within the former UST and AST area of concern. Exploration GP-1 was able to be located within the apparent western limit of the former 10,000 gallon UST as shown on the 1968 plan titled *Floor Plan – Part C*. Exploration GP-2 was located approximately ten feet south of the former 10,000 gallon UST, and another exploration, GP-3, was conducted approximately 22 feet west of the former 10,000 gallon UST location. A monitoring well was installed in GP-1 to a depth of 12 feet below the ground surface. Saturated soils were encountered at approximately seven feet below the ground surface in GP-1 and GP-3. There was no visual or olfactory indications of contamination in the subsurface soils in this area.

The explorations were generally conducted to 15 feet below the ground surface unless refusal to rock was encountered before that depth, and there was no visual or olfactory indication of contamination in the subsurface soils. Explorations GP-6 through GP-9 were conducted outside the eastern boiler room of the school. A plan titled *Boiler Room Plan HV-8*, dated August 12, 1968, shows a 550 gallon tank and a

10,000 gallon tank outside this boiler room. There was no visual or olfactory indications of contamination in the subsurface soils in the area explored adjacent to the eastern boiler room.
Explorations conducted elsewhere on the subject property were completed to provide general coverage of the site, and to collect samples of soils that are within proposed "cut" areas of the site, and may require off site reuse/disposal during future construction.

Explorations GP-4, GP-5, GP-10, GP-11 and GP12 were conducted within or near the proposed new school building footprint as depicted in SMMA's plan *C-111 Site Preparation Plan I Phase 1* dated January 4, 2021. Explorations GP-13, GP-14 and GP-15 were conducted around the existing school building.

The general subsurface profile consisted of two to eight feet of granular fill (sand with gravel, cobbles and silt) underlain by tan, orange mottled or gray layers of sand, sand and gravel, and silty sand and gravel. Some layers of slightly plastic silt and sand were also noted in the subsurface, as well as sand layers with trace (-) silt. The soils are glacial stratified deposits. Explorations were conducted to 15 feet except where refusals to rock were encountered at shallower depths.

Groundwater was encountered at typically seven to nine feet below the ground surface, with some locations showing a deeper groundwater table. Saturated soils were encountered at 11 feet below the ground surface in GP-11.

Review of the United States Geological Survey Topographic Map of the Natick, Massachusetts Quadrangle shows that surface drainage and groundwater flow direction may be to the north-northeast toward easterly flowing Hussey Brook located approximately 800 feet to the north of the existing school building and playing fields.

Preliminary Field Screening

Field screening of soil samples was conducted during the Geoprobe exploration program using an Ion Science Tiger with a 10.6 eV lamp. The field screening results ranged from 0.0 ppm to 0.5 ppm. These data are not indicative of the significant presence of volatile organic compounds. Screening data are included on the Geoprobe logs in Appendix B. There was no odor or indication of petroleum in the soil or groundwater in the explorations.

ADS submitted soil samples to Alpha Analytical Laboratories of Westborough, Massachusetts for quantitative analytical laboratory testing. Samples submitted for analysis included:

Soil samples from the former UST Areas:

GP-1/Comp – composite of upper 10 feet, samples S-1 and S-2 outside western boiler room

GP8/S-3 – soil from five to 10 feet below the ground surface outside eastern boiler room

Topsoil Characterization samples:

TOPSOIL COMP 1 – composite of topsoil from the western areas of the property (GP-5, GP-10, GP-11)

TOPSOIL COMP 2 – composite of topsoil from the eastern region of the property (GP-6, GP-7, GP-8, GP-13, GP-14, GP-15)

Proposed cut area soils:

CUT COMP 1 – composite of upper five to ten feet of soil in proposed cut areas in western portion of the property (GP-4, GP-5, GP10 and GP-11)

CUT COMP 2 – composite of upper five feet of soil in proposed cut areas in eastern portion of the property (GP13, GP-14, GP-15)

The soil samples from the UST areas were analyzed for diesel range organics Extractable Petroleum Hydrocarbons (EPH). The topsoil and proposed cut area soils were analyzed for off site disposal characterization analyses including extractable petroleum hydrocarbon ranges (EPH), volatile petroleum hydrocarbon fractions (VPH), volatile and semi-volatile organic compounds (VOCs and semi-VOCs), MCP14 metals, PCBs, pH, ignitability, reactivity and conductivity (generally consistent with Comm-97-001 characterization).

Analytical Laboratory Test Results

Analytical laboratory reports are attached in Appendix D. Analytical test results of EPH analyses conducted on soil from the areas of the former USTs showed no detection of EPH fractions. This is consistent with field observations.

Results of the disposal characterization analyses of the topsoil and subsurface soil composite samples showed no detection of VOCs, PCBs and VPH fractions. Trace concentrations of an EPH fraction were identified in the topsoil samples, likely the result of petroleum fueled lawn maintenance equipment. C11-C22 Aromatics were identified at 17.0 mg/Kg in the TOPSOIL COMP-1 sample, and 18.3 mg/Kg C11-C22 Aromatics were identified in TOPSOIL COMP-2. For comparison, the RCS-1 (residential, school properties) Reportable Concentration of C11-C22 Aromatics is 1,000 mg/Kg.

Also, trace concentrations of polycyclic aromatic hydrocarbon (PAH) compounds were identified in the TOPSOIL COMP 2 sample, also likely due to the ubiquitous use of petroleum including the use of petroleum fueled lawnmowing equipment. The PAH compounds identified in Topsoil COMP 2 included fluoranthene (360 ug/Kg), bis(2-ethylhexyl)phthalate (440 ug/Kg), benzo(a)anthracene (140 ug/Kg), benzo(a)pyrene (150 ug/Kg), benzo(b)fluoranthene (220 ug/Kg), chrysene (180 ug/Kg), phenanthrene (260ug/Kg) and pyrene (310 ug/Kg). For comparison, the RCS-1 Reportable Concentrations for these compounds identified at residential or school properties range from 2,000 ug/Kg to 1,000,000 ug/Kg.

Concentrations of MCP 14 heavy metals were deemed to be within background ranges for soil, well below their MCP RCS-1 Reportable Concentrations.

CONCLUSIONS

In summary, results of the subsurface exploration and analytical testing program at West Elementary School in Andover, Massachusetts did not indicate the presence of contamination that would require special management during future construction. ADS did not find evidence that there was a release in areas of former documented underground and above ground fuel oil storage tanks. Topsoil samples showed only trace concentrations of petroleum hydrocarbons, well below their RCS-1 MCP Reportable Concentrations, and the detections were judged to be due to the ubiquitous use of petroleum in automobiles and in landscaping equipment. Concentrations of metals identified are consistent with naturally occurring background concentrations, and there was no detection of other contaminants that would indicate a release of oil or hazardous materials to the environment. It is the opinion of ADS that

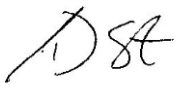
the excess soils generated during future construction work at the property can be reused off site without restriction from an environmental perspective.

It should be noted that given that the environmental site history of the subject property includes underground storage and use of fuel oil to heat the school building, it is possible that isolated areas of soil exhibiting petroleum odors could be encountered during construction or demolition of the existing building. If odors or indications of petroleum or fill materials containing debris are noted during future excavation, work should stop in these areas, and the suspect soils should be stockpiled separately until ADS can assess the conditions and make recommendations on how to proceed.

It has been a pleasure to assist you in this project. Please contact me if you have any questions regarding the work completed and findings.

Sincerely,

ADS ENVIRONMENTAL ENGINEERING, LLC



Andrea D. Stiller, LSP
Principal

Attachments:

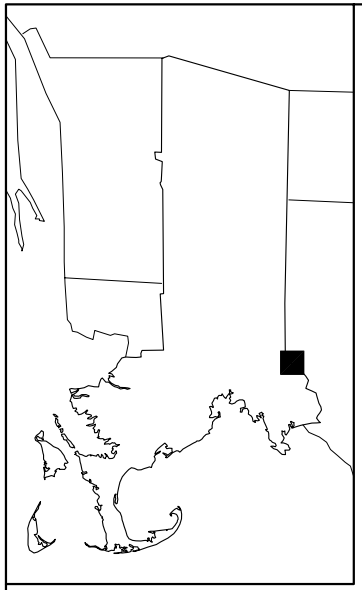
FIGURES

Figure 1 – Locus Plan
Figure 2 – Site Plan
Figure 3 – Building Area Plan
Figure 4 – Exploration Location Plan

APPENDICES

Appendix A – Limitations
Appendix B – Geoprobe Logs
Appendix C – Drawings Showing Former Tanks
Appendix D – Analytical Laboratory Reports

FIGURES



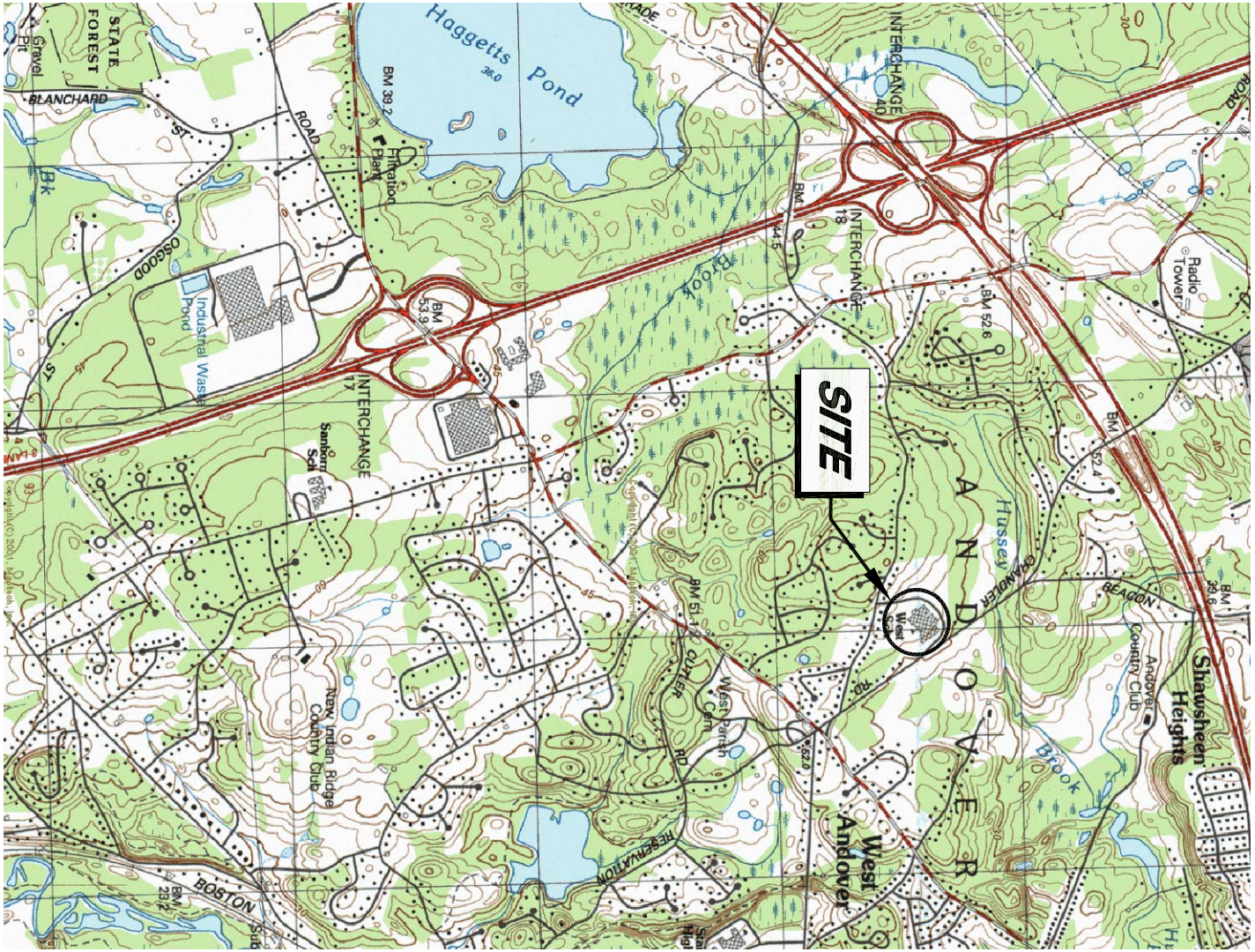


FIGURE No. 1

WEST ELEMENTARY SCHOOL

58 -60 BEACON STREET ANDOVER, MA

LOCUS PLAN

SOURCE

1987 USGS LAWRENCE, MASSACHUSETTS/ NEW HAMPSHIRE. QUADRANGLE MAP

(NOT TO SCALE)

REV No.	DATE	INT.	- DESCRIPTION -

DRAWN BY: JJP	REVIEWED BY: ADS
DATE: 11/25/2019	JOB No. 0200

ADS ENVIRONMENTAL ENGINEERING, LLC

205 Woodland Street
Sherborn, Ma. 01770
Tel: (781) 727-6646
www.adslsp.com

JACK POWERS, 11/27/2019, 18:23:09 | FILE: C:\ADS\2019\0200 ANDOVER\PLANS\0200F01.DWG

NOTES:

1. BASE MAP DEVELOPED FROM PLAN BY MASS GIS OLIVER AND FROM TOWN OF ANDOVER ASSESSORS MAP.

LEGEND:

INDICATES PROPERTY LINE

N

ROBERT DRIVE

RESIDENTIAL UNDER CONSTRUCTION

WOODED

RESIDENTIAL

SPENCER COURT

BALL FIELDS

PLAYGROUND

PAVEMENT

PAVED PLAY AREA

WEST ELEMENTARY SCHOOL

BEACON STREET

GOLF AND RESIDENTIAL

GRASS

WOODED

RESIDENTIAL

HIGH PLAINS ROAD

RESIDENTIAL

ADS ENVIRONMENTAL ENGINEERING, LLC
205 Woodland Street
Sherborn, Ma. 01770
Tel: (781) 727-6646
www.adslsp.com

REV No.	DATE	INT.	- DESCRIPTION -

DRAWN BY: JJP | REVIEWED BY: ADS

DATE: 12/2/2019 | SCALE: 1"=200' | JOB No. 0200

WEST ELEMENTARY SCHOOL
58-60 BEACON STREET
ANDOVER, MA

SITE PLAN

FIGURE No. 2

NOTES:

1. BASE MAP DEVELOPED FROM PLAN BY MASS GIS OLIVER AND FROM TOWN OF ANDOVER ASSESSORS MAP.

LEGEND:

INDICATES PROPERTY LINE

N

APPROXIMATE LOCATION
FORMER 550 GALLON UST
AND 10,000 GALLON UST

BEACON STREET

WEST
ELEMENTARY
SCHOOL

APPROXIMATE LOCATION
FORMER #2 FUEL OIL
ABOVE GROUND TANK

APPROXIMATE LOCATION
OF TWO OIL TANKS SHOWN
ON AUGUST 12, 1968 PLAN

APPROXIMATE LOCATION
PAD MOUNTED TRANSFORMER

RESIDENTIAL

RESIDENTIAL

ADS ENVIRONMENTAL ENGINEERING, LLC
205 Woodland Street
Sherborn, Ma. 01770
Tel: (781) 727-6646
www.adslsp.com

REV No.	DATE	- DESCRIPTION -	INT.

DRAWN BY: JJP
REVIEWED BY: ADS
DATE: 12/2/2019
SCALE: 1"=80'
JOB No. 0200

WEST ELEMENTARY SCHOOL
58-60 BEACON STREET
ANDOVER, MA

BUILDING AREA PLAN

FIGURE No. 3

NOTES:

1. BASE MAP DEVELOPED FROM PLANS PROVIDED BY SMMA TITLED "SITE PREPARATION PLAN I - PHASE 1", ORIGINAL SCALE: 1"=30', DATED 01/04/2021, GEOPORBES CONDUCTED ON DECEMBER 4, 2019 BY
2. THE LOCATIONS OF THE GEOPROBES DETERMINED BY LINE OF SIGHT, PACING AND TAPE MEASUREMENTS AND SHOULD BE CONSIDERED APPROXIMATE.

LEGEND:

APPROXIMATE LOCATION OF GEOPROBES CONDUCTED ON JULY 27 & 28, 2021 BY GEOSEARCH ENVIRONMENTAL CONTRACTORS. OBSERVED AND LOGGED BY ADS ENVIRONMENTAL ENGINEERING, LLC.

(MW) DENOTES THAT A MONITORING WELL WAS INSTALLED IN THE EXPLORATION

ADS ENVIRONMENTAL ENGINEERING, LLC
205 Woodland Street
Sherborn, Ma. 01770
Tel: (781) 727-6646
www.adslsp.com

REV No.	DATE	INT.	- DESCRIPTION -

DRAWN BY: JJP | REVIEWED BY: ADS | SCALE: 1"=100' | JOB No. 0200 | DATE: 8/23/2021

WEST ELEMENTARY SCHOOL
ANDOVER, MA

EXPLOCATION LOCATION PLAN

FIGURE No. 4

APPENDIX A

LIMITATIONS

LIMITATIONS

1. In preparing this Report, ADS gathered information from interviews with various parties and review of the files of various public agencies. In addition, work completed by others was referenced by ADS. The accuracy of this work cannot be verified by ADS. Due to the potential for errors, omissions or inaccuracies that may exist there is some risk associated with reliance on such information. Although there may have been some corroboration provided by multiple sources, ADS cannot be responsible for the accuracy or completeness of the information reviewed or received during the course of this work

2. Observations were made of the site as indicated within the Report. If areas exist which were inaccessible and therefore not observed, ADS can render no opinion as to the conditions in that area. This includes but is not limited to the areas covered by fill, stockpiles, structures and vegetation.

3. The conclusions and recommendations contained in this Report are based in part upon the data obtained from soil samples collected from subsurface explorations completed at the referenced property. The nature and extent of variations between these explorations may not become evident until additional work is undertaken at the site. If variations or latent conditions then appear evident, it will be necessary to reevaluate the conclusions and recommendations of this report.

4. Groundwater was encountered in the explorations on-site at the times and under the conditions stated in this report. However, it must be noted that fluctuations in the level of groundwater may occur due to rainfall, temperature, subterranean structures and other factors.

5. The purpose of this Report was to provide environmental services at the subject site with respect to the presence in the environment of hazardous material or oil, as defined in Massachusetts General Laws Chapter 21E. No specific attempt was made to check on the compliance of present or past owners or operators of the site with federal, state, or local laws and regulations, environmental or otherwise.

6. This report was prepared for the exclusive use of Symmes Maini & McKee Associates, solely for use in connection with environmental studies of the property located at the West Elementary School, 58 Beacon Street, Andover, Massachusetts. This report was prepared in accordance with generally accepted environmental engineering practice. No other warranty, expressed or implied, is made.

APPENDIX B

GEOPROBE LOGS

ADS Environmental Engineering, LLC	SOIL BORING LOG	Boring No.:	GP- 1
	Project Name: West Elementary School	Page:	1 of 1
	Project Location: 58 Beacon St. Andover, MA	Project No.:	NA
205 Woodland St., Sherborn, MA, 01770 (P: 781.727.6646)		Checked By:	ads

Drilling Company:	GeoSearch	Soil Boring Location:			
Drilling Foreman:	Ed Belsky	Ground Surface Elevation	NA	Datum:	NA
ADS Inspector(s):	A. Stiller	Date Started:	07/27/21	Date Completed:	7/27/21

DRILLING METHOD		SAMPLER		GROUND WATER DEPTH			
VEHICLE:	6610DT	TYPE:	5-foot macrocore	DATE	DEPTH (feet)	REFERENCE	METHOD
MODEL:	Geoprobe 6610	HAMMER:	NA				Soil
METHOD:	Direct push	FALL:	NA				

SAMPLE								
DEPTH (feet)	SAMPLE No.	Recovery (inches)	INTERVAL (feet)	DEPTH Feet	SOIL SAMPLE DESCRIPTION	GRAPHIC LOG	PID (ppm)	NOTES
1	S-1	34	0-5		Bituminous Pavement 2"			
					Tan f/m SAND & f/c GRAVEL, tr Silt, fill		0.5	
2						Fill		
3								
4					Sand and Gravel with Asphalt mix 4-4.5 ft			
5		32	5 to 10					
					Tan f/m SAND & f/c GRAVEL, tr (-) Silt			
6	S-2					Sand with Gravel	0.3	
7								wet at 7 ft.
8					Grey f/m SAND, little f/c Gravel, little Silt 8-9'			
9								
10		32	10 to 14					
11								
	S-3				Grey f/m SAND, little f/c Gravel, little Silt		0.2	
12								
13					Tan f/c SAND, tr(-) Silt	Sand		
14								
					Refusal 14 ft.			
15								
					2" diameter monitoring well installed to 12 feet. 10 feet of screen, risder to surface. Sand backfill to 1.5 ft, Bentonite 1 to 1.5 ft. Roadway box.			
16								
17								
18								
19								

Notes:

1. Proportions: trace (<10%), little (10-20%), some (20-35%), and (35-50%)
2. Blow Counts, Clay: very soft (<2), soft (2-4), medium stiff (4-8),
3. stiff (8-15), very stiff (15-30), hard (>30)
4. Blow Counts, Sand: very loose (4), loose (4-10), medium dense (10-30),
5. dense (30-50), very dense (50)

Legend

s = sand; si = silt; cl = clay; l = loam; f = fine; m = medium; c = coarse; a = angular; sa = subangular; sr = subrounded; r = rounded; cobbles = >3"; gravel = 1/4 to 3"; sand = 0.003 to 1/4"; fines = <0.003". USCS must include: group symbol, color, group name, particle size range, soil type/consistency, moisture, structure, and origin. Additionally, discuss organics, root holes, mica, gypsum, caving, sloughing, loss of drilling water, contamination, etc. Descriptions based on split spoon observations.

SOIL BORING LOG

ADS Environmental Engineering, LLC
205 Woodland St., Sherborn, MA, 01770 (P: 781.727.6646)

Project Name:	West Elementary School
Project Location:	58 Beacon St. Andover, MA
Boring No.:	GP- 2
Page:	1 of 1
Project No.:	NA
Checked By:	ads

Drilling Company:	GeoSearch	Soil Boring Location:	
Drilling Foreman:	Ed Belsky	Ground Surface Elevation: NA	Datum: NA
ADS Inspector(s):	A. Stiller	Date Started: 07/27/21	Date Completed: 7/27/21

DRILLING METHOD		SAMPLER		GROUND WATER DEPTH			
VEHICLE:	6610DT	TYPE:	5-foot macrocore	DATE	DEPTH (feet)	REFERENCE	METHOD
MODEL:	Geoprobe 6610	HAMMER:	NA				Soil
METHOD:	Direct push	FALL:	NA				

SAMPLE					SOIL SAMPLE DESCRIPTION	GRAPHIC LOG	PID (ppm)	NOTES
DEPTH (feet)	SAMPLE No.	Recovery (inches)	INTERVAL (feet)	DEPTH Feet				
		Vac Ex	0-5		Bituminous Pavement 7"			
1	S-1			0-5	Brown f/m SAND, little (+) f/c GRAVEL, tr Silt, asphalt, fill		0.3	vacuum excavation to 5 ft due to utilities
2						Fill		
3								
4					Sand and Gravel and Asphalt mix 4-4.5 ft			
5		19	5 to 7		Tan f/m SAND, tr Silt			
6	S-2			5-7	Orange f/m SAND, tr. Silt, tr f/c Gravel Tan f/m SAND & SILT, little f/c Gravel, orange mottling.	Sand with Gravel	0.1	
7					soils damp 7 ft.			
8					Refusal to rock at 7 ft.			
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								

Notes:

1. Proportions: trace (<10%), little (10-20%), some (20-35%), and (35-50%)
2. Blow Counts, Clay: very soft (<2), soft (2-4), medium stiff (4-8),
3. stiff (8-15), very stiff (15-30), hard (>30)
4. Blow Counts, Sand: very loose (4), loose (4-10), medium dense (10-30),
5. dense (30-50), very dense (50)

Legend

s = sand; si = silt; cl = clay; l = loam; f = fine; m = medium; c = coarse; a = angular; sa = subangular; sr = subrounded; r = rounded; cobbles = >3"; gravel = 1/4 to 3"; sand = 0.003 to 1/4"; fines = <0.003". USCS must include: group symbol, color, group name, particle size range, soil type/consistency, moisture, structure, and origin. Additionally, discuss organics, root holes, mica, gypsum, caving, sloughing, loss of drilling water, contamination, etc. Descriptions based on split spoon observations.

SOIL BORING LOG

ADS Environmental Engineering, LLC
205 Woodland St., Sherborn, MA, 01770 (P: 781.727.6646)

Project Name:	West Elementary School
Project Location:	58 Beacon St. Andover, MA
Boring No.:	GP- 3
Page:	1 of 1
Project No.:	NA
Checked By:	ads

Drilling Company:	GeoSearch	Soil Boring Location:	
Drilling Foreman:	Ed Belsky	Ground Surface Elevation	NA
ADS Inspector(s):	A. Stiller	Date Started:	07/27/21
		Datum:	NA
		Date Completed:	7/27/21

DRILLING METHOD		SAMPLER		GROUND WATER DEPTH			
VEHICLE:	6610DT	TYPE:	5-foot macrocore	DATE	DEPTH (feet)	REFERENCE	METHOD
MODEL:	Geoprobe 6610	HAMMER:	NA				Soil
METHOD:	Direct push	FALL:	NA				

DEPTH (feet)	SAMPLE No.	Recovery (inches)	INTERVAL (feet)	DEPTH Feet	SOIL SAMPLE DESCRIPTION	GRAPHIC LOG	PID (ppm)	NOTES
1	S-1		0-5		Pavement 2-7"			
					Tan f/m SAND, little f/c Gravel, tr Silt, fill		0.1	vacuum excavation to 5 ft due to underground utilities
2					Cobbles and small boulders in Vac Ex soil	Fill		
3								
4								
5		23	5 to 10		Dark brown f/m SAND, Some f/c Gravel, Little Silt			
6	S-2					Sand with Gravel	0.1	
7					soils wet at 7 ft.			wet 7 ft.
8					Grey f/m SAND, some (+) f/c Gravel, tr(+) Silt	Gravelly Sand		
9								
10		39	10 to 12		Tan f/m SAND, little f/c Gravel, little Silt			
	S-3						0.2	
11								
12								
13					Refusal at 12 ft.			
14								
15								
16								
17								
18								
19								

Notes:

1. Proportions: trace (<10%), little (10-20%), some (20-35%), and (35-50%)
2. Blow Counts, Clay: very soft (<2), soft (2-4), medium stiff (4-8),
3. stiff (8-15), very stiff (15-30), hard (>30)
4. Blow Counts, Sand: very loose (4), loose (4-10), medium dense (10-30),
5. dense (30-50), very dense (50)

Legend

s = sand; si = silt; cl = clay; l = loam; f = fine; m = medium; c = coarse; a = angular; sa = subangular; sr = subrounded; r = rounded; cobbles = >3"; gravel = 1/4 to 3"; sand = 0.003 to 1/4"; fines = <0.003". USCS must include: group symbol, color, group name, particle size range, soil type/consistency, moisture, structure, and origin. Additionally, discuss organics, root holes, mica, gypsum, caving, sloughing, loss of drilling water, contamination, etc. Descriptions based on split spoon observations.

ADS Environmental Engineering, LLC	SOIL BORING LOG	Boring No.:	GP- 4
	Project Name: West Elementary School	Page:	1 of 1
	Project Location: 58 Beacon St. Andover, MA	Project No.:	NA
205 Woodland St., Sherborn, MA, 01770 (P: 781.727.6646)		Checked By:	ads

Drilling Company:	GeoSearch	Soil Boring Location:			
Drilling Foreman:	Ed Belsky	Ground Surface Elevation	NA	Datum:	NA
ADS Inspector(s):	A. Stiller	Date Started:	07/27/21	Date Completed:	7/27/21

DRILLING METHOD		SAMPLER		GROUND WATER DEPTH			
VEHICLE:	6610DT	TYPE:	5-foot macrocore	DATE	DEPTH (feet)	REFERENCE	METHOD
MODEL:	Geoprobe 6610	HAMMER:	NA				Soil
METHOD:	Direct push	FALL:	NA				

SAMPLE								
DEPTH (feet)	SAMPLE No.	Recovery (inches)	INTERVAL (feet)	DEPTH Feet	SOIL SAMPLE DESCRIPTION	GRAPHIC LOG	PID (ppm)	NOTES
1	S-1	41	0-5		Bituminous Pavement 4" Dark brown to med brown f/m SAND, little f/c Gravel, tr Silt, fill		0.3	
2						Fill		
3	S-2			2 to 3	Dark Brown organics mixed with f/Sand and silt.		0.0	
4	S-3			3 to 5	Brown f/c GRAVEL & f/m SAND, tr (-) Silt	Sand and Gravel	0.4	
5		45	5 to 10					
6								
7	S-4			6 to 10	Tan orange mottled f/m SAND & SILT, little f/c Gravel,		0.0	
8						Sand with Gravel		
9								
10		32	10-12.5		Brown f/m SAND & f/c GRAVEL, tr Silt,	Sand and Gravel		
11	S-5						0.0	
12								
13					Refusal at 12.5 ft.			
14								
15								
16								
17								
18								
19								

Notes:

1. Proportions: trace (<10%), little (10-20%), some (20-35%), and (35-50%)
2. Blow Counts, Clay: very soft (<2), soft (2-4), medium stiff (4-8),
3. stiff (8-15), very stiff (15-30), hard (>30)
4. Blow Counts, Sand: very loose (4), loose (4-10), medium dense (10-30),
5. dense (30-50), very dense (50)

Legend

s = sand; si = silt; cl = clay; l = loam; f = fine; m = medium; c = coarse; a = angular; sa = subangular; sr = subrounded; r = rounded; cobbles = >3"; gravel = 1/4 to 3"; sand = 0.003 to 1/4"; fines = <0.003". USCS must include: group symbol, color, group name, particle size range, soil type/consistency, moisture, structure, and origin. Additionally, discuss organics, root holes, mica, gypsum, caving, sloughing, loss of drilling water, contamination, etc. Descriptions based on split spoon observations.

ADS Environmental Engineering, LLC	SOIL BORING LOG		Boring No.:	GP- 5
	Project Name:	West Elementary School	Page:	1 of 1
	Project Location:	58 Beacon St. Andover, MA	Project No.:	NA
205 Woodland St., Sherborn, MA, 01770 (P: 781.727.6646)			Checked By:	ads

Drilling Company:	GeoSearch	Soil Boring Location:			
Drilling Foreman:	Ed Belsky	Ground Surface Elevation	NA	Datum:	NA
ADS Inspector(s):	A. Stiller	Date Started:	07/27/21	Date Completed:	7/27/21

DRILLING METHOD		SAMPLER		GROUND WATER DEPTH			
VEHICLE:	6610DT	TYPE:	5-foot macrocore	DATE	DEPTH (feet)	REFERENCE	METHOD
MODEL:	Geoprobe 6610	HAMMER:	NA				Soil
METHOD:	Direct push	FALL:	NA				

SAMPLE								
DEPTH (feet)	SAMPLE No.	Recovery (inches)	INTERVAL (feet)	DEPTH Feet	SOIL SAMPLE DESCRIPTION	GRAPHIC LOG	PID (ppm)	NOTES
1	S-1	36	0-5	0-1	Grass, topsoil 1 ft.	Topsoil	0.0	
2	S-2			1.5-5.5	Tan f/m SAND, little f/c Gravel, tr. Silt		0.1	
3					Tan f/c GRAVEL, some f/m SAND, tr Silt	Gravelly Sand		
4						Rock		
5		4	5 to 6			Rock		
6					Tan f/m SAND, Some f/c Gravel, tr. Silt. Rock			
7					Refusal 6 ft.			
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								

Notes:

1. Proportions: trace (<10%), little (10-20%), some (20-35%), and (35-50%)
2. Blow Counts, Clay: very soft (<2), soft (2-4), medium stiff (4-8),
3. stiff (8-15), very stiff (15-30), hard (>30)
4. Blow Counts, Sand: very loose (4), loose (4-10), medium dense (10-30),
5. dense (30-50), very dense (50)

Legend

s = sand; si = silt; cl = clay; l = loam; f = fine; m = medium; c = coarse; a = angular; sa = subangular; sr = subrounded; r = rounded; cobbles = >3"; gravel = 1/4 to 3"; sand = 0.003 to 1/4"; fines = <0.003". USCS must include: group symbol, color, group name, particle size range, soil type/consistency, moisture, structure, and origin. Additionally, discuss organics, root holes, mica, gypsum, caving, sloughing, loss of drilling water, contamination, etc. Descriptions based on split spoon observations.

SOIL BORING LOG

ADS Environmental Engineering, LLC
205 Woodland St., Sherborn, MA, 01770 (P: 781.727.6646)

Project Name:	West Elementary School
Project Location:	58 Beacon St. Andover, MA
Boring No.:	GP- 6
Page:	1 of 1
Project No.:	NA
Checked By:	ads

Drilling Company:	GeoSearch	Soil Boring Location:	
Drilling Foreman:	Ed Belsky	Ground Surface Elevation	NA
ADS Inspector(s):	A. Stiller	Date Started:	07/27/21
		Datum:	NA
		Date Completed:	7/27/21

DRILLING METHOD		SAMPLER		GROUND WATER DEPTH			
VEHICLE:	6610DT	TYPE:	5-foot macrocore	DATE	DEPTH (feet)	REFERENCE	METHOD
MODEL:	Geoprobe 6610	HAMMER:	NA				Soil
METHOD:	Direct push	FALL:	NA				

DEPTH (feet)	SAMPLE No.	Recovery (inches)	INTERVAL (feet)	DEPTH Feet	SOIL SAMPLE DESCRIPTION	GRAPHIC LOG	PID (ppm)	NOTES
1	S-1	20	0-5	0-0.5	grass, topsoil, earthworm	topsoil	0.0	
2	S-2			0.5-5	Tan f/m SAND, little f/c Gravel, tr Silt	Gravelly Sand	0.0	
3								
4								
5		41	5 to 10					
6					Tan f/m SAND, tr Silt	Sand		
7					Tan f/m SAND, little f/c Gravel, tr Silt 7-10 ft	Gravelly Sand		
8								
9								
10		53						Wet 9 ft
11	S-3			10-15	Tan to orange f/m SAND, little to some f/c Gravel, tr (+) Silt, dense		0.0	
12								
13								
14								
15								
16					Bottom of exploration 15 ft.			
17								
18								
19								

Notes:

1. Proportions: trace (<10%), little (10-20%), some (20-35%), and (35-50%)
2. Blow Counts, Clay: very soft (<2), soft (2-4), medium stiff (4-8),
3. stiff (8-15), very stiff (15-30), hard (>30)
4. Blow Counts, Sand: very loose (4), loose (4-10), medium dense (10-30),
5. dense (30-50), very dense (50)

Legend

s = sand; si = silt; cl = clay; l = loam; f = fine; m = medium; c = coarse; a = angular; sa = subangular; sr = subrounded; r = rounded; cobbles = >3"; gravel = 1/4 to 3"; sand = 0.003 to 1/4"; fines = <0.003". USCS must include: group symbol, color, group name, particle size range, soil type/consistency, moisture, structure, and origin. Additionally, discuss organics, root holes, mica, gypsum, caving, sloughing, loss of drilling water, contamination, etc. Descriptions based on split spoon observations.

ADS Environmental Engineering, LLC	SOIL BORING LOG		Boring No.:	GP- 7
	Project Name:	West Elementary School	Page:	1 of 1
	Project Location:	58 Beacon St. Andover, MA	Project No.:	NA
205 Woodland St., Sherborn, MA, 01770 (P: 781.727.6646)			Checked By:	ads

Drilling Company:	GeoSearch	Soil Boring Location:			
Drilling Foreman:	Ed Belsky	Ground Surface Elevation	NA	Datum:	NA
ADS Inspector(s):	A. Stiller	Date Started:	07/27/21	Date Completed:	7/27/21

DRILLING METHOD		SAMPLER		GROUND WATER DEPTH			
VEHICLE:	6610DT	TYPE:	5-foot macrocore	DATE	DEPTH (feet)	REFERENCE	METHOD
MODEL:	Geoprobe 6610	HAMMER:	NA				Soil
METHOD:	Direct push	FALL:	NA				

SAMPLE								
DEPTH (feet)	SAMPLE No.	Recovery (inches)	INTERVAL (feet)	DEPTH Feet	SOIL SAMPLE DESCRIPTION	GRAPHIC LOG	PID (ppm)	NOTES
1	S-1	49	0-5		grass, topsoil 18"	topsoil	0.0	
2	S-2				Tan f/m SAND, little f/c Gravel, tr Silt	Gravelly Sand	0.1	
3								
4					stratified sand 4.5-5 ft.			
5		46	5 to 10					
6	S-3			5 to 10	Orange f/m SAND, little f/c Gravel, tr (+) silt		0.0	
7								
8					Tan f/m SAND, tr Silt	Sand		
9					Gravel vein 8.5-9 ft.	Sand and Gravel		wet 8.5 ft
10		31						
11	S-3			10 to 15	Tan f/m SAND, tr f/Gravel, tr (+) Silt	Sand with Gravel	0.0	
12								
13								
14								
15								
16					Bottom of exploration 15 ft.			
17								
18								
19								

Notes:

1. Proportions: trace (<10%), little (10-20%), some (20-35%), and (35-50%)
2. Blow Counts, Clay: very soft (<2), soft (2-4), medium stiff (4-8),
3. stiff (8-15), very stiff (15-30), hard (>30)
4. Blow Counts, Sand: very loose (4), loose (4-10), medium dense (10-30),
5. dense (30-50), very dense (50)

Legend

s = sand; si = silt; cl = clay; l = loam; f = fine; m = medium; c = coarse; a = angular; sa = subangular; sr = subrounded; r = rounded; cobbles = >3"; gravel = 1/4 to 3"; sand = 0.003 to 1/4"; fines = <0.003". USCS must include: group symbol, color, group name, particle size range, soil type/consistency, moisture, structure, and origin. Additionally, discuss organics, root holes, mica, gypsum, caving, sloughing, loss of drilling water, contamination, etc. Descriptions based on split spoon observations.

ADS Environmental Engineering, LLC	SOIL BORING LOG		Boring No.:	GP- 8
	Project Name:	West Elementary School	Page:	1 of 1
	Project Location:	58 Beacon St. Andover, MA	Project No.:	NA
205 Woodland St., Sherborn, MA, 01770 (P: 781.727.6646)			Checked By:	ads

Drilling Company:	GeoSearch	Soil Boring Location:			
Drilling Foreman:	Ed Belsky	Ground Surface Elevation	NA	Datum:	NA
ADS Inspector(s):	A. Stiller	Date Started:	07/27/21	Date Completed:	7/27/21

DRILLING METHOD		SAMPLER		GROUND WATER DEPTH			
VEHICLE:	6610DT	TYPE:	5-foot macrocore	DATE	DEPTH (feet)	REFERENCE	METHOD
MODEL:	Geoprobe 6610	HAMMER:	NA				Soil
METHOD:	Direct push	FALL:	NA				

SAMPLE								
DEPTH (feet)	SAMPLE No.	Recovery (inches)	INTERVAL (feet)	DEPTH Feet	SOIL SAMPLE DESCRIPTION	GRAPHIC LOG	PID (ppm)	NOTES
1	S-1	34	0-5		grass, topsoil	topsoil	0.1	
2	S-2				Tan f/m SAND, little f/c Gravel, tr Silt	Fill	0.0	
3								
4								
5		12	5 to 10					
6	S-3			5 to 10	Tan f/m SAND, tr. f/ Gravel, tr. Silt	Fill	0.2	
7								
8								
9								wet 9 ft.
10		42						
11	S-4			10 to 15	Tan f/m SAND, tr (-) Silt	Sand	0.1	
12					Tan f/m SAND, little (-) f/c Gravel, little Silt	Sand with Gravel		
13								
14					Orange f/m SAND, tr f/Gravel, tr (+) Slt,			
15								
16					Bottom of exploration 15 ft.			
17								
18								
19								

Notes:

1. Proportions: trace (<10%), little (10-20%), some (20-35%), and (35-50%)
2. Blow Counts, Clay: very soft (<2), soft (2-4), medium stiff (4-8),
3. stiff (8-15), very stiff (15-30), hard (>30)
4. Blow Counts, Sand: very loose (4), loose (4-10), medium dense (10-30),
5. dense (30-50), very dense (50)

Legend

s = sand; si = silt; cl = clay; l = loam; f = fine; m = medium; c = coarse; a = angular; sa = subangular; sr = subrounded; r = rounded; cobbles = >3"; gravel = 1/4 to 3"; sand = 0.003 to 1/4"; fines = <0.003". USCS must include: group symbol, color, group name, particle size range, soil type/consistency, moisture, structure, and origin. Additionally, discuss organics, root holes, mica, gypsum, caving, sloughing, loss of drilling water, contamination, etc. Descriptions based on split spoon observations.

SOIL BORING LOG

ADS Environmental Engineering, LLC
205 Woodland St., Sherborn, MA, 01770 (P: 781.727.6646)

Project Name:	West Elementary School
Project Location:	58 Beacon St. Andover, MA
Boring No.:	GP- 9
Page:	1 of 1
Project No.:	NA
Checked By:	ads

Drilling Company:	GeoSearch	Soil Boring Location:	
Drilling Foreman:	Ed Belsky	Ground Surface Elevation	NA
ADS Inspector(s):	A. Stiller	Date Started:	07/27/21
		Datum:	NA
		Date Completed:	7/27/21

DRILLING METHOD		SAMPLER		GROUND WATER DEPTH			
VEHICLE:	6610DT	TYPE:	5-foot macrocore	DATE	DEPTH (feet)	REFERENCE	METHOD
MODEL:	Geoprobe 6610	HAMMER:	NA				Soil
METHOD:	Direct push	FALL:	NA				

SAMPLE					SOIL SAMPLE DESCRIPTION	GRAPHIC LOG	PID (ppm)	NOTES
DEPTH (feet)	SAMPLE No.	Recovery (inches)	INTERVAL (feet)	DEPTH Feet				
		36	0-5		Concrete 2"			
1						Gravelly Sand		
2	S-1				Tan f/m SAND, little f/c Gravel, tr Silt		0.0	
3								
4								
5		38	5 to 10		Orange f/m SAND, little (+) Silt	Gravelly Sand		pos. remnant
					Tan f/m SAND, Some f/c Gravel, tr Silt		0.1	topsoil
6	S-2			4.5-5				
7					Tan f/SAND, some Silt, stratified	Sand		
8								
9								wet 9 ft.
10		53						
	S-3			10 to 15			0.1	
11								
12								
13					Dense Orange tan mottled f/m SAND, little f/c Gravel, little Silt	Gravelly Sand		
14								
15								
					Bottom of exploration 15 ft.			
16								
17								
18								
19								

Notes:

1. Proportions: trace (<10%), little (10-20%), some (20-35%), and (35-50%)
2. Blow Counts, Clay: very soft (<2), soft (2-4), medium stiff (4-8),
3. stiff (8-15), very stiff (15-30), hard (>30)
4. Blow Counts, Sand: very loose (4), loose (4-10), medium dense (10-30),
5. dense (30-50), very dense (50)

Legend

s = sand; si = silt; cl = clay; l = loam; f = fine; m = medium; c = coarse; a = angular; sa = subangular; sr = subrounded; r = rounded; cobbles = >3"; gravel = 1/4 to 3"; sand = 0.003 to 1/4"; fines = <0.003". USCS must include: group symbol, color, group name, particle size range, soil type/consistency, moisture, structure, and origin. Additionally, discuss organics, root holes, mica, gypsum, caving, sloughing, loss of drilling water, contamination, etc. Descriptions based on split spoon observations.

ADS Environmental Engineering, LLC	SOIL BORING LOG		Boring No.:	GP- 10
	Project Name:	West Elementary School	Page:	1 of 1
	Project Location:	58 Beacon St. Andover, MA	Project No.:	NA
205 Woodland St., Sherborn, MA, 01770 (P: 781.727.6646)			Checked By:	ads

Drilling Company:	GeoSearch	Soil Boring Location:			
Drilling Foreman:	Ed Belsky	Ground Surface Elevation	NA	Datum:	NA
ADS Inspector(s):	A. Stiller	Date Started:	07/27/21	Date Completed:	7/27/21

DRILLING METHOD		SAMPLER		GROUND WATER DEPTH			
VEHICLE:	6610DT	TYPE:	5-foot macrocore	DATE	DEPTH (feet)	REFERENCE	METHOD
MODEL:	Geoprobe 6610	HAMMER:	NA				Soil
METHOD:	Direct push	FALL:	NA				

SAMPLE								
DEPTH (feet)	SAMPLE No.	Recovery (inches)	INTERVAL (feet)	DEPTH Feet	SOIL SAMPLE DESCRIPTION	GRAPHIC LOG	PID (ppm)	NOTES
	S-1	37	0-5		grass, topsoil 8"	topsoil	0.0	
1	S-2			0-1	Fill	Fill	0.0	
2	S-2A			2-2.5				
					Possible remnant topsoil layer 2-2.5 ft.		0.1	
3								
	S-3			3 to 5	Tan f/m SAND, tr (+) f/c Gravel, tr (+) Silt. Stratified		0.1	
4								
						Sand with Gravel		
5		46	5 to 10					
6	S-4			5 to 10	Tan orange mottled f/m SAND, tr f/Gravel, tr (+) Silt		0.0	
7								
8								
9								
10					Weathered Rock with f/m SAND	Rock		wet at 10 ft
	S-5	5		10 to 11			0.0	
11								
					Refusal at 11 ft.			
12								
13								
14								
15								
16								
17								
18								
19								

Notes:

1. Proportions: trace (<10%), little (10-20%), some (20-35%), and (35-50%)
2. Blow Counts, Clay: very soft (<2), soft (2-4), medium stiff (4-8),
3. stiff (8-15), very stiff (15-30), hard (>30)
4. Blow Counts, Sand: very loose (4), loose (4-10), medium dense (10-30),
5. dense (30-50), very dense (50)

Legend

s = sand; si = silt; cl = clay; l = loam; f = fine; m = medium; c = coarse; a = angular; sa = subangular; sr = subrounded; r = rounded; cobbles = >3"; gravel = 1/4 to 3"; sand = 0.003 to 1/4"; fines = <0.003". USCS must include: group symbol, color, group name, particle size range, soil type/consistency, moisture, structure, and origin. Additionally, discuss organics, root holes, mica, gypsum, caving, sloughing, loss of drilling water, contamination, etc. Descriptions based on split spoon observations.

ADS Environmental Engineering, LLC	SOIL BORING LOG	Boring No.:	GP- 11
	Project Name: West Elementary School	Page:	1 of 1
	Project Location: 58 Beacon St. Andover, MA	Project No.:	NA
205 Woodland St., Sherborn, MA, 01770 (P: 781.727.6646)		Checked By:	ads

Drilling Company:	GeoSearch	Soil Boring Location:			
Drilling Foreman:	Ed Belsky	Ground Surface Elevation	NA	Datum:	NA
ADS Inspector(s):	A. Stiller	Date Started:	07/27/21	Date Completed:	7/27/21

DRILLING METHOD		SAMPLER		GROUND WATER DEPTH			
VEHICLE:	6610DT	TYPE:	5-foot macrocore	DATE	DEPTH (feet)	REFERENCE	METHOD
MODEL:	Geoprobe 6610	HAMMER:	NA				Soil
METHOD:	Direct push	FALL:	NA				

SAMPLE								
DEPTH (feet)	SAMPLE No.	Recovery (inches)	INTERVAL (feet)	DEPTH Feet	SOIL SAMPLE DESCRIPTION	GRAPHIC LOG	PID (ppm)	NOTES
1	S-1	25	0-5		grass, topsoil, 8"	topsoil	0.0	
2	S-2			1-5	Tan f/m SAND, little f/c Gravel, tr Silt	Fill Gravelly Sand	0.2	
3								
4								
5		41	5 to 10					
6					Orange f/m SAND, tr. Silt. Possible remnant subsoil 5.5-6 ft.			
7					Tan f/m SAND, little f/c Gravel, tr Silt (5-7.5 ft)	gravelly sand		
8	S-3			5-10	Tan to grey f/ SAND, Some Silt	Sand	0.1	
9								
10		53						
11	S-3			10-15	Grey f/m SAND, tr f/Gravel, little Silt		0.3	
12								
13								
14								
15					Orange f/m SAND, tr Gravel, little Silt			
16					Bottom of exploration 15 ft.			
17								
18								
19								

Notes:

1. Proportions: trace (<10%), little (10-20%), some (20-35%), and (35-50%)
2. Blow Counts, Clay: very soft (<2), soft (2-4), medium stiff (4-8),
3. stiff (8-15), very stiff (15-30), hard (>30)
4. Blow Counts, Sand: very loose (4), loose (4-10), medium dense (10-30),
5. dense (30-50), very dense (50)

Legend

s = sand; si = silt; cl = clay; l = loam; f = fine; m = medium; c = coarse; a = angular; sa = subangular; sr = subrounded; r = rounded; cobbles = >3"; gravel = 1/4 to 3"; sand = 0.003 to 1/4"; fines = <0.003". USCS must include: group symbol, color, group name, particle size range, soil type/consistency, moisture, structure, and origin. Additionally, discuss organics, root holes, mica, gypsum, caving, sloughing, loss of drilling water, contamination, etc. Descriptions based on split spoon observations.

ADS Environmental Engineering, LLC	SOIL BORING LOG		Boring No.:	GP- 12
	Project Name:	West Elementary School	Page:	1 of 1
	Project Location:	58 Beacon St. Andover, MA	Project No.:	NA
205 Woodland St., Sherborn, MA, 01770 (P: 781.727.6646)			Checked By:	ads

Drilling Company:	GeoSearch	Soil Boring Location:			
Drilling Foreman:	Ed Belsky	Ground Surface Elevation	NA	Datum:	NA
ADS Inspector(s):	A. Stiller	Date Started:	07/27/21	Date Completed:	7/28/21

DRILLING METHOD		SAMPLER		GROUND WATER DEPTH			
VEHICLE:	6610DT	TYPE:	5-foot macrocore	DATE	DEPTH (feet)	REFERENCE	METHOD
MODEL:	Geoprobe 6610	HAMMER:	NA				Soil
METHOD:	Direct push	FALL:	NA				

SAMPLE					SOIL SAMPLE DESCRIPTION	GRAPHIC LOG	PID (ppm)	NOTES
DEPTH (feet)	SAMPLE No.	Recovery (inches)	INTERVAL (feet)	DEPTH Feet				
		42	0-5		bituminous pavement 3"			
1	S-1			0.5-2	sand and gravel base course	Fill	0.1	
					Brown f/m SAND, little f/c Gravel, tr Silt			
2								
					Organic layer 2-2.3 ft (possible remnant topsoil)			
3	S-2			2 to 5	Orange to tan f/m SAND, tr Gravel, tr Silt	Sand with Gravel	0.1	
4								
5								
	S-3	48	5 to 10		Tan to grey f/m SAND, tr f/ Gravel, little (+) Silt		0.1	
6								
7								
					soils slightly plastic 7-10 ft.	Silty Sand with		wet 7 ft.
8						Gravel		
9								
					Orange f/m SAND, little f/c Gravel, little silt 9.5-10			
10								
		50	10 to 14					
11	S-4			10 to 14	Grey f/m SAND and SILT, tr f/Gravel, slight plasticity, dense	Sand and Silt	0.0	
12								
13								
14								
					Refusal at 14 ft.			
15								
16								
17								
18								
19								

Notes:

1. Proportions: trace (<10%), little (10-20%), some (20-35%), and (35-50%)
2. Blow Counts, Clay: very soft (<2), soft (2-4), medium stiff (4-8),
3. stiff (8-15), very stiff (15-30), hard (>30)
4. Blow Counts, Sand: very loose (4), loose (4-10), medium dense (10-30),
5. dense (30-50), very dense (50)

Legend

s = sand; si = silt; cl = clay; l = loam; f = fine; m = medium; c = coarse; a = angular; sa = subangular; sr = subrounded; r = rounded; cobbles = >3"; gravel = 1/4 to 3"; sand = 0.003 to 1/4"; fines = <0.003". USCS must include: group symbol, color, group name, particle size range, soil type/consistency, moisture, structure, and origin. Additionally, discuss organics, root holes, mica, gypsum, caving, sloughing, loss of drilling water, contamination, etc. Descriptions based on split spoon observations.

ADS Environmental Engineering, LLC	SOIL BORING LOG		Boring No.:	GP- 13
	Project Name:	West Elementary School	Page:	1 of 1
	Project Location:	58 Beacon St. Andover, MA	Project No.:	NA
205 Woodland St., Sherborn, MA, 01770 (P: 781.727.6646)			Checked By:	ads

Drilling Company:	GeoSearch	Soil Boring Location:			
Drilling Foreman:	Ed Belsky	Ground Surface Elevation	NA	Datum:	NA
ADS Inspector(s):	A. Stiller	Date Started:	07/27/21	Date Completed:	7/28/21

DRILLING METHOD		SAMPLER		GROUND WATER DEPTH			
VEHICLE:	6610DT	TYPE:	5-foot macrocore	DATE	DEPTH (feet)	REFERENCE	METHOD
MODEL:	Geoprobe 6610	HAMMER:	NA				Soil
METHOD:	Direct push	FALL:	NA				

SAMPLE								
DEPTH (feet)	SAMPLE No.	Recovery (inches)	INTERVAL (feet)	DEPTH Feet	SOIL SAMPLE DESCRIPTION	GRAPHIC LOG	PID (ppm)	NOTES
	S-1	44	0-5	0-0.2	Grass, topsoil 3"		0.2	
1	S-2			0.2-5	Brown f/m SAND, little f/Gravel, tr Silt, brick fragment		0.0	
2								
3					2" asphalt at 2 ft.	Fill		
4					Brown f/m SAND, some f/c Gravel, tr Silt. Fill			
5					possible remnant fopsoil at 4.5 ft.			
		44	5 to 10		brown f/m SAND, tr f/Gravel, tr(-) Silt	Clean Sand		
6								
7	S-3			5 to 10	Tan Grey f/m SAND, little f/c Gravel, tr (+) Silt	Gravelly Sand	0.0	
8								
9								
10								
	S-4	38	10 to 15	10-15	Tan f/m SAND and SILT, some f/c Gravel, cobbles		0.0	
11								
								Soil wet 11 ft
12								
13								
14					soil orange at 14 ft. slight plasticity at 14.5 ft.			
15								
					Bottom of exploration 15 ft.			
16								
17								
18								
19								

Notes:

1. Proportions: trace (<10%), little (10-20%), some (20-35%), and (35-50%)
2. Blow Counts, Clay: very soft (<2), soft (2-4), medium stiff (4-8),
3. stiff (8-15), very stiff (15-30), hard (>30)
4. Blow Counts, Sand: very loose (4), loose (4-10), medium dense (10-30),
5. dense (30-50), very dense (50)

Legend

s = sand; si = silt; cl = clay; l = loam; f = fine; m = medium; c = coarse; a = angular; sa = subangular; sr = subrounded; r = rounded; cobbles = >3"; gravel = 1/4 to 3"; sand = 0.003 to 1/4"; fines = <0.003". USCS must include: group symbol, color, group name, particle size range, soil type/consistency, moisture, structure, and origin. Additionally, discuss organics, root holes, mica, gypsum, caving, sloughing, loss of drilling water, contamination, etc. Descriptions based on split spoon observations.

ADS Environmental Engineering, LLC	SOIL BORING LOG		Boring No.:	GP- 14
	Project Name:	West Elementary School	Page:	1 of 1
	Project Location:	58 Beacon St. Andover, MA	Project No.:	NA
205 Woodland St., Sherborn, MA, 01770 (P: 781.727.6646)			Checked By:	ads

Drilling Company:	GeoSearch	Soil Boring Location:			
Drilling Foreman:	Ed Belsky	Ground Surface Elevation	NA	Datum:	NA
ADS Inspector(s):	A. Stiller	Date Started:	07/27/21	Date Completed:	7/27/21

DRILLING METHOD		SAMPLER		GROUND WATER DEPTH			
VEHICLE:	6610DT	TYPE:	5-foot macrocore	DATE	DEPTH (feet)	REFERENCE	METHOD
MODEL:	Geoprobe 6610	HAMMER:	NA				Soil
METHOD:	Direct push	FALL:	NA				

SAMPLE								
DEPTH (feet)	SAMPLE No.	Recovery (inches)	INTERVAL (feet)	DEPTH Feet	SOIL SAMPLE DESCRIPTION	GRAPHIC LOG	PID (ppm)	NOTES
	S-1	35	0-5	0-0.5	grass, topsoil 6 "	Topsoil	0.0	
1	S-2			0.5-5	Brown f/m SAND, tr f/c Gravel, tr (+) Silt,	Sand	0.0	
2								
						Sand		
3					Tan f/m SAND, tr Silt 2.5-3.5 ft			
					Rock 4-4.5 ft	Sand and Gravel		
4								
5		36						
	S-3			5 to 8	Grey f/ SAND and f/c GRAVEL, tr Silt		0.0	
6						Sand and Gravel		
7								
8								
					Refusal at 8 ft.			
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								

Notes:

1. Proportions: trace (<10%), little (10-20%), some (20-35%), and (35-50%)
2. Blow Counts, Clay: very soft (<2), soft (2-4), medium stiff (4-8),
3. stiff (8-15), very stiff (15-30), hard (>30)
4. Blow Counts, Sand: very loose (4), loose (4-10), medium dense (10-30),
5. dense (30-50), very dense (50)

Legend

s = sand; si = silt; cl = clay; l = loam; f = fine; m = medium; c = coarse; a = angular; sa = subangular; sr = subrounded; r = rounded; cobbles = >3"; gravel = 1/4 to 3"; sand = 0.003 to 1/4"; fines = <0.003". USCS must include: group symbol, color, group name, particle size range, soil type/consistency, moisture, structure, and origin. Additionally, discuss organics, root holes, mica, gypsum, caving, sloughing, loss of drilling water, contamination, etc. Descriptions based on split spoon observations.

ADS Environmental Engineering, LLC	SOIL BORING LOG		Boring No.:	GP- 15
	Project Name:	West Elementary School	Page:	1 of 1
	Project Location:	58 Beacon St. Andover, MA	Project No.:	NA
205 Woodland St., Sherborn, MA, 01770 (P: 781.727.6646)			Checked By:	ads

Drilling Company:	GeoSearch	Soil Boring Location:			
Drilling Foreman:	Ed Belsky	Ground Surface Elevation	NA	Datum:	NA
ADS Inspector(s):	A. Stiller	Date Started:	07/27/21	Date Completed:	7/27/21

DRILLING METHOD		SAMPLER		GROUND WATER DEPTH			
VEHICLE:	6610DT	TYPE:	5-foot macrocore	DATE	DEPTH (feet)	REFERENCE	METHOD
MODEL:	Geoprobe 6610	HAMMER:	NA				Soil
METHOD:	Direct push	FALL:	NA				

SAMPLE								
DEPTH (feet)	SAMPLE No.	Recovery (inches)	INTERVAL (feet)	DEPTH Feet	SOIL SAMPLE DESCRIPTION	GRAPHIC LOG	PID (ppm)	NOTES
	S-1	39	0-5	0-0.3	grass, topsoil 3 "	Topsoil	0.0	
1	S-2			0.3-5	tan to orange f/m SAND, tr f/c Gravel, tr (+) Silt,		0.0	
						Sand with Gravel		
2								
3								
4								
					orange staining 4.5-5 ft.			
5		48	5-9.5					
	S-3			5 to 9.5	Grey f/m SAND, little (-) Silt, tr f/ Gravel		0.0	
6						Sand with gravel		
7								
8								
					Rock at around 8 ft.			
9								
10					Refusal at 9.5 ft.			
11								
12								
13								
14								
15								
16								
17								
18								
19								

Notes:

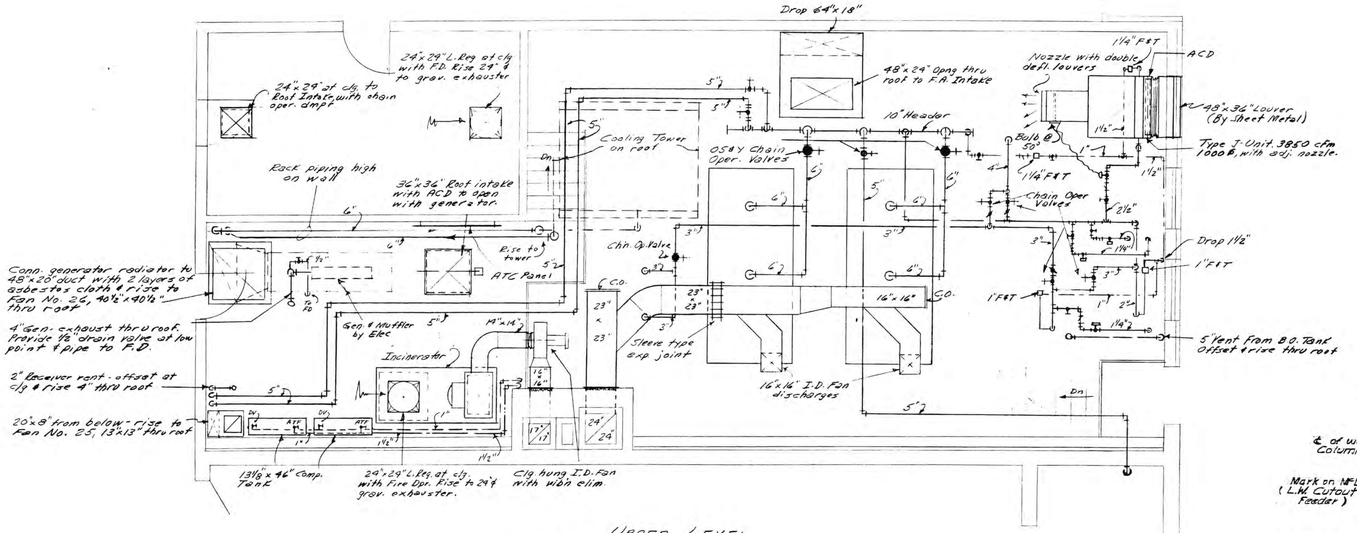
1. Proportions: trace (<10%), little (10-20%), some (20-35%), and (35-50%)
2. Blow Counts, Clay: very soft (<2), soft (2-4), medium stiff (4-8),
3. stiff (8-15), very stiff (15-30), hard (>30)
4. Blow Counts, Sand: very loose (4), loose (4-10), medium dense (10-30),
5. dense (30-50), very dense (50)

Legend

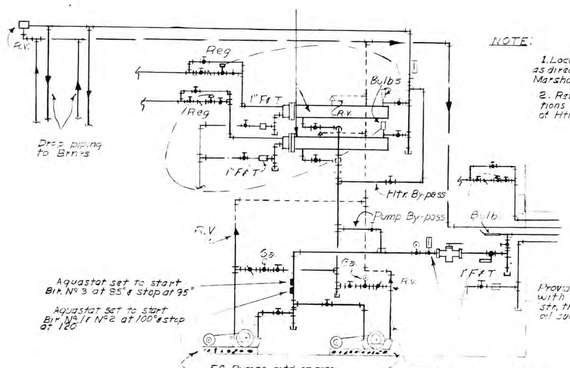
s = sand; si = silt; cl = clay; l = loam; f = fine; m = medium; c = coarse; a = angular; sa = subangular; sr = subrounded; r = rounded; cobbles = >3"; gravel = 1/4 to 3"; sand = 0.003 to 1/4"; fines = <0.003". USCS must include: group symbol, color, group name, particle size range, soil type/consistency, moisture, structure, and origin. Additionally, discuss organics, root holes, mica, gypsum, caving, sloughing, loss of drilling water, contamination, etc. Descriptions based on split spoon observations.

APPENDIX C

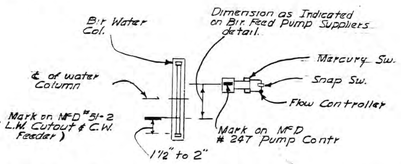
DRAWINGS SHOWING FORMER TANK LOCATIONS



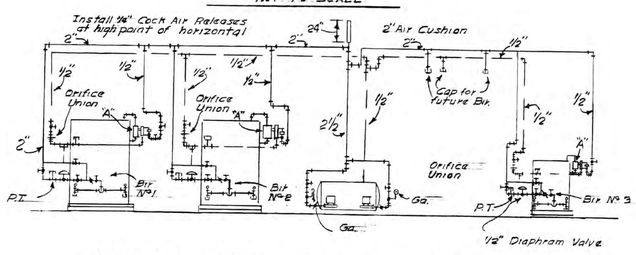
UPPER LEVEL
PLAN OF BOILER ROOM
SCALE 1/4" = 1'-0"



SCHEMATIC OIL HEATING & PIPING DIAGRAM
NOT TO SCALE



DETAIL "A" FLOAT OPER. PILOT VALVE & PUMP CONTROL SWITCH
NOT TO SCALE



Piping: ¾" and larger Standard steel, ½ and smaller Type K hard copper with sweat fittings.

DIAGRAMMATIC ELEVATION OF FEED SYSTEM
NOT TO SCALE

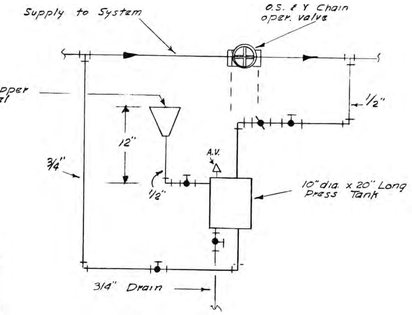
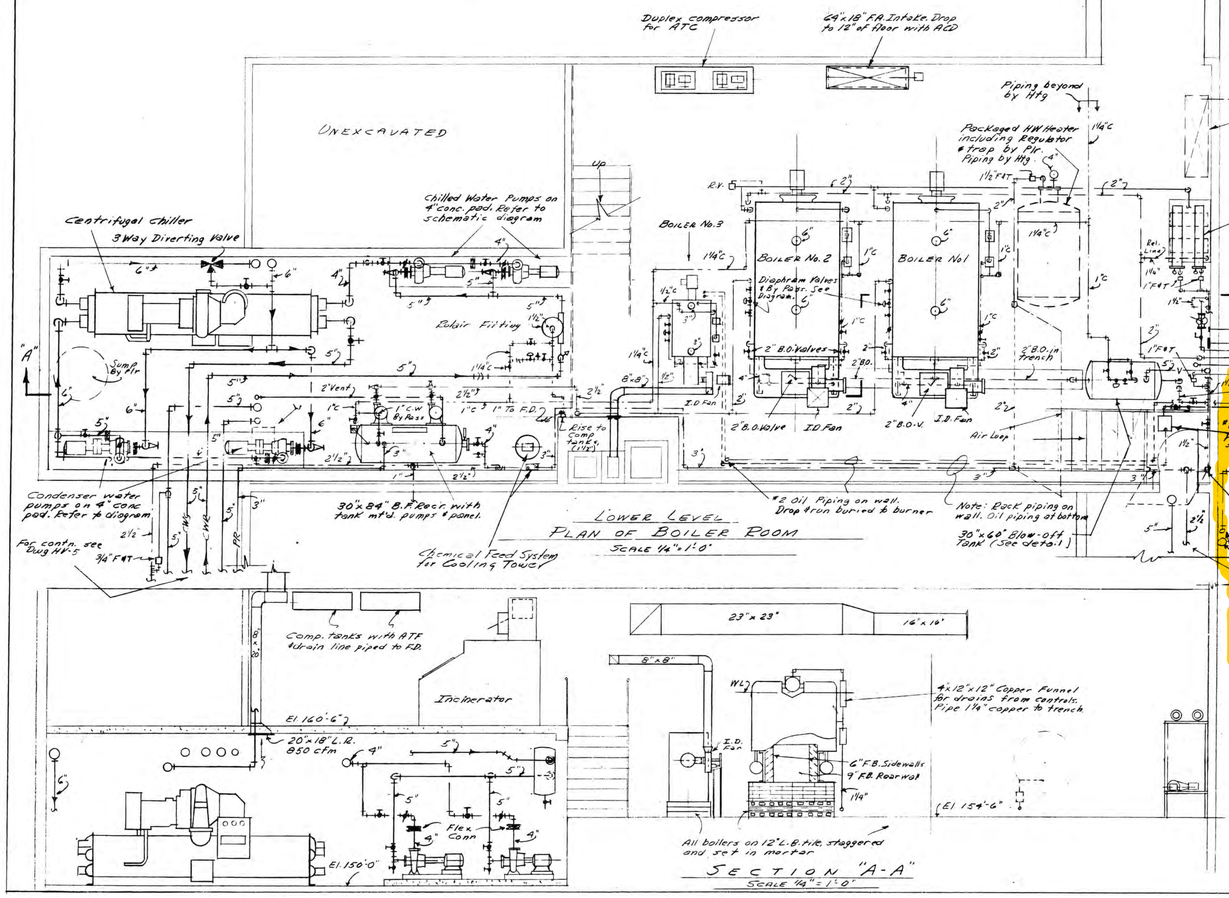
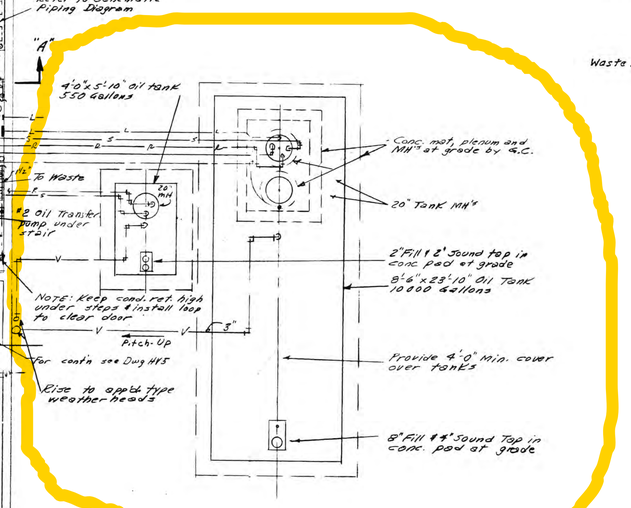
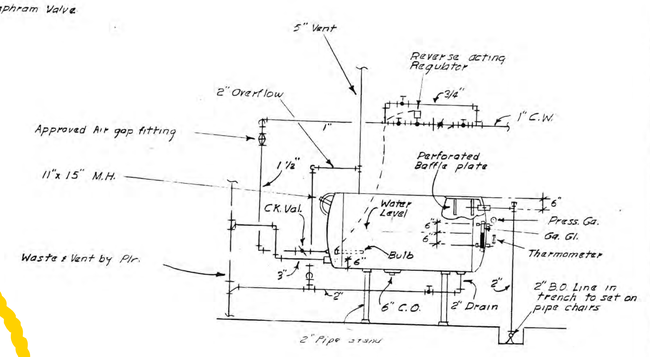


DIAGRAM OF SHOT FEEDER
NOT TO SCALE



LOWER LEVEL
PLAN OF BOILER ROOM
SCALE 1/4" = 1'-0"



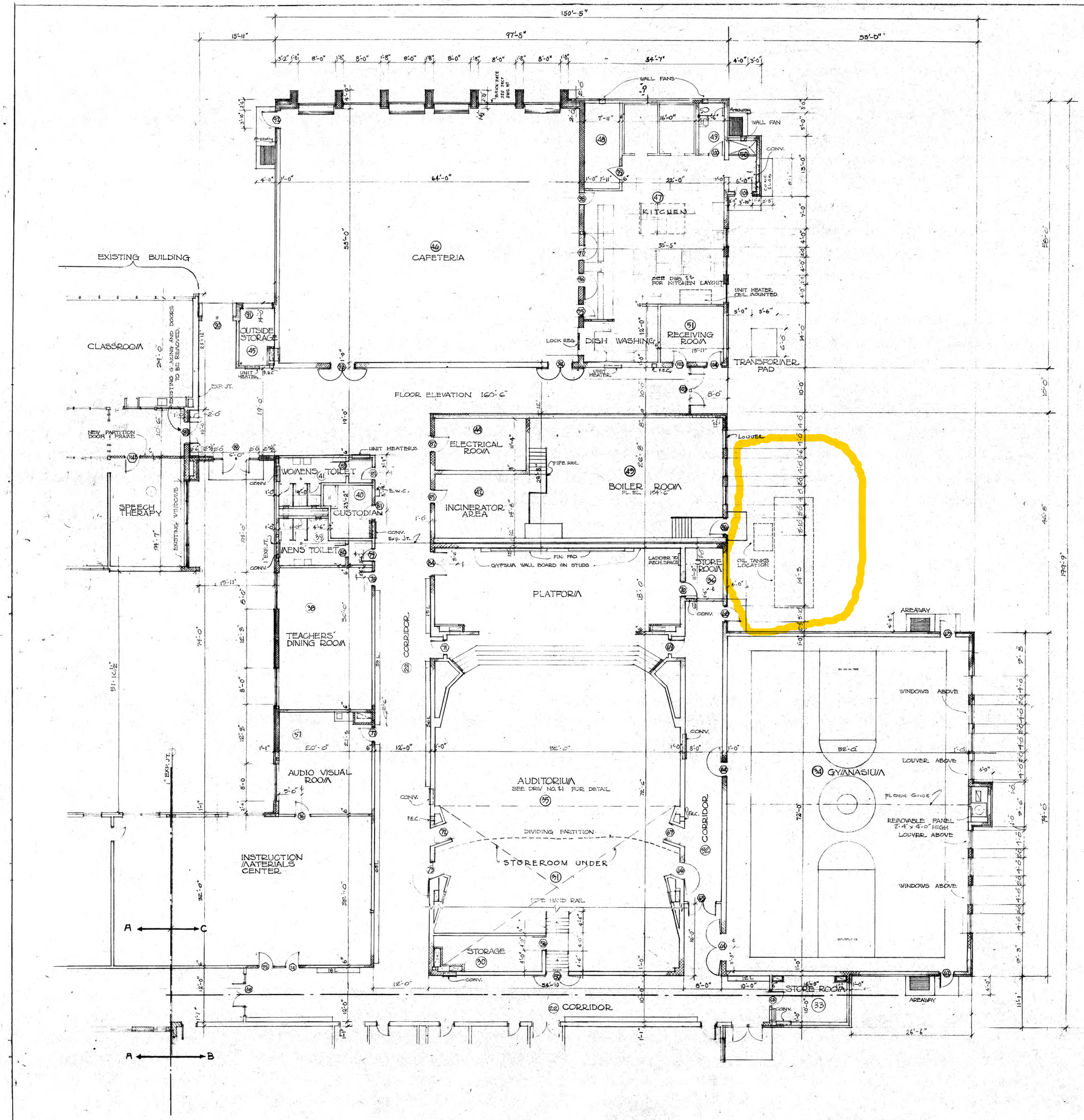


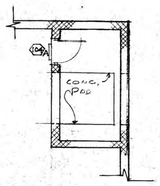
DETAIL OF BLOW-OFF TANK & PIPING
NOT TO SCALE

ADDITIONS TO WEST ELEMENTARY SCHOOL BUILDING
ANDOVER MASSACHUSETTS

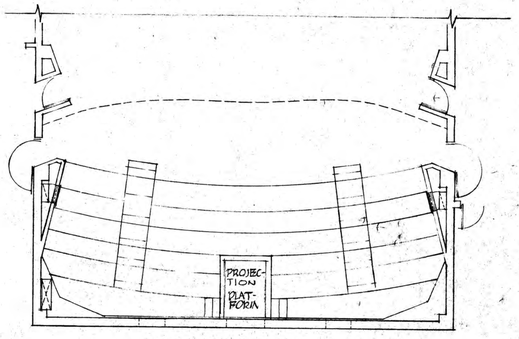
CRIMP BROWN & FISHER INC. ARCHITECTS
177 STATE STREET BOSTON, MASSACHUSETTS

SCALE		
AS NOTED	BOILER ROOM PLAN	HV-8
DATE AUG. 12, 1968.		

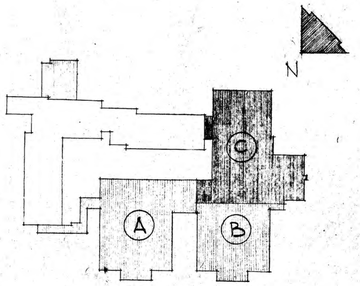




MECHANICAL SPACE ABOVE PLATFORM



AUDITORIUM STADIUM PLAN
(SEE 1/4" DWG. FOR DETAILS)



KEY PLAN

ADDITIONS TO WEST ELEMENTARY SCHOOL BUILDING
ANDOVER, MASSACHUSETTS

CRIMP BROWN & FISHER INC. ARCHITECTS
177 STATE STREET BOSTON, MASSACHUSETTS

SCALE 1/8" = 1'-0"
DATE AUG. 12, 1968

FLOOR PLAN - PART C

10

APPENDIX D

ANALYTICAL LABORATORY REPORTS

ANALYTICAL REPORT

Lab Number:	L2140490
Client:	ADS Environmental 205 Woodland St. Sherborn, MA 01770
ATTN:	Andrea Stiller
Phone:	(781) 727-6646
Project Name:	58 BEACON ST.
Project Number:	0200.01
Report Date:	08/09/21

The original project report/data package is held by Alpha Analytical. This report/data package is paginated and should be reproduced only in its entirety. Alpha Analytical holds no responsibility for results and/or data that are not consistent with the original.

Certifications & Approvals: MA (M-MA086), NH NELAP (2064), CT (PH-0574), IL (200077), ME (MA00086), MD (348), NJ (MA935), NY (11148), NC (25700/666), PA (68-03671), RI (LAO00065), TX (T104704476), VT (VT-0935), VA (460195), USDA (Permit #P330-17-00196).

Eight Walkup Drive, Westborough, MA 01581-1019
508-898-9220 (Fax) 508-898-9193 800-624-9220 - www.alphalab.com

Project Name: 58 BEACON ST.
Project Number: 0200.01

Lab Number: L2140490
Report Date: 08/09/21

Alpha Sample ID	Client ID	Matrix	Sample Location	Collection Date/Time	Receive Date
L2140490-01	GP-1/COMP	SOIL	ANDOVER, MA	07/27/21 08:30	07/28/21
L2140490-02	GP-8/S-3	SOIL	ANDOVER, MA	07/27/21 13:10	07/28/21
L2140490-03	CUT COMP 1	SOIL	ANDOVER, MA	07/28/21 12:00	07/28/21
L2140490-04	CUT COMP 2	SOIL	ANDOVER, MA	07/28/21 11:30	07/28/21
L2140490-05	TOPSOIL COMP 1	SOIL	ANDOVER, MA	07/28/21 12:02	07/28/21
L2140490-06	TOPSOIL COMP 2	SOIL	ANDOVER, MA	07/28/21 12:15	07/28/21

Project Name:	58 BEACON ST.	**Lab Number:**	L2140490
Project Number:	0200.01	**Report Date:**	08/09/21

MADEP MCP Response Action Analytical Report Certification

This form provides certifications for all samples performed by MCP methods. Please refer to the Sample Results and Container Information sections of this report for specification of MCP methods used for each analysis. The following questions pertain only to MCP Analytical Methods.

An affirmative response to questions A through F is required for "Presumptive Certainty" status		
A	Were all samples received in a condition consistent with those described on the Chain-of-Custody, properly preserved (including temperature) in the field or laboratory, and prepared/analyzed within method holding times?	YES
B	Were the analytical method(s) and all associated QC requirements specified in the selected CAM protocol(s) followed?	YES
C	Were all required corrective actions and analytical response actions specified in the selected CAM protocol(s) implemented for all identified performance standard non-conformances?	YES
D	Does the laboratory report comply with all the reporting requirements specified in CAM VII A, "Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data?"	YES
E a.	VPH, EPH, and APH Methods only: Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications).	YES
E b.	APH and TO-15 Methods only: Was the complete analyte list reported for each method?	N/A
F	Were all applicable CAM protocol QC and performance standard non-conformances identified and evaluated in a laboratory narrative (including all "No" responses to Questions A through E)?	YES

A response to questions G, H and I is required for "Presumptive Certainty" status		
G	Were the reporting limits at or below all CAM reporting limits specified in the selected CAM protocol(s)?	YES
H	Were all QC performance standards specified in the CAM protocol(s) achieved?	NO
I	Were results reported for the complete analyte list specified in the selected CAM protocol(s)?	NO

For any questions answered "No", please refer to the case narrative section on the following page(s).

Please note that sample matrix information is located in the Sample Results section of this report.

Project Name:	58 BEACON ST.	**Lab Number:**	L2140490
Project Number:	0200.01	**Report Date:**	08/09/21

Case Narrative

The samples were received in accordance with the Chain of Custody and no significant deviations were encountered during the preparation or analysis unless otherwise noted. Sample Receipt, Container Information, and the Chain of Custody are located at the back of the report.

Results contained within this report relate only to the samples submitted under this Alpha Lab Number and meet NELAP requirements for all NELAP accredited parameters unless otherwise noted in the following narrative. The data presented in this report is organized by parameter (i.e. VOC, SVOC, etc.). Sample specific Quality Control data (i.e. Surrogate Spike Recovery) is reported at the end of the target analyte list for each individual sample, followed by the Laboratory Batch Quality Control at the end of each parameter. Tentatively Identified Compounds (TICs), if requested, are reported for compounds identified to be present and are not part of the method/program Target Compound List, even if only a subset of the TCL are being reported. If a sample was re-analyzed or re-extracted due to a required quality control corrective action and if both sets of data are reported, the Laboratory ID of the re-analysis or re-extraction is designated with an "R" or "RE", respectively.

When multiple Batch Quality Control elements are reported (e.g. more than one LCS), the associated samples for each element are noted in the grey shaded header line of each data table. Any Laboratory Batch, Sample Specific % recovery or RPD value that is outside the listed Acceptance Criteria is bolded in the report. In reference to questions H (CAM) or 4 (RCP) when "NO" is checked, the performance criteria for CAM and RCP methods allow for some quality control failures to occur and still be within method compliance. In these instances, the specific failure is not narrated but noted in the associated QC Outlier Summary Report, located directly after the Case Narrative. QC information is also incorporated in the Data Usability Assessment table (Format 11) of our Data Merger tool, where it can be reviewed in conjunction with the sample result, associated regulatory criteria and any associated data usability implications.

Soil/sediments, solids and tissues are reported on a dry weight basis unless otherwise noted. Definitions of all data qualifiers and acronyms used in this report are provided in the Glossary located at the back of the report.

HOLD POLICY - For samples submitted on hold, Alpha's policy is to hold samples (with the exception of Air canisters) free of charge for 21 calendar days from the date the project is completed. After 21 calendar days, we will dispose of all samples submitted including those put on hold unless you have contacted your Alpha Project Manager and made arrangements for Alpha to continue to hold the samples. Air canisters will be disposed after 3 business days from the date the project is completed.

Please contact Project Management at 800-624-9220 with any questions.

Project Name:	58 BEACON ST.	**Lab Number:**	L2140490
Project Number:	0200.01	**Report Date:**	08/09/21

Case Narrative (continued)

Report Submission

August 09, 2021: This final report includes the results of all requested analyses.

August 04, 2021: This is a preliminary report.

The analysis of MCP14 Metals was subcontracted. A copy of the laboratory report is included as an addendum.

Please note: This data is only available in PDF format and is not available on Data Merger.

MCP Related Narratives

Volatile Organics

In reference to question H:

L2140490-03 through -06: Initial Calibration did not meet:

Lowest Calibration Standard Minimum Response Factor: 1,4-dioxane (0.0016), 4-methyl-2-pentanone (0.0805)

Average Response Factor: 1,4-dioxane

L2140490-03 through -06: The associated continuing calibration standard is outside the acceptance criteria for several compounds; however, it is within overall method allowances. A copy of the continuing calibration standard is included as an addendum to this report.

VPH

In reference to question I:

All samples were analyzed for a subset of MCP analytes per client request.

EPH

In reference to question I:

All samples were analyzed for a subset of MCP analytes per client request.

I, the undersigned, attest under the pains and penalties of perjury that, to the best of my knowledge and belief and based upon my personal inquiry of those responsible for providing the information contained in this analytical report, such information is accurate and complete. This certificate of analysis is not complete unless this page accompanies any and all pages of this report.

Authorized Signature: Tiffani Morrissey - Tiffani Morrissey

Title: Technical Director/Representative Date: 08/09/21

QC OUTLIER SUMMARY REPORT

Project Name: 58 BEACON ST.
Project Number: 0200.01

Lab Number: L2140490
Report Date: 08/09/21

Method	Client ID (Native ID)	Lab ID	Parameter	QC Type	Recovery/RPD (%)	QC Limits (%)	Associated Samples	Data Quality Assessment
MCP Volatile Organics by EPA 5035 Low - Westborough Lab								
8260C	Batch QC	WG1531018-3	Methyl ethyl ketone	LCS	69	70-130	03-06	potential low bias

ORGANICS

VOLATILES

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-03
Client ID: CUT COMP 1
Sample Location: ANDOVER, MA

Date Collected: 07/28/21 12:00
Date Received: 07/28/21
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/03/21 02:23
Analyst: JC
Percent Solids: 89%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
Methylene chloride	ND		ug/kg	5.8	--	1
1,1-Dichloroethane	ND		ug/kg	1.2	--	1
Chloroform	ND		ug/kg	1.8	--	1
Carbon tetrachloride	ND		ug/kg	1.2	--	1
1,2-Dichloropropane	ND		ug/kg	1.2	--	1
Dibromochloromethane	ND		ug/kg	1.2	--	1
1,1,2-Trichloroethane	ND		ug/kg	1.2	--	1
Tetrachloroethene	ND		ug/kg	0.58	--	1
Chlorobenzene	ND		ug/kg	0.58	--	1
Trichlorofluoromethane	ND		ug/kg	4.7	--	1
1,2-Dichloroethane	ND		ug/kg	1.2	--	1
1,1,1-Trichloroethane	ND		ug/kg	0.58	--	1
Bromodichloromethane	ND		ug/kg	0.58	--	1
trans-1,3-Dichloropropene	ND		ug/kg	1.2	--	1
cis-1,3-Dichloropropene	ND		ug/kg	0.58	--	1
1,3-Dichloropropene, Total	ND		ug/kg	0.58	--	1
1,1-Dichloropropene	ND		ug/kg	0.58	--	1
Bromoform	ND		ug/kg	4.7	--	1
1,1,2,2-Tetrachloroethane	ND		ug/kg	0.58	--	1
Benzene	ND		ug/kg	0.58	--	1
Toluene	ND		ug/kg	1.2	--	1
Ethylbenzene	ND		ug/kg	1.2	--	1
Chloromethane	ND		ug/kg	4.7	--	1
Bromomethane	ND		ug/kg	2.3	--	1
Vinyl chloride	ND		ug/kg	1.2	--	1
Chloroethane	ND		ug/kg	2.3	--	1
1,1-Dichloroethene	ND		ug/kg	1.2	--	1
trans-1,2-Dichloroethene	ND		ug/kg	1.8	--	1

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-03 Date Collected: 07/28/21 12:00

Client ID: CUT COMP 1 Date Received: 07/28/21

Sample Location: ANDOVER, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
Trichloroethene	ND		ug/kg	0.58	--	1
1,2-Dichlorobenzene	ND		ug/kg	2.3	--	1
1,3-Dichlorobenzene	ND		ug/kg	2.3	--	1
1,4-Dichlorobenzene	ND		ug/kg	2.3	--	1
Methyl tert butyl ether	ND		ug/kg	2.3	--	1
p/m-Xylene	ND		ug/kg	2.3	--	1
o-Xylene	ND		ug/kg	1.2	--	1
Xylenes, Total	ND		ug/kg	1.2	--	1
cis-1,2-Dichloroethene	ND		ug/kg	1.2	--	1
1,2-Dichloroethene, Total	ND		ug/kg	1.2	--	1
Dibromomethane	ND		ug/kg	2.3	--	1
1,2,3-Trichloropropane	ND		ug/kg	2.3	--	1
Styrene	ND		ug/kg	1.2	--	1
Dichlorodifluoromethane	ND		ug/kg	12	--	1
Acetone	ND		ug/kg	29	--	1
Carbon disulfide	ND		ug/kg	12	--	1
Methyl ethyl ketone	ND		ug/kg	12	--	1
Methyl isobutyl ketone	ND		ug/kg	12	--	1
2-Hexanone	ND		ug/kg	12	--	1
Bromochloromethane	ND		ug/kg	2.3	--	1
Tetrahydrofuran	ND		ug/kg	4.7	--	1
2,2-Dichloropropane	ND		ug/kg	2.3	--	1
1,2-Dibromoethane	ND		ug/kg	1.2	--	1
1,3-Dichloropropane	ND		ug/kg	2.3	--	1
1,1,1,2-Tetrachloroethane	ND		ug/kg	0.58	--	1
Bromobenzene	ND		ug/kg	2.3	--	1
n-Butylbenzene	ND		ug/kg	1.2	--	1
sec-Butylbenzene	ND		ug/kg	1.2	--	1
tert-Butylbenzene	ND		ug/kg	2.3	--	1
o-Chlorotoluene	ND		ug/kg	2.3	--	1
p-Chlorotoluene	ND		ug/kg	2.3	--	1
1,2-Dibromo-3-chloropropane	ND		ug/kg	3.5	--	1
Hexachlorobutadiene	ND		ug/kg	4.7	--	1
Isopropylbenzene	ND		ug/kg	1.2	--	1
p-Isopropyltoluene	ND		ug/kg	1.2	--	1
Naphthalene	ND		ug/kg	4.7	--	1
n-Propylbenzene	ND		ug/kg	1.2	--	1

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-03 Date Collected: 07/28/21 12:00

Client ID: CUT COMP 1 Date Received: 07/28/21

Sample Location: ANDOVER, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	2.3	--	1
1,2,4-Trichlorobenzene	ND		ug/kg	2.3	--	1
1,3,5-Trimethylbenzene	ND		ug/kg	2.3	--	1
1,2,4-Trimethylbenzene	ND		ug/kg	2.3	--	1
Diethyl ether	ND		ug/kg	2.3	--	1
Diisopropyl Ether	ND		ug/kg	2.3	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/kg	2.3	--	1
Tertiary-Amyl Methyl Ether	ND		ug/kg	2.3	--	1
1,4-Dioxane	ND		ug/kg	94	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	115		70-130
Toluene-d8	93		70-130
4-Bromofluorobenzene	98		70-130
Dibromofluoromethane	116		70-130

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-04
Client ID: CUT COMP 2
Sample Location: ANDOVER, MA

Date Collected: 07/28/21 11:30
Date Received: 07/28/21
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/03/21 02:48
Analyst: JC
Percent Solids: 90%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
Methylene chloride	ND		ug/kg	5.3	--	1
1,1-Dichloroethane	ND		ug/kg	1.1	--	1
Chloroform	ND		ug/kg	1.6	--	1
Carbon tetrachloride	ND		ug/kg	1.1	--	1
1,2-Dichloropropane	ND		ug/kg	1.1	--	1
Dibromochloromethane	ND		ug/kg	1.1	--	1
1,1,2-Trichloroethane	ND		ug/kg	1.1	--	1
Tetrachloroethene	ND		ug/kg	0.53	--	1
Chlorobenzene	ND		ug/kg	0.53	--	1
Trichlorofluoromethane	ND		ug/kg	4.2	--	1
1,2-Dichloroethane	ND		ug/kg	1.1	--	1
1,1,1-Trichloroethane	ND		ug/kg	0.53	--	1
Bromodichloromethane	ND		ug/kg	0.53	--	1
trans-1,3-Dichloropropene	ND		ug/kg	1.1	--	1
cis-1,3-Dichloropropene	ND		ug/kg	0.53	--	1
1,3-Dichloropropene, Total	ND		ug/kg	0.53	--	1
1,1-Dichloropropene	ND		ug/kg	0.53	--	1
Bromoform	ND		ug/kg	4.2	--	1
1,1,2,2-Tetrachloroethane	ND		ug/kg	0.53	--	1
Benzene	ND		ug/kg	0.53	--	1
Toluene	ND		ug/kg	1.1	--	1
Ethylbenzene	ND		ug/kg	1.1	--	1
Chloromethane	ND		ug/kg	4.2	--	1
Bromomethane	ND		ug/kg	2.1	--	1
Vinyl chloride	ND		ug/kg	1.1	--	1
Chloroethane	ND		ug/kg	2.1	--	1
1,1-Dichloroethene	ND		ug/kg	1.1	--	1
trans-1,2-Dichloroethene	ND		ug/kg	1.6	--	1

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-04 Date Collected: 07/28/21 11:30

Client ID: CUT COMP 2 Date Received: 07/28/21

Sample Location: ANDOVER, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
Trichloroethene	ND		ug/kg	0.53	--	1
1,2-Dichlorobenzene	ND		ug/kg	2.1	--	1
1,3-Dichlorobenzene	ND		ug/kg	2.1	--	1
1,4-Dichlorobenzene	ND		ug/kg	2.1	--	1
Methyl tert butyl ether	ND		ug/kg	2.1	--	1
p/m-Xylene	ND		ug/kg	2.1	--	1
o-Xylene	ND		ug/kg	1.1	--	1
Xylenes, Total	ND		ug/kg	1.1	--	1
cis-1,2-Dichloroethene	ND		ug/kg	1.1	--	1
1,2-Dichloroethene, Total	ND		ug/kg	1.1	--	1
Dibromomethane	ND		ug/kg	2.1	--	1
1,2,3-Trichloropropane	ND		ug/kg	2.1	--	1
Styrene	ND		ug/kg	1.1	--	1
Dichlorodifluoromethane	ND		ug/kg	11	--	1
Acetone	ND		ug/kg	27	--	1
Carbon disulfide	ND		ug/kg	11	--	1
Methyl ethyl ketone	ND		ug/kg	11	--	1
Methyl isobutyl ketone	ND		ug/kg	11	--	1
2-Hexanone	ND		ug/kg	11	--	1
Bromochloromethane	ND		ug/kg	2.1	--	1
Tetrahydrofuran	ND		ug/kg	4.2	--	1
2,2-Dichloropropane	ND		ug/kg	2.1	--	1
1,2-Dibromoethane	ND		ug/kg	1.1	--	1
1,3-Dichloropropane	ND		ug/kg	2.1	--	1
1,1,1,2-Tetrachloroethane	ND		ug/kg	0.53	--	1
Bromobenzene	ND		ug/kg	2.1	--	1
n-Butylbenzene	ND		ug/kg	1.1	--	1
sec-Butylbenzene	ND		ug/kg	1.1	--	1
tert-Butylbenzene	ND		ug/kg	2.1	--	1
o-Chlorotoluene	ND		ug/kg	2.1	--	1
p-Chlorotoluene	ND		ug/kg	2.1	--	1
1,2-Dibromo-3-chloropropane	ND		ug/kg	3.2	--	1
Hexachlorobutadiene	ND		ug/kg	4.2	--	1
Isopropylbenzene	ND		ug/kg	1.1	--	1
p-Isopropyltoluene	ND		ug/kg	1.1	--	1
Naphthalene	ND		ug/kg	4.2	--	1
n-Propylbenzene	ND		ug/kg	1.1	--	1

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-04 Date Collected: 07/28/21 11:30

Client ID: CUT COMP 2 Date Received: 07/28/21

Sample Location: ANDOVER, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	2.1	--	1
1,2,4-Trichlorobenzene	ND		ug/kg	2.1	--	1
1,3,5-Trimethylbenzene	ND		ug/kg	2.1	--	1
1,2,4-Trimethylbenzene	ND		ug/kg	2.1	--	1
Diethyl ether	ND		ug/kg	2.1	--	1
Diisopropyl Ether	ND		ug/kg	2.1	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/kg	2.1	--	1
Tertiary-Amyl Methyl Ether	ND		ug/kg	2.1	--	1
1,4-Dioxane	ND		ug/kg	85	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	115		70-130
Toluene-d8	96		70-130
4-Bromofluorobenzene	96		70-130
Dibromofluoromethane	115		70-130

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-05 Date Collected: 07/28/21 12:02
Client ID: TOPSOIL COMP 1 Date Received: 07/28/21
Sample Location: ANDOVER, MA Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/03/21 03:13
Analyst: JC
Percent Solids: 79%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
Methylene chloride	ND		ug/kg	7.9	--	1
1,1-Dichloroethane	ND		ug/kg	1.6	--	1
Chloroform	ND		ug/kg	2.4	--	1
Carbon tetrachloride	ND		ug/kg	1.6	--	1
1,2-Dichloropropane	ND		ug/kg	1.6	--	1
Dibromochloromethane	ND		ug/kg	1.6	--	1
1,1,2-Trichloroethane	ND		ug/kg	1.6	--	1
Tetrachloroethene	ND		ug/kg	0.79	--	1
Chlorobenzene	ND		ug/kg	0.79	--	1
Trichlorofluoromethane	ND		ug/kg	6.3	--	1
1,2-Dichloroethane	ND		ug/kg	1.6	--	1
1,1,1-Trichloroethane	ND		ug/kg	0.79	--	1
Bromodichloromethane	ND		ug/kg	0.79	--	1
trans-1,3-Dichloropropene	ND		ug/kg	1.6	--	1
cis-1,3-Dichloropropene	ND		ug/kg	0.79	--	1
1,3-Dichloropropene, Total	ND		ug/kg	0.79	--	1
1,1-Dichloropropene	ND		ug/kg	0.79	--	1
Bromoform	ND		ug/kg	6.3	--	1
1,1,2,2-Tetrachloroethane	ND		ug/kg	0.79	--	1
Benzene	ND		ug/kg	0.79	--	1
Toluene	ND		ug/kg	1.6	--	1
Ethylbenzene	ND		ug/kg	1.6	--	1
Chloromethane	ND		ug/kg	6.3	--	1
Bromomethane	ND		ug/kg	3.2	--	1
Vinyl chloride	ND		ug/kg	1.6	--	1
Chloroethane	ND		ug/kg	3.2	--	1
1,1-Dichloroethene	ND		ug/kg	1.6	--	1
trans-1,2-Dichloroethene	ND		ug/kg	2.4	--	1

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-05 Date Collected: 07/28/21 12:02

Client ID: TOPSOIL COMP 1 Date Received: 07/28/21

Sample Location: ANDOVER, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
Trichloroethene	ND		ug/kg	0.79	--	1
1,2-Dichlorobenzene	ND		ug/kg	3.2	--	1
1,3-Dichlorobenzene	ND		ug/kg	3.2	--	1
1,4-Dichlorobenzene	ND		ug/kg	3.2	--	1
Methyl tert butyl ether	ND		ug/kg	3.2	--	1
p/m-Xylene	ND		ug/kg	3.2	--	1
o-Xylene	ND		ug/kg	1.6	--	1
Xylenes, Total	ND		ug/kg	1.6	--	1
cis-1,2-Dichloroethene	ND		ug/kg	1.6	--	1
1,2-Dichloroethene, Total	ND		ug/kg	1.6	--	1
Dibromomethane	ND		ug/kg	3.2	--	1
1,2,3-Trichloropropane	ND		ug/kg	3.2	--	1
Styrene	ND		ug/kg	1.6	--	1
Dichlorodifluoromethane	ND		ug/kg	16	--	1
Acetone	ND		ug/kg	40	--	1
Carbon disulfide	ND		ug/kg	16	--	1
Methyl ethyl ketone	ND		ug/kg	16	--	1
Methyl isobutyl ketone	ND		ug/kg	16	--	1
2-Hexanone	ND		ug/kg	16	--	1
Bromochloromethane	ND		ug/kg	3.2	--	1
Tetrahydrofuran	ND		ug/kg	6.3	--	1
2,2-Dichloropropane	ND		ug/kg	3.2	--	1
1,2-Dibromoethane	ND		ug/kg	1.6	--	1
1,3-Dichloropropane	ND		ug/kg	3.2	--	1
1,1,1,2-Tetrachloroethane	ND		ug/kg	0.79	--	1
Bromobenzene	ND		ug/kg	3.2	--	1
n-Butylbenzene	ND		ug/kg	1.6	--	1
sec-Butylbenzene	ND		ug/kg	1.6	--	1
tert-Butylbenzene	ND		ug/kg	3.2	--	1
o-Chlorotoluene	ND		ug/kg	3.2	--	1
p-Chlorotoluene	ND		ug/kg	3.2	--	1
1,2-Dibromo-3-chloropropane	ND		ug/kg	4.7	--	1
Hexachlorobutadiene	ND		ug/kg	6.3	--	1
Isopropylbenzene	ND		ug/kg	1.6	--	1
p-Isopropyltoluene	ND		ug/kg	1.6	--	1
Naphthalene	ND		ug/kg	6.3	--	1
n-Propylbenzene	ND		ug/kg	1.6	--	1

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-05 Date Collected: 07/28/21 12:02

Client ID: TOPSOIL COMP 1 Date Received: 07/28/21

Sample Location: ANDOVER, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	3.2	--	1
1,2,4-Trichlorobenzene	ND		ug/kg	3.2	--	1
1,3,5-Trimethylbenzene	ND		ug/kg	3.2	--	1
1,2,4-Trimethylbenzene	ND		ug/kg	3.2	--	1
Diethyl ether	ND		ug/kg	3.2	--	1
Diisopropyl Ether	ND		ug/kg	3.2	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/kg	3.2	--	1
Tertiary-Amyl Methyl Ether	ND		ug/kg	3.2	--	1
1,4-Dioxane	ND		ug/kg	130	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	115		70-130
Toluene-d8	93		70-130
4-Bromofluorobenzene	99		70-130
Dibromofluoromethane	117		70-130

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-06 Date Collected: 07/28/21 12:15
Client ID: TOPSOIL COMP 2 Date Received: 07/28/21
Sample Location: ANDOVER, MA Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8260C
Analytical Date: 08/03/21 03:38
Analyst: JC
Percent Solids: 85%

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
Methylene chloride	ND		ug/kg	7.0	--	1
1,1-Dichloroethane	ND		ug/kg	1.4	--	1
Chloroform	ND		ug/kg	2.1	--	1
Carbon tetrachloride	ND		ug/kg	1.4	--	1
1,2-Dichloropropane	ND		ug/kg	1.4	--	1
Dibromochloromethane	ND		ug/kg	1.4	--	1
1,1,2-Trichloroethane	ND		ug/kg	1.4	--	1
Tetrachloroethene	ND		ug/kg	0.70	--	1
Chlorobenzene	ND		ug/kg	0.70	--	1
Trichlorofluoromethane	ND		ug/kg	5.6	--	1
1,2-Dichloroethane	ND		ug/kg	1.4	--	1
1,1,1-Trichloroethane	ND		ug/kg	0.70	--	1
Bromodichloromethane	ND		ug/kg	0.70	--	1
trans-1,3-Dichloropropene	ND		ug/kg	1.4	--	1
cis-1,3-Dichloropropene	ND		ug/kg	0.70	--	1
1,3-Dichloropropene, Total	ND		ug/kg	0.70	--	1
1,1-Dichloropropene	ND		ug/kg	0.70	--	1
Bromoform	ND		ug/kg	5.6	--	1
1,1,2,2-Tetrachloroethane	ND		ug/kg	0.70	--	1
Benzene	ND		ug/kg	0.70	--	1
Toluene	ND		ug/kg	1.4	--	1
Ethylbenzene	ND		ug/kg	1.4	--	1
Chloromethane	ND		ug/kg	5.6	--	1
Bromomethane	ND		ug/kg	2.8	--	1
Vinyl chloride	ND		ug/kg	1.4	--	1
Chloroethane	ND		ug/kg	2.8	--	1
1,1-Dichloroethene	ND		ug/kg	1.4	--	1
trans-1,2-Dichloroethene	ND		ug/kg	2.1	--	1

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-06 Date Collected: 07/28/21 12:15

Client ID: TOPSOIL COMP 2 Date Received: 07/28/21

Sample Location: ANDOVER, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
Trichloroethene	ND		ug/kg	0.70	--	1
1,2-Dichlorobenzene	ND		ug/kg	2.8	--	1
1,3-Dichlorobenzene	ND		ug/kg	2.8	--	1
1,4-Dichlorobenzene	ND		ug/kg	2.8	--	1
Methyl tert butyl ether	ND		ug/kg	2.8	--	1
p/m-Xylene	ND		ug/kg	2.8	--	1
o-Xylene	ND		ug/kg	1.4	--	1
Xylenes, Total	ND		ug/kg	1.4	--	1
cis-1,2-Dichloroethene	ND		ug/kg	1.4	--	1
1,2-Dichloroethene, Total	ND		ug/kg	1.4	--	1
Dibromomethane	ND		ug/kg	2.8	--	1
1,2,3-Trichloropropane	ND		ug/kg	2.8	--	1
Styrene	ND		ug/kg	1.4	--	1
Dichlorodifluoromethane	ND		ug/kg	14	--	1
Acetone	ND		ug/kg	35	--	1
Carbon disulfide	ND		ug/kg	14	--	1
Methyl ethyl ketone	ND		ug/kg	14	--	1
Methyl isobutyl ketone	ND		ug/kg	14	--	1
2-Hexanone	ND		ug/kg	14	--	1
Bromochloromethane	ND		ug/kg	2.8	--	1
Tetrahydrofuran	ND		ug/kg	5.6	--	1
2,2-Dichloropropane	ND		ug/kg	2.8	--	1
1,2-Dibromoethane	ND		ug/kg	1.4	--	1
1,3-Dichloropropane	ND		ug/kg	2.8	--	1
1,1,1,2-Tetrachloroethane	ND		ug/kg	0.70	--	1
Bromobenzene	ND		ug/kg	2.8	--	1
n-Butylbenzene	ND		ug/kg	1.4	--	1
sec-Butylbenzene	ND		ug/kg	1.4	--	1
tert-Butylbenzene	ND		ug/kg	2.8	--	1
o-Chlorotoluene	ND		ug/kg	2.8	--	1
p-Chlorotoluene	ND		ug/kg	2.8	--	1
1,2-Dibromo-3-chloropropane	ND		ug/kg	4.2	--	1
Hexachlorobutadiene	ND		ug/kg	5.6	--	1
Isopropylbenzene	ND		ug/kg	1.4	--	1
p-Isopropyltoluene	ND		ug/kg	1.4	--	1
Naphthalene	ND		ug/kg	5.6	--	1
n-Propylbenzene	ND		ug/kg	1.4	--	1

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-06 Date Collected: 07/28/21 12:15

Client ID: TOPSOIL COMP 2 Date Received: 07/28/21

Sample Location: ANDOVER, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Volatile Organics by EPA 5035 Low - Westborough Lab						
1,2,3-Trichlorobenzene	ND		ug/kg	2.8	--	1
1,2,4-Trichlorobenzene	ND		ug/kg	2.8	--	1
1,3,5-Trimethylbenzene	ND		ug/kg	2.8	--	1
1,2,4-Trimethylbenzene	ND		ug/kg	2.8	--	1
Diethyl ether	ND		ug/kg	2.8	--	1
Diisopropyl Ether	ND		ug/kg	2.8	--	1
Ethyl-Tert-Butyl-Ether	ND		ug/kg	2.8	--	1
Tertiary-Amyl Methyl Ether	ND		ug/kg	2.8	--	1
1,4-Dioxane	ND		ug/kg	110	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	119		70-130
Toluene-d8	93		70-130
4-Bromofluorobenzene	98		70-130
Dibromofluoromethane	119		70-130

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/02/21 19:45
Analyst: KJD

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 Low - Westborough Lab for sample(s): 03-06 Batch: WG1531018-5					
Methylene chloride	ND		ug/kg	5.0	--
1,1-Dichloroethane	ND		ug/kg	1.0	--
Chloroform	ND		ug/kg	1.5	--
Carbon tetrachloride	ND		ug/kg	1.0	--
1,2-Dichloropropane	ND		ug/kg	1.0	--
Dibromochloromethane	ND		ug/kg	1.0	--
1,1,2-Trichloroethane	ND		ug/kg	1.0	--
Tetrachloroethene	ND		ug/kg	0.50	--
Chlorobenzene	ND		ug/kg	0.50	--
Trichlorofluoromethane	ND		ug/kg	4.0	--
1,2-Dichloroethane	ND		ug/kg	1.0	--
1,1,1-Trichloroethane	ND		ug/kg	0.50	--
Bromodichloromethane	ND		ug/kg	0.50	--
trans-1,3-Dichloropropene	ND		ug/kg	1.0	--
cis-1,3-Dichloropropene	ND		ug/kg	0.50	--
1,3-Dichloropropene, Total	ND		ug/kg	0.50	--
1,1-Dichloropropene	ND		ug/kg	0.50	--
Bromoform	ND		ug/kg	4.0	--
1,1,2,2-Tetrachloroethane	ND		ug/kg	0.50	--
Benzene	ND		ug/kg	0.50	--
Toluene	ND		ug/kg	1.0	--
Ethylbenzene	ND		ug/kg	1.0	--
Chloromethane	ND		ug/kg	4.0	--
Bromomethane	ND		ug/kg	2.0	--
Vinyl chloride	ND		ug/kg	1.0	--
Chloroethane	ND		ug/kg	2.0	--
1,1-Dichloroethene	ND		ug/kg	1.0	--
trans-1,2-Dichloroethene	ND		ug/kg	1.5	--
Trichloroethene	ND		ug/kg	0.50	--

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/02/21 19:45
Analyst: KJD

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 Low - Westborough Lab for sample(s): 03-06 Batch: WG1531018-5					
1,2-Dichlorobenzene	ND		ug/kg	2.0	--
1,3-Dichlorobenzene	ND		ug/kg	2.0	--
1,4-Dichlorobenzene	ND		ug/kg	2.0	--
Methyl tert butyl ether	ND		ug/kg	2.0	--
p/m-Xylene	ND		ug/kg	2.0	--
o-Xylene	ND		ug/kg	1.0	--
Xylenes, Total	ND		ug/kg	1.0	--
cis-1,2-Dichloroethene	ND		ug/kg	1.0	--
1,2-Dichloroethene, Total	ND		ug/kg	1.0	--
Dibromomethane	ND		ug/kg	2.0	--
1,2,3-Trichloropropane	ND		ug/kg	2.0	--
Styrene	ND		ug/kg	1.0	--
Dichlorodifluoromethane	ND		ug/kg	10	--
Acetone	ND		ug/kg	25	--
Carbon disulfide	ND		ug/kg	10	--
Methyl ethyl ketone	ND		ug/kg	10	--
Methyl isobutyl ketone	ND		ug/kg	10	--
2-Hexanone	ND		ug/kg	10	--
Bromochloromethane	ND		ug/kg	2.0	--
Tetrahydrofuran	ND		ug/kg	4.0	--
2,2-Dichloropropane	ND		ug/kg	2.0	--
1,2-Dibromoethane	ND		ug/kg	1.0	--
1,3-Dichloropropane	ND		ug/kg	2.0	--
1,1,1,2-Tetrachloroethane	ND		ug/kg	0.50	--
Bromobenzene	ND		ug/kg	2.0	--
n-Butylbenzene	ND		ug/kg	1.0	--
sec-Butylbenzene	ND		ug/kg	1.0	--
tert-Butylbenzene	ND		ug/kg	2.0	--
o-Chlorotoluene	ND		ug/kg	2.0	--

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8260C
Analytical Date: 08/02/21 19:45
Analyst: KJD

Parameter	Result	Qualifier	Units	RL	MDL
MCP Volatile Organics by EPA 5035 Low - Westborough Lab for sample(s): 03-06 Batch: WG1531018-5					
p-Chlorotoluene	ND		ug/kg	2.0	--
1,2-Dibromo-3-chloropropane	ND		ug/kg	3.0	--
Hexachlorobutadiene	ND		ug/kg	4.0	--
Isopropylbenzene	ND		ug/kg	1.0	--
p-Isopropyltoluene	ND		ug/kg	1.0	--
Naphthalene	ND		ug/kg	4.0	--
n-Propylbenzene	ND		ug/kg	1.0	--
1,2,3-Trichlorobenzene	ND		ug/kg	2.0	--
1,2,4-Trichlorobenzene	ND		ug/kg	2.0	--
1,3,5-Trimethylbenzene	ND		ug/kg	2.0	--
1,2,4-Trimethylbenzene	ND		ug/kg	2.0	--
Diethyl ether	ND		ug/kg	2.0	--
Diisopropyl Ether	ND		ug/kg	2.0	--
Ethyl-Tert-Butyl-Ether	ND		ug/kg	2.0	--
Tertiary-Amyl Methyl Ether	ND		ug/kg	2.0	--
1,4-Dioxane	ND		ug/kg	80	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
1,2-Dichloroethane-d4	102		70-130
Toluene-d8	95		70-130
4-Bromofluorobenzene	95		70-130
Dibromofluoromethane	104		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: 58 BEACON ST.
Project Number: 0200.01

Lab Number: L2140490
Report Date: 08/09/21

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 Low - Westborough Lab Associated sample(s): 03-06 Batch: WG1531018-3 WG1531018-4								
Methylene chloride	95		91		70-130	4		20
1,1-Dichloroethane	95		91		70-130	4		20
Chloroform	90		86		70-130	5		20
Carbon tetrachloride	85		84		70-130	1		20
1,2-Dichloropropane	94		93		70-130	1		20
Dibromochloromethane	88		91		70-130	3		20
1,1,2-Trichloroethane	94		97		70-130	3		20
Tetrachloroethene	100		98		70-130	2		20
Chlorobenzene	96		96		70-130	0		20
Trichlorofluoromethane	99		93		70-130	6		20
1,2-Dichloroethane	88		88		70-130	0		20
1,1,1-Trichloroethane	94		91		70-130	3		20
Bromodichloromethane	89		90		70-130	1		20
trans-1,3-Dichloropropene	96		97		70-130	1		20
cis-1,3-Dichloropropene	98		97		70-130	1		20
1,1-Dichloropropene	102		97		70-130	5		20
Bromoform	76		79		70-130	4		20
1,1,2,2-Tetrachloroethane	94		96		70-130	2		20
Benzene	96		95		70-130	1		20
Toluene	95		94		70-130	1		20
Ethylbenzene	95		94		70-130	1		20
Chloromethane	97		91		70-130	6		20
Bromomethane	117		114		70-130	3		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: 58 BEACON ST.
Project Number: 0200.01

Lab Number: L2140490
Report Date: 08/09/21

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 Low - Westborough Lab	Associated sample(s): 03-06		Batch: WG1531018-3 WG1531018-4					
Vinyl chloride	98		93		70-130	5		20
Chloroethane	97		92		70-130	5		20
1,1-Dichloroethene	98		95		70-130	3		20
trans-1,2-Dichloroethene	98		94		70-130	4		20
Trichloroethene	97		96		70-130	1		20
1,2-Dichlorobenzene	98		97		70-130	1		20
1,3-Dichlorobenzene	101		99		70-130	2		20
1,4-Dichlorobenzene	99		96		70-130	3		20
Methyl tert butyl ether	91		91		70-130	0		20
p/m-Xylene	102		101		70-130	1		20
o-Xylene	91		91		70-130	0		20
cis-1,2-Dichloroethene	94		92		70-130	2		20
Dibromomethane	90		91		70-130	1		20
1,2,3-Trichloropropane	90		91		70-130	1		20
Styrene	97		96		70-130	1		20
Dichlorodifluoromethane	80		75		70-130	6		20
Acetone	83		90		70-130	8		20
Carbon disulfide	90		86		70-130	5		20
Methyl ethyl ketone	**69**	Q	74		70-130	7		20
Methyl isobutyl ketone	92		98		70-130	6		20
2-Hexanone	80		86		70-130	7		20
Bromochloromethane	94		92		70-130	2		20
Tetrahydrofuran	83		89		70-130	7		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: 58 BEACON ST.
Project Number: 0200.01

Lab Number: L2140490
Report Date: 08/09/21

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 Low - Westborough Lab Associated sample(s): 03-06 Batch: WG1531018-3 WG1531018-4								
2,2-Dichloropropane	95		92		70-130	3		20
1,2-Dibromoethane	88		92		70-130	4		20
1,3-Dichloropropane	96		99		70-130	3		20
1,1,1,2-Tetrachloroethane	90		91		70-130	1		20
Bromobenzene	96		97		70-130	1		20
n-Butylbenzene	105		102		70-130	3		20
sec-Butylbenzene	103		100		70-130	3		20
tert-Butylbenzene	100		97		70-130	3		20
o-Chlorotoluene	100		98		70-130	2		20
p-Chlorotoluene	100		97		70-130	3		20
1,2-Dibromo-3-chloropropane	84		88		70-130	5		20
Hexachlorobutadiene	101		97		70-130	4		20
Isopropylbenzene	101		98		70-130	3		20
p-Isopropyltoluene	101		99		70-130	2		20
Naphthalene	97		97		70-130	0		20
n-Propylbenzene	103		100		70-130	3		20
1,2,3-Trichlorobenzene	102		99		70-130	3		20
1,2,4-Trichlorobenzene	104		100		70-130	4		20
1,3,5-Trimethylbenzene	98		96		70-130	2		20
1,2,4-Trimethylbenzene	99		96		70-130	3		20
Diethyl ether	91		90		70-130	1		20
Diisopropyl Ether	94		94		70-130	0		20
Ethyl-Tert-Butyl-Ether	92		93		70-130	1		20

Lab Control Sample Analysis
Batch Quality Control

Project Name: 58 BEACON ST.
Project Number: 0200.01

Lab Number: L2140490
Report Date: 08/09/21

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Volatile Organics by EPA 5035 Low - Westborough Lab Associated sample(s): 03-06 Batch: WG1531018-3 WG1531018-4								
Tertiary-Amyl Methyl Ether	88		89		70-130	1		20
1,4-Dioxane	101		105		70-130	4		20

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
1,2-Dichloroethane-d4	92		92		70-130
Toluene-d8	97		98		70-130
4-Bromofluorobenzene	98		98		70-130
Dibromofluoromethane	95		94		70-130

SEMIVOLATILES

Project Name: 58 BEACON ST.
Project Number: 0200.01
Lab Number: L2140490
Report Date: 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-03
Client ID: CUT COMP 1
Sample Location: ANDOVER, MA

Date Collected: 07/28/21 12:00
Date Received: 07/28/21
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8270D
Analytical Date: 08/02/21 13:06
Analyst: IM
Percent Solids: 89%

Extraction Method: EPA 3546
Extraction Date: 07/31/21 10:49

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Semivolatile Organics - Westborough Lab						
Acenaphthene	ND		ug/kg	150	--	1
1,2,4-Trichlorobenzene	ND		ug/kg	190	--	1
Hexachlorobenzene	ND		ug/kg	78	--	1
Bis(2-chloroethyl)ether	ND		ug/kg	78	--	1
2-Chloronaphthalene	ND		ug/kg	190	--	1
1,2-Dichlorobenzene	ND		ug/kg	190	--	1
1,3-Dichlorobenzene	ND		ug/kg	190	--	1
1,4-Dichlorobenzene	ND		ug/kg	78	--	1
3,3'-Dichlorobenzidine	ND		ug/kg	190	--	1
2,4-Dinitrotoluene	ND		ug/kg	78	--	1
2,6-Dinitrotoluene	ND		ug/kg	190	--	1
Azobenzene	ND		ug/kg	190	--	1
Fluoranthene	ND		ug/kg	110	--	1
4-Bromophenyl phenyl ether	ND		ug/kg	190	--	1
Bis(2-chloroisopropyl)ether	ND		ug/kg	78	--	1
Bis(2-chloroethoxy)methane	ND		ug/kg	200	--	1
Hexachlorobutadiene	ND		ug/kg	190	--	1
Hexachloroethane	ND		ug/kg	78	--	1
Isophorone	ND		ug/kg	170	--	1
Naphthalene	ND		ug/kg	190	--	1
Nitrobenzene	ND		ug/kg	170	--	1
Bis(2-ethylhexyl)phthalate	ND		ug/kg	190	--	1
Butyl benzyl phthalate	ND		ug/kg	190	--	1
Di-n-butylphthalate	ND		ug/kg	190	--	1
Di-n-octylphthalate	ND		ug/kg	190	--	1
Diethyl phthalate	ND		ug/kg	190	--	1
Dimethyl phthalate	ND		ug/kg	78	--	1
Benzo(a)anthracene	ND		ug/kg	110	--	1

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-03 Date Collected: 07/28/21 12:00

Client ID: CUT COMP 1 Date Received: 07/28/21

Sample Location: ANDOVER, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Semivolatile Organics - Westborough Lab						
Benzo(a)pyrene	ND		ug/kg	150	--	1
Benzo(b)fluoranthene	ND		ug/kg	110	--	1
Benzo(k)fluoranthene	ND		ug/kg	110	--	1
Chrysene	ND		ug/kg	110	--	1
Acenaphthylene	ND		ug/kg	150	--	1
Anthracene	ND		ug/kg	110	--	1
Benzo(ghi)perylene	ND		ug/kg	150	--	1
Fluorene	ND		ug/kg	190	--	1
Phenanthrene	ND		ug/kg	110	--	1
Dibenzo(a,h)anthracene	ND		ug/kg	78	--	1
Indeno(1,2,3-cd)pyrene	ND		ug/kg	150	--	1
Pyrene	ND		ug/kg	110	--	1
Aniline	ND		ug/kg	220	--	1
4-Chloroaniline	ND		ug/kg	190	--	1
Dibenzofuran	ND		ug/kg	190	--	1
2-Methylnaphthalene	ND		ug/kg	78	--	1
Acetophenone	ND		ug/kg	190	--	1
2,4,6-Trichlorophenol	ND		ug/kg	78	--	1
2-Chlorophenol	ND		ug/kg	78	--	1
2,4-Dichlorophenol	ND		ug/kg	78	--	1
2,4-Dimethylphenol	ND		ug/kg	78	--	1
2-Nitrophenol	ND		ug/kg	400	--	1
4-Nitrophenol	ND		ug/kg	260	--	1
2,4-Dinitrophenol	ND		ug/kg	900	--	1
Pentachlorophenol	ND		ug/kg	370	--	1
Phenol	ND		ug/kg	190	--	1
2-Methylphenol	ND		ug/kg	190	--	1
3-Methylphenol/4-Methylphenol	ND		ug/kg	270	--	1
2,4,5-Trichlorophenol	ND		ug/kg	190	--	1

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-03 Date Collected: 07/28/21 12:00

Client ID: CUT COMP 1 Date Received: 07/28/21

Sample Location: ANDOVER, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Semivolatile Organics - Westborough Lab						

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2-Fluorophenol	59		30-130
Phenol-d6	65		30-130
Nitrobenzene-d5	68		30-130
2-Fluorobiphenyl	47		30-130
2,4,6-Tribromophenol	44		30-130
4-Terphenyl-d14	38		30-130

Project Name: 58 BEACON ST.
Project Number: 0200.01
Lab Number: L2140490
Report Date: 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-04
Client ID: CUT COMP 2
Sample Location: ANDOVER, MA

Date Collected: 07/28/21 11:30
Date Received: 07/28/21
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8270D
Analytical Date: 08/02/21 13:30
Analyst: IM
Percent Solids: 90%

Extraction Method: EPA 3546
Extraction Date: 07/31/21 10:51

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Semivolatile Organics - Westborough Lab						
Acenaphthene	ND		ug/kg	150	--	1
1,2,4-Trichlorobenzene	ND		ug/kg	180	--	1
Hexachlorobenzene	ND		ug/kg	77	--	1
Bis(2-chloroethyl)ether	ND		ug/kg	77	--	1
2-Chloronaphthalene	ND		ug/kg	180	--	1
1,2-Dichlorobenzene	ND		ug/kg	180	--	1
1,3-Dichlorobenzene	ND		ug/kg	180	--	1
1,4-Dichlorobenzene	ND		ug/kg	77	--	1
3,3'-Dichlorobenzidine	ND		ug/kg	180	--	1
2,4-Dinitrotoluene	ND		ug/kg	77	--	1
2,6-Dinitrotoluene	ND		ug/kg	180	--	1
Azobenzene	ND		ug/kg	180	--	1
Fluoranthene	ND		ug/kg	110	--	1
4-Bromophenyl phenyl ether	ND		ug/kg	180	--	1
Bis(2-chloroisopropyl)ether	ND		ug/kg	77	--	1
Bis(2-chloroethoxy)methane	ND		ug/kg	200	--	1
Hexachlorobutadiene	ND		ug/kg	180	--	1
Hexachloroethane	ND		ug/kg	77	--	1
Isophorone	ND		ug/kg	160	--	1
Naphthalene	ND		ug/kg	180	--	1
Nitrobenzene	ND		ug/kg	160	--	1
Bis(2-ethylhexyl)phthalate	ND		ug/kg	180	--	1
Butyl benzyl phthalate	ND		ug/kg	180	--	1
Di-n-butylphthalate	ND		ug/kg	180	--	1
Di-n-octylphthalate	ND		ug/kg	180	--	1
Diethyl phthalate	ND		ug/kg	180	--	1
Dimethyl phthalate	ND		ug/kg	77	--	1
Benzo(a)anthracene	ND		ug/kg	110	--	1

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-04 Date Collected: 07/28/21 11:30

Client ID: CUT COMP 2 Date Received: 07/28/21

Sample Location: ANDOVER, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Semivolatile Organics - Westborough Lab						
Benzo(a)pyrene	ND		ug/kg	150	--	1
Benzo(b)fluoranthene	ND		ug/kg	110	--	1
Benzo(k)fluoranthene	ND		ug/kg	110	--	1
Chrysene	ND		ug/kg	110	--	1
Acenaphthylene	ND		ug/kg	150	--	1
Anthracene	ND		ug/kg	110	--	1
Benzo(ghi)perylene	ND		ug/kg	150	--	1
Fluorene	ND		ug/kg	180	--	1
Phenanthrene	ND		ug/kg	110	--	1
Dibenzo(a,h)anthracene	ND		ug/kg	77	--	1
Indeno(1,2,3-cd)pyrene	ND		ug/kg	150	--	1
Pyrene	ND		ug/kg	110	--	1
Aniline	ND		ug/kg	220	--	1
4-Chloroaniline	ND		ug/kg	180	--	1
Dibenzofuran	ND		ug/kg	180	--	1
2-Methylnaphthalene	ND		ug/kg	77	--	1
Acetophenone	ND		ug/kg	180	--	1
2,4,6-Trichlorophenol	ND		ug/kg	77	--	1
2-Chlorophenol	ND		ug/kg	77	--	1
2,4-Dichlorophenol	ND		ug/kg	77	--	1
2,4-Dimethylphenol	ND		ug/kg	77	--	1
2-Nitrophenol	ND		ug/kg	400	--	1
4-Nitrophenol	ND		ug/kg	260	--	1
2,4-Dinitrophenol	ND		ug/kg	880	--	1
Pentachlorophenol	ND		ug/kg	370	--	1
Phenol	ND		ug/kg	180	--	1
2-Methylphenol	ND		ug/kg	180	--	1
3-Methylphenol/4-Methylphenol	ND		ug/kg	260	--	1
2,4,5-Trichlorophenol	ND		ug/kg	180	--	1

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-04 Date Collected: 07/28/21 11:30

Client ID: CUT COMP 2 Date Received: 07/28/21

Sample Location: ANDOVER, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Semivolatile Organics - Westborough Lab						

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2-Fluorophenol	75		30-130
Phenol-d6	83		30-130
Nitrobenzene-d5	86		30-130
2-Fluorobiphenyl	61		30-130
2,4,6-Tribromophenol	56		30-130
4-Terphenyl-d14	51		30-130

Project Name: 58 BEACON ST.
Project Number: 0200.01
Lab Number: L2140490
Report Date: 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-05
Client ID: TOPSOIL COMP 1
Sample Location: ANDOVER, MA

Date Collected: 07/28/21 12:02
Date Received: 07/28/21
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8270D
Analytical Date: 08/02/21 13:53
Analyst: IM
Percent Solids: 79%

Extraction Method: EPA 3546
Extraction Date: 07/31/21 10:51

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Semivolatile Organics - Westborough Lab						
Acenaphthene	ND		ug/kg	160	--	1
1,2,4-Trichlorobenzene	ND		ug/kg	210	--	1
Hexachlorobenzene	ND		ug/kg	86	--	1
Bis(2-chloroethyl)ether	ND		ug/kg	86	--	1
2-Chloronaphthalene	ND		ug/kg	210	--	1
1,2-Dichlorobenzene	ND		ug/kg	210	--	1
1,3-Dichlorobenzene	ND		ug/kg	210	--	1
1,4-Dichlorobenzene	ND		ug/kg	86	--	1
3,3'-Dichlorobenzidine	ND		ug/kg	210	--	1
2,4-Dinitrotoluene	ND		ug/kg	86	--	1
2,6-Dinitrotoluene	ND		ug/kg	210	--	1
Azobenzene	ND		ug/kg	210	--	1
Fluoranthene	ND		ug/kg	120	--	1
4-Bromophenyl phenyl ether	ND		ug/kg	210	--	1
Bis(2-chloroisopropyl)ether	ND		ug/kg	86	--	1
Bis(2-chloroethoxy)methane	ND		ug/kg	220	--	1
Hexachlorobutadiene	ND		ug/kg	210	--	1
Hexachloroethane	ND		ug/kg	86	--	1
Isophorone	ND		ug/kg	180	--	1
Naphthalene	ND		ug/kg	210	--	1
Nitrobenzene	ND		ug/kg	180	--	1
Bis(2-ethylhexyl)phthalate	ND		ug/kg	210	--	1
Butyl benzyl phthalate	ND		ug/kg	210	--	1
Di-n-butylphthalate	ND		ug/kg	210	--	1
Di-n-octylphthalate	ND		ug/kg	210	--	1
Diethyl phthalate	ND		ug/kg	210	--	1
Dimethyl phthalate	ND		ug/kg	86	--	1
Benzo(a)anthracene	ND		ug/kg	120	--	1

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-05 Date Collected: 07/28/21 12:02

Client ID: TOPSOIL COMP 1 Date Received: 07/28/21

Sample Location: ANDOVER, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Semivolatile Organics - Westborough Lab						
Benzo(a)pyrene	ND		ug/kg	160	--	1
Benzo(b)fluoranthene	ND		ug/kg	120	--	1
Benzo(k)fluoranthene	ND		ug/kg	120	--	1
Chrysene	ND		ug/kg	120	--	1
Acenaphthylene	ND		ug/kg	160	--	1
Anthracene	ND		ug/kg	120	--	1
Benzo(ghi)perylene	ND		ug/kg	160	--	1
Fluorene	ND		ug/kg	210	--	1
Phenanthrene	ND		ug/kg	120	--	1
Dibenzo(a,h)anthracene	ND		ug/kg	86	--	1
Indeno(1,2,3-cd)pyrene	ND		ug/kg	160	--	1
Pyrene	ND		ug/kg	120	--	1
Aniline	ND		ug/kg	250	--	1
4-Chloroaniline	ND		ug/kg	210	--	1
Dibenzofuran	ND		ug/kg	210	--	1
2-Methylnaphthalene	ND		ug/kg	86	--	1
Acetophenone	ND		ug/kg	210	--	1
2,4,6-Trichlorophenol	ND		ug/kg	86	--	1
2-Chlorophenol	ND		ug/kg	86	--	1
2,4-Dichlorophenol	ND		ug/kg	86	--	1
2,4-Dimethylphenol	ND		ug/kg	86	--	1
2-Nitrophenol	ND		ug/kg	440	--	1
4-Nitrophenol	ND		ug/kg	290	--	1
2,4-Dinitrophenol	ND		ug/kg	990	--	1
Pentachlorophenol	ND		ug/kg	410	--	1
Phenol	ND		ug/kg	210	--	1
2-Methylphenol	ND		ug/kg	210	--	1
3-Methylphenol/4-Methylphenol	ND		ug/kg	300	--	1
2,4,5-Trichlorophenol	ND		ug/kg	210	--	1

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-05 Date Collected: 07/28/21 12:02

Client ID: TOPSOIL COMP 1 Date Received: 07/28/21

Sample Location: ANDOVER, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Semivolatile Organics - Westborough Lab						

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2-Fluorophenol	75		30-130
Phenol-d6	83		30-130
Nitrobenzene-d5	90		30-130
2-Fluorobiphenyl	65		30-130
2,4,6-Tribromophenol	56		30-130
4-Terphenyl-d14	62		30-130

Project Name: 58 BEACON ST.
Project Number: 0200.01
Lab Number: L2140490
Report Date: 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-06
Client ID: TOPSOIL COMP 2
Sample Location: ANDOVER, MA

Date Collected: 07/28/21 12:15
Date Received: 07/28/21
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8270D
Analytical Date: 08/02/21 14:17
Analyst: IM
Percent Solids: 85%

Extraction Method: EPA 3546
Extraction Date: 07/31/21 10:51

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Semivolatile Organics - Westborough Lab						
Acenaphthene	ND		ug/kg	150	--	1
1,2,4-Trichlorobenzene	ND		ug/kg	190	--	1
Hexachlorobenzene	ND		ug/kg	80	--	1
Bis(2-chloroethyl)ether	ND		ug/kg	80	--	1
2-Chloronaphthalene	ND		ug/kg	190	--	1
1,2-Dichlorobenzene	ND		ug/kg	190	--	1
1,3-Dichlorobenzene	ND		ug/kg	190	--	1
1,4-Dichlorobenzene	ND		ug/kg	80	--	1
3,3'-Dichlorobenzidine	ND		ug/kg	190	--	1
2,4-Dinitrotoluene	ND		ug/kg	80	--	1
2,6-Dinitrotoluene	ND		ug/kg	190	--	1
Azobenzene	ND		ug/kg	190	--	1
Fluoranthene	360		ug/kg	110	--	1
4-Bromophenyl phenyl ether	ND		ug/kg	190	--	1
Bis(2-chloroisopropyl)ether	ND		ug/kg	80	--	1
Bis(2-chloroethoxy)methane	ND		ug/kg	210	--	1
Hexachlorobutadiene	ND		ug/kg	190	--	1
Hexachloroethane	ND		ug/kg	80	--	1
Isophorone	ND		ug/kg	170	--	1
Naphthalene	ND		ug/kg	190	--	1
Nitrobenzene	ND		ug/kg	170	--	1
Bis(2-ethylhexyl)phthalate	440		ug/kg	190	--	1
Butyl benzyl phthalate	ND		ug/kg	190	--	1
Di-n-butylphthalate	ND		ug/kg	190	--	1
Di-n-octylphthalate	ND		ug/kg	190	--	1
Diethyl phthalate	ND		ug/kg	190	--	1
Dimethyl phthalate	ND		ug/kg	80	--	1
Benzo(a)anthracene	140		ug/kg	110	--	1

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-06 Date Collected: 07/28/21 12:15

Client ID: TOPSOIL COMP 2 Date Received: 07/28/21

Sample Location: ANDOVER, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Semivolatile Organics - Westborough Lab						
Benzo(a)pyrene	150		ug/kg	150	--	1
Benzo(b)fluoranthene	220		ug/kg	110	--	1
Benzo(k)fluoranthene	ND		ug/kg	110	--	1
Chrysene	180		ug/kg	110	--	1
Acenaphthylene	ND		ug/kg	150	--	1
Anthracene	ND		ug/kg	110	--	1
Benzo(ghi)perylene	ND		ug/kg	150	--	1
Fluorene	ND		ug/kg	190	--	1
Phenanthrene	260		ug/kg	110	--	1
Dibenzo(a,h)anthracene	ND		ug/kg	80	--	1
Indeno(1,2,3-cd)pyrene	ND		ug/kg	150	--	1
Pyrene	310		ug/kg	110	--	1
Aniline	ND		ug/kg	230	--	1
4-Chloroaniline	ND		ug/kg	190	--	1
Dibenzofuran	ND		ug/kg	190	--	1
2-Methylnaphthalene	ND		ug/kg	80	--	1
Acetophenone	ND		ug/kg	190	--	1
2,4,6-Trichlorophenol	ND		ug/kg	80	--	1
2-Chlorophenol	ND		ug/kg	80	--	1
2,4-Dichlorophenol	ND		ug/kg	80	--	1
2,4-Dimethylphenol	ND		ug/kg	80	--	1
2-Nitrophenol	ND		ug/kg	410	--	1
4-Nitrophenol	ND		ug/kg	270	--	1
2,4-Dinitrophenol	ND		ug/kg	920	--	1
Pentachlorophenol	ND		ug/kg	380	--	1
Phenol	ND		ug/kg	190	--	1
2-Methylphenol	ND		ug/kg	190	--	1
3-Methylphenol/4-Methylphenol	ND		ug/kg	280	--	1
2,4,5-Trichlorophenol	ND		ug/kg	190	--	1

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-06 Date Collected: 07/28/21 12:15

Client ID: TOPSOIL COMP 2 Date Received: 07/28/21

Sample Location: ANDOVER, MA Field Prep: Not Specified

Sample Depth:

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
MCP Semivolatile Organics - Westborough Lab						

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2-Fluorophenol	65		30-130
Phenol-d6	73		30-130
Nitrobenzene-d5	78		30-130
2-Fluorobiphenyl	55		30-130
2,4,6-Tribromophenol	52		30-130
4-Terphenyl-d14	44		30-130

Project Name: 58 BEACON ST.
Project Number: 0200.01
Lab Number: L2140490
Report Date: 08/09/21

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8270D
Analytical Date: 08/01/21 20:05
Analyst: IM

Extraction Method: EPA 3546
Extraction Date: 07/31/21 01:08

Parameter	Result	Qualifier	Units	RL	MDL
MCP Semivolatile Organics - Westborough Lab for sample(s): 03-06 Batch: WG1530067-1					
Acenaphthene	ND		ug/kg	130	--
1,2,4-Trichlorobenzene	ND		ug/kg	160	--
Hexachlorobenzene	ND		ug/kg	69	--
Bis(2-chloroethyl)ether	ND		ug/kg	69	--
2-Chloronaphthalene	ND		ug/kg	160	--
1,2-Dichlorobenzene	ND		ug/kg	160	--
1,3-Dichlorobenzene	ND		ug/kg	160	--
1,4-Dichlorobenzene	ND		ug/kg	69	--
3,3'-Dichlorobenzidine	ND		ug/kg	160	--
2,4-Dinitrotoluene	ND		ug/kg	69	--
2,6-Dinitrotoluene	ND		ug/kg	160	--
Azobenzene	ND		ug/kg	160	--
Fluoranthene	ND		ug/kg	98	--
4-Bromophenyl phenyl ether	ND		ug/kg	160	--
Bis(2-chloroisopropyl)ether	ND		ug/kg	69	--
Bis(2-chloroethoxy)methane	ND		ug/kg	180	--
Hexachlorobutadiene	ND		ug/kg	160	--
Hexachloroethane	ND		ug/kg	69	--
Isophorone	ND		ug/kg	150	--
Naphthalene	ND		ug/kg	160	--
Nitrobenzene	ND		ug/kg	150	--
Bis(2-ethylhexyl)phthalate	ND		ug/kg	160	--
Butyl benzyl phthalate	ND		ug/kg	160	--
Di-n-butylphthalate	ND		ug/kg	160	--
Di-n-octylphthalate	ND		ug/kg	160	--
Diethyl phthalate	ND		ug/kg	160	--
Dimethyl phthalate	ND		ug/kg	69	--
Benzo(a)anthracene	ND		ug/kg	98	--
Benzo(a)pyrene	ND		ug/kg	130	--

Project Name: 58 BEACON ST.
Project Number: 0200.01

Lab Number: L2140490
Report Date: 08/09/21

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8270D
Analytical Date: 08/01/21 20:05
Analyst: IM

Extraction Method: EPA 3546
Extraction Date: 07/31/21 01:08

Parameter	Result	Qualifier	Units	RL	MDL
MCP Semivolatile Organics - Westborough Lab for sample(s): 03-06 Batch: WG1530067-1					
Benzo(b)fluoranthene	ND		ug/kg	98	--
Benzo(k)fluoranthene	ND		ug/kg	98	--
Chrysene	ND		ug/kg	98	--
Acenaphthylene	ND		ug/kg	130	--
Anthracene	ND		ug/kg	98	--
Benzo(ghi)perylene	ND		ug/kg	130	--
Fluorene	ND		ug/kg	160	--
Phenanthrene	ND		ug/kg	98	--
Dibenzo(a,h)anthracene	ND		ug/kg	69	--
Indeno(1,2,3-cd)pyrene	ND		ug/kg	130	--
Pyrene	ND		ug/kg	98	--
Aniline	ND		ug/kg	200	--
4-Chloroaniline	ND		ug/kg	160	--
Dibenzofuran	ND		ug/kg	160	--
2-Methylnaphthalene	ND		ug/kg	69	--
Acetophenone	ND		ug/kg	160	--
2,4,6-Trichlorophenol	ND		ug/kg	69	--
2-Chlorophenol	ND		ug/kg	69	--
2,4-Dichlorophenol	ND		ug/kg	69	--
2,4-Dimethylphenol	ND		ug/kg	69	--
2-Nitrophenol	ND		ug/kg	350	--
4-Nitrophenol	ND		ug/kg	230	--
2,4-Dinitrophenol	ND		ug/kg	790	--
Pentachlorophenol	ND		ug/kg	330	--
Phenol	ND		ug/kg	160	--
2-Methylphenol	ND		ug/kg	160	--
3-Methylphenol/4-Methylphenol	ND		ug/kg	240	--
2,4,5-Trichlorophenol	ND		ug/kg	160	--

Project Name: 58 BEACON ST.
Project Number: 0200.01

Lab Number: L2140490
Report Date: 08/09/21

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8270D
Analytical Date: 08/01/21 20:05
Analyst: IM

Extraction Method: EPA 3546
Extraction Date: 07/31/21 01:08

Parameter	Result	Qualifier	Units	RL	MDL
MCP Semivolatile Organics - Westborough Lab for sample(s): 03-06 Batch: WG1530067-1					

Surrogate	%Recovery	Qualifier	Acceptance Criteria
2-Fluorophenol	82		30-130
Phenol-d6	86		30-130
Nitrobenzene-d5	83		30-130
2-Fluorobiphenyl	76		30-130
2,4,6-Tribromophenol	76		30-130
4-Terphenyl-d14	83		30-130

Lab Control Sample Analysis

Batch Quality Control

Project Name: 58 BEACON ST.

Project Number: 0200.01

Lab Number: L2140490

Report Date: 08/09/21

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Semivolatile Organics - Westborough Lab Associated sample(s): 03-06 Batch: WG1530067-2 WG1530067-3								
Acenaphthene	72		87		40-140	19		30
1,2,4-Trichlorobenzene	62		75		40-140	19		30
Hexachlorobenzene	62		74		40-140	18		30
Bis(2-chloroethyl)ether	64		78		40-140	20		30
2-Chloronaphthalene	67		80		40-140	18		30
1,2-Dichlorobenzene	64		78		40-140	20		30
1,3-Dichlorobenzene	63		77		40-140	20		30
1,4-Dichlorobenzene	64		76		40-140	17		30
3,3'-Dichlorobenzidine	52		64		40-140	21		30
2,4-Dinitrotoluene	73		89		40-140	20		30
2,6-Dinitrotoluene	72		85		40-140	17		30
Azobenzene	78		91		40-140	15		30
Fluoranthene	74		88		40-140	17		30
4-Bromophenyl phenyl ether	64		76		40-140	17		30
Bis(2-chloroisopropyl)ether	67		80		40-140	18		30
Bis(2-chloroethoxy)methane	68		81		40-140	17		30
Hexachlorobutadiene	52		63		40-140	19		30
Hexachloroethane	63		79		40-140	23		30
Isophorone	70		84		40-140	18		30
Naphthalene	67		82		40-140	20		30
Nitrobenzene	71		86		40-140	19		30
Bis(2-ethylhexyl)phthalate	79		92		40-140	15		30
Butyl benzyl phthalate	77		92		40-140	18		30

Lab Control Sample Analysis
Batch Quality Control

Project Name: 58 BEACON ST.
Project Number: 0200.01

Lab Number: L2140490
Report Date: 08/09/21

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Semivolatile Organics - Westborough Lab Associated sample(s): 03-06 Batch: WG1530067-2 WG1530067-3								
Di-n-butylphthalate	76		91		40-140	18		30
Di-n-octylphthalate	77		93		40-140	19		30
Diethyl phthalate	74		86		40-140	15		30
Dimethyl phthalate	69		80		40-140	15		30
Benzo(a)anthracene	74		89		40-140	18		30
Benzo(a)pyrene	75		92		40-140	20		30
Benzo(b)fluoranthene	74		91		40-140	21		30
Benzo(k)fluoranthene	71		88		40-140	21		30
Chrysene	70		86		40-140	21		30
Acenaphthylene	70		83		40-140	17		30
Anthracene	74		89		40-140	18		30
Benzo(ghi)perylene	73		89		40-140	20		30
Fluorene	73		87		40-140	18		30
Phenanthrene	74		89		40-140	18		30
Dibenzo(a,h)anthracene	75		92		40-140	20		30
Indeno(1,2,3-cd)pyrene	71		85		40-140	18		30
Pyrene	74		88		40-140	17		30
Aniline	51		60		40-140	16		30
4-Chloroaniline	73		86		40-140	16		30
Dibenzofuran	71		86		40-140	19		30
2-Methylnaphthalene	66		78		40-140	17		30
Acetophenone	70		84		40-140	18		30
2,4,6-Trichlorophenol	68		81		30-130	17		30

Lab Control Sample Analysis
Batch Quality Control

Project Name: 58 BEACON ST.
Project Number: 0200.01

Lab Number: L2140490
Report Date: 08/09/21

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
MCP Semivolatile Organics - Westborough Lab Associated sample(s): 03-06 Batch: WG1530067-2 WG1530067-3								
2-Chlorophenol	71		87		30-130	20		30
2,4-Dichlorophenol	74		88		30-130	17		30
2,4-Dimethylphenol	75		89		30-130	17		30
2-Nitrophenol	69		82		30-130	17		30
4-Nitrophenol	77		93		30-130	19		30
2,4-Dinitrophenol	63		79		30-130	23		30
Pentachlorophenol	64		76		30-130	17		30
Phenol	74		90		30-130	20		30
2-Methylphenol	75		90		30-130	18		30
3-Methylphenol/4-Methylphenol	82		98		30-130	18		30
2,4,5-Trichlorophenol	69		82		30-130	17		30

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
2-Fluorophenol	67		82		30-130
Phenol-d6	73		86		30-130
Nitrobenzene-d5	69		80		30-130
2-Fluorobiphenyl	64		74		30-130
2,4,6-Tribromophenol	62		73		30-130
4-Terphenyl-d14	67		77		30-130

PETROLEUM HYDROCARBONS

Project Name: 58 BEACON ST.
Project Number: 0200.01
Lab Number: L2140490
Report Date: 08/09/21

SAMPLE RESULTS

Lab ID:	L2140490-01	Date Collected:	07/27/21 08:30
Client ID:	GP-1/COMP	Date Received:	07/28/21
Sample Location:	ANDOVER, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	07/31/21 10:31
Analytical Date:	08/02/21 17:40	Cleanup Method1:	EPH-19-2.1
Analyst:	SC	Cleanup Date1:	08/02/21
Percent Solids:	91%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	ND		mg/kg	6.95	--	1
C19-C36 Aliphatics	ND		mg/kg	6.95	--	1
C11-C22 Aromatics	ND		mg/kg	6.95	--	1
C11-C22 Aromatics, Adjusted	ND		mg/kg	6.95	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	68		40-140
o-Terphenyl	69		40-140
2-Fluorobiphenyl	79		40-140
2-Bromonaphthalene	80		40-140

Project Name: 58 BEACON ST.
Project Number: 0200.01
Lab Number: L2140490
Report Date: 08/09/21

SAMPLE RESULTS

Lab ID:	L2140490-02	Date Collected:	07/27/21 13:10
Client ID:	GP-8/S-3	Date Received:	07/28/21
Sample Location:	ANDOVER, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	07/31/21 10:31
Analytical Date:	08/02/21 18:05	Cleanup Method1:	EPH-19-2.1
Analyst:	SC	Cleanup Date1:	08/02/21
Percent Solids:	90%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	ND		mg/kg	7.18	--	1
C19-C36 Aliphatics	ND		mg/kg	7.18	--	1
C11-C22 Aromatics	ND		mg/kg	7.18	--	1
C11-C22 Aromatics, Adjusted	ND		mg/kg	7.18	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	71		40-140
o-Terphenyl	70		40-140
2-Fluorobiphenyl	82		40-140
2-Bromonaphthalene	81		40-140

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID:	L2140490-03	Date Collected:	07/28/21 12:00
Client ID:	CUT COMP 1	Date Received:	07/28/21
Sample Location:	ANDOVER, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil		
Analytical Method:	131,VPH-18-2.1		
Analytical Date:	07/30/21 14:13		
Analyst:	MKS		
Percent Solids:	89%		

Trap:	EST, Carbopack B/Carboxen 1000&1001	Analytical Column:	Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Were samples received in methanol?	Yes (Covering the Soil)
Methanol ratio:	2.3:1

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	ND		mg/kg	13.4	--	1
C9-C12 Aliphatics	ND		mg/kg	13.4	--	1
C9-C10 Aromatics	ND		mg/kg	13.4	--	1
C5-C8 Aliphatics, Adjusted	ND		mg/kg	13.4	--	1
C9-C12 Aliphatics, Adjusted	ND		mg/kg	13.4	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	120		70-130
2,5-Dibromotoluene-FID	125		70-130

Project Name: 58 BEACON ST.
Project Number: 0200.01
Lab Number: L2140490
Report Date: 08/09/21

SAMPLE RESULTS

Lab ID:	L2140490-03	Date Collected:	07/28/21 12:00
Client ID:	CUT COMP 1	Date Received:	07/28/21
Sample Location:	ANDOVER, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	07/31/21 10:31
Analytical Date:	08/02/21 18:30	Cleanup Method1:	EPH-19-2.1
Analyst:	SC	Cleanup Date1:	08/02/21
Percent Solids:	89%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	ND		mg/kg	7.25	--	1
C19-C36 Aliphatics	ND		mg/kg	7.25	--	1
C11-C22 Aromatics	ND		mg/kg	7.25	--	1
C11-C22 Aromatics, Adjusted	ND		mg/kg	7.25	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	73		40-140
o-Terphenyl	76		40-140
2-Fluorobiphenyl	84		40-140
2-Bromonaphthalene	85		40-140

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID:	L2140490-04	Date Collected:	07/28/21 11:30
Client ID:	CUT COMP 2	Date Received:	07/28/21
Sample Location:	ANDOVER, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil		
Analytical Method:	131,VPH-18-2.1		
Analytical Date:	07/30/21 14:43		
Analyst:	MKS		
Percent Solids:	90%		

Trap:	EST, Carbopack B/Carboxen 1000&1001	Analytical Column:	Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Were samples received in methanol?	Yes (Covering the Soil)
Methanol ratio:	2.1:1

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	ND		mg/kg	12.4	--	1
C9-C12 Aliphatics	ND		mg/kg	12.4	--	1
C9-C10 Aromatics	ND		mg/kg	12.4	--	1
C5-C8 Aliphatics, Adjusted	ND		mg/kg	12.4	--	1
C9-C12 Aliphatics, Adjusted	ND		mg/kg	12.4	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	122		70-130
2,5-Dibromotoluene-FID	127		70-130

Project Name: 58 BEACON ST.
Project Number: 0200.01
Lab Number: L2140490
Report Date: 08/09/21

SAMPLE RESULTS

Lab ID:	L2140490-04	Date Collected:	07/28/21 11:30
Client ID:	CUT COMP 2	Date Received:	07/28/21
Sample Location:	ANDOVER, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	07/31/21 10:31
Analytical Date:	08/02/21 18:55	Cleanup Method1:	EPH-19-2.1
Analyst:	SC	Cleanup Date1:	08/02/21
Percent Solids:	90%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	ND		mg/kg	7.19	--	1
C19-C36 Aliphatics	ND		mg/kg	7.19	--	1
C11-C22 Aromatics	ND		mg/kg	7.19	--	1
C11-C22 Aromatics, Adjusted	ND		mg/kg	7.19	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	70		40-140
o-Terphenyl	69		40-140
2-Fluorobiphenyl	81		40-140
2-Bromonaphthalene	81		40-140

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID:	L2140490-05	Date Collected:	07/28/21 12:02
Client ID:	TOPSOIL COMP 1	Date Received:	07/28/21
Sample Location:	ANDOVER, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil		
Analytical Method:	131,VPH-18-2.1		
Analytical Date:	07/30/21 15:12		
Analyst:	MKS		
Percent Solids:	79%		

Trap:	EST, Carbopack B/Carboxen 1000&1001	Analytical Column:	Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Were samples received in methanol?	Yes (Covering the Soil)
Methanol ratio:	2.8:1

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	ND		mg/kg	19.4	--	1
C9-C12 Aliphatics	ND		mg/kg	19.4	--	1
C9-C10 Aromatics	ND		mg/kg	19.4	--	1
C5-C8 Aliphatics, Adjusted	ND		mg/kg	19.4	--	1
C9-C12 Aliphatics, Adjusted	ND		mg/kg	19.4	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	115		70-130
2,5-Dibromotoluene-FID	121		70-130

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID:	L2140490-05	Date Collected:	07/28/21 12:02
Client ID:	TOPSOIL COMP 1	Date Received:	07/28/21
Sample Location:	ANDOVER, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	07/31/21 10:31
Analytical Date:	08/02/21 19:20	Cleanup Method1:	EPH-19-2.1
Analyst:	SC	Cleanup Date1:	08/02/21
Percent Solids:	79%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	ND		mg/kg	8.17	--	1
C19-C36 Aliphatics	ND		mg/kg	8.17	--	1
C11-C22 Aromatics	17.0		mg/kg	8.17	--	1
C11-C22 Aromatics, Adjusted	17.0		mg/kg	8.17	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	62		40-140
o-Terphenyl	57		40-140
2-Fluorobiphenyl	69		40-140
2-Bromonaphthalene	73		40-140

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID:	L2140490-06	Date Collected:	07/28/21 12:15
Client ID:	TOPSOIL COMP 2	Date Received:	07/28/21
Sample Location:	ANDOVER, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil		
Analytical Method:	131,VPH-18-2.1		
Analytical Date:	07/30/21 15:42		
Analyst:	MKS		
Percent Solids:	85%		

Trap:	EST, Carbopack B/Carboxen 1000&1001	Analytical Column:	Restek, RTX-502.2, 105m, 0.53ID, 3um

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Were samples received in methanol?	Yes (Covering the Soil)
Methanol ratio:	2.3:1

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Volatile Petroleum Hydrocarbons - Westborough Lab						
C5-C8 Aliphatics	ND		mg/kg	14.3	--	1
C9-C12 Aliphatics	ND		mg/kg	14.3	--	1
C9-C10 Aromatics	ND		mg/kg	14.3	--	1
C5-C8 Aliphatics, Adjusted	ND		mg/kg	14.3	--	1
C9-C12 Aliphatics, Adjusted	ND		mg/kg	14.3	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	113		70-130
2,5-Dibromotoluene-FID	118		70-130

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

SAMPLE RESULTS

Lab ID:	L2140490-06	Date Collected:	07/28/21 12:15
Client ID:	TOPSOIL COMP 2	Date Received:	07/28/21
Sample Location:	ANDOVER, MA	Field Prep:	Not Specified
Sample Depth:			
Matrix:	Soil	Extraction Method:	EPA 3546
Analytical Method:	135,EPH-19-2.1	Extraction Date:	07/31/21 10:31
Analytical Date:	08/02/21 19:45	Cleanup Method1:	EPH-19-2.1
Analyst:	SC	Cleanup Date1:	08/02/21
Percent Solids:	85%		

Quality Control Information

Condition of sample received:	Satisfactory
Sample Temperature upon receipt:	Received on Ice
Sample Extraction method:	Extracted Per the Method

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor
Extractable Petroleum Hydrocarbons - Westborough Lab						
C9-C18 Aliphatics	ND		mg/kg	7.60	--	1
C19-C36 Aliphatics	ND		mg/kg	7.60	--	1
C11-C22 Aromatics	20.1		mg/kg	7.60	--	1
C11-C22 Aromatics, Adjusted	18.3		mg/kg	7.60	--	1

Surrogate	% Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	68		40-140
o-Terphenyl	70		40-140
2-Fluorobiphenyl	79		40-140
2-Bromonaphthalene	78		40-140

Project Name: 58 BEACON ST.
Project Number: 0200.01
Lab Number: L2140490
Report Date: 08/09/21

Method Blank Analysis
Batch Quality Control

Analytical Method: 135,EPH-19-2.1
Analytical Date: 08/02/21 16:25
Analyst: SC

Extraction Method: EPA 3546
Extraction Date: 07/31/21 10:31
Cleanup Method: EPH-19-2.1
Cleanup Date: 08/02/21

Parameter	Result	Qualifier	Units	RL	MDL
Extractable Petroleum Hydrocarbons - Westborough Lab for sample(s): 01-06 Batch: WG1530142-1					
C9-C18 Aliphatics	ND		mg/kg	6.53	--
C19-C36 Aliphatics	ND		mg/kg	6.53	--
C11-C22 Aromatics	ND		mg/kg	6.53	--
C11-C22 Aromatics, Adjusted	ND		mg/kg	6.53	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
Chloro-Octadecane	66		40-140
o-Terphenyl	63		40-140
2-Fluorobiphenyl	75		40-140
2-Bromonaphthalene	75		40-140

Project Name: 58 BEACON ST. **Lab Number:** L2140490

Project Number: 0200.01 **Report Date:** 08/09/21

Method Blank Analysis
Batch Quality Control

Analytical Method: 131,VPH-18-2.1
Analytical Date: 07/30/21 13:43
Analyst: MKS

Parameter	Result	Qualifier	Units	RL	MDL
Volatile Petroleum Hydrocarbons - Westborough Lab for sample(s): 03-06 Batch: WG1530160-4					
C5-C8 Aliphatics	ND		mg/kg	5.00	--
C9-C12 Aliphatics	ND		mg/kg	5.00	--
C9-C10 Aromatics	ND		mg/kg	5.00	--
C5-C8 Aliphatics, Adjusted	ND		mg/kg	5.00	--
C9-C12 Aliphatics, Adjusted	ND		mg/kg	5.00	--

Surrogate	%Recovery	Qualifier	Acceptance Criteria
2,5-Dibromotoluene-PID	108		70-130
2,5-Dibromotoluene-FID	111		70-130

Lab Control Sample Analysis
Batch Quality Control

Project Name: 58 BEACON ST.
Project Number: 0200.01

Lab Number: L2140490
Report Date: 08/09/21

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Extractable Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 01-06 Batch: WG1530142-2 WG1530142-3								
C9-C18 Aliphatics	66		58		40-140	13		25
C19-C36 Aliphatics	81		77		40-140	5		25
C11-C22 Aromatics	64		70		40-140	9		25
Naphthalene	60		60		40-140	0		25
2-Methylnaphthalene	60		61		40-140	2		25
Acenaphthylene	60		62		40-140	3		25
Acenaphthene	64		66		40-140	3		25
Fluorene	63		66		40-140	5		25
Phenanthrene	63		68		40-140	8		25
Anthracene	63		68		40-140	8		25
Fluoranthene	66		72		40-140	9		25
Pyrene	65		70		40-140	7		25
Benzo(a)anthracene	66		72		40-140	9		25
Chrysene	65		68		40-140	5		25
Benzo(b)fluoranthene	60		66		40-140	10		25
Benzo(k)fluoranthene	62		66		40-140	6		25
Benzo(a)pyrene	63		69		40-140	9		25
Indeno(1,2,3-cd)Pyrene	53		60		40-140	12		25
Dibenzo(a,h)anthracene	60		65		40-140	8		25
Benzo(ghi)perylene	54		58		40-140	7		25

Lab Control Sample Analysis
Batch Quality Control

Project Name: 58 BEACON ST.
Project Number: 0200.01

Lab Number: L2140490
Report Date: 08/09/21

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Extractable Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 01-06 Batch: WG1530142-2 WG1530142-3								

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
Chloro-Octadecane	73		66		40-140
o-Terphenyl	61		66		40-140
2-Fluorobiphenyl	72		80		40-140
2-Bromonaphthalene	69		77		40-140
% Naphthalene Breakthrough	0		0		
% 2-Methylnaphthalene Breakthrough	0		0		

Lab Control Sample Analysis
Batch Quality Control

Project Name: 58 BEACON ST.
Project Number: 0200.01

Lab Number: L2140490
Report Date: 08/09/21

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
Volatile Petroleum Hydrocarbons - Westborough Lab Associated sample(s): 03-06 Batch: WG1530160-2 WG1530160-3								
C5-C8 Aliphatics	104		102		70-130	2		25
C9-C12 Aliphatics	108		106		70-130	2		25
C9-C10 Aromatics	97		96		70-130	1		25
Benzene	98		97		70-130	1		25
Toluene	98		97		70-130	1		25
Ethylbenzene	100		98		70-130	2		25
p/m-Xylene	100		98		70-130	1		25
o-Xylene	99		98		70-130	1		25
Methyl tert butyl ether	100		100		70-130	0		25
Naphthalene	97		99		70-130	2		25
1,2,4-Trimethylbenzene	97		96		70-130	1		25
Pentane	97		94		70-130	3		25
2-Methylpentane	104		102		70-130	2		25
2,2,4-Trimethylpentane	110		108		70-130	2		25
n-Nonane	109		107		30-130	2		25
n-Decane	108		106		70-130	2		25
n-Butylcyclohexane	108		106		70-130	2		25

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria
2,5-Dibromotoluene-PID	98		98		70-130
2,5-Dibromotoluene-FID	101		101		70-130

PCBS

Project Name: 58 BEACON ST.
Project Number: 0200.01
Lab Number: L2140490
Report Date: 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-03
Client ID: CUT COMP 1
Sample Location: ANDOVER, MA

Date Collected: 07/28/21 12:00
Date Received: 07/28/21
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8082A
Analytical Date: 08/02/21 00:36
Analyst: CW
Percent Solids: 89%

Extraction Method: EPA 3546
Extraction Date: 07/31/21 08:07
Cleanup Method: EPA 3665A
Cleanup Date: 07/31/21
Cleanup Method: EPA 3660B
Cleanup Date: 07/31/21

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/kg	37.2	--	1	A
Aroclor 1221	ND		ug/kg	37.2	--	1	A
Aroclor 1232	ND		ug/kg	37.2	--	1	A
Aroclor 1242	ND		ug/kg	37.2	--	1	A
Aroclor 1248	ND		ug/kg	37.2	--	1	A
Aroclor 1254	ND		ug/kg	37.2	--	1	A
Aroclor 1260	ND		ug/kg	37.2	--	1	A
Aroclor 1262	ND		ug/kg	37.2	--	1	A
Aroclor 1268	ND		ug/kg	37.2	--	1	A
PCBs, Total	ND		ug/kg	37.2	--	1	A

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	67		30-150	B
Decachlorobiphenyl	62		30-150	B
2,4,5,6-Tetrachloro-m-xylene	64		30-150	A
Decachlorobiphenyl	61		30-150	A

Project Name: 58 BEACON ST.
Project Number: 0200.01
Lab Number: L2140490
Report Date: 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-04
Client ID: CUT COMP 2
Sample Location: ANDOVER, MA

Date Collected: 07/28/21 11:30
Date Received: 07/28/21
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8082A
Analytical Date: 08/02/21 00:44
Analyst: CW
Percent Solids: 90%

Extraction Method: EPA 3546
Extraction Date: 07/31/21 08:07
Cleanup Method: EPA 3665A
Cleanup Date: 07/31/21
Cleanup Method: EPA 3660B
Cleanup Date: 07/31/21

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/kg	36.6	--	1	A
Aroclor 1221	ND		ug/kg	36.6	--	1	A
Aroclor 1232	ND		ug/kg	36.6	--	1	A
Aroclor 1242	ND		ug/kg	36.6	--	1	A
Aroclor 1248	ND		ug/kg	36.6	--	1	A
Aroclor 1254	ND		ug/kg	36.6	--	1	A
Aroclor 1260	ND		ug/kg	36.6	--	1	A
Aroclor 1262	ND		ug/kg	36.6	--	1	A
Aroclor 1268	ND		ug/kg	36.6	--	1	A
PCBs, Total	ND		ug/kg	36.6	--	1	A

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	60		30-150	B
Decachlorobiphenyl	54		30-150	B
2,4,5,6-Tetrachloro-m-xylene	57		30-150	A
Decachlorobiphenyl	55		30-150	A

Project Name: 58 BEACON ST.
Project Number: 0200.01
Lab Number: L2140490
Report Date: 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-05
Client ID: TOPSOIL COMP 1
Sample Location: ANDOVER, MA

Date Collected: 07/28/21 12:02
Date Received: 07/28/21
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8082A
Analytical Date: 08/02/21 00:52
Analyst: CW
Percent Solids: 79%

Extraction Method: EPA 3546
Extraction Date: 07/31/21 08:07
Cleanup Method: EPA 3665A
Cleanup Date: 07/31/21
Cleanup Method: EPA 3660B
Cleanup Date: 07/31/21

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/kg	41.1	--	1	A
Aroclor 1221	ND		ug/kg	41.1	--	1	A
Aroclor 1232	ND		ug/kg	41.1	--	1	A
Aroclor 1242	ND		ug/kg	41.1	--	1	A
Aroclor 1248	ND		ug/kg	41.1	--	1	A
Aroclor 1254	ND		ug/kg	41.1	--	1	A
Aroclor 1260	ND		ug/kg	41.1	--	1	A
Aroclor 1262	ND		ug/kg	41.1	--	1	A
Aroclor 1268	ND		ug/kg	41.1	--	1	A
PCBs, Total	ND		ug/kg	41.1	--	1	A

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	51		30-150	B
Decachlorobiphenyl	46		30-150	B
2,4,5,6-Tetrachloro-m-xylene	48		30-150	A
Decachlorobiphenyl	42		30-150	A

Project Name: 58 BEACON ST.
Project Number: 0200.01
Lab Number: L2140490
Report Date: 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-06
Client ID: TOPSOIL COMP 2
Sample Location: ANDOVER, MA

Date Collected: 07/28/21 12:15
Date Received: 07/28/21
Field Prep: Not Specified

Sample Depth:
Matrix: Soil
Analytical Method: 97,8082A
Analytical Date: 08/02/21 01:01
Analyst: CW
Percent Solids: 85%

Extraction Method: EPA 3546
Extraction Date: 07/31/21 08:20
Cleanup Method: EPA 3665A
Cleanup Date: 07/31/21
Cleanup Method: EPA 3660B
Cleanup Date: 07/31/21

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Column
MCP Polychlorinated Biphenyls - Westborough Lab							
Aroclor 1016	ND		ug/kg	38.8	--	1	A
Aroclor 1221	ND		ug/kg	38.8	--	1	A
Aroclor 1232	ND		ug/kg	38.8	--	1	A
Aroclor 1242	ND		ug/kg	38.8	--	1	A
Aroclor 1248	ND		ug/kg	38.8	--	1	A
Aroclor 1254	ND		ug/kg	38.8	--	1	A
Aroclor 1260	ND		ug/kg	38.8	--	1	A
Aroclor 1262	ND		ug/kg	38.8	--	1	A
Aroclor 1268	ND		ug/kg	38.8	--	1	A
PCBs, Total	ND		ug/kg	38.8	--	1	A

Surrogate	% Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	57		30-150	B
Decachlorobiphenyl	53		30-150	B
2,4,5,6-Tetrachloro-m-xylene	54		30-150	A
Decachlorobiphenyl	49		30-150	A

Project Name: 58 BEACON ST.
Project Number: 0200.01
Lab Number: L2140490
Report Date: 08/09/21

Method Blank Analysis
Batch Quality Control

Analytical Method: 97,8082A
Analytical Date: 08/01/21 19:47
Analyst: JAW

Extraction Method: EPA 3546
Extraction Date: 07/30/21 11:22
Cleanup Method: EPA 3665A
Cleanup Date: 07/30/21
Cleanup Method: EPA 3660B
Cleanup Date: 07/31/21

Parameter	Result	Qualifier	Units	RL	MDL	Column
MCP Polychlorinated Biphenyls - Westborough Lab for sample(s): 03-06 Batch: WG1529867-1						
Aroclor 1016	ND		ug/kg	32.5	--	A
Aroclor 1221	ND		ug/kg	32.5	--	A
Aroclor 1232	ND		ug/kg	32.5	--	A
Aroclor 1242	ND		ug/kg	32.5	--	A
Aroclor 1248	ND		ug/kg	32.5	--	A
Aroclor 1254	ND		ug/kg	32.5	--	A
Aroclor 1260	ND		ug/kg	32.5	--	A
Aroclor 1262	ND		ug/kg	32.5	--	A
Aroclor 1268	ND		ug/kg	32.5	--	A
PCBs, Total	ND		ug/kg	32.5	--	A

Surrogate	%Recovery	Qualifier	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	83		30-150	B
Decachlorobiphenyl	65		30-150	B
2,4,5,6-Tetrachloro-m-xylene	80		30-150	A
Decachlorobiphenyl	70		30-150	A

Lab Control Sample Analysis
Batch Quality Control

Project Name: 58 BEACON ST.
Project Number: 0200.01
Lab Number: L2140490
Report Date: 08/09/21

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits	Column
MCP Polychlorinated Biphenyls - Westborough Lab Associated sample(s): 03-06 Batch: WG1529867-2 WG1529867-3									
Aroclor 1016	94		98		40-140	4		30	A
Aroclor 1260	81		87		40-140	7		30	A

Surrogate	LCS %Recovery	Qual	LCSD %Recovery	Qual	Acceptance Criteria	Column
2,4,5,6-Tetrachloro-m-xylene	97		98		30-150	B
Decachlorobiphenyl	72		73		30-150	B
2,4,5,6-Tetrachloro-m-xylene	90		93		30-150	A
Decachlorobiphenyl	73		78		30-150	A

INORGANICS
&
MISCELLANEOUS

Project Name: 58 BEACON ST.
Project Number: 0200.01

Lab Number: L2140490
Report Date: 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-01
Client ID: GP-1/COMP
Sample Location: ANDOVER, MA

Date Collected: 07/27/21 08:30
Date Received: 07/28/21
Field Prep: Not Specified

Sample Depth:
Matrix: Soil

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total	91.1		%	0.100	NA	1	-	07/28/21 21:48	121,2540G	SB

Project Name: 58 BEACON ST.
Project Number: 0200.01
Lab Number: L2140490
Report Date: 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-02
Client ID: GP-8/S-3
Sample Location: ANDOVER, MA

Date Collected: 07/27/21 13:10
Date Received: 07/28/21
Field Prep: Not Specified

Sample Depth:
Matrix: Soil

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Solids, Total	89.6		%	0.100	NA	1	-	07/28/21 21:48	121,2540G	SB

Project Name: 58 BEACON ST.
Project Number: 0200.01
Lab Number: L2140490
Report Date: 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-03
Client ID: CUT COMP 1
Sample Location: ANDOVER, MA
Sample Depth:
Matrix: Soil

Date Collected: 07/28/21 12:00
Date Received: 07/28/21
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Specific Conductance @ 25 C	48		umhos/cm	10	--	1	-	07/30/21 00:15	1,9050A	KA
Solids, Total	88.7		%	0.100	NA	1	-	07/28/21 21:48	121,2540G	SB
Flash Point	>150		deg F	70	NA	1	-	08/02/21 11:25	1,1010A	AC
Cyanide, Reactive	ND		mg/kg	10	--	1	08/01/21 16:48	08/01/21 18:59	125,7.3	JD
Sulfide, Reactive	ND		mg/kg	10	--	1	08/01/21 16:48	08/01/21 18:28	125,7.3	JD

Project Name: 58 BEACON ST.
Project Number: 0200.01
Lab Number: L2140490
Report Date: 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-04
Client ID: CUT COMP 2
Sample Location: ANDOVER, MA
Sample Depth:
Matrix: Soil

Date Collected: 07/28/21 11:30
Date Received: 07/28/21
Field Prep: Not Specified

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Specific Conductance @ 25 C	21		umhos/cm	10	--	1	-	07/30/21 00:15	1,9050A	KA
Solids, Total	89.8		%	0.100	NA	1	-	07/28/21 21:48	121,2540G	SB
Flash Point	>150		deg F	70	NA	1	-	08/02/21 11:25	1,1010A	AC
Cyanide, Reactive	ND		mg/kg	10	--	1	07/30/21 21:21	07/30/21 23:46	125,7.3	JD
Sulfide, Reactive	ND		mg/kg	10	--	1	07/30/21 21:21	07/30/21 23:16	125,7.3	JD

Project Name: 58 BEACON ST.
Project Number: 0200.01

Lab Number: L2140490
Report Date: 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-05
Client ID: TOPSOIL COMP 1
Sample Location: ANDOVER, MA

Date Collected: 07/28/21 12:02
Date Received: 07/28/21
Field Prep: Not Specified

Sample Depth:
Matrix: Soil

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Specific Conductance @ 25 C	ND		umhos/cm	10	--	1	-	07/30/21 00:15	1,9050A	KA
Solids, Total	78.5		%	0.100	NA	1	-	07/28/21 21:48	121,2540G	SB
Flash Point	>150		deg F	70	NA	1	-	08/02/21 11:25	1,1010A	AC
Cyanide, Reactive	ND		mg/kg	10	--	1	07/30/21 21:21	07/30/21 23:46	125,7.3	JD
Sulfide, Reactive	ND		mg/kg	10	--	1	07/30/21 21:21	07/30/21 23:16	125,7.3	JD

Project Name: 58 BEACON ST.
Project Number: 0200.01

Lab Number: L2140490
Report Date: 08/09/21

SAMPLE RESULTS

Lab ID: L2140490-06
Client ID: TOPSOIL COMP 2
Sample Location: ANDOVER, MA

Date Collected: 07/28/21 12:15
Date Received: 07/28/21
Field Prep: Not Specified

Sample Depth:
Matrix: Soil

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab										
Specific Conductance @ 25 C	21		umhos/cm	10	--	1	-	07/30/21 00:15	1,9050A	KA
Solids, Total	84.7		%	0.100	NA	1	-	07/28/21 21:48	121,2540G	SB
Flash Point	>150		deg F	70	NA	1	-	08/02/21 11:25	1,1010A	AC
Cyanide, Reactive	ND		mg/kg	10	--	1	07/30/21 21:21	07/30/21 23:47	125,7.3	JD
Sulfide, Reactive	ND		mg/kg	10	--	1	07/30/21 21:21	07/30/21 23:16	125,7.3	JD

Project Name: 58 BEACON ST.
Project Number: 0200.01
Lab Number: L2140490
Report Date: 08/09/21

Method Blank Analysis
Batch Quality Control

Parameter	Result	Qualifier	Units	RL	MDL	Dilution Factor	Date Prepared	Date Analyzed	Analytical Method	Analyst
General Chemistry - Westborough Lab for sample(s): 04-06 Batch: WG1529993-1										
Sulfide, Reactive	ND		mg/kg	10	--	1	07/30/21 21:21	07/30/21 23:13	125,7.3	JD
General Chemistry - Westborough Lab for sample(s): 04-06 Batch: WG1530003-1										
Cyanide, Reactive	ND		mg/kg	10	--	1	07/30/21 21:21	07/30/21 23:45	125,7.3	JD
General Chemistry - Westborough Lab for sample(s): 03 Batch: WG1530228-1										
Sulfide, Reactive	ND		mg/kg	10	--	1	08/01/21 16:48	08/01/21 18:26	125,7.3	JD
General Chemistry - Westborough Lab for sample(s): 03 Batch: WG1530229-1										
Cyanide, Reactive	ND		mg/kg	10	--	1	08/01/21 16:48	08/01/21 18:58	125,7.3	JD

Lab Control Sample Analysis

Batch Quality Control

Project Name: 58 BEACON ST.

Project Number: 0200.01

Lab Number: L2140490

Report Date: 08/09/21

Parameter	LCS %Recovery	Qual	LCSD %Recovery	Qual	%Recovery Limits	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 03-06 Batch: WG1529615-1								
Specific Conductance	100		-		99-101	-		
General Chemistry - Westborough Lab Associated sample(s): 04-06 Batch: WG1529993-2								
Sulfide, Reactive	77		-		60-125	-		40
General Chemistry - Westborough Lab Associated sample(s): 04-06 Batch: WG1530003-2								
Cyanide, Reactive	102		-		30-125	-		40
General Chemistry - Westborough Lab Associated sample(s): 03 Batch: WG1530228-2								
Sulfide, Reactive	87		-		60-125	-		40
General Chemistry - Westborough Lab Associated sample(s): 03 Batch: WG1530229-2								
Cyanide, Reactive	88		-		30-125	-		40
General Chemistry - Westborough Lab Associated sample(s): 03-06 Batch: WG1530521-1								
Flash Point	101		-		96-104	-		

Lab Duplicate Analysis

Batch Quality Control

Project Name: 58 BEACON ST.

Project Number: 0200.01

Lab Number: L2140490

Report Date: 08/09/21

Parameter	Native Sample	Duplicate Sample	Units	RPD	Qual	RPD Limits
General Chemistry - Westborough Lab Associated sample(s): 03-06 QC Batch ID: WG1529615-2 QC Sample: L2140490-03 Client ID: CUT COMP 1						
Specific Conductance @ 25 C	48	52	umhos/cm	8		20

Project Name: 58 BEACON ST.
Project Number: 0200.01

Lab Number: L2140490
Report Date: 08/09/21

Sample Receipt and Container Information

Were project specific reporting limits specified? YES

Cooler Information

Cooler	Custody Seal
A	Absent

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2140490-01A	Glass 60mL/2oz unpreserved	A	NA		2.7	Y	Absent		EPH-20(14)
L2140490-01B	Plastic 2oz unpreserved for TS	A	NA		2.7	Y	Absent		TS(7)
L2140490-02A	Glass 60mL/2oz unpreserved	A	NA		2.7	Y	Absent		EPH-20(14)
L2140490-02B	Plastic 2oz unpreserved for TS	A	NA		2.7	Y	Absent		TS(7)
L2140490-03A	Vial MeOH preserved	A	NA		2.7	Y	Absent		MCP-8260HLW-10(14),VPH-18(28)
L2140490-03B	Vial water preserved	A	NA		2.7	Y	Absent	28-JUL-21 17:53	MCP-8260HLW-10(14)
L2140490-03C	Vial water preserved	A	NA		2.7	Y	Absent	28-JUL-21 17:53	MCP-8260HLW-10(14)
L2140490-03D	Plastic 2oz unpreserved for TS	A	NA		2.7	Y	Absent		TS(7)
L2140490-03E	Metals Only-Glass 60mL/2oz unpreserved	A	NA		2.7	Y	Absent		SUB-MCP 14 METALS()
L2140490-03F	Glass 250ml/8oz unpreserved	A	NA		2.7	Y	Absent		REACTS(14),MCP-8082-10(365),MCP-8270-10(14),EPH-20(14),FLASH(),REACTCN(14),COND-9050(28)
L2140490-04A	Vial MeOH preserved	A	NA		2.7	Y	Absent		MCP-8260HLW-10(14),VPH-18(28)
L2140490-04B	Vial water preserved	A	NA		2.7	Y	Absent	28-JUL-21 17:53	MCP-8260HLW-10(14)
L2140490-04C	Vial water preserved	A	NA		2.7	Y	Absent	28-JUL-21 17:53	MCP-8260HLW-10(14)
L2140490-04D	Plastic 2oz unpreserved for TS	A	NA		2.7	Y	Absent		TS(7)
L2140490-04E	Metals Only-Glass 60mL/2oz unpreserved	A	NA		2.7	Y	Absent		-
L2140490-04F	Glass 250ml/8oz unpreserved	A	NA		2.7	Y	Absent		REACTS(14),MCP-8082-10(365),MCP-8270-10(14),EPH-20(14),FLASH(),REACTCN(14),COND-9050(28)
L2140490-04G	Glass 250ml/8oz unpreserved	A	NA		2.7	Y	Absent		FLASH()
L2140490-04X	Glass 60ml unpreserved split	A	NA		2.7	Y	Absent		SUB-MCP 14 METALS()
L2140490-05A	Vial MeOH preserved	A	NA		2.7	Y	Absent		MCP-8260HLW-10(14),VPH-18(28)
L2140490-05B	Vial water preserved	A	NA		2.7	Y	Absent	28-JUL-21 17:53	MCP-8260HLW-10(14)
L2140490-05C	Vial water preserved	A	NA		2.7	Y	Absent	28-JUL-21 17:53	MCP-8260HLW-10(14)

*Values in parentheses indicate holding time in days

Project Name: 58 BEACON ST.
Project Number: 0200.01

Lab Number: L2140490
Report Date: 08/09/21

Container Information

Container ID	Container Type	Cooler	Initial pH	Final pH	Temp deg C	Pres	Seal	Frozen Date/Time	Analysis(*)
L2140490-05D	Plastic 2oz unpreserved for TS	A	NA		2.7	Y	Absent		TS(7)
L2140490-05E	Metals Only-Glass 60mL/2oz unpreserved	A	NA		2.7	Y	Absent		-
L2140490-05F	Glass 250ml/8oz unpreserved	A	NA		2.7	Y	Absent		REACTS(14),MCP-8082-10(365),MCP-8270-10(14),EPH-20(14),FLASH(),REACTCN(14),COND-9050(28)
L2140490-05X	Glass 60ml unpreserved split	A	NA		2.7	Y	Absent		SUB-MCP 14 METALS()
L2140490-06A	Vial MeOH preserved	A	NA		2.7	Y	Absent		MCP-8260HLW-10(14),VPH-18(28)
L2140490-06B	Vial water preserved	A	NA		2.7	Y	Absent	28-JUL-21 17:53	MCP-8260HLW-10(14)
L2140490-06C	Vial water preserved	A	NA		2.7	Y	Absent	28-JUL-21 17:53	MCP-8260HLW-10(14)
L2140490-06D	Plastic 2oz unpreserved for TS	A	NA		2.7	Y	Absent		TS(7)
L2140490-06E	Metals Only-Glass 60mL/2oz unpreserved	A	NA		2.7	Y	Absent		-
L2140490-06F	Glass 250ml/8oz unpreserved	A	NA		2.7	Y	Absent		REACTS(14),MCP-8082-10(365),EPH-20(14),MCP-8270-10(14),FLASH(),REACTCN(14),COND-9050(28)
L2140490-06X	Glass 60ml unpreserved split	A	NA		2.7	Y	Absent		SUB-MCP 14 METALS()

*Values in parentheses indicate holding time in days

Project Name:	58 BEACON ST.	**Lab Number:**	L2140490
Project Number:	0200.01	**Report Date:**	08/09/21

GLOSSARY

Acronyms

DL	- Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the limit of quantitation (LOQ). The DL includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
EDL	- Estimated Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The EDL includes any adjustments from dilutions, concentrations or moisture content, where applicable. The use of EDLs is specific to the analysis of PAHs using Solid-Phase Microextraction (SPME).
EMPC	- Estimated Maximum Possible Concentration: The concentration that results from the signal present at the retention time of an analyte when the ions meet all of the identification criteria except the ion abundance ratio criteria. An EMPC is a worst-case estimate of the concentration.
EPA	- Environmental Protection Agency.
LCS	- Laboratory Control Sample: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LCSD	- Laboratory Control Sample Duplicate: Refer to LCS.
LFB	- Laboratory Fortified Blank: A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes.
LOD	- Limit of Detection: This value represents the level to which a target analyte can reliably be detected for a specific analyte in a specific matrix by a specific method. The LOD includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
LOQ	- Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.) Limit of Quantitation: The value at which an instrument can accurately measure an analyte at a specific concentration. The LOQ includes any adjustments from dilutions, concentrations or moisture content, where applicable. (DoD report formats only.)
MDL	- Method Detection Limit: This value represents the level to which target analyte concentrations are reported as estimated values, when those target analyte concentrations are quantified below the reporting limit (RL). The MDL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
MS	- Matrix Spike Sample: A sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. For Method 332.0, the spike recovery is calculated using the native concentration, including estimated values.
MSD	- Matrix Spike Sample Duplicate: Refer to MS.
NA	- Not Applicable.
NC	- Not Calculated: Term is utilized when one or more of the results utilized in the calculation are non-detect at the parameter's reporting unit.
NDPA/DPA	- N-Nitrosodiphenylamine/Diphenylamine.
NI	- Not Ignitable.
NP	- Non-Plastic: Term is utilized for the analysis of Atterberg Limits in soil.
NR	- No Results: Term is utilized when 'No Target Compounds Requested' is reported for the analysis of Volatile or Semivolatile Organic TIC only requests.
RL	- Reporting Limit: The value at which an instrument can accurately measure an analyte at a specific concentration. The RL includes any adjustments from dilutions, concentrations or moisture content, where applicable.
RPD	- Relative Percent Difference: The results from matrix and/or matrix spike duplicates are primarily designed to assess the precision of analytical results in a given matrix and are expressed as relative percent difference (RPD). Values which are less than five times the reporting limit for any individual parameter are evaluated by utilizing the absolute difference between the values; although the RPD value will be provided in the report.
SRM	- Standard Reference Material: A reference sample of a known or certified value that is of the same or similar matrix as the associated field samples.
STLP	- Semi-dynamic Tank Leaching Procedure per EPA Method 1315.
TEF	- Toxic Equivalency Factors: The values assigned to each dioxin and furan to evaluate their toxicity relative to 2,3,7,8-TCDD.
TEQ	- Toxic Equivalent: The measure of a sample's toxicity derived by multiplying each dioxin and furan by its corresponding TEF and then summing the resulting values.
TIC	- Tentatively Identified Compound: A compound that has been identified to be present and is not part of the target compound list (TCL) for the method and/or program. All TICs are qualitatively identified and reported as estimated concentrations.

Report Format: Data Usability Report

Project Name:	58 BEACON ST.	**Lab Number:**	L2140490
Project Number:	0200.01	**Report Date:**	08/09/21

Footnotes

1 - The reference for this analyte should be considered modified since this analyte is absent from the target analyte list of the original method.

Terms

Analytical Method: Both the document from which the method originates and the analytical reference method. (Example: EPA 8260B is shown as 1,8260B.) The codes for the reference method documents are provided in the References section of the Addendum.

Difference: With respect to Total Oxidizable Precursor (TOP) Assay analysis, the difference is defined as the Post-Treatment value minus the Pre-Treatment value.

Final pH: As it pertains to Sample Receipt & Container Information section of the report, Final pH reflects pH of container determined after adjustment at the laboratory, if applicable. If no adjustment required, value reflects Initial pH.

Frozen Date/Time: With respect to Volatile Organics in soil, Frozen Date/Time reflects the date/time at which associated Reagent Water-preserved vials were initially frozen. Note: If frozen date/time is beyond 48 hours from sample collection, value will be reflected in 'bold'.

Initial pH: As it pertains to Sample Receipt & Container Information section of the report, Initial pH reflects pH of container determined upon receipt, if applicable.

PAH Total: With respect to Alkylated PAH analyses, the 'PAHs, Total' result is defined as the summation of results for all or a subset of the following compounds: Naphthalene, C1-C4 Naphthalenes, 2-Methylnaphthalene, 1-Methylnaphthalene, Biphenyl, Acenaphthylene, Acenaphthene, Fluorene, C1-C3 Fluorenes, Phenanthrene, C1-C4 Phenanthrenes/Anthracenes, Anthracene, Fluoranthene, Pyrene, C1-C4 Fluoranthenes/Pyrenes, Benz(a)anthracene, Chrysene, C1-C4 Chrysenes, Benzo(b)fluoranthene, Benzo(j)+(k)fluoranthene, Benzo(e)pyrene, Benzo(a)pyrene, Perylene, Indeno(1,2,3-cd)pyrene, Dibenz(ah)+(ac)anthracene, Benzo(g,h,i)perylene. If a 'Total' result is requested, the results of its individual components will also be reported.

PFAS Total: With respect to PFAS analyses, the 'PFAS, Total (5)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA and PFOS. In addition, the 'PFAS, Total (6)' result is defined as the summation of results for: PFHpA, PFHxS, PFOA, PFNA, PFDA and PFOS. For MassDEP DW compliance analysis only, the 'PFAS, Total (6)' result is defined as the summation of results at or above the RL. Note: If a 'Total' result is requested, the results of its individual components will also be reported.

The target compound Chlordane (CAS No. 57-74-9) is reported for GC ECD analyses. Per EPA,this compound "refers to a mixture of chlordane isomers, other chlorinated hydrocarbons and numerous other components." (Reference: USEPA Toxicological Review of Chlordane, In Support of Summary Information on the Integrated Risk Information System (IRIS), December 1997.)

Total: With respect to Organic analyses, a 'Total' result is defined as the summation of results for individual isomers or Aroclors. If a 'Total' result is requested, the results of its individual components will also be reported. This is applicable to 'Total' results for methods 8260, 8081 and 8082.

Data Qualifiers

A - Spectra identified as "Aldol Condensates" are byproducts of the extraction/concentration procedures when acetone is introduced in the process.

B - The analyte was detected above the reporting limit in the associated method blank. Flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For MCP-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank. For DOD-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte at less than ten times (10x) the concentration found in the blank AND the analyte was detected above one-half the reporting limit (or above the reporting limit for common lab contaminants) in the associated method blank. For NJ-Air-related projects, flag only applies to associated field samples that have detectable concentrations of the analyte above the reporting limit. For NJ-related projects (excluding Air), flag only applies to associated field samples that have detectable concentrations of the analyte, which was detected above the reporting limit in the associated method blank or above five times the reporting limit for common lab contaminants (Phthalates, Acetone, Methylene Chloride, 2-Butanone).

C - Co-elution: The target analyte co-elutes with a known lab standard (i.e. surrogate, internal standards, etc.) for co-extracted analyses.

D - Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

E - Concentration of analyte exceeds the range of the calibration curve and/or linear range of the instrument.

F - The ratio of quantifier ion response to qualifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.

G - The concentration may be biased high due to matrix interferences (i.e, co-elution) with non-target compound(s). The result should be considered estimated.

H - The analysis of pH was performed beyond the regulatory-required holding time of 15 minutes from the time of sample collection.

I - The lower value for the two columns has been reported due to obvious interference.

J - Estimated value. This represents an estimated concentration for Tentatively Identified Compounds (TICs).

M - Reporting Limit (RL) exceeds the MCP CAM Reporting Limit for this analyte.

ND - Not detected at the reporting limit (RL) for the sample.

NJ - Presumptive evidence of compound. This represents an estimated concentration for Tentatively Identified Compounds (TICs), where

Report Format: Data Usability Report

Project Name:	58 BEACON ST.	**Lab Number:**	L2140490
Project Number:	0200.01	**Report Date:**	08/09/21

Data Qualifiers

the identification is based on a mass spectral library search.

P - The RPD between the results for the two columns exceeds the method-specified criteria.

Q - The quality control sample exceeds the associated acceptance criteria. For DOD-related projects, LCS and/or Continuing Calibration Standard exceedences are also qualified on all associated sample results. Note: This flag is not applicable for matrix spike recoveries when the sample concentration is greater than 4x the spike added or for batch duplicate RPD when the sample concentrations are less than 5x the RL. (Metals only.)

R - Analytical results are from sample re-analysis.

RE - Analytical results are from sample re-extraction.

S - Analytical results are from modified screening analysis.

Report Format: Data Usability Report

Project Name:	58 BEACON ST.	**Lab Number:**	L2140490
Project Number:	0200.01	**Report Date:**	08/09/21

REFERENCES

1 Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. Third Edition. Updates I - VI, 2018.

97 EPA Test Methods (SW-846) with QC Requirements & Performance Standards for the Analysis of EPA SW-846 Methods under the Massachusetts Contingency Plan, WSC-CAM-IIA, IIB, IIIA, IIIB, IIIC, IIID, VA, VB, VC, VIA, VIB, VIIIA and VIIIB, July 2010.

121 Standard Methods for the Examination of Water and Wastewater. APHA-AWWA-WEF. Standard Methods Online.

125 Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. Third Edition. Updates IIIA, April 1998.

131 Method for the Determination of Volatile Petroleum Hydrocarbons (VPH), MassDEP, February 2018, Revision 2.1 with QC Requirements & Performance Standards for the Analysis of VPH under the Massachusetts Contingency Plan, WSC-CAM-IVA, June 1, 2018.

135 Method for the Determination of Extractable Petroleum Hydrocarbons (EPH), MassDEP, December 2019, Revision 2.1 with QC Requirements & Performance Standards for the Analysis of EPH under the Massachusetts Contingency Plan, WSC-CAM-IVB, March 1, 2020.

LIMITATION OF LIABILITIES

Alpha Analytical performs services with reasonable care and diligence normal to the analytical testing laboratory industry. In the event of an error, the sole and exclusive responsibility of Alpha Analytical shall be to re-perform the work at it's own expense. In no event shall Alpha Analytical be held liable for any incidental, consequential or special damages, including but not limited to, damages in any way connected with the use of, interpretation of, information or analysis provided by Alpha Analytical.

We strongly urge our clients to comply with EPA protocol regarding sample volume, preservation, cooling, containers, sampling procedures, holding time and splitting of samples in the field.

Certification Information

The following analytes are not included in our Primary NELAP Scope of Accreditation:

Westborough Facility
EPA 624/624.1: m/p-xylene, o-xylene, Naphthalene
EPA 625/625.1: alpha-Terpineol
EPA 8260C/8260D: NPW: 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene, Azobenzene; SCM: Iodomethane (methyl iodide), 1,2,4,5-Tetramethylbenzene; 4-Ethyltoluene.
EPA 8270D/8270E: NPW: Dimethylnaphthalene,1,4-Diphenylhydrazine, alpha-Terpineol; SCM: Dimethylnaphthalene,1,4-Diphenylhydrazine.
SM4500: NPW: Amenable Cyanide; SCM: Total Phosphorus, TKN, NO2, NO3.

Mansfield Facility
SM 2540D: TSS
EPA 8082A: NPW: PCB: 1, 5, 31, 87,101, 110, 141, 151, 153, 180, 183, 187.
EPA TO-15: Halothane, 2,4,4-Trimethyl-2-pentene, 2,4,4-Trimethyl-1-pentene, Thiophene, 2-Methylthiophene, 3-Methylthiophene, 2-Ethylthiophene, 1,2,3-Trimethylbenzene, Indan, Indene, 1,2,4,5-Tetramethylbenzene, Benzothiophene, 1-Methylnaphthalene.
Biological Tissue Matrix: EPA 3050B

The following analytes are included in our Massachusetts DEP Scope of Accreditation

Westborough Facility:

Drinking Water
EPA 300.0: Chloride, Nitrate-N, Fluoride, Sulfate; **EPA 353.2**: Nitrate-N, Nitrite-N; **SM4500NO3-F**: Nitrate-N, Nitrite-N; **SM4500F-C, SM4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, SM2320B, SM2540C, SM4500H-B, SM4500NO2-B**
EPA 332: Perchlorate; **EPA 524.2:** THMs and VOCs; **EPA 504.1:** EDB, DBCP.
Microbiology: **SM9215B; SM9223-P/A, SM9223B-Colilert-QT,SM9222D**.

Non-Potable Water
SM4500H,B, EPA 120.1, SM2510B, SM2540C, SM2320B, SM4500CL-E, SM4500F-BC, SM4500NH3-BH: Ammonia-N and Kjeldahl-N, **EPA 350.1**: Ammonia-N, **LACHAT 10-107-06-1-B**: Ammonia-N, **EPA 351.1, SM4500NO3-F, EPA 353.2**: Nitrate-N, **SM4500P-E, SM4500P-B, E, SM4500SO4-E, SM5220D, EPA 410.4, SM5210B, SM5310C, SM4500CL-D, EPA 1664, EPA 420.1, SM4500-CN-CE, SM2540D, EPA 300: Chloride, Sulfate, Nitrate.**
EPA 624.1: Volatile Halocarbons & Aromatics,
EPA 608.3: Chlordane, Toxaphene, Aldrin, alpha-BHC, beta-BHC, gamma-BHC, delta-BHC, Dieldrin, DDD, DDE, DDT, Endosulfan I, Endosulfan II, Endosulfan sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, PCBs
EPA 625.1: SVOC (Acid/Base/Neutral Extractables), **EPA 600/4-81-045**: PCB-Oil.
Microbiology: **SM9223B-Colilert-QT; Enterolert-QT, SM9221E, EPA 1600, EPA 1603, SM9222D.**

Mansfield Facility:

Drinking Water
EPA 200.7: Al, Ba, Cd, Cr, Cu, Fe, Mn, Ni, Na, Ag, Ca, Zn. **EPA 200.8:** Al, Sb, As, Ba, Be, Cd, Cr, Cu, Pb, Mn, Ni, Se, Ag, TL, Zn. **EPA 245.1** Hg.
EPA 522, EPA 537.1.

Non-Potable Water
EPA 200.7: Al, Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Se, Ag, Na, Sr, TL, Ti, V, Zn.
EPA 200.8: Al, Sb, As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Ni, K, Se, Ag, Na, TL, Zn.
EPA 245.1 Hg.
SM2340B

For a complete listing of analytes and methods, please contact your Alpha Project Manager.

CHAIN OF CUSTODY

PAGE 1 OF 1

Date Rec'd in Lab: 7/28/21

ALPHA Job #: L2140490

ALPHA ANALYTICAL
8 Walkup Drive, Westboro, MA 01581, Tel: 508-898-9220
320 Forbes Blvd, Mansfield, MA 02048, Tel: 508-822-9300

Client Information

Client: ADS
Address: 205 Woodland St, Sherborn MA
Phone: 781-727-6646
Email: astiller@adslsp.com

Additional Project Information:

Project Information

Project Name: 58 Beacon St
Project Location: Andover, MA
Project #: 0200.01
Project Manager: A Stiller
ALPHA Quote #:

Turn-Around Time

☒ Standard ☐ RUSH (only confirmed if pre-approved!)
Date Due:

Report Information - Data Deliverables

☒ ADEx ☐ EMAIL

Billing Information

☒ Same as Client info PO #:

Regulatory Requirements & Project Information Requirements

☒ Yes ☐ No MA MCP Analytical Methods ☐ Yes ☐ No CT RCP Analytical Methods
☐ Yes ☐ No Matrix Spike Required on this SDG? (Required for MCP Inorganics)
☐ Yes ☐ No GW1 Standards (Info Required for Metals & EPH with Targets)
☐ Yes ☐ No NPDES RGP
☐ Other State /Fed Program _____ Criteria _____

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler Initials	VOC: ☒ 8260 ☐ 624 ☐ 524.2	SVOC: ☒ ABN ☐ PAH	METALS: ☐ MCP 13 ☒ MCP 14 ☐ RCP 15	METALS: ☐ RCRA5 ☐ RCRA8 ☐ PP13	EPH: ☐ Ranges & Targets ☒ Ranges Only	VPH: ☐ Ranges & Targets ☒ Ranges Only	☒ PCB ☐ PEST	TPH: ☐ Quant Only ☐ Fingerprint	EPH Diesel Ranges	PH, Flashpoint, Reactivity, Corrosivity	Sample Comments	TOTAL # BOTTLES
40490-01	GP-1/COMP	7/27	8:30	S	ADS								X			Frozen 7/27	
02	GP-8/S-3	7/27	1:10 PM	S	ADS								X			Frozen 7/27	
03	Cut Comp 1	7/28	12:00	S	ADS	X	X	X		X	X	X			X	X	
04	CUT COMP 2	7/28	11:30	S	ADS	X	X	X		X	X	X			X	X	
05	Topsoil Comp 1	7/28	12:02	S	ADS	X	X	X		X	X	X			X	X	
06	TOPSOIL COMP 2	7/28	12:15	S	ADS	X	X	X		X	X	X			X	X	

SAMPLE INFO
Filtration ☐ Field ☐ Lab to do
Preservation ☐ Lab to do

| | | | | | | | |

Method Blank Summary
Form 4
Volatiles

Client	: ADS Environmental	**Lab Number**	: L2140490
Project Name	: 58 BEACON ST.	**Project Number**	: 0200.01
Lab Sample ID	: WG1531018-5	**Lab File ID**	: V04210802N04
Instrument ID	: VOA104		
Matrix	: SOIL	**Analysis Date**	: 08/02/21 19:45

Client Sample No.	Lab Sample ID	Analysis Date
WG1531018-3LCS	WG1531018-3	08/02/21 18:28
WG1531018-4LCSD	WG1531018-4	08/02/21 18:53
CUT COMP 1	L2140490-03	08/03/21 02:23
CUT COMP 2	L2140490-04	08/03/21 02:48
TOPSOIL COMP 1	L2140490-05	08/03/21 03:13
TOPSOIL COMP 2	L2140490-06	08/03/21 03:38

Calibration Verification Summary
Form 7
Volatiles

Client	: ADS Environmental		**Lab Number**	: L2140490	
Project Name	: 58 BEACON ST.		**Project Number**	: 0200.01	
Instrument ID	: VOA104		**Calibration Date**	: 08/02/21 18:28	
Lab File ID	: V04210802N01		**Init. Calib. Date(s)**	: 07/07/21	07/08/21
Sample No	: WG1531018-2		**Init. Calib. Times**	: 20:54	00:16
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
Fluorobenzene	1	1	-	0	20	106	0
Dichlorodifluoromethane	0.29	0.232	-	20	20	85	0
Chloromethane	0.386	0.374	-	3.1	20	109	-.02
Vinyl chloride	0.321	0.315	-	1.9	20	103	0
Bromomethane	40	46.796	-	-17	20	115	0
Chloroethane	0.132	0.129	-	2.3	20	115	0
Trichlorofluoromethane	0.418	0.414	-	1	20	101	0
Ethyl ether	0.145	0.132	-	9	20	99	0
1,1-Dichloroethene	0.241	0.237	-	1.7	20	101	0
Carbon disulfide	0.896	0.807	-	9.9	20	98	0
Freon-113	0.266	0.267	-	-0.4	20	102	0
Acrolein	0.034	0.031*	-	8.8	20	96	0
Methylene chloride	40	38.003	-	5	20	98	0
Acetone	40	33.228	-	16.9	20	94	0
trans-1,2-Dichloroethene	0.273	0.267	-	2.2	20	101	0
Methyl acetate	0.154	0.131	-	14.9	20	88	0
Methyl tert-butyl ether	0.699	0.634	-	9.3	20	94	0
tert-Butyl alcohol	0.03	0.021*	-	30*	20	76	-.01
Diisopropyl ether	0.999	0.938	-	6.1	20	93	0
1,1-Dichloroethane	0.614	0.582	-	5.2	20	100	0
Halothane	0.221	0.217	-	1.8	20	100	0
Acrylonitrile	0.092	0.082	-	10.9	20	92	0
Ethyl tert-butyl ether	0.898	0.83	-	7.6	20	92	0
Vinyl acetate	0.61	0.515	-	15.6	20	86	0
cis-1,2-Dichloroethene	0.306	0.289	-	5.6	20	100	0
2,2-Dichloropropane	0.433	0.413	-	4.6	20	100	0
Bromochloromethane	0.141	0.132	-	6.4	20	98	0
Cyclohexane	0.574	0.564	-	1.7	20	102	0
Chloroform	0.536	0.483	-	9.9	20	100	0
Ethyl acetate	0.229	0.195	-	14.8	20	87	0
Carbon tetrachloride	0.4	0.339	-	15.3	20	86	0
Tetrahydrofuran	0.089	0.074	-	16.9	20	88	0
Dibromofluoromethane	0.305	0.289	-	5.2	20	107	0
1,1,1-Trichloroethane	0.425	0.399	-	6.1	20	97	0
2-Butanone	40	27.581	-	31*	20	72	0
1,1-Dichloropropene	0.346	0.352	-	-1.7	20	100	0
Benzene	1.017	0.979	-	3.7	20	98	0
tert-Amyl methyl ether	0.635	0.557	-	12.3	20	90	0
1,2-Dichloroethane-d4	0.289	0.266	-	8	20	104	0
1,2-Dichloroethane	0.399	0.352	-	11.8	20	94	0
Methyl cyclohexane	0.411	0.405	-	1.5	20	98	0
Trichloroethene	0.28	0.272	-	2.9	20	98	0
Dibromomethane	0.163	0.146	-	10.4	20	95	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: ADS Environmental	**Lab Number**	: L2140490
Project Name	: 58 BEACON ST.	**Project Number**	: 0200.01
Instrument ID	: VOA104	**Calibration Date**	: 08/02/21 18:28
Lab File ID	: V04210802N01	**Init. Calib. Date(s)**	: 07/07/21 07/08/21
Sample No	: WG1531018-2	**Init. Calib. Times**	: 20:54 00:16
Channel	:		

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
1,2-Dichloropropane	0.338	0.319	-	5.6	20	97	0
2-Chloroethyl vinyl ether	0.17	0.148	-	12.9	20	86	0
Bromodichloromethane	0.385	0.344	-	10.6	20	93	0
1,4-Dioxane	0.00221	0.00224*	-	-1.4	20	101	0
cis-1,3-Dichloropropene	0.415	0.406	-	2.2	20	94	0
Chlorobenzene-d5	1	1	-	0	20	106	0
Toluene-d8	1.259	1.218	-	3.3	20	102	0
Toluene	0.836	0.793	-	5.1	20	98	0
4-Methyl-2-pentanone	0.123	0.113	-	8.1	20	91	0
Tetrachloroethene	0.392	0.393	-	-0.3	20	96	0
trans-1,3-Dichloropropene	0.471	0.454	-	3.6	20	93	0
Ethyl methacrylate	0.387	0.341	-	11.9	20	89	0
1,1,2-Trichloroethane	0.234	0.22	-	6	20	93	0
Chlorodibromomethane	0.347	0.304	-	12.4	20	83	0
1,3-Dichloropropane	0.459	0.44	-	4.1	20	94	0
1,2-Dibromoethane	40	35.395	-	11.5	20	92	0
2-Hexanone	0.235	0.189	-	19.6	20	94	0
Chlorobenzene	0.964	0.921	-	4.5	20	96	0
Ethylbenzene	1.631	1.552	-	4.8	20	99	0
1,1,1,2-Tetrachloroethane	0.351	0.315	-	10.3	20	87	0
p/m Xylene	80	81.214	-	-1.5	20	97	0
o Xylene	0.641	0.585	-	8.7	20	98	0
Styrene	1.017	0.987	-	2.9	20	99	0
1,4-Dichlorobenzene-d4	1	1	-	0	20	104	0
Bromoform	0.444	0.338	-	23.9*	20	75	0
Isopropylbenzene	3.164	3.192	-	-0.9	20	99	0
4-Bromofluorobenzene	0.926	0.907	-	2.1	20	101	0
Bromobenzene	0.768	0.741	-	3.5	20	95	0
n-Propylbenzene	3.548	3.647	-	-2.8	20	100	0
1,4-Dichlorobutane	1.259	1.157	-	8.1	20	94	0
1,1,2,2-Tetrachloroethane	0.659	0.619	-	6.1	20	94	0
4-Ethyltoluene	3.053	3.096	-	-1.4	20	98	0
2-Chlorotoluene	2.126	2.118	-	0.4	20	99	0
1,3,5-Trimethylbenzene	2.596	2.534	-	2.4	20	96	0
1,2,3-Trichloropropane	0.51	0.456	-	10.6	20	92	0
trans-1,4-Dichloro-2-buten	0.236	0.211	-	10.6	20	87	0
4-Chlorotoluene	2.208	2.198	-	0.5	20	99	0
tert-Butylbenzene	2.194	2.205	-	-0.5	20	100	0
1,2,4-Trimethylbenzene	2.594	2.562	-	1.2	20	98	0
sec-Butylbenzene	3.441	3.539	-	-2.8	20	100	0
p-Isopropyltoluene	2.789	2.82	-	-1.1	20	98	0
1,3-Dichlorobenzene	1.514	1.53	-	-1.1	20	100	0
1,4-Dichlorobenzene	1.547	1.531	-	1	20	100	0

* Value outside of QC limits.

Calibration Verification Summary
Form 7
Volatiles

Client	: ADS Environmental		**Lab Number**	: L2140490	
Project Name	: 58 BEACON ST.		**Project Number**	: 0200.01	
Instrument ID	: VOA104		**Calibration Date**	: 08/02/21 18:28	
Lab File ID	: V04210802N01		**Init. Calib. Date(s)**	: 07/07/21	07/08/21
Sample No	: WG1531018-2		**Init. Calib. Times**	: 20:54	00:16
Channel	:				

Compound	Ave. RRF	RRF	Min RRF	%D	Max %D	Area%	Dev(min)
p-Diethylbenzene	1.641	1.685	-	-2.7	20	100	0
n-Butylbenzene	2.478	2.601	-	-5	20	102	0
1,2-Dichlorobenzene	1.427	1.398	-	2	20	99	0
1,2,4,5-Tetramethylbenzene	2.664	2.717	-	-2	20	102	0
1,2-Dibromo-3-chloropropan	0.11	0.092	-	16.4	20	84	0
1,3,5-Trichlorobenzene	1.078	1.129	-	-4.7	20	102	0
Hexachlorobutadiene	0.613	0.617	-	-0.7	20	98	0
1,2,4-Trichlorobenzene	0.991	1.033	-	-4.2	20	103	0
Naphthalene	2.108	2.043	-	3.1	20	98	0
1,2,3-Trichlorobenzene	0.902	0.916	-	-1.6	20	102	0

* Value outside of QC limits.

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August 9, 2021

Nathalie Lewis
Alpha Analytical Laboratory
8 Walkup Drive
Westborough, MA 01581

Project Location: MA
Client Job Number:
Project Number: L2140490
Laboratory Work Order Number: 21H0041

Enclosed are results of analyses for samples received by the laboratory on August 2, 2021. If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Scott C. Basal
Project Manager

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Alpha Analytical Laboratory
8 Walkup Drive
Westborough, MA 01581
ATTN: Nathalie Lewis

REPORT DATE: 8/9/2021

PURCHASE ORDER NUMBER:

PROJECT NUMBER: L2140490

ANALYTICAL SUMMARY

WORK ORDER NUMBER: 21H0041

The results of analyses performed on the following samples submitted to CON-TEST, a Pace Analytical Laboratory, are found in this report.

PROJECT LOCATION: MA

FIELD SAMPLE #	LAB ID:	MATRIX	SAMPLE DESCRIPTION	TEST	SUB LAB
CUT COMP 1	21H0041-01	Soil		SM 2540G	
				SW-846 6010D	
				SW-846 7471B	
CUT COMP 2	21H0041-02	Soil		SM 2540G	
				SW-846 6010D	
				SW-846 7471B	
TOPSOIL COMP 1	21H0041-03	Soil		SM 2540G	
				SW-846 6010D	
				SW-846 7471B	
TOPSOIL COMP 2	21H0041-04	Soil		SM 2540G	
				SW-846 6010D	
				SW-846 7471B	

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CASE NARRATIVE SUMMARY

All reported results are within defined laboratory quality control objectives unless listed below or otherwise qualified in this report.

SW-846 7471B

Qualifications:

R-05

Laboratory fortified blank duplicate RPD is outside of control limits. Reduced precision is anticipated for any reported value for this compound.

Analyte & Samples(s) Qualified:

Mercury
B287480-BSD1

The results of analyses reported only relate to samples submitted to Con-Test, a Pace Analytical Laboratory, for testing.
I certify that the analyses listed above, unless specifically listed as subcontracted, if any, were performed under my direction according to the approved methodologies listed in this document, and that based upon my inquiry of those individuals immediately responsible for obtaining the information, the material contained in this report is, to the best of my knowledge and belief, accurate and complete.



Lisa A. Worthington
Technical Representative

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Project Location: MA | Sample Description: | Work Order: 21H0041

Date Received: 8/2/2021

Field Sample #: CUT COMP 1 | Sampled: 7/28/2021 12:00

Sample ID: 21H0041-01

Sample Matrix: Soil

Metals Analyses (Total)

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Antimony	ND	1.8	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:41	MJH
Arsenic	5.7	3.7	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:41	MJH
Barium	19	1.8	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:41	MJH
Beryllium	0.55	0.18	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:41	MJH
Cadmium	ND	0.37	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:41	MJH
Chromium	17	0.73	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:41	MJH
Lead	4.1	0.55	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:41	MJH
Mercury	ND	0.032	mg/Kg dry	1		SW-846 7471B	8/4/21	8/5/21 12:32	CJV
Nickel	12	0.73	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:41	MJH
Selenium	ND	3.7	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:41	MJH
Silver	ND	0.37	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:41	MJH
Thallium	ND	1.8	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:41	MJH
Vanadium	13	0.73	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:41	MJH
Zinc	14	0.73	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:41	MJH

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Project Location: MA | Sample Description: | Work Order: 21H0041

Date Received: 8/2/2021

Field Sample #: CUT COMP 1 | Sampled: 7/28/2021 12:00

Sample ID: 21H0041-01

Sample Matrix: Soil

Conventional Chemistry Parameters by EPA/APHA/SW-846 Methods (Total)

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
% Solids	88.7		% Wt	1		SM 2540G	8/3/21	8/9/21 0:00	JLC

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Project Location: MA | Sample Description: | Work Order: 21H0041

Date Received: 8/2/2021

Field Sample #: CUT COMP 2 | Sampled: 7/28/2021 11:30

Sample ID: 21H0041-02

Sample Matrix: Soil

Metals Analyses (Total)

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Antimony	ND	1.8	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:48	MJH
Arsenic	8.3	3.6	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:48	MJH
Barium	27	1.8	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:48	MJH
Beryllium	0.64	0.18	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:48	MJH
Cadmium	ND	0.36	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:48	MJH
Chromium	22	0.72	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:48	MJH
Lead	5.5	0.54	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:48	MJH
Mercury	ND	0.030	mg/Kg dry	1		SW-846 7471B	8/4/21	8/5/21 12:34	CJV
Nickel	14	0.72	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:48	MJH
Selenium	ND	3.6	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:48	MJH
Silver	ND	0.36	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:48	MJH
Thallium	ND	1.8	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:48	MJH
Vanadium	20	0.72	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:48	MJH
Zinc	21	0.72	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:48	MJH

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Project Location: MA | Sample Description: | Work Order: 21H0041

Date Received: 8/2/2021

Field Sample #: CUT COMP 2 | Sampled: 7/28/2021 11:30

Sample ID: 21H0041-02

Sample Matrix: Soil

Conventional Chemistry Parameters by EPA/APHA/SW-846 Methods (Total)

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
% Solids	89.1		% Wt	1		SM 2540G	8/3/21	8/4/21 11:36	JML

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Project Location: MA | Sample Description: | Work Order: 21H0041

Date Received: 8/2/2021

Field Sample #: TOPSOIL COMP 1 | Sampled: 7/28/2021 12:02

Sample ID: 21H0041-03

Sample Matrix: Soil

Metals Analyses (Total)

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Antimony	ND	2.1	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:54	MJH
Arsenic	6.0	4.2	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:54	MJH
Barium	26	2.1	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:54	MJH
Beryllium	0.79	0.21	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:54	MJH
Cadmium	ND	0.42	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:54	MJH
Chromium	37	0.84	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:54	MJH
Lead	20	0.63	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:54	MJH
Mercury	0.053	0.037	mg/Kg dry	1		SW-846 7471B	8/4/21	8/5/21 12:36	CJV
Nickel	15	0.84	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:54	MJH
Selenium	ND	4.2	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:54	MJH
Silver	ND	0.42	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:54	MJH
Thallium	ND	2.1	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:54	MJH
Vanadium	23	0.84	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:54	MJH
Zinc	23	0.84	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 17:54	MJH

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Project Location: MA | Sample Description: | Work Order: 21H0041

Date Received: 8/2/2021

Field Sample #: TOPSOIL COMP 1 | Sampled: 7/28/2021 12:02

Sample ID: 21H0041-03

Sample Matrix: Soil

Conventional Chemistry Parameters by EPA/APHA/SW-846 Methods (Total)

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
% Solids	78.6		% Wt	1		SM 2540G	8/3/21	8/4/21 11:36	JML

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Project Location: MA | Sample Description: | Work Order: 21H0041

Date Received: 8/2/2021

Field Sample #: TOPSOIL COMP 2 | Sampled: 7/28/2021 12:15

Sample ID: 21H0041-04

Sample Matrix: Soil

Metals Analyses (Total)

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
Antimony	ND	1.9	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 18:01	MJH
Arsenic	6.0	3.9	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 18:01	MJH
Barium	26	1.9	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 18:01	MJH
Beryllium	0.59	0.19	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 18:01	MJH
Cadmium	ND	0.39	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 18:01	MJH
Chromium	18	0.78	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 18:01	MJH
Lead	49	0.58	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 18:01	MJH
Mercury	0.047	0.033	mg/Kg dry	1		SW-846 7471B	8/4/21	8/5/21 12:37	CJV
Nickel	11	0.78	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 18:01	MJH
Selenium	ND	3.9	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 18:01	MJH
Silver	ND	0.39	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 18:01	MJH
Thallium	ND	1.9	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 18:01	MJH
Vanadium	18	0.78	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 18:01	MJH
Zinc	30	0.78	mg/Kg dry	1		SW-846 6010D	8/3/21	8/4/21 18:01	MJH

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Project Location: MA | Sample Description: | Work Order: 21H0041

Date Received: 8/2/2021

Field Sample #: TOPSOIL COMP 2 | Sampled: 7/28/2021 12:15

Sample ID: 21H0041-04

Sample Matrix: Soil

Conventional Chemistry Parameters by EPA/APHA/SW-846 Methods (Total)

Analyte	Results	RL	Units	Dilution	Flag/Qual	Method	Date Prepared	Date/Time Analyzed	Analyst
% Solids	84.5		% Wt	1		SM 2540G	8/3/21	8/4/21 11:37	JML

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Sample Extraction Data

Prep Method: % Solids **Analytical Method: SM 2540G**

Lab Number [Field ID]	Batch	Date
21H0041-01 [CUT COMP 1]	B287378	08/03/21
21H0041-02 [CUT COMP 2]	B287378	08/03/21
21H0041-03 [TOPSOIL COMP 1]	B287378	08/03/21
21H0041-04 [TOPSOIL COMP 2]	B287378	08/03/21

Prep Method: SW-846 3050B **Analytical Method: SW-846 6010D**

Lab Number [Field ID]	Batch	Initial [g]	Final [mL]	Date
21H0041-01 [CUT COMP 1]	B287362	1.54	50.0	08/03/21
21H0041-02 [CUT COMP 2]	B287362	1.56	50.0	08/03/21
21H0041-03 [TOPSOIL COMP 1]	B287362	1.52	50.0	08/03/21
21H0041-04 [TOPSOIL COMP 2]	B287362	1.52	50.0	08/03/21

Prep Method: SW-846 7471 **Analytical Method: SW-846 7471B**

Lab Number [Field ID]	Batch	Initial [g]	Final [mL]	Date
21H0041-01 [CUT COMP 1]	B287480	0.522	50.0	08/04/21
21H0041-02 [CUT COMP 2]	B287480	0.565	50.0	08/04/21
21H0041-03 [TOPSOIL COMP 1]	B287480	0.518	50.0	08/04/21
21H0041-04 [TOPSOIL COMP 2]	B287480	0.535	50.0	08/04/21

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QUALITY CONTROL

Metals Analyses (Total) - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B287362 - SW-846 3050B										
Blank (B287362-BLK1)				Prepared: 08/03/21 Analyzed: 08/04/21						
Antimony	ND	1.7	mg/Kg wet							
Arsenic	ND	3.3	mg/Kg wet							
Barium	ND	1.7	mg/Kg wet							
Beryllium	ND	0.17	mg/Kg wet							
Cadmium	ND	0.33	mg/Kg wet							
Chromium	ND	0.67	mg/Kg wet							
Lead	ND	0.50	mg/Kg wet							
Nickel	ND	0.67	mg/Kg wet							
Selenium	ND	3.3	mg/Kg wet							
Silver	ND	0.33	mg/Kg wet							
Thallium	ND	1.7	mg/Kg wet							
Vanadium	ND	0.67	mg/Kg wet							
Zinc	ND	0.67	mg/Kg wet							
LCS (B287362-BS1)				Prepared: 08/03/21 Analyzed: 08/04/21						
Antimony	112	5.0	mg/Kg wet	134		83.5	1.9-200.7			
Arsenic	160	10	mg/Kg wet	170		94.4	82.9-117.6			
Barium	185	5.0	mg/Kg wet	183		101	82.5-117.5			
Beryllium	120	0.50	mg/Kg wet	116		103	83.4-116.4			
Cadmium	85.0	1.0	mg/Kg wet	89.5		95.0	82.8-117.3			
Chromium	99.7	2.0	mg/Kg wet	101		98.7	82.1-117.8			
Lead	139	1.5	mg/Kg wet	140		99.1	82.9-117.1			
Nickel	66.3	2.0	mg/Kg wet	68.3		97.1	82.1-117.7			
Selenium	161	10	mg/Kg wet	182		88.4	79.7-120.3			
Silver	51.9	1.0	mg/Kg wet	50.1		104	80.2-120			
Thallium	99.6	5.0	mg/Kg wet	87.7		114	81.1-118.6			
Vanadium	157	2.0	mg/Kg wet	153		103	79.1-120.9			
Zinc	215	2.0	mg/Kg wet	228		94.3	80.7-118.9			
LCS Dup (B287362-BSD1)				Prepared: 08/03/21 Analyzed: 08/04/21						
Antimony	102	4.9	mg/Kg wet	134		75.9	1.9-200.7	9.54	30	
Arsenic	150	9.8	mg/Kg wet	170		88.4	82.9-117.6	6.56	30	
Barium	176	4.9	mg/Kg wet	183		96.2	82.5-117.5	4.74	20	
Beryllium	114	0.49	mg/Kg wet	116		98.0	83.4-116.4	5.09	30	
Cadmium	80.8	0.98	mg/Kg wet	89.5		90.2	82.8-117.3	5.15	20	
Chromium	93.7	2.0	mg/Kg wet	101		92.7	82.1-117.8	6.20	30	
Lead	128	1.5	mg/Kg wet	140		91.7	82.9-117.1	7.76	30	
Nickel	63.6	2.0	mg/Kg wet	68.3		93.0	82.1-117.7	4.22	30	
Selenium	152	9.8	mg/Kg wet	182		83.3	79.7-120.3	5.97	30	
Silver	48.6	0.98	mg/Kg wet	50.1		97.1	80.2-120	6.52	30	
Thallium	94.7	4.9	mg/Kg wet	87.7		108	81.1-118.6	4.97	30	
Vanadium	147	2.0	mg/Kg wet	153		96.3	79.1-120.9	6.35	30	
Zinc	204	2.0	mg/Kg wet	228		89.3	80.7-118.9	5.42	30	

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QUALITY CONTROL

Metals Analyses (Total) - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD		RPD Limit	Notes
Batch B287362 - SW-846 3050B											
Reference (B287362-SRM1)				Prepared: 08/03/21 Analyzed: 08/04/21							
Lead	0.541	0.48	mg/Kg wet	0.484		112	80-120				
Batch B287480 - SW-846 7471											
Blank (B287480-BLK1)				Prepared: 08/04/21 Analyzed: 08/05/21							
Mercury	ND	0.025	mg/Kg wet								
LCS (B287480-BS1)				Prepared: 08/04/21 Analyzed: 08/05/21							
Mercury	15.1	0.74	mg/Kg wet	15.6		96.7	59.3-140.4				
LCS Dup (B287480-BSD1)				Prepared: 08/04/21 Analyzed: 08/05/21							
Mercury	18.9	0.75	mg/Kg wet	15.6		121	59.3-140.4	**22.2**	*	20	R-05

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QUALITY CONTROL

Conventional Chemistry Parameters by EPA/APHA/SW-846 Methods (Total) - Quality Control

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch B287378 - % Solids										
Duplicate (B287378-DUP1)	**Source: 21H0041-03**			Prepared: 08/03/21 Analyzed: 08/04/21						
% Solids	79.5		% Wt		78.6			1.07	5	
Duplicate (B287378-DUP2)	**Source: 21H0041-04**			Prepared: 08/03/21 Analyzed: 08/04/21						
% Solids	85.2		% Wt		84.5			0.903	5	

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FLAG/QUALIFIER SUMMARY

*	QC result is outside of established limits.
†	Wide recovery limits established for difficult compound.
‡	Wide RPD limits established for difficult compound.
#	Data exceeded client recommended or regulatory level
ND	Not Detected
RL	Reporting Limit is at the level of quantitation (LOQ)
DL	Detection Limit is the lower limit of detection determined by the MDL study
MCL	Maximum Contaminant Level
	Percent recoveries and relative percent differences (RPDs) are determined by the software using values in the calculation which have not been rounded.
	No results have been blank subtracted unless specified in the case narrative section.
R-05	Laboratory fortified blank duplicate RPD is outside of control limits. Reduced precision is anticipated for any reported value for this compound.

con-test® A Pace Analytical® Laboratory

39 Spruce Street * East Longmeadow, MA 01028 * FAX 413/525-6405 * TEL. 413/525-2332

CERTIFICATIONS

Certified Analyses included in this Report

Analyte	Certifications
SW-846 6010D in Soil	
Antimony	CT,NH,NY,ME,VA,NC
Arsenic	CT,NH,NY,ME,VA,NC
Barium	CT,NH,NY,ME,VA,NC
Beryllium	CT,NH,NY,ME,VA,NC
Cadmium	CT,NH,NY,ME,VA,NC
Chromium	CT,NH,NY,ME,VA,NC
Lead	CT,NH,NY,AIHA,ME,VA,NC
Nickel	CT,NH,NY,ME,VA,NC
Selenium	CT,NH,NY,ME,VA,NC
Silver	CT,NH,NY,ME,VA,NC
Thallium	CT,NH,NY,ME,VA,NC
Vanadium	CT,NH,NY,ME,VA,NC
Zinc	CT,NH,NY,ME,VA,NC
SW-846 7471B in Soil	
Mercury	CT,NH,NY,NC,ME,VA

Con-Test, a Pace Environmental Laboratory, operates under the following certifications and accreditations:

Code	Description	Number	Expires
AIHA	AIHA-LAP, LLC - ISO17025:2017	100033	03/1/2022
MA	Massachusetts DEP	M-MA100	06/30/2022
CT	Connecticut Department of Publilc Health	PH-0165	12/31/2022
NY	New York State Department of Health	10899 NELAP	04/1/2022
NH-S	New Hampshire Environmental Lab	2516 NELAP	02/5/2022
RI	Rhode Island Department of Health	LAO00112	12/30/2021
NC	North Carolina Div. of Water Quality	652	12/31/2021
NJ	New Jersey DEP	MA007 NELAP	06/30/2022
FL	Florida Department of Health	E871027 NELAP	06/30/2022
VT	Vermont Department of Health Lead Laboratory	LL720741	07/30/2022
ME	State of Maine	MA00100	06/9/2023
VA	Commonwealth of Virginia	460217	12/14/2021
NH-P	New Hampshire Environmental Lab	2557 NELAP	09/6/2021
VT-DW	Vermont Department of Health Drinking Water	VT-255716	06/12/2022
NC-DW	North Carolina Department of Health	25703	07/31/2022
PA	Commonwealth of Pennsylvania DEP	68-05812	06/30/2022
MI	Dept. of Env, Great Lakes, and Energy	9100	09/6/2021

ALPHA ANALYTICAL — World Class Chemistry

21H00491

Subcontract Chain of Custody

Con-Test Analytical Laboratory
39 Spruce St
East Longmeadow, MA 01028

Alpha Job Number
L2140490

Client Information

Client: Alpha Analytical Labs
Address: Eight Walkup Drive
Westborough, MA 01581-1019

Phone: 508.439.5170
Email: nlewis@alphalab.com

Project Information

Project Location: MA
Project Manager: Nathalie Lewis

Turnaround & Deliverables Information

Due Date:
Deliverables:

Regulatory Requirements/Report Limits

State/Federal Program: MA-MCP

Regulatory Criteria:

Project Specific Requirements and/or Report Requirements

Reference following Alpha Job Number on final report/deliverables: L2140490

Report to include Method Blank, LCS/LCSD:

Additional Comments: Send all results/reports to subreports@alphalab.com

Lab ID	Client ID	Collection Date/Time	Sample Matrix	Analysis	Batch QC
1	CUT COMP 1	07-28-21 12:00	SOIL	MCP 14 List of Metals	
2	CUT COMP 2	07-28-21 11:30	SOIL	MCP 14 List of Metals	
3	TOPSOIL COMP 1	07-28-21 12:02	SOIL	MCP 14 List of Metals	
4	TOPSOIL COMP 2	07-28-21 12:15	SOIL	MCP 14 List of Metals	

	Relinquished By:	Date/Time:	Received By:	Date/Time:
	[signature]	08/02/21	[signature]	8/2/21 1040
	[signature]	8/2/21 1410	[signature]	8/2/21 1410
Form No: AL_subcoc				

Serial_No:08092118:04
Table of Contents

I Have Not Confirmed Sample Container Numbers With Lab Staff Before Relinquishing Over Samples_____

con-test® ANALYTICAL LABORATORY

Doc# 277 Rev 5 2017

Login Sample Receipt Checklist - (Rejection Criteria Listing - Using Acceptance Policy) Any False Statement will be brought to the attention of the Client - State True or False

Client Alpha

Received By _____ Date 8/2/21 Time 1410

How were the samples received? In Cooler T No Cooler _____ On Ice T No Ice _____ Direct from Sampling _____ Ambient _____ Melted Ice _____

Were samples within Temperature? 2-6°C T By Gun # 3 Actual Temp - 2.9 By Blank # _____ Actual Temp - _____

Was Custody Seal Intact? n/a Were Samples Tampered with? n/a

Was COC Relinquished ? T Does Chain Agree With Samples? T

Are there broken/leaking/loose caps on any samples? F

Is COC in ink/ Legible? T Were samples received within holding time? T

Did COC include all pertinent Information? Client T Analysis T Sampler Name T Project T ID's T Collection Dates/Times T

Are Sample labels filled out and legible? T

Are there Lab to Filters? F Who was notified? _____

Are there Rushes? F Who was notified? _____

Are there Short Holds? F Who was notified? _____

Is there enough Volume? T

Is there Headspace where applicable? n/a MS/MSD? F

Proper Media/Containers Used? T Is splitting samples required? F

Were trip blanks received? F On COC? F

Do all samples have the proper pH? Acid n/a Base n/a

Vials	#	Containers:	#		#		#
Unp-		1 Liter Amb.		1 Liter Plastic		16 oz Amb.	
HCL-		500 mL Amb.		500 mL Plastic		8oz Amb/Clear	
Meoh-		250 mL Amb.		250 mL Plastic		4oz Amb/Clear	
Bisulfate-		Flashpoint		Col./Bacteria		2oz Amb/Clear	4
DI-		Other Glass		Other Plastic		Encore	
Thiosulfate-		SOC Kit		Plastic Bag		Frozen:	
Sulfuric-		Perchlorate		Ziplock			

Unused Media

Vials	#	Containers:	#		#		#
Unp-		1 Liter Amb.		1 Liter Plastic		16 oz Amb.	
HCL-		500 mL Amb.		500 mL Plastic		8oz Amb/Clear	
Meoh-		250 mL Amb.		250 mL Plastic		4oz Amb/Clear	
Bisulfate-		Col./Bacteria		Flashpoint		2oz Amb/Clear	
DI-		Other Plastic		Other Glass		Encore	
Thiosulfate-		SOC Kit		Plastic Bag		Frozen:	
Sulfuric-		Perchlorate		Ziplock			

Comments:

MADEP MCP Analytical Method Report Certification Form

Laboratory Name: Con-Test, a Pace Analytical Laboratory	Project #: 21H0041
Project Location: MA	RTN:

This Form provides certifications for the following data set: [list Laboratory Sample ID Number(s)]

21H0041-01 thru 21H0041-04

Matrices: Soil

CAM Protocol (check all that below)

8260 VOC CAM II A ( )	7470/7471 Hg CAM IIIB (X)	MassDEP VPH CAM IV A ( )	8082 PCB CAM V A ( )	9014 Total Cyanide/PAC CAM VI A ( )	6860 Perchlorate CAM VIII B ( )
8270 SVOC CAM II B ( )	7010 Metals CAM III C ( )	MassDEP VPH CAM IV C ( )	8081 Pesticides CAM V B ( )	7196 Hex Cr CAM VI B ( )	MassDEP APH CAM IX A ( )
6010 Metals CAM III A (X)	6020 Metals CAM III D ( )	MassDEP EPH CAM IV B ( )	8151 Herbicides CAM V C ( )	8330 Explosives CAM VIII A ( )	TO-15 VOC CAM IX B ( )

Affirmative response to Questions A throughF is required for "Presumptive Certainty" status

A	Were all samples received in a condition consistent with those described on the Chain-of-Custody, properly preserved (including temperature) in the field or laboratory, and prepared/analyzed within method holding times?	☑ Yes	☐ No[1]
B	Were the analytical method(s) and all associated QC requirements specificed in the selected CAM protocol(s) followed?	☑ Yes	☐ No[1]
C	Were all required corrective actions and analytical response actions specified in the selected CAM protocol(s) implemented for all identified performance standard non-conformances?	☑ Yes	☐ No[1]
D	Does the laboratory report comply with all the reporting requirements specified in CAM VII A, Quality Assurance and Quality Control Guidlines for the Acquisition and Reporting of Analytical Data?	☑ Yes	☐ No[1]
E a	VPH, EPH, and APH Methods only: Was each method conducted without significant modification(s)? (Refer to the individual method(s) for a list of significant modifications).	☐ Yes	☐ No[1]
E b	APH and TO-15 Methods only: Was the complete analyte list reported for each method?	☐ Yes	☐ No[1]
F	Were all applicable CAM protocol QC and performance standard non-conformances identified and evaluated in a laboratory narrative (including all No responses to Qestions A through E)?	☑ Yes	☐ No[1]
	A response to questions G, H and I below is required for "Presumptive Certainty" status		
G	Were the reporting limits at or below all CAM reporting limits specified in the selected CAM protocol(s)?	☑ Yes	☐ No[1]
	<u>Data User Note:</u> Data that achieve "Presumptive Certainty" status may not necessarily meet the data usability and representativeness requirements described in 310 CMR 40. 1056 (2)(k) and WSC-07-350.		
H	Were all QC perfomance standards specified in the CAM protocol(s) achieved?	☐ Yes	☑ No[1]
I	Were results reported for the complete analyte list specified in the selected CAM protocol(s)?	☑ Yes	☐ No[1]

[1] *All Negative responses must be addressed in an attached Environmental Laboratory case narrative.*

I, the undersigned, attest under the pains and penalties of perjury that, based upon my personal inquiry of those responsible for obtaining the information, the material contained in this analytical report is, to the best of my knowledge and belief, accurate and complete.

Signature: Lisa Worthington Position: Technical Representative

Printed Name: Lisa A. Worthington Date: 08/09/21

Appendix G: Illicit Discharge Compliance Statement

SMMA

Illicit Discharge Compliance Statement

Responsibility:

The Owner is responsible for ultimate compliance with all provisions of the Massachusetts Stormwater Management Policy, the US EPA NPDES Construction General Permit and responsible for identifying and eliminating illicit discharges (as defined by US EPA).

Owner: Town of Andover

Address: 36 Bartlet Street

Andover, MA 01810

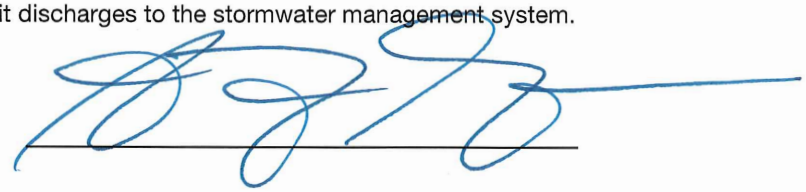
Phone: 978-623-8210

Owner's Compliance Statement:

To the best of my knowledge, the attached plans, computations and specifications meet the requirements of Standard 10 of the Massachusetts Stormwater Handbook regarding illicit discharges to the stormwater management system and that no detectable illicit discharges exist on the site. All documents and attachments were prepared under my direction and qualified personnel gathered and evaluated the information submitted, to the best of my knowledge.

Included with this statement are site plans, drawn to scale, that identify the location of systems for conveying stormwater on the site and show that these systems do not allow the entry of any illicit discharges into the stormwater management system. The plans also show any systems for conveying wastewater and/or groundwater on the site and show that there are no connections between the stormwater and wastewater systems.

The Owner has taken all actions to identify and remove illicit discharges, including visual screening, and removed any sources of illicit discharges to the stormwater management system.

Signature: 

Appendix H: Stormwater Pollution Prevention Plan (Draft—in progress)

Stormwater Pollution Prevention Plan (SWPPP)

For Construction Activities At:

West Elementary School
58 Beacon Street
Andover, MA 01810

SWPPP Prepared For:

Town of Andover
36 Bartlet Street
Andover, MA 01810

SWPPP Prepared By:

Symmes, Maini & McKee Associates, Inc.
1000 Massachusetts Avenue
Cambridge, MA 02138
617-547-5400

SWPPP Preparation Date:

12/07/2021

Estimated Project Dates:

Project Start Date: [EST] 4/18/2022

Project Completion Date: [EST] 09/01/2025

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SECTION 1: CONTACT INFORMATION/RESPONSIBLE PARTIES

1.1 Operator(s) / Subcontractor(s)

Operator(s):

Operator & Subcontractors TBD

Emergency 24-Hour Contact: TBD

1.2 Stormwater Team

The following individual(s) at SMMA have developed the SWPPP and will work with the contractor to modify the SWPPP as conditions warrant.

Erin Prestileo, PE
Civil Engineering
617-547-5400
eprestileo@smma.com

The following individual(s) with the General Contractor is responsible for installing, maintaining and inspecting stormwater controls, and implementing modifications to the SWPPP.

General Contractor TBD

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SECTION 2: SITE EVALUATION, ASSESSMENT, AND PLANNING

2.1 Project/Site Information

Project Name and Address

Project/Site Name: West Elementary and Shawsheen Preschool
Project Street/Location: 58 Beacon Street
City: Andover
State: Massachusetts
ZIP Code: 01810

Project Latitude/Longitude

Latitude: __ __. __ __ __ __° N (decimal degrees)

Longitude: __ __. __ __ __ __ °W (decimal degrees)

Latitude/longitude data source:

☐ Map ☐ GPS ☐ Other (please specify):

Horizontal Reference Datum:

☐ NAD 27 ☐ NAD 83 ☐ WGS 84

Additional Project Information

Are you requesting permit coverage as a "federal operator" as defined in Appendix A of the 2017 CGP? ☐ Yes ☒ No

Is the project/site located on Indian country lands, or located on a property of religious or cultural significance to an Indian tribe? ☐ Yes ☒ No

2.2 Discharge Information

Does your project/site discharge stormwater into a Municipal Separate Storm Sewer System (MS4)? ☒ Yes ☐ No

Are there any waters of the U.S. within 50 feet of your project's earth disturbances? ☐ Yes ☐ No

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For each point of discharge, provide a point of discharge ID (a unique 3-digit ID, e.g., 001, 002), the name of the first water of the U.S. that receives stormwater directly from the point of discharge and/or from the MS4 that the point of discharge discharges to, and the following receiving water information, if applicable:								
Point of Discharge ID	Name of receiving water:	Is the receiving water impaired (on the CWA 303(d) list)?	If yes, list the pollutants that are causing the impairment:	Has a TMDL been completed for this receiving waterbody?	If yes, list TMDL Name and ID:	Pollutant(s) for which there is a TMDL:	Is this receiving water designated as a Tier 2, Tier 2.5, or Tier 3 water?	If yes, specify which Tier (2, 2.5, or 3)?
[001]		☐ Yes ☐ No		☐ Yes ☐ No			☐ Yes ☐ No	[INSERT "Tier 2", "Tier 2.5", or "Tier 3"]
[002]		☐ Yes ☐ No		☐ Yes ☐ No			☐ Yes ☐ No	[INSERT "Tier 2", "Tier 2.5", or "Tier 3"]
[003]		☐ Yes ☐ No		☐ Yes ☐ No			☐ Yes ☐ No	[INSERT "Tier 2", "Tier 2.5", or "Tier 3"]
[004]		☐ Yes ☐ No		☐ Yes ☐ No			☐ Yes ☐ No	[INSERT "Tier 2", "Tier 2.5", or "Tier 3"]
[005]		☐ Yes ☐ No		☐ Yes ☐ No			☐ Yes ☐ No	[INSERT "Tier 2", "Tier 2.5", or "Tier 3"]
[006]		☐ Yes ☐ No		☐ Yes ☐ No			☐ Yes ☐ No	[INSERT "Tier 2", "Tier 2.5", or "Tier 3"]

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2.3 Nature of the Construction Activities

General Description of Project

The project proposes…

Size of Construction Site

Size of Property	x acres
Total Area Expected to be Disturbed by Construction Activities	x acres
Maximum Area Expected to be Disturbed at Any One Time	x acres

Type of Construction Site *(check all that apply)*:

☐ Single-Family Residential ☐ Multi-Family Residential ☐ Commercial ☐ Industrial

☐ Institutional ☐ Highway or Road ☐ Utility ☐ Other _____

Will there be demolition of any structure built or renovated before January 1, 1980? ☐ Yes ☐ No

If yes, do any of the structures being demolished have at least 10,000 square feet of floor space? ☐ Yes ☐ No ☐ N/A

Was the pre-development land use used for agriculture (see Appendix A for definition of "agricultural land")? ☐ Yes ☐ No

Pollutant-Generating Activities

List and describe all pollutant-generating activities and indicate for each activity the type of pollutant that will be generated. Take into account where potential spills and leaks could occur that contribute pollutants to stormwater discharges, and any known hazardous or toxic substances, such as PCBs and asbestos, that will be disturbed during construction.

Pollutant-Generating Activity (e.g., paving operations; concrete, paint, and stucco washout and waste disposal; solid waste storage and disposal; and dewatering operations)	**Pollutants or Pollutant Constituents** (e.g., sediment, fertilizers, pesticides, paints, caulks, sealants, fluorescent light ballasts, contaminated substrates, solvents, fuels)
TBD	TBD

[Include additional rows or delete as necessary.]

Construction Support Activities *(only provide if applicable)*

Describe any construction support activities for the project (e.g., concrete or asphalt batch plants, equipment staging yards, material storage areas, excavated material disposal areas, borrow areas):

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INSERT DESCRIPTION OF CONSTRUCTION SUPPORT ACTIVITY

Contact information for construction support activity:
Contact info TBD

[Repeat as necessary.]

2.4 Sequence and Estimated Dates of Construction Activities

Instructions (see CGP Part 7.2.5):

- Describe the intended construction sequence and duration of major activities.
- For each portion or phase of the construction site, include the following:
  - ✓ Commencement and duration of construction activities, including clearing and grubbing, mass grading, demolition activities, site preparation (i.e., excavating, cutting and filling), final grading, and creation of soil and vegetation stockpiles requiring stabilization;
  - ✓ Temporary or permanent cessation of construction activities;
  - ✓ Temporary or final stabilization of areas of exposed soil. The dates for stabilization must reflect the applicable deadlines to which you are subject to in Part 2.2.14; and
  - ✓ Removal of temporary stormwater controls and construction equipment or vehicles, and cessation of any pollutant-generating activities.
- The construction sequence must reflect the following requirements:
  - ✓ Part 2.1.3 (installation of stormwater controls); and
  - ✓ Parts 2.2.14 (stabilization deadlines).

Phase I

INSERT GENERAL DESCRIPTION OF PHASE	
Estimated Start Date of Construction Activities for this Phase	TBD
Estimated End Date of Construction Activities for this Phase	TBD
Estimated Date(s) of Application of Stabilization Measures for Areas of the Site Required to be Stabilized	TBD
Estimated Date(s) when Stormwater Controls will be Removed	TBD

2.5 Authorized Non-Stormwater Discharges

List of Authorized Non-Stormwater Discharges Present at the Site

Type of Authorized Non-Stormwater Discharge	Likely to be Present at Your Site?
Discharges from emergency fire-fighting activities	☐ Yes ☐ No
Fire hydrant flushings	☐ Yes ☐ No
Landscape irrigation	☐ Yes ☐ No

Waters used to wash vehicles and equipment	☐ Yes ☐ No
Water used to control dust	☐ Yes ☐ No
Potable water including uncontaminated water line flushings	☐ Yes ☐ No
External building washdown (soaps/solvents are not used and external surfaces do not contain hazardous substances)	☐ Yes ☐ No
Pavement wash waters	☐ Yes ☐ No
Uncontaminated air conditioning or compressor condensate	☐ Yes ☐ No
Uncontaminated, non-turbid discharges of ground water or spring water	☐ Yes ☐ No
Foundation or footing drains	☐ Yes ☐ No
Construction dewatering water	☐ Yes ☐ No

(Note: You are required to identify the likely locations of these authorized non-stormwater discharges on your site map. See Section 2.6, below, of the SWPPP Template.)

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2.6 Site Maps

Instructions (see CGP Part 7.2.4):

- Attach site maps in Appendix A of the Template. For most projects, a series of site maps is necessary and recommended. The first should show the undeveloped site and its current features. An additional map or maps should be created to show the developed site or, for more complicated sites, show the major phases of development.

These maps must include the following features:

- Boundaries of the property and of the locations where construction will occur, including:
  - ✓ Locations where earth-disturbing activities will occur, noting any phasing of construction activities and any demolition activities;
  - ✓ Approximate slopes before and after major grading activities. Note areas of steep slopes, as defined in CGP Appendix A;
  - ✓ Locations where sediment, soil, or other construction materials will be stockpiled;
  - ✓ Locations of any crossings of waters of the U.S.;
  - ✓ Designated points where vehicles will exit onto paved roads;
  - ✓ Locations of structures and other impervious surfaces upon completion of construction; and
  - ✓ Locations of on-site and off-site construction support activity areas covered by this permit (see Part 1.2.1.c).
- Locations of all waters of the U.S., including wetlands, on your site and within one mile downstream of the site's discharge point. Indicate which waterbodies are listed as impaired, and which are identified by your state, tribe, or EPA as Tier 2, Tier 2.5, or Tier 3 waters.
- Areas of federally-listed critical habitat for endangered or threatened species within the site and/or at discharge locations.
- Type and extent of pre-construction cover on the site (e.g., vegetative cover, forest, pasture, pavement, structures)
- Drainage pattern(s) of stormwater and authorized non-stormwater before and after major grading activities.
- Stormwater and authorized non-stormwater discharge locations, including:
  - ✓ Locations where stormwater and/or authorized non-stormwater will be discharged to storm drain inlets; and
  - ✓ Locations where stormwater or allowable non-stormwater will be discharged to waters of the U.S. (including wetlands).
- Locations of all potential pollutant-generating activities.
- Locations of stormwater controls, including natural buffer areas and any shared controls utilized to comply with the permit.
- Locations where polymers, flocculants, or other treatment chemicals will be used and stored.

SECTION 3: DOCUMENTATION OF COMPLIANCE WITH OTHER FEDERAL REQUIREMENTS

3.1 Endangered Species Protection

Eligibility Criterion

Under which criterion listed in Appendix D are you eligible for coverage under this permit?

☐ **Criterion A**: No ESA-listed species and/or designated critical habitat present in action area. Using the process outlined in Appendix D of this permit, you certify that ESA-listed species and designated critical habitat(s) under the jurisdiction of the USFWS or NMFS are not likely to occur in your site's "action area" as defined in Appendix A of this permit.

Basis statement content/Supporting documentation: A basis statement supporting the selection of Criterion A should identify the USFWS and NMFS information sources used. Attaching aerial image(s) of the site to your NOI is helpful to EPA, USFWS, and NMFS in confirming eligibility under this criterion. Please Note: NMFS' jurisdiction includes ESA-listed marine and estuarine species that spawn in inland rivers. Check the applicable source(s) of information you relied upon:

- ☐ Specific communication with staff of the USFWS and/or NMFS. INSERT DATE OF COMMUNICATION AND WHO YOU SPOKE WITH
- ☐ Species list from USFWS and/or NMFS. See the CGP ESA webpage, Step 2 for available websites. INSERT SPECIFIC DOCUMENT AND/OR WEBSITE RELIED UPON

3.2 Historic Preservation

Appendix E, Step 1

Do you plan on installing any of the following stormwater controls at your site? Check all that apply below, and proceed to Appendix E, Step 2.

- ☐ Dike
- ☐ Berm
- ☐ Catch Basin
- ☐ Pond
- ☐ Stormwater Conveyance Channel (e.g., ditch, trench, perimeter drain, swale, etc.)
- ☐ Culvert
- ☐ Other type of ground-disturbing stormwater control: Precast concrete subsurface infiltration system.

(Note: If you will not be installing any ground-disturbing stormwater controls, no further documentation is required for Section 3.2 of the Template.)

Appendix E, Step 2

If you answered yes in Step 1, have prior surveys or evaluations conducted on the site already determined that historic properties do not exist, or that prior disturbances at the site have precluded the existence of historic properties? ☒ YES ☐ NO

- If yes, no further documentation is required for Section 3.2 of the Template.
- If no, proceed to Appendix E, Step 3.

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Appendix E, Step 3

If you answered no in Step 2, have you determined that your installation of subsurface earth-disturbing stormwater controls will have no effect on historic properties? ☐ YES ☐ NO

3.3 Safe Drinking Water Act Underground Injection Control Requirements

Do you plan to install any of the following controls? Check all that apply below.

☐ Infiltration trenches (if stormwater is directed to any bored, drilled, driven shaft or dug hole that is deeper than its widest surface dimension, or has a subsurface fluid distribution system)

☐ Commercially manufactured pre-cast or pre-built proprietary subsurface detention vaults, chambers, or other devices designed to capture and infiltrate stormwater flow

☐ Drywells, seepage pits, or improved sinkholes (if stormwater is directed to any bored, drilled, driven shaft or dug hole that is deeper than its widest surface dimension, or has a subsurface fluid distribution system)

IF YES, INSERT COPIES OF LETTERS, EMAILS, OR OTHER COMMUNICATION BETWEEN YOU AND THE STATE AGENCY OR EPA REGIONAL OFFICE

DRAFT

SECTION 4: EROSION AND SEDIMENT CONTROLS

4.1 Natural Buffers or Equivalent Sediment Controls

Buffer Compliance Alternatives

There are/are not surface waters within 50 feet of the project's earth disturbances.

4.2 Perimeter Controls

General Description

Several perimeter control practices will be installed adjacent to resource areas, down gradient of the limit of work, and where run on occurs from adjacent sites to provide a perimeter to control overland flow.

Specific Perimeter Controls

Perimeter Control # 1: Siltation Fence

Perimeter Control Description and Specifications

- A siltation fence will be installed adjacent to resource areas and in areas down gradient of the limit of work prior to the start of any earthwork. No construction activities will occur down gradient of the siltation barrier.
- The fence material shall be Mirafi #100 Sediment Control Fence, Trevira 1127, or an approved equal. The fence should be keyed into the ground a minimum of 6-inches. Refer to the detail provided in the attached plan set.
- The drainage area should be limited to ¼ acre per 100 feet of fence and no more than 1.5 acres in total. The fence will be located at least 10-feet from the toe of steep slopes to provide storage for sediment and access for cleanout. While most of the fence line should be level, the last 10 to 20 feet of the barrier should be slightly uphill. Stabilized outlets may be required for bypass flow.

Installation Date: Prior to all earth disturbances

Maintenance Requirements

- Sediment will be removed before it has accumulated to one-half of the above-ground height of the siltation barrier.
- If any damage or improper installation is observed during periodic inspections, the perimeter control should be repaired in accordance with corrective action requirements.

Perimeter Control # 2: Straw or Hay Bale Barrier

Perimeter Control Description and Specifications

- A temporary sediment barrier consisting of a row of anchored straw bales will be installed adjacent to in areas down gradient of the limit of work prior to the start of any earthwork. No construction activities will occur down gradient of the barrier.
- Straw bales should be placed along level ground in a single row and entrenched a depth of 4-inches. Each bale should be secured with two stakes.

Installation Date: Prior to all earth disturbances

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Maintenance Requirements

- Sediment will be removed before it has accumulated to one-half of the above-ground height of the perimeter control.
- If any damage or improper installation is observed during periodic inspections, the perimeter control should be repaired in accordance with corrective action requirements.

4.3 Sediment Track-Out

General Description

Construction vehicles will be restricted to exit the construction areas at one point for each phase of construction, where proper sediment track-out control will be placed.

Specific Track-Out Controls

Track-Out Control # 1: Stabilized Construction Entrance

Track-Out Control Description and Specifications

- A stabilized construction entrance will be installed at each exit point from the construction area.
- The construction entrance shall consist of 6-inch thick 1 to 3-inch stone, with minimum dimensions of 10 feet wide and 50 feet long. A geotextile filter fabric will be placed between the stone and the underlying soil to prevent soil migration. Refer to the location and detail in the attached plan set in Appendix A.
- The stabilized construction entrance will also serve as a truck wash area when site conditions warrant. Runoff from the wash down procedures will flow onto the construction site and be directed to a sediment control device.

Installation Date: Prior to any trucking activity

Maintenance Requirements

- Where sediment has been tracked-out from the site onto the surface of off-site streets, other paved areas, and sidewalks, the deposited sediment will be removed by the end of the same work day in which the track-out occurs, or by the end of the next work day if track-out occurs on a non-work day. The track-out will be removed by sweeping, shoveling, or vacuuming these surfaces, or by using other similarly effective means of sediment removal. Sediment will not be hosed or swept into any stormwater conveyance (unless it is connected to a sediment basin, sediment trap, or similarly effective control), storm drain inlet, or surface water.
- When gravel begins to clog the construction entrance, the pad will be top-dressed with new stone or replaced completely.
- If any damage or improper installation is observed during periodic site inspections, the stabilized construction entrance should be repaired in accordance with corrective action requirements.

4.4 Stockpiled Sediment or Soil

General Description

Sediment or soil stock piles will be located in the construction area upgradient of stormwater runoff flows to the extent possible. The following controls will also be implemented to minimize erosion of stockpiles.

Specific Stockpile Controls

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Stockpile Control # 1: Straw Bales and Siltation Fence

Stockpiled Sediment/Soil Control Description and Specifications

- A straw bale and siltation fence barrier will be installed around the perimeter of any sediment or soil stockpile area to prevent runoff from eroding the stockpile.
- The fence material shall be Mirafi #100 Sediment Control Fence, Trevira 1127, or an approved equal. The fence should be keyed into the ground a minimum of 6-inches. Refer to the detail provided in the attached plan set.
- Straw bales should be placed along level ground in a single row and entrenched a depth of 4-inches. Each bale should be secured with two stakes.

Installation Date: As needed

Maintenance Requirements

- Sediment will be removed before it has accumulated to one-half of the above-ground height of the perimeter control.
- If any damage or improper installation is observed during periodic inspections, the perimeter control should be repaired in accordance with corrective action requirements.
- Soil or sediment accumulated on pavement or other impervious surfaces will not be hosed or swept into any stormwater conveyance (unless connected to a sediment basin, sediment trap, or similarly effective control), storm drain inlet, or surface water.

Stockpile Control # 2: Vegetative Stabilization

Stockpiled Sediment/Soil Control Description and Specifications

- Stockpiles of sediment or soil stored for a period longer than 14 days will be stabilized by seeding with uniform vegetation
- The seed mixture and application rate will consist of one of the following:
    - Annual Rye (Lolium multiflorum) with a minimum 90 percent germination rate, 95 percent purity, and applied at 160 lbs/acre. Annual Rye spring seeding will be completed between April 15 and June 1, and the fall seeding will be completed between September 1 and October 15.
    - Winter Rye (Secale cereale) with a minimum 90 percent germination rate, 95 percent purity and applied at 200 lbs/acre. Winter Rye fall seeding will be completed between September 1 and December 15.

Installation Date: As needed

Maintenance Requirements

- If any damage or improper installation is observed during periodic inspections, the perimeter control should be repaired in accordance with corrective action requirements.
- Soil or sediment accumulated on pavement or other impervious surfaces will not be hosed or swept into any stormwater conveyance (unless connected to a sediment basin, sediment trap, or similarly effective control), storm drain inlet, or surface water.

Stockpile Control # 3: Erosion Control Blankets

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Stockpiled Sediment/Soil Control Description and Specifications

- Erosion control blankets will be used to cover stockpiled sediment and soil to prevent erosion.
- Erosion control blakets shall consist of straw (0.35 lb./sq. yd.) and coconut fibers (0.15 lb./sq. yd) sewn with cotton biodegradable thread between two UV-stabilized nets such as North American Green SC 150, or an approved equal.

Installation Date: As needed

Maintenance Requirements

- If any damage or improper installation is observed during periodic inspections, the erosion control blanket should be repaired or replaced in accordance with corrective action requirements.
- Soil or sediment accumulated on pavement or other impervious surfaces will not be hosed or swept into any stormwater conveyance (unless connected to a sediment basin, sediment trap, or similarly effective control), storm drain inlet, or surface water.

4.5 Minimize Dust

General Description

Several strategies will be employed on the project site to miminize dust migration.

Specific Dust Controls

Dust Control # 1: Spraying

Dust Control Description and Specifications

- Water will be applied to exposed soil surfaces such as construction roadways to minimize the generatioin of dust from the construction area.
- Excessive water use should be avoided to reduce the risk of creating a runoff problem.
- Spraying should be conducted as directed by the person responsible for inspections as noted in Section 6.1 or the General Contractor.

Installation Date: As needed

Maintenance Requirements

- Respray area as necessary to keep dust to a minimum.

Dust Control # 2: Sediment Fence

Dust Control Description and Specifications

- A chain link fence with filter fabric will be used around the site perimeter to prevent soil from blowing offsite.

Installation Date: As needed

Maintenance Requirements

- If any damage or improper installation is observed during periodic inspections, the sediment fence should be repaired in accordance with corrective action requirements.

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4.6 Minimize the Disturbance of Steep Slopes

General Description

The disturbance of steep slopes (greater than 15%) will be minimized as much as practicable. Disturbed slopes will be stabilized as noted below.

Specific Steep Slope Controls

Steep Slope Control # 1: Erosion Control Blankets

Steep Slope Control Description and Specifications

- Erosion control blankets will be installed immediately whenever earth-disturbing activities have permanently or temporarily ceased (i.e. where construction will not resume for a period of 14 calendar days or more) on any portion of the site.
- Erosion control blakets shall consist of straw (0.35 lb./sq. yd.) and coconut fibers (0.15 lb./sq. yd) sewn with cotton biodegradable thread between two UV-stabilized nets such as North American Green SC 150, or an approved equal.

Installation Date: As needed

Maintenance Requirements

- If any damage or improper installation is observed during periodic inspections, the erosion control blanket should be repaired or replaced in accordance with corrective action requirements.

Stockpile Control # 2: Vegetative Stabilization

Stockpiled Sediment/Soil Control Description and Specifications

- Stockpiles of sediment or soil stored for a period longer than 14 days will be stabilized by seeding with uniform vegetation.
- The seed mixture and application rate will consist of one of the following:
    - Annual Rye (Lolium multiflorum) with a minimum 90 percent germination rate, 95 percent purity, and applied at 160 lbs/acre. Annual Rye spring seeding will be completed between April 15 and June 1, and the fall seeding will be completed between September 1 and October 15.
    - Winter Rye (Secale cereale) with a minimum 90 percent germination rate, 95 percent purity and applied at 200 lbs/acre. Winter Rye fall seeding will be completed between September 1 and December 15.

Installation Date: As needed

Maintenance Requirements

- If any damage or improper installation is observed during periodic inspections, the perimeter control should be repaired in accordance with corrective action requirements.
- Soil or sediment accumulated on pavement or other impervious surfaces will not be hosed or swept into any stormwater conveyance (unless connected to a sediment basin, sediment trap, or similarly effective control), storm drain inlet, or surface water.

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4.7 Topsoil

General Description

Topsoil will be preserved on site as much as practicable. Sod and grass will be removed before stripping topsoil. Topsoil will then be stripped to whatever depth is encountered in a manner to prevent intermingling with underlying soils and stockpiled on-site.

Specific Topsoil Controls

Topsoil Control # 1: Vegetative Stabilization

Topsoil Control Description and Specifications

- Stockpiles of top soil will be stabilized by seeding with uniform vegetation.
- The seed mixture and application rate will consist of one of the following:
    - Annual Rye (Lolium multiflorum) with a minimum 90 percent germination rate, 95 percent purity, and applied at 160 lbs/acre. Annual Rye spring seeding will be completed between April 15 and June 1, and the fall seeding will be completed between September 1 and October 15.
    - Winter Rye (Secale cereale) with a minimum 90 percent germination rate, 95 percent purity and applied at 200 lbs/acre. Winter Rye fall seeding will be completed between September 1 and December 15.

Installation Date: As needed

Maintenance Requirements

- If any damage or improper installation is observed during periodic inspections, the stabilization of stockpiled topsoil should be repaired in accordance with corrective action requirements.

4.8 Soil Compaction General Description

Construction vehicle access will be restricted in areas where final vegetative stabilization will occur. Prior to seeding or planting compacted soils will be conditioned to support vegetative growth.

Specific Soil Compaction Controls

Soil Compaction Control Description and Specifications – Refer to project specifications

4.9 Storm Drain Inlets

General Description

Catch basin filters will be installed at existing and proposed storm drain inlets to reduce sediment entering the stormwater system.

Specific Storm Drain Inlet Controls

Storm Drain Inlet Control # 1: Silt Sacks

Storm Drain Inlet Control Description and Specifications

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- Catch basin silt sacks specifically designed for catch basin grates will be installed.
- Refer to detail on plans in Appendix A.

Installation Date:

Prior to all earth disturbances

Maintenance Requirements

- Clean, or remove and replace silt sacks as sediment accumulates, the filter becomes clogged, and/or performance is compromised. Where there is evidence of sediment accumulation adjacent to the inlet protection measure, you must remove the deposited sediment by the end of the same work day in which it is found or by the end of the following work day if removal by the same work day is not feasible.

4.10 Constructed Stormwater Conveyance Channels

General Description

Constructed stormwater conveyance ridges, channels, or a combination will be installed as needed to direct runoff away from unstabilized areas on the site and to reduce erosion.

Specific Conveyance Channel Controls

Stormwater Conveyance Channel Control # 1

Stormwater Conveyance Channel Control Description and Specifications

- Stormwater conveyance channels will be lined with soil stabilization fabric.
- Straw bales or filter fabric check dams will be used with the conveyance channel as needed to reduce the speed of the flow and allow sediment to settle out.
- The maximum contributing drainage area to each diversion control is 3 acres. Temporary diversion shall have a peak runoff capacity of the 10-year storm, with a minimum width of 4 feet, maximum height of 18-inches, side slopes of 2H:1V, and a maximum channel grade of 1.0 percent.

Installation Date: As needed

Maintenance Requirements

- Sediment will be removed before it has accumulated to one-half of the depth of the channel or check dam.
- If any damage or improper installation is observed during periodic inspections, the conveyance channel should be repaired in accordance with corrective action requirements.

4.11 Sediment Basins

General Description

Sediment basins with primary outlets and emergency spillways may be used to receive surface runoff and discharge from conveyance channels, although it is not anticipated that basins will be needed.

Specific Sediment Basin Controls

Sediment Basin Control # 1

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Sediment Basin Control Description and Specifications

- Sediment basins shall been designed to store the calculated volume of runoff from a 2-year, 24-hour storm and have a length to width ratio of at least 2:1 and maximum side slopes of 3H:1V. Outled structures have been designed to withdraw water from the surface to minimize the discharge of pollutants. The total spillway capacity shall be designed to convey a 10-year peak flow with 1 foot of freeboard.

Installation Date: As needed

Maintenance Requirements

- The sediment basins will be kept in effective operating condition and accumulated sediment will be removed to maintain at least ½ of the design capacity of the sediment basin at all times.
- If any damage or improper installation is observed during periodic inspections, the sediment basin should be repaired in accordance with corrective action requirements.

4.12 Chemical Treatment

Chemical treatment not anticipated.

4.13 Dewatering Practices

General Description

Dewatering may be accomplished by pumping water from exavation areas to a sediment basin or other appropriate control devide approved by the Stormwater Team.

Specific Dewatering Practices

General Description

Dewatering will be accomplished by pumping water from exavation areas to a sediment basin or other appropriate control devide approved by the Stormwater Team. Limited dewatering is anticipated for this project.

Specific Dewatering Practices

Dewatering Practice # 1

Dewatering Practice Description and Specifications

- Contractor responsible for treatment of any and all groundwater that is to be dewatered during construction.

Installation Date:

As needed

Maintenance Requirements

- Haul away back-wash water for disposal or return it to the beginning of the treatment process. Clean the filter media used in dewatering devices when the pressure differential equals or exceeds the manufacturer's specifications.

4.14 Site Stabilization

General Description

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The project is not located in an arid, semi-arid, or drought stricken area. The site stabilization practices will include vegetative and non-vegetative methods for both temporary and permanent stabilization.

Specific Site Stabilization Practices

Site Stabilization Practice # 1: Hydroseeding

Description of Practice:

- Hydroseeding will be applied immediately whenever earth-disturbing activities have permanently or temporarily ceased (i.e. construction will not resume for a period of 14 calendar days or more) on any portion of the site. Uniform vegetation which provides at least 70 percent of the density of coverage that existed before the commencing of earth-disturbing activities will be provided.

- Temporary seeding requirements include the following seed mixture and application rates:
    - Annual Rye (Lolium multiflorum) with a minimum 90 percent germination rate, 95 percent purity, and applied at 160 lbs/acre. Annual Rye spring seeding will be completed between April 15 and June 1, and the fall seeding will be completed between September 1 and October 15.
    - Winter Rye (Secale cereale) with a minimum 90 percent germination rate, 95 percent purity and applied at 200 lbs/acre. Winter Rye fall seeding will be completed between September 1 and December 15.

  Areas with slopes greater than 3H:1V will be covered with erosion control blankets to protect seeding while vegetation is being established.

- For permanent seeding requirements refer to Specification 32 92 00 Turf and Grasses.

Installation Date: As needed

Maintenance Requirements

- If any damage or improper installation is observed during periodic inspections, the stabilization of disturbed areas will be repaired in accordance with corrective action requirements.

Site Stabilization Practice # 2: Erosion Control Blankets

Description of Practice:

- Erosion control blankets will be installed immediately whenever earth-disturbing activities have permanently or temporarily ceased (i.e. where construction will not resume for a period of 14 calendar days or more) on any portion of the site.

- Erosion control blakets shall consist of straw (0.35 lb./sq. yd.) and coconut fibers (0.15 lb./sq. yd) sewn with cotton biodegradable thread between two UV-stabilized nets such as North American Green SC 150, or an approved equal.

Installation Date: As needed

Maintenance Requirements

- If any damage or improper installation is observed during periodic inspections, the stabilization of disturbed areas will be repaired in accordance with corrective action requirements.

SECTION 5: POLLUTION PREVENTION STANDARDS

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5.1 Potential Sources of Pollution

Construction Site Pollutants

Areas of Work	Stormwater Primary Pollutant	Other Pollutants						
	Sediment	Nutrients	Heavy Metals	Ph	Pesticides & Herbicides	Oil &Grease	Bacteria	Trash, Debris& Solids
Clearing, grading, excavating, and unstabilized areas	√	√	√	√				√
Demolition and debris disposal	√	√						√
Drilling and blasting operations	Not applicable							√
Dewatering operations	Not applicable							
Material delivery and storage		√		√		√		√
Contaminated soils	Not applicable							
Stock piles of materials (e.g. gravel, loam)	√	√						
Paving operations	√	√	√		√			√
Structure construction								√
Concrete washout and waste		√						√
Solid waste	Not applicable							
Hazardous waste	Not Applicable							
Sanitary waste	Not Applicable							
Vehicle/equipment use and storage						√		
Vehicle/equipment fueling and maintenance						√		
Landscaping operations	√	√			√			√

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5.2 Spill Prevention and Response

General Description

A spill contingency plan will be implemented during construction, including the following provisions:

- Equipment necessary to quickly attend to inadvertent spills or leaks will be stored on-site in a secure but accessible location. Such equipment shall include safety goggles, chemically resistant gloves and overshoe boots, water and chemical fire extinguishers, sand and shovels, suitable absorbent materials, hydrocarbon sorbent bats, storage containers and first aid equipment.

- Spills or leaks will be treated properly according to material type, volume of spillage, and location of the spill. Mitigation will include preventing further spillage, containing the spilled material in a safe and environmentally sound manner, and remediating any damage done to the environment.

- For spills of < 10 gallons of material, proceed with source control and containment, and clean up with absorbent materials or other applicable means, unless an imminent hazard or other circumstances dictate that the spill should be treated by a professional emergency response contractor.

- For spills of > 10 gallons of material, immediately contact the MA DEP Emergency Response Section at 888/304-1133. Provide information on the type of material spilled, the location of the spill, the quantity of the spill and the time of the spill to the emergency response contractor or coordinator, and proceed with prevention, containment and/or clean-up if so directed.

- If there is a Reportable Quantity (RQ) release during the construction period, immediately contact the MA DEP Emergency Response Section at 888/304-1133; within 14 days a report will be submitted to the EPA regional office describing the release, the date and circumstances of the release, and the steps taken to prevent another release. This Storm Water Prevention Plan must be updated to reflect any such steps or actions taken.

- Provide a 55-gallon spill containment kit and maintain on site throughout the construction period.

Prohibited Discharges

The following discharges from the project site are prohibited.

- Wastewater from concrete washout, unless managed by an appropriate control.
- Wastewater from the washout of stucco, paint, form release oils, curing compounds, and other construction materials unless managed by an appropriate control.
- Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance
- Soaps, solvents, or detergents used in vehicle and equipment washing; and
- Toxic or hazardous substances from a spill or other release.

5.3 Fueling and Maintenance of Equipment or Vehicles

General Description

The following measures will be implemented to provide an effective means of eliminating the discharged of spilled or leaked chemicals, including fuel, from the area where these activities will take place.

Pollution Prevention Practice # 1

Description and Specifications:

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- Ensure adequate supplies are available at all times to handle spills, leaks, and disposal of used systems.
- Use drip pans and absorbents under or around leaky vehicles.
- Dispose of or recycle oil and oily wastes in accordance with other federal, state, tribal, or local requirements.
- Clean up spills or contaminated surfaces immediately using dry clean up measures where possible, and eliminate the source of the spill to prevent discharge or furtherance of an ongoing discharge; and
- Do not clean surfaces by hosing the area down.

Installation Date:

- Prepare a spill contingency plan at the beginning of construction.

Maintenance Requirements:

- Update spill contingency plan as required.

5.4 Washing of Equipment and Vehicles

General Description

Discharge from equipment and vehicle washing practices will be kept to a minimum.

Specific Pollution Prevention Practices

Pollution Prevention Practice # 1: Storage of Soaps, Solvents, and Detergents

Description and Specifications:

- Soaps, solvents, and detergents will be stored under a cover such as sheeting or a temporary roof to prevent these substances from coming into contact with rainwater.

Installation Date:

As needed

Maintenance Requirements:

- Soap, solvent and detergent storage areas will be inspected routinely and appropriate repairs or modifications will be made immediately.

Pollution Prevention Practice # 2: Equipment and Vehicle Washing Practices

Description and Specifications:

- Equipment and vehicle washing will be located at the dedicated construction entrance away from surface waters or stormwater drain inlets.

Installation Date:

- Refer to Section 4.3.

Maintenance Requirements:

- Refer to Section 4.3.

5.5 Storage, Handling, and Disposal of Construction Products, Materials, and Wastes

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5.5.1 Building Products

General Description

It is not anticipated that harmful chemicals associated with building products will be associated with the propsoed project.

Specific Pollution Prevention Practices

Pollution Prevention Practice # 1: Proper Storage

Description and Specifications

- Building products will be stored under a cover such as sheeting or temporary roofs to prevent rainwater from coming into contact with harmful chemicals. Chemicals including petroleum products such as diesel fuel, oil, and hydraulic fluids will be stored in water-tight containers.

Installation Date: As needed

Maintenance Requirements

- Building product storage areas will be inspected routinely and appropriate repairs or modifications will be made immediately.

5.5.2 Pesticides, Herbicides, Insecticides, Fertilizers, and Landscape Materials

General Description

The use of pesticides, herbicides, insecticides, fertilizers and landscape materials will be kept to a minimum.

Specific Pollution Prevention Practices

Pollution Prevention Practice # 1: Proper Storage

Description and Specifications

- Harmful chemicals associated with landscaping products will be prevented from coming into contact with rainwater by storing them in sealed containers. Landscaping products will be stored under a cover such as sheeting or temporary roofs to prevent rainwater from coming into contact with harmful chemicals.

Installation Date: As needed

Maintenance Requirements

- Landscaping product storage areas will be inspected routinely and appropriate repairs or modifications will be made immediately.

5.5.3 Diesel Fuel, Oil, Hydraulic Fluids, Other Petroleum Products, and Other Chemicals

General Description

It is not anticipated that diesel fuel, oil, hydraulic fluids, or other petroleum products or chemicals will be stored on the project site.

5.5.4 Hazardous or Toxic Waste

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General Description

Hazardous or toxic waste will be prevented from coming into contact with rainwater. It is not anticipated that there will be significant amounts of hazardous or toxic waste stored on site.

Specific Pollution Prevention Practices

Pollution Prevention Practice # 1: Proper Storage

Description and Specifications

- Any hazardous or toxic waste will be stored in sealed containers constructed of suitable materials to prevent leakage and corrosion.
- Containers that will be stored outside will be within appropriately sized secondary containment.

Installation Date: As needed

Maintenance Requirements

- Hazardous and toxic waste storage areas will be inspected routinely and appropriate repairs or modifications will be made immediately.

5.5.5 Construction and Domestic Waste

General Description

Appropriate waste containers of a sufficient size and number will be provided for construction and domestic waste.

Specific Pollution Prevention Practices

Pollution Prevention Practice # 1: Proper Storage

Description and Specifications

- Construction and domestic waste may be stored under a cover such as sheeting or temporary roofs to prevent rainwater from coming into contact with harmful chemicals.
- Waste will be cleaned up and appropriately disposed in designated containers on work days.
- Containers that overflow will be cleaned up immediately.

Installation Date: As needed

Maintenance Requirements

- Construction and domestic waste storage areas will be inspected routinely and appropriate repairs or modifications will be made immediately.

5.5.6 Sanitary Waste

General Description

Portable Toilets will be provided for sanitary waste.

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Specific Pollution Prevention Practices

Pollution Prevention Practice # 1: Portable Toilets

Description and Specifications

- Portable toilets of a sufficient size and number for the construction personnel will be provided for sanitary waste. These units will be secured such that will not be tipped or knocked over.

Installation Date: As needed

Maintenance Requirements

- Portable toilets will be inspected routeinely and emptied regularly as needed.

5.6 Washing of Applicators and Containers used for Paint, Concrete or Other Materials

General Description

Washwater from applicators and containers used for paint, concrete, form release oils, curing compounds, stucco, and other construction materials will be disposed of properly.

Specific Pollution Prevention Practices

Pollution Prevention Practice # 1: Washing Practices

Description and Specifications

- Washout activities will be located as far away as possible from surface waters and stormwater inlets or conveyances.
- Designated areas for these activities will be identified to the extent practicable.

Installation Date: As needed

Maintenance Requirements

- Washout areas will be inspected routinely and appropriate repairs or modifications will be made immediately.

Pollution Prevention Practice # 1: Washwater Handling and Disposal

Description and Specifications

- All washwater will be directed to a leak-proof container or leak-proof pit designed so that no overflows occur.
- Whashout and cleanout wastes will not be dumped into storm sewers.

Installation Date: As needed

Maintenance Requirements

- Washwater containment areas will be inspected routinely and appropriate repairs or modifications will be made immediately.

5.7 Fertilizers

General Description

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Discharges of fertilizers containing nitrogen or phosphorous will be minimized.

Specific Pollution Prevention Practices

Pollution Prevention Practice # 1: Fertilizing Practices

Description and Specifications

- Fertilizer will be applied at a rate and in amounts consistent with the manufacturer's specifications.
- Fertilizer will be applied at appropriate timees of year for the project location and timed as closely as possible with the period of maximum vegetation uptake.
- Application of fertilizer will be avoided before a heavy rain.
- Fertilizers will not be applied to stormwater conveyance channels with moving water or to frozen ground.

Installation Date: As needed

Maintenance Requirements

- Stabilized areas that are fertilized to facilitate vegetation will be inspected routinely and any damage to the stabilized areas will be repaired immediately.

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SECTION 6: INSPECTION AND CORRECTIVE ACTION

6.1 Inspection Personnel and Procedures

Personnel Responsible for Inspections The day-to-day operator or their trained representative will perform the inspections of the erosion and sediment controls. This applies to all inspections noted within this SWPPP.

Inspection Schedule

The site will be inspected once every 7 days and within 24 hours of the occurrence of a storm event of ¼ inch or greater.

Inspection Report Forms

Refer to Appendix D.

6.2 Corrective Action

General Description

Personnel Responsible for Corrective Actions

The day-to-day operator will be responsible for corrective actions to the erosion and sediment controls. [This section will be completed after the contract is awarded]

Refer to Section 5 of the 2012 CGP corrective action requirements including reporting and record keeping.

Corrective Action Forms

Refer to Appendix E.

6.3 Delegation of Authority

Duly Authorized Representative(s) or Position(s)

[This section will be completed after the contract is awarded]

SECTION 7: TRAINING

The Operator will provide training for personnel who are responsible for the design, installation, maintenance, and/or repair of stormwater controls (including pollution prevention measures); personnel responsible for the application and storage of treatment chemicals (if applicable); personnel who are responsible for conducting inspections as required in Part 4.1.1; and personnel who are responsible for taking corrective actions as required in Part 5.

The personnel will be trained to understand The location of all stormwater controls on the site required by this permit, and how they are to be maintained; The proper procedures to follow with respect to the permit's pollution prevention requirements; and When and how to conduct inspections, record applicable findings, and take corrective actions.

Table 7-1: Documentation for Completion of Training

Name	Date Training Completed

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SECTION 8: CERTIFICATION AND NOTIFICATION

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

Name: _____ Title: _____

Signature: _____ Date: _____

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SWPPP APPENDICES

Attach the following documentation to the SWPPP:

Appendix A – Site Maps

Appendix B – Copy of 2017 CGP
(Note: The 2017 CGP is available at https://www.epa.gov/npdes/epas-2017-construction-general-permit-cgp-and-related-documents)

Appendix C – NOI and EPA Authorization Email

Appendix D – Inspection Form
(Note: EPA has developed a sample inspection form that CGP operators can use. The form is available at https://www.epa.gov/npdes/stormwater-discharges-construction-activities#resources)

Appendix E – Corrective Action Form
(Note: EPA has developed a sample corrective action form that CGP operators can use. The form is available at https://www.epa.gov/npdes/stormwater-discharges-construction-activities#resources)

Appendix F – SWPPP Amendment Log

Appendix G – Subcontractor Certifications/Agreements

Appendix H – Grading and Stabilization Activities Log

Appendix I – Training Log

Appendix J – Delegation of Authority

Appendix K – Endangered Species Documentation

Appendix L – Historic Preservation Documentation

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Appendix A – Site Maps

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Appendix B – Copy of 2017 CGP

(Note: The 2017 CGP is available at https://www.epa.gov/npdes/epas-2017-construction-general-permit-cgp-and-related-documents)

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Appendix C – Copy of NOI and EPA Authorization email

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Appendix D – Copy of Inspection Form

(Note: EPA has developed a sample inspection form that CGP operators can use. The form is available at https://www.epa.gov/npdes/stormwater-discharges-construction-activities#resources)

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Appendix E – Copy of Corrective Action Form

(Note: EPA has developed a sample corrective action form that CGP operators can use. The form is available at https://www.epa.gov/npdes/stormwater-discharges-construction-activities#resources)

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Appendix F – *Sample* SWPPP Amendment Log

Instructions (see CGP Part 7.4):

- Create a log here of changes and updates to the SWPPP. You may use the table below to track these modifications.
- SWPPP modifications are required pursuant to CGP Part 7.4.1 in the following circumstances:
  - ✓ Whenever new operators become active in construction activities on your site, or you make changes to your construction plans, stormwater controls, or other activities at your site that are no longer accurately reflected in your SWPPP;
  - ✓ To reflect areas on your site map where operational control has been transferred (and the date of transfer) since initiating permit coverage;
  - ✓ If inspections or investigations determine that SWPPP modifications are necessary for compliance with this permit;
  - ✓ Where EPA determines it is necessary to install and/or implement additional controls at your site in order to meet requirements of the permit; and
- To reflect any revisions to applicable federal, state, tribal, or local requirements that affect the stormwater control measures implemented at the site.
- If applicable, if a change in chemical treatment systems or chemically-enhanced stormwater control is made, including use of a different treatment chemical, different dosage rate, or different area of application.

No.	Description of the Amendment	Date of Amendment	Amendment Prepared by [Name(s) and Title]
		INSERT DATE	
		INSERT DATE	
		INSERT DATE	
		INSERT DATE	
		INSERT DATE	
		INSERT DATE	
		INSERT DATE	
		INSERT DATE	

Appendix G – *Sample* Subcontractor Certifications/Agreements

SUBCONTRACTOR CERTIFICATION
STORMWATER POLLUTION PREVENTION PLAN

Project Number: _____

Project Title: _____

Operator(s): _____

As a subcontractor, you are required to comply with the Stormwater Pollution Prevention Plan (SWPPP) for any work that you perform on-site. Any person or group who violates any condition of the SWPPP may be subject to substantial penalties or loss of contract. You are encouraged to advise each of your employees working on this project of the requirements of the SWPPP. A copy of the SWPPP is available for your review at the office trailer.

Each subcontractor engaged in activities at the construction site that could impact stormwater must be identified and sign the following certification statement:

I certify under the penalty of law that I have read and understand the terms and conditions of the SWPPP for the above designated project and agree to follow the practices described in the SWPPP.

This certification is hereby signed in reference to the above named project:

Company: _____

Address: _____

Telephone Number: _____

Type of construction service to be provided: _____

_____

_____

Signature: _____

Title: _____

Date: _____

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Appendix H – *Sample* Grading and Stabilization Activities Log

Date Grading Activity Initiated	**Description of Grading Activity**	**Description of Stabilization Measure and Location**	**Date Grading Activity Ceased** (Indicate Temporary or Permanent)	**Date When Stabilization Measures Initiated**
INSERT DATE			INSERT DATE ☐ Temporary ☐ Permanent	INSERT DATE
INSERT DATE			INSERT DATE ☐ Temporary ☐ Permanent	INSERT DATE
INSERT DATE			INSERT DATE ☐ Temporary ☐ Permanent	INSERT DATE
INSERT DATE			INSERT DATE ☐ Temporary ☐ Permanent	INSERT DATE
INSERT DATE			INSERT DATE ☐ Temporary ☐ Permanent	INSERT DATE
INSERT DATE			INSERT DATE ☐ Temporary ☐ Permanent	INSERT DATE
INSERT DATE			INSERT DATE ☐ Temporary ☐ Permanent	INSERT DATE
INSERT DATE			INSERT DATE ☐ Temporary ☐ Permanent	INSERT DATE

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Appendix I – *Sample* SWPPP Training Log

Stormwater Pollution Prevention Training Log

Project Name:

Project Location:

Instructor's Name(s):

Instructor's Title(s):

Course Location: _____ Date: _____

Course Length (hours): _____

Stormwater Training Topic: *(check as appropriate)*

- ☐ **Sediment and Erosion Controls**
- ☐ **Stabilization Controls**
- ☐ **Pollution Prevention Measures**
- ☐ **Emergency Procedures**
- ☐ **Inspections/Corrective Actions**

Specific Training Objective:_____

_____

Attendee Roster: *(attach additional pages as necessary)*

No.	Name of Attendee	Company
1		
2		
3		
4		
5		
6		
7		
8		

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Appendix J – *Sample* Delegation of Authority Form

Delegation of Authority

I, _____ (name), hereby designate the person or specifically described position below to be a duly authorized representative for the purpose of overseeing compliance with environmental requirements, including the Construction General Permit (CGP), at the _____ construction site. The designee is authorized to sign any reports, stormwater pollution prevention plans and all other documents required by the permit.

_____ (name of person or position)
_____ (company)
_____ (address)
_____ (city, state, zip)
_____ (phone)

By signing this authorization, I confirm that I meet the requirements to make such a designation as set forth in Appendix I of EPA's CGP, and that the designee above meets the definition of a "duly authorized representative" as set forth in Appendix I.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I have no personal knowledge that the information submitted is other than true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: _____

Company: _____

Title: _____

Signature: _____

Date: _____

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Appendix K – Endangered Species Documentation

DRAFT

Appendix L – Historic Properties Documentation

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Appendix M – Rainfall Gauge Recording

Use the table below to record the rainfall gauge readings at the beginning and end of each work day. An example table follows.

Month/Year			Month/Year			Month/Year		
Day	Start time	End time	Day	Start time	End time	Day	Start time	End time
1			1			1		
2			2			2		
3			3			3		
4			4			4		
5			5			5		
6			6			6		
7			7			7		
8			8			8		
9			9			9		
10			10			10		
11			11			11		
12			12			12		
13			13			13		
14			14			14		
15			15			15		
16			16			16		
17			17			17		
18			18			18		
19			19			19		
20			20			20		
21			21			21		
22			22			22		
23			23			23		
24			24			24		
25			25			25		
26			26			26		
27			27			27		
28			28			28		
29			29			29		
30			30			30		
31			31			31		

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Example Rainfall Gauge Recording

April 2017			May 2017			June 2017		
Day	7:00 am	4:400 pm	Day	7:00 am	4:00 pm	Day	7:00 am	4:00 pm
1	--	--	1	0.2	0	1	0	0.4
2	--	--	2	0	0	2	0	0
3	0	0	3	0.1	0.3	3	--	--
4	0	0.3	4	0	0	4	--	--
5	0	0	5	0	0	5	0	0

In this example (for only partial months), 0.25-inch rainfall inspections would have been conducted on April 4 and June 1.

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Appendix I: Order Of Resource Area Delineation

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 4B – Order of Resource Area Delineation

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

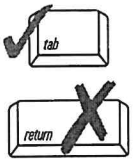
Provided by MassDEP:
090-1346
MassDEP File Number

eDEP Transaction Number

Andover
City/Town

A. General Information

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



Note: Before completing this form consult your local Conservation Commission regarding any municipal bylaw or ordinance.

From: Andover
1. Conservation Commission

2. This Issuance is for (check one):

a. ☒ Order of Resource Area Delineation

b. ☐ Amended Order of Resource Area Delineation

3. Applicant:

Sheldon
a. First Name

Berman
b. Last Name

Town of Andover School Department
c. Organization

36R Bartlet Street
d. Mailing Address

Andover
e. City/Town

MA
f. State

01810
g. Zip Code

4. Property Owner (if different from applicant):

a. First Name

b. Last Name

c. Organization

d. Mailing Address

e. City/Town

f. State

g. Zip Code

5. Project Location:

54, 54R and 60 Beacon St/0 High Plain Rd
a. Street Address

Andover
b. City/Town

01810
c. Zip Code

88, 107
d. Assessors Map/Plat Number

57, 57A, 58 / 16, 6
e. Parcel/Lot Number

Latitude and Longitude (in degrees, minutes, seconds):

42d39m52.812s
f. Latitude

71d10m18.552s
g. Longitude

6. Dates:

April 6, 2020
a. Date ANRAD filed

January 19, 2021
b. Date Public Hearing Closed

January 22, 2021
c. Date of Issuance

7. Title and Date (or Revised Date if applicable) of Final Plans and Other Documents:

Existing Condition Plan
a. Title

11/17/2020
b. Date

c. Title

d. Date

B. Order of Delineation

1. The Conservation Commission has determined the following (check whichever is applicable):

a. ☒ **Accurate**: The boundaries described on the referenced plan(s) above and in the Abbreviated Notice of Resource Area Delineation are accurately drawn for the following resource area(s):

1. ☒ Bordering Vegetated Wetlands

2. ☒ Other resource area(s), specifically:

a. Intermittent Stream

b. ☐ **Modified**: The boundaries described on the plan(s) referenced above, as modified by the Conservation Commission from the plans contained in the Abbreviated Notice of Resource Area Delineation, are accurately drawn from the following resource area(s):

1. ☐ Bordering Vegetated Wetlands

2. ☐ Other resource area(s), specifically:

a.

c. ☐ **Inaccurate**: The boundaries described on the referenced plan(s) and in the Abbreviated Notice of Resource Area Delineation were found to be inaccurate and cannot be confirmed for the following resource area(s):

1. ☐ Bordering Vegetated Wetlands

2. ☐ Other resource area(s), specifically:

3. ☐ The boundaries were determined to be inaccurate because:

C. Findings

This Order of Resource Area Delineation determines that the boundaries of those resource areas noted above, have been delineated and approved by the Commission and are binding as to all decisions rendered pursuant to the Massachusetts Wetlands Protection Act (M.G.L. c.131, § 40) and its regulations (310 CMR 10.00). This Order does not, however, determine the boundaries of any resource area or Buffer Zone to any resource area not specifically noted above, regardless of whether such boundaries are contained on the plans attached to this Order or to the Abbreviated Notice of Resource Area Delineation.

This Order must be signed by a majority of the Conservation Commission. The Order must be sent by certified mail (return receipt requested) or hand delivered to the applicant. A copy also must be mailed or hand delivered at the same time to the appropriate DEP Regional Office (see http://www.mass.gov/eea/agencies/massdep/about/contacts/find-the-massdep-regional-office-for-your-city-or-town.html).

D. Appeals

The applicant, the owner, any person aggrieved by this Order, any owner of land abutting the land subject to this Order, or any ten residents of the city or town in which such land is located, are hereby notified of their right to request the appropriate DEP Regional Office to issue a Superseding Order of Resource Area Delineation. When requested to issue a Superseding Order of Resource Area Delineation, the Department's review is limited to the objections to the resource area delineation(s) stated in the appeal request. The request must be made by certified mail or hand delivery to the Department, with the appropriate filing fee and a completed Request for Departmental Action Fee Transmittal Form, as provided in 310 CMR 10.03(7) within ten business days from the date of issuance of this Order. A copy of the request shall at the same time be sent by certified mail or hand delivery to the Conservation Commission and to the applicant, if he/she is not the appellant.

Any appellants seeking to appeal the Department's Superseding Order of Resource Area Delineation will be required to demonstrate prior participation in the review of this project. Previous participation in the permit proceeding means the submission of written information to the Conservation Commission prior to the close of the public hearing, requesting a Superseding Order or Determination, or providing written information to the Department prior to issuance of a Superseding Order or Determination.

The request shall state clearly and concisely the objections to the Order which is being appealed and how the Order does not contribute to the protection of the interests identified in the Massachusetts Wetlands Protection Act, (M.G.L. c. 131, § 40) and is inconsistent with the wetlands regulations (310 CMR 10.00). To the extent that the Order is based on a municipal bylaw or ordinance, and not on the Massachusetts Wetlands Protection Act or regulations, the Department of Environmental Protection has no appellate jurisdiction.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 4B – Order of Resource Area Delineation

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:
090-1346
MassDEP File Number

eDEP Transaction Number

Andover
City/Town

E. Signatures

Date of Issuance

Please indicate the number of members who will sign this form. 6
1. Number of Signers

D. Cooper
Signature of Conservation Commission Member

Signature of Conservation Commission Member

Signature of Conservation Commission Member

Signature of Conservation Commission Member

Signature of Conservation Commission Member

Alexandra Driscoll
Signature of Conservation Commission Member

Signature of Conservation Commission Member

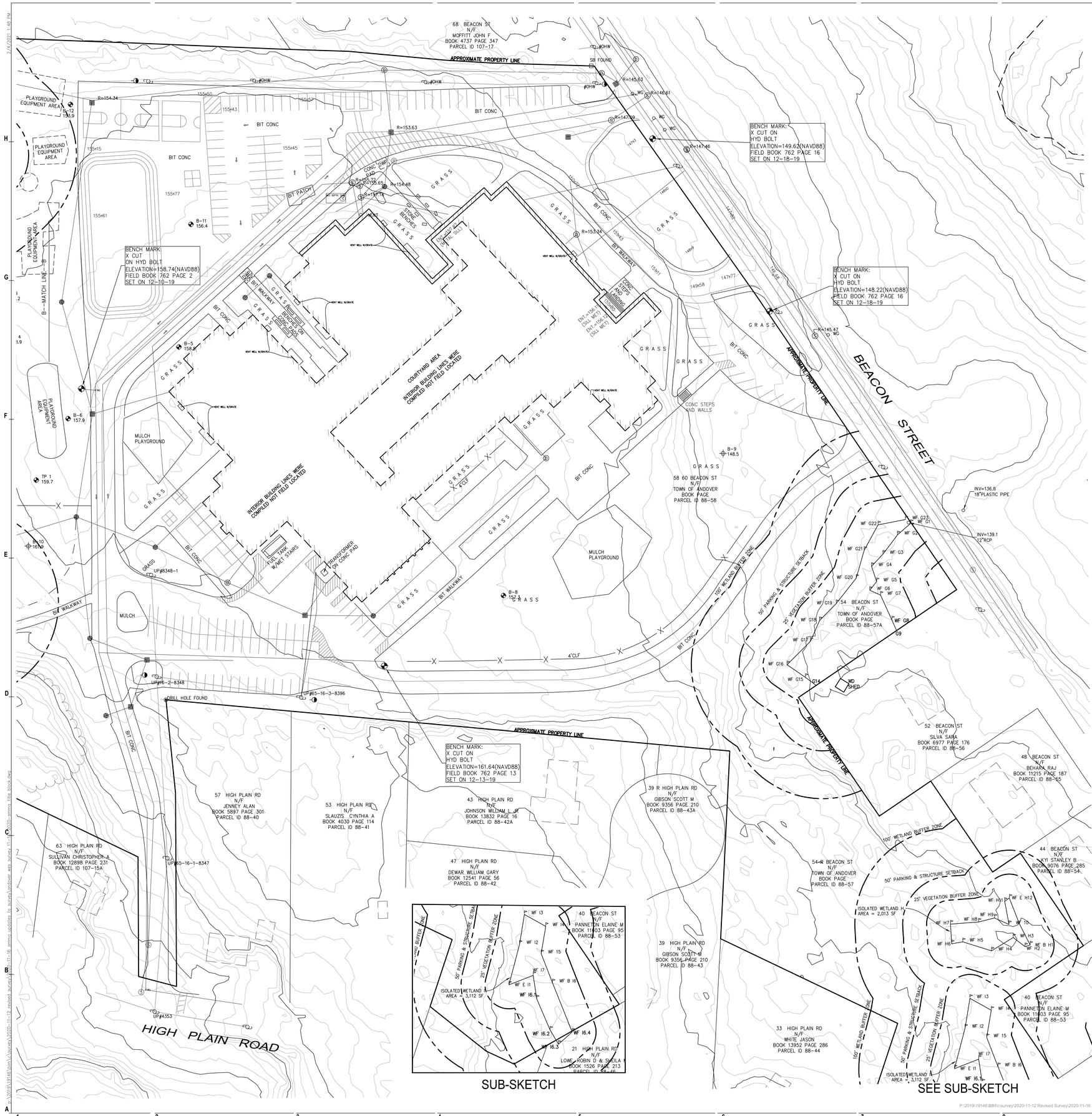
This Order is valid for three years from the date of issuance.

If this Order constitutes an Amended Order of Resource Area Delineation, this Order does not extend the issuance date of the original Final Order, which expires on unless extended in writing by the issuing authority.

This Order is issued to the applicant and the property owner (if different) as follows:

2. ☒ By hand delivery on Interoffice mail
January 22, 2021
a. Date

3. ☐ By certified mail, return receipt requested on
a. Date



	CATCH BASIN
C	CABLE TELEVISION MANHOLE
D	DRAIN MANHOLE
E	ELECTRIC MANHOLE
M	MISCELLANEOUS MANHOLE
S	SEWER MANHOLE
T	TELEPHONE MANHOLE
W	WATER MANHOLE
GSO	GAS SHUT-OFF
WSO	WATER SHUT-OFF
GG	GAS GATE
WG	WATER GATE
BWW	BOSTON WATER WORKS
	FIRE HYDRANT
	DOWN SPOUT
UP	UTILITY POLE
UP W/ UE	UTILITY POLE WITH CONDUIT LINE TO GROUND
	LIGHT POLE
HH	HAND HOLE
TC	TRASH CAN
FACB	FIRE ALARM CALL BOX
MP	METAL POST
CP	CONCRETE POST
PM	PARKING METER
S	SIGN POST
12"	DECIDUOUS TREE WITH TRUNK DIAMETER
12"	CONIFEROUS TREE WITH TRUNK DIAMETER
601x43	SPOT ELEVATION
CLF	CHAIN LINK FENCE
BB	BITUMINOUS CONCRETE BERM
VGC	VERTICAL GRANITE CURB
WCR	WHEELCHAIR RAMP
R=	RIM ELEVATION EQUALS
I=	INVERT ELEVATION EQUALS
TH=	TOP OF HOOD ELEVATION EQUALS
NPV	NO PIPES VISIBLE
TOW=	TOP OF WATER
601x43TW	TOP OF WALL ELEVATION
CATV	UNDERGROUND CABLE TELEVISION LINE
D	UNDERGROUND DRAIN LINE
E	UNDERGROUND ELECTRIC LINE
G	UNDERGROUND GAS LINE
S	UNDERGROUND SEWER LINE
T	UNDERGROUND TELEPHONE LINE
W	UNDERGROUND WATER LINE
OHW	OVERHEAD WIRES
	MONITORING WELL
	BENCH MARK

UTILITY INFORMATION STATEMENT

1. THE SUB-SURFACE UTILITY INFORMATION SHOWN HEREON IS COMPILED BASED ON FIELD SURVEY INFORMATION, RECORD INFORMATION AS SUPPLIED BY THE APPROPRIATE UTILITY COMPANIES, AND PLAN INFORMATION SUPPLIED BY THE CLIENT, IF ANY; THEREFORE WE CANNOT GUARANTEE THE ACCURACY OF SAID COMPILED SUB-SURFACE INFORMATION TO ANY CERTAIN DEGREE OF STATED TOLERANCE. ONLY PHYSICALLY LOCATED SUB-SURFACE UTILITY FEATURES FALL WITHIN NORMAL STANDARD OF CARE ACCURACIES.

2. THE LOCATIONS OF UNDERGROUND PIPES, CONDUITS, AND STRUCTURES HAVE BEEN DETERMINED FROM SAID INFORMATION, AND ARE APPROXIMATE ONLY. COMPILED LOCATIONS OF ANY UNDERGROUND STRUCTURES, NOT VISIBLY OBSERVED AND LOCATED, CAN VARY FROM THEIR ACTUAL LOCATIONS.

3. ADDITIONAL BURIED UTILITIES/STRUCTURES MAY BE ENCOUNTERED.

4. THE STATUS OF UTILITIES, WHETHER ACTIVE, ABANDONED, OR REMOVED, IS AN UNKNOWN CONDITION AS FAR AS OUR COMPILATION OF THIS INFORMATION.

5. IT IS INCUMBENT UPON INDIVIDUALS USING THIS INFORMATION TO UNDERSTAND THAT COMPILING UTILITY INFORMATION IS NOT EXACT, AND IS SUBJECT TO CHANGE BASED UPON VARYING PLAN INFORMATION RECEIVED AND ACTUAL LOCATIONS.

6. THE ACCURACY OF MEASURED UTILITY INVERTS AND PIPE SIZES IS SUBJECT TO FIELD CONDITIONS, THE ABILITY TO MAKE VISUAL OBSERVATIONS, DIRECT ACCESS TO THE VARIOUS ELEMENTS AND OTHER MATTERS.

7. THE PROPER UTILITY ENGINEERING/COMPANY SHOULD BE CONSULTED AND THE ACTUAL LOCATIONS OF SUBSURFACE STRUCTURES SHOULD BE VERIFIED IN THE FIELD (V.I.F.) BEFORE PLANNING FUTURE CONNECTIONS. CONTACT THE DIG SAFE CALL CENTER AT 1-888-344-7233, SEVENTY-TWO HOURS PRIOR TO EXCAVATION, BLASTING, GRADING, AND/OR PAVING.

8. AS OF THE DATE OF THIS PLAN RECORD INFORMATION HAS NOT BEEN RECEIVED BY NITSCH ENGINEERING FOR THE FOLLOWING UTILITIES: MBTA, COLUMBIA GAS.

NOTES

1. THIS DOCUMENT IS AN INSTRUMENT OF SERVICE OF NITSCH ENGINEERING. IT IS ISSUED TO SMMA FOR PURPOSES RELATED DIRECTLY AND SOLELY TO NITSCH ENGINEERING'S SCOPE OF SERVICES UNDER CONTRACT WITH SMMA FOR PROFESSIONAL LAND SERVICES ASSOCIATED WITH THE WEST ELEMENTARY SCHOOL LOCATED IN ANDOVER, MA. ANY USE OR REUSE OF THIS DOCUMENT FOR ANY REASON BY ANY PARTY FOR PURPOSES UNRELATED DIRECTLY AND SOLELY TO SAID CONTRACT AND PROJECT SHALL BE AT THE USER'S SOLE AND EXCLUSIVE RISK AND LIABILITY, INCLUDING LIABILITY FOR VIOLATION OF COPYRIGHT LAWS, UNLESS WRITTEN AUTHORIZATION IS GIVEN THEREFOR BY NITSCH ENGINEERING.

2. THE PURPOSE OF THIS PLAN IS TO SHOW SITE FEATURES TO BE USED FOR PRELIMINARY PURPOSES ONLY. THIS PLAN REPRESENTS A COMPILATION OF DATA INCLUDING GIS DATA OBTAINED FROM MASSGIS (ABUTTERS BUILDINGS) AND NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA) LIDAR DATA (CONTOUR DATA). THIS DATA SET IS FROM THE LIDAR 2011 USGS LIDAR: NORTHEAST (NY TO ME) WITH AN ESTIMATED VERTICAL ACCURACY OF SIX-TENTHS OF A FOOT, ALONG WITH A LIMITED FIELD TOPOGRAPHIC AND LOCATION SURVEY OF OF THE SITE TO INCLUDE LOCATIONS OF ON SITE BUILDINGS, BUILDING ENTRANCES, EDGE OF PAVING, OBSERVABLE UTILITIES, AND SPOT CHECKS OF LIDAR DATA. BELOW GRADE UTILITY INFORMATION WAS PROVIDED BY VARIOUS SOURCES.

3. LIMITED ON THE GROUND TOPOGRAPHIC SURVEY WAS PERFORMED FROM 12-10-19 TO AND 10-18-19. LIMITS ARE SHOWN ON PLAN.

4. PROPERTY LINES SHOWN ARE BASED ON PRELIMINARY RESEARCH OF PUBLIC RECORDS FROM THE ESSEX REGISTRY OF DEEDS AND PRELIMINARY FIELD LOCATIONS OF MONUMENTATION AND OCCUPATION LINES AND DOES NOT REPRESENT A FINAL DETERMINATION OF PROPERTY LINE LOCATIONS.

5. HORIZONTAL COORDINATES REFER TO MASS STATE PLANE NAD83 (2011) EPOCH 2010.0, US SURVEY FOOT, UTILIZING GPS RTK METHODS.

6. ELEVATION REFERS TO NAVD88. HELD BENCHMARKS AS SHOWN ON A PLAN BY COLER & COLANTONIO DATED 2012.

7. ADJUSTMENTS TO THIS PLAN WERE MADE BY SMMA BASED ON FIELD INFORMATION PROVIDED BY RIMMER ENVIRONMENTAL CONSULTING, THIS INCLUDES ADJUSTED FLAGS IN THE G-SERIES (FLAGS G8 – G11), H-SERIES (FLAGS H11 – H12) AND I-SERIES (FLAGS I6.1 – I6.4). AN OFF-SITE WETLAND NORTH OF THE B-SERIES IS APPROXIMATELY LOCATED AND ITS BUFFERS ARE ADJUSTED. AN INTERMITTENT STREAM IS SHOWN WITHIN THE B-SERIES, NEAR FLAGS B13 TO B15.

8. ADJUSTMENTS TO THIS PLAN WERE MADE BY SMMA BASED ON FILED INFORMATION PROVIDED BY ANDOVER DPW. THIS INCLUDES THE LOCATION AND APPROXIMATE INVERT OF A 6" PIPE FROM NEAR F-SERIES FLAGS F14 AND F15 TO A CATCH BASIN.

GRAPHIC SCALE

40 20 0 40 80 120

SCALE: 1"=40'

SMMA

SYMMES MAINI & McKEE ASSOCIATES
1000 Massachusetts Avenue
Cambridge, Massachusetts 02138
P:617.547.5400 F:617.648.4920

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F: (617) 338-6472

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

WEST ELEMENTARY SCHOOL
58 BEACON STREET
ANDOVER, MA 01810

MARK:	DATE:	DESCRIPTION:
ISSUE LOG		
1	02/04/2021	FINAL ANRAD - ISOLATED AREAS
2	11/17/2020	WETLAND DELINEATION REV.

△ = CLOUDED CHANGE

JOHN C. HART CIVIL No. 36738 REGISTERED PROFESSIONAL ENGINEER
COMMONWEALTH OF MASSACHUSETTS

SCALE	1" = 40'
DRAWN BY	ACO
CHECK BY	
PROJ.ARCH./ENGR.	JCH
PROJ. MRG.	LBF
JOB NO.	19146.00

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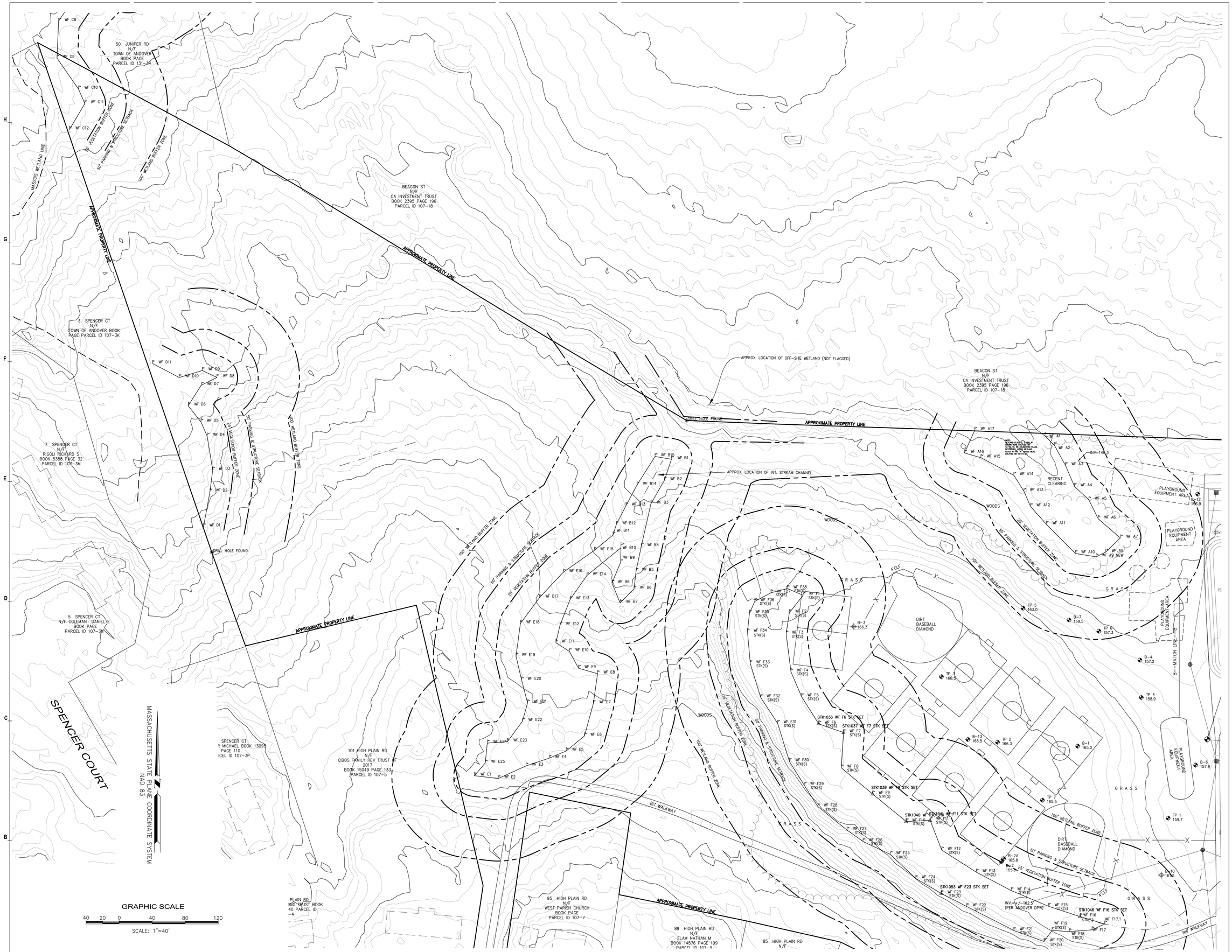
EXISTING CONDITION PLAN I

C-101

SHEET OF

P:\2019\19146\BIM\c\survey\2020-11-12 Revised Survey\2020-11-16 SMMA Updates to survey\Andover WES Survey 11-16-2020-SMMA Title Block.dwg



SMMA

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

WEST ELEMENTARY SCHOOL
58 BEACON STREET
ANDOVER, MA 01810

MARK:	DATE:	DESCRIPTION:
	02/04/2021	FINAL ANRAD - ISOLATED AREAS
	11/17/2020	WETLAND DELINEATION REV.

ISSUE LOG
△ = CLOUDED CHANGE

COMMONWEALTH OF MASSACHUSETTS
JOHN C. HART
CIVIL
No. 38738
REGISTERED PROFESSIONAL ENGINEER

SCALE	1" = 40'
DRAWN BY	ACO
CHECK BY	
PROJ.ARCH./ENGR.	JCH
PROJ. MRG.	LBF
JOB NO.	19146.00

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EXISTING CONDITION PLAN II

C-102

SHEET
OF

10.

Plans (Separate Documents)